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DEPARTMENT OF DIGITAL SYSTEMS

EXAMINING SELF-REGULATED LEARNING THROUGH EPORTFOLIOS IN HIGHER EDUCATION:
THE CASE OF AN EPORTFOLIO BASED SELF-REGULATED LEARNING (EPSRL) APPROACH FOR ADVANCING ACADEMIC ACHIEVEMENT

A Thesis

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ

ΤΜΗΜΑ ΨΗΦΙΑΚΩΝ ΣΥΣΤΗΜΑΤΩΝ

ΕΞΕΤΑΖΟΝΤΑΣ ΤΗΝ ΑΥΤΟ-ΡΥΘΜΙΖΟΜΕΝΗ ΜΑΘΗΣΗ ΣΤΟΥΣ ΗΛΕΚΤΡΟΝΙΚΟΥΣ ΦΑΚΕΛΟΥΣ ΜΑΘΗΣΗΣ ΣΤΗΝ ΤΡΙΤΟΒΑΘΜΙΑ ΕΚΠΑΙΔΕΥΣΗ: Η ΠΕΡΙΠΤΩΣΗ ΕΝΟΣ ΗΛΕΚΤΡΟΝΙΚΟΥ ΦΑΚΕΛΟΥ ΜΑΘΗΣΗΣ ΒΑΣΙΣΜΕΝΟΥ ΣΤΗΝ ΑΥΤΟ-ΡΥΘΜΙΖΟΜΕΝΗ ΜΑΘΗΣΗ ΓΙΑ ΤΗΝ ΠΡΟΩΘΗΣΗ ΤΗΣ ΑΚΑΔΗΜΑΪΚΗΣ ΑΝΑΠΤΥΞΗΣ

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The beginning is the most important part of the work.

Plato, The Republic

From the ancient times to the modern world, human beings attempted to comprehend the world and discover the truth. As a researcher sailed around several beliefs about the world so as to cultivate my ontological mindset, that may arise my epistemological assumptions, which inform the methodology that will give rise to methods employed for collecting data. This research journey was initiated ten years ago when I started my Master thesis and continued with my PhD research. The sail was long, I had to visit uncharted water, visit new harbors, face 'symplegades' and compete with 'my' cloudy and shiny days.

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Katia Alexiou

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Abstract

The ubiquitous presence of technology, the penetration of social media in academic life and the new landscape of skills seem to challenge Higher Education (HE) environments, academic achievement and individuals' well-being. There are several examples of students who cannot find a balance between their academic and social life, thus they fail to follow a smooth transition into HE and advance their academic performance. Further, low achievement uncovers limitations on cognitive, affective, behavioral and social processes of learning.

Self-Regulated Learning (SRL) competency has impact on academic performance, well-being and lifelong learning but constitutes an uncharted area for the majority of HE students. Research should explore the potential of designing effective interventions that encourage the use of SRL strategies through Technology-Enhanced Learning Environments (TELEs). Among TELEs, ePortfolio can be seen as a powerful tool that becomes popular in education. Acknowledging the fact that ePortfolios can enhance an individual's ability to learn in a self-regulated way and promote the development of both hard and soft skills, the design of an ePortfolio intervention (as a dynamic TELE) for establishing SRL skills and measuring the interconnections among SRL process, academic achievement and the system is recommended.

The above facts imply that there is a need of thorough investigation of the predictors that contribute to high academic achievement. Thus, this research attempted to investigate the predictors that ensure that learners can be motivated, use strategies effectively and manage their learning. Also, it was examined how these predictors can positively affect students' academic achievement. Considering these facts, a general question that is posed to: 'In what ways may an educational intervention contribute to high academic achievement and students' well-being?'.

Towards this, it was selected an interesting research paradigm that delves deeper into complex authentic learning settings and is titled design-based research. According to the design-based research, in the preliminary stage an extended literature review was undertaken and a dedicated conceptual model was designed. In the prototyping stage, the designed solution (conceptual model) was tested through a number of iterations. Each iteration was a micro cycle where mixed-methods of data collection were used. For the needs of this research, three micro cycles were conducted as three stand-alone studies (Study 1, Study 2, Study 3) focused on various forms of data including questionnaires, rubrics, individual's reflections, log files, pre- and post-tests and student products. The majority of the participants (N_{total}= 237) was in the age range from 18 to 22 years old, undergraduate male students in a Greek Higher Education Institution. Most of the participants were expert users in using digital devices, internet browsing, using text editing software and using social networking sites (SNSs). Also, the majority of the participants were

positive about the ePortfolio implementation as they wanted to gain new knowledge and advance their skills. In Study 1 (N_1=86) the conceptual framework and the ePortfolio system (version 1) designed and tested (Prototype Stage -Iteration 1). Findings indicated that the ePortfolio system (version 1) needed further modifications in order to support participants improve their SRL skills, engage in the process and boost their academic achievement. Based on valuable insights, the re-design of the conceptual framework, the delivery of an updated ePortfolio system (Version 2) and the implementation of an ePortfolio intervention was attempted. In Study 2 (N_2=123) and Study 3 (N_3=28) the ePortfolio-based Self-Regulated Learning approach/intervention (ePSRL) delivered and tested (Prototype Stage -Iteration 2 & 3). Finally, in the assessment stage the delivery of findings of the research (Study 1, 2 & 3) provided reflections on the results and future research implications. The results of the quantitative and qualitative analysis (mixed methods research design) revealed that: the implementation of the ePortfolio-based Self-Regulated Learning (ePSRL) approach and the system affected students' SRL. Participants used a wide range of SRL processes and their goal setting, motivation, intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy, learning strategies, time management, peer learning, help seeking improved after applying the ePSRL approach to their academic study. Further, the ePortfolio intervention had a positive impact on academic achievement. The level of agreement among four assessors (students, peers, instructor and external evaluators) that independently rated the constructs of the scale (ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics) can be considered substantial. Also, the consistency among the ePortfolio criteria was acceptably high and each construct should be reserved. Finally, the ePSRL intervention in HE supported students to practise SRL processes. Participants evaluated the ePSRL approach and agreed that the design of the ePortfolio supported SRL well and tended to increase during the SRL phases (namely forethought, performance-control, and self-reflection).

To sum up, the key findings of this PhD added to the literature, by showing how to design a conceptual framework based on SRL (cognitive, affective, behavioral and contextual processes) for ePortfolios in HE (ePortfolio-based Self-Regulated Learning (ePSRL) approach) and tailor a workflow process that supports individuals to initiate SRL processes and manage their learning path. Also, this PhD contributed to the field of Personal Development Planning (PDP) and well-being by providing valuable insights about the effect of the ePortfolio intervention on SRL and academic achievement. Towards this, theoretical and practical implications for (large- and small-scale developments) faculty, educators, instructional designers, technology specialists, coaching managers, designers of training materials, project managers and human resource experts were proposed.

Περίληψη

Η πανταχού παρουσία της τεχνολογίας, η διείσδυση των κοινωνικών μέσων στην ακαδημαϊκή ζωή και το νέο σύνολο δεξιοτήτων φαίνεται να δημιουργούν νέες προκλήσεις για την Τριτοβάθμια εκπαίδευση, την ακαδημαϊκή επίδοση, την ευεξία και την ευημερία των ατόμων. Υπάρχουν πολλά παραδείγματα εκπαιδευόμενων που δυσκολεύονται τόσο ώστε να έχουν ισορροπία ανάμεσα στην ακαδημαϊκή και την κοινωνική ζωή όσο και να ακολουθήσουν μια ομαλή μετάβαση στην τριτοβάθμια εκπαίδευση και επομένως να ενισχύσουν την ακαδημαϊκή τους απόδοση. Επιπροσθέτως, η χαμηλή επίδοση των εκπαιδευομένων αποκαλύπτει αδυναμίες σε πτυχές που αφορούν στη διαδικασία της μάθησης όπως είναι: γνωστικές, συναισθηματικές, συμπεριφορικές και κοινωνικές διαδικασίες.

Η Αυτο-Ρυθμιζόμενη Μάθηση είναι μία δεξιότητα που έχει επίδραση στην ακαδημαϊκή απόδοση, την ευεξία, την ευημερία και τη δια-βίου μάθηση ωστόσο αποτελεί μία αχαρτογράφητη περιοχή για την πλειονότητα των εκπαιδευομένων της Τριτοβάθμιας εκπαίδευσης. Οι ερευνητικές μελέτες πρέπει να διερευνήσουν την πιθανότητα σχεδιασμού εκπαιδευτικών παρεμβάσεων οι οποίες να ενθαρρύνουν τη χρήση στρατηγικών Αυτο-ρυθμιζόμενης Μάθησης μέσω Τεχνολογικά υποστηριζόμενων Περιβαλλόντων Μάθησης. Μεταξύ των Τεχνολογικά υποστηριζόμενων Περιβαλλόντων Μάθησης, οι Ηλεκτρονικοί Φάκελοι αποτελούν ένα δυναμικό εργαλείο το οποίο είναι γνωστό στον χώρο της εκπαίδευσης. Οι Ηλεκτρονικοί Φάκελοι μπορούν να ενισχύσουν την ικανότητα του ατόμου να μαθαίνει με έναν αυτο-ρυθμιζόμενο τρόπο ώστε να αναπτύξει μία ευρεία γκάμα δεξιοτήτων, έτσι προτείνεται ο σχεδιασμός μίας εκπαιδευτικής παρέμβασης βασισμένη στους Ηλεκτρονικούς Φακέλους (ως δυναμικά Τεχνολογικά υποστηριζόμενα Περιβάλλοντα Μάθησης) για την εδραίωση των δεξιοτήτων Αυτο-ρυθμιζόμενης Μάθησης και τη διερεύνηση των σχέσεων μεταξύ της Αυτό-ρυθμιζόμενης διαδικασίας μάθησης, της ακαδημαϊκής επίδοσης και του συστήματος μάθησης.

Τα παραπάνω δεδομένα υποστηρίζουν ότι υπάρχει ανάγκη για ενδελεχή έρευνα των παραγόντων που συμβάλλουν στην υψηλή ακαδημαϊκή επίδοση. Επομένως, επιδιώκεται η μελέτη των παραγόντων που μπορούν να προβλέψουν και να διασφαλίσουν ότι οι εκπαιδευόμενοι μπορούν να έχουν κίνητρο στη μάθηση τους, να αξιοποιούν αποτελεσματικά στρατηγικές και να διαχειρίζονται τη μάθηση τους. Επιπροσθέτως, είναι σημαντικό να εξεταστούν εκείνοι οι παράγοντες που επηρεάζουν θετικά την ακαδημαϊκή επίδοση των εκπαιδευομένων. Λαμβάνοντας υπόψη τα δεδομένα, ένα γενικό ερώτημα τέθηκε: ‘Πώς μπορεί μία εκπαιδευτική παρέμβαση να διασφαλίσει ότι οι εκπαιδευόμενοι θα κατακτήσουν υψηλή ακαδημαϊκή επίδοση και θα συνεισφέρει στην ευεξία/ευημερία των ατόμων;’

Προς αυτή την κατεύθυνση, επιλέχθηκε μία ενδιαφέρουσα ερευνητική μεθοδολογία, η έρευνα βασισμένη σε σχεδιασμό, ώστε να μελετηθεί σε ένα αυθεντικό πλαίσιο το ερευνητικό πρόβλημα. Σύμφωνα με την έρευνα βασισμένη σε σχεδιασμό, υπάρχουν τρία στάδια εξέλιξης: στο αρχικό στάδιο εκπονήθηκε ενδελεχής επισκόπηση της βιβλιογραφίας όπου και δημιουργήθηκε ένα εννοιολογικό μοντέλο. Στο στάδιο της προτυποποίησης, αφού σχεδιάσθηκε η 'προτεινόμενη λύση' (εννοιολογικό μοντέλο) εξετάστηκε μέσα από επαναληπτικές πειραματικές διαδικασίες. Κάθε πειραματική διαδικασία ήταν μία ερευνητική παρέμβαση όπου συλλέγονταν τα δεδομένα βάσει της μικτής ερευνητικής στρατηγικής. Για τις ανάγκες της παρούσας έρευνας, τρεις μικρο-κύκλοι εκπονήθηκαν ως τρεις διαφορετικές ερευνητικές παρεμβάσεις (Μελέτη 1, Μελέτη 2 και Μελέτη 3) όπου συλλέχθηκαν δεδομένα από τα ερωτηματολόγια, τις ρουμπρίκες, τους ατομικούς αναστοχασμούς, το ιστορικό του συστήματος, τα τεστ πριν- και μετά- τη διαδικασία και τα τεχνουργήματα/παραδοτέα των εκπαιδευομένων. Η πλειοψηφία των συμμετεχόντων (N_{total}= 237) ήταν μεταξύ 18 και 22 χρονών, προπτυχιακοί φοιτητές σε ένα ελληνικό πανεπιστήμιο. Οι περισσότεροι συμμετέχοντες είναι ειδικοί ώστε να χρησιμοποιούν ψηφιακές συσκευές, να πλοηγούνται στο διαδίκτυο, να αξιοποιούν επεξεργαστές κειμένου και να χρησιμοποιούν τα κοινωνικά δίκτυα. Επίσης, οι συμμετέχοντες ήταν θετικοί για την υλοποίηση του Ηλεκτρονικού Φακέλου και την απόκτηση νέων γνώσεων και δεξιοτήτων.

Στην Μελέτη 1 (N_1=86), σχεδιάσθηκε το εννοιολογικό πλαίσιο και το σύστημα (έκδοση 1), το οποίο και εξετάστηκε μέσω της πειραματικής διαδικασίας (Στάδιο Προτυποποίησης- $1^η$ Επανάληψη). Σύμφωνα με τα ευρήματα, προέκυψε ότι το σύστημα (έκδοση 1) είχε ανάγκη από μετατροπές και προσθήκες ώστε να υποστηρίξει κατάλληλα τους εκπαιδευόμενους να ενισχύσουν τις δεξιότητες αυτο-ρυθμιζόμενης μάθησης, να εμπλακούν ενεργά στη διαδικασία και ενισχύσουν την ακαδημαϊκή τους επίδοση. Ακολουθώντας τα πολύτιμα αποτελέσματα, επιχειρήθηκε ο επανασχεδιασμός του εννοιολογικού πλαισίου, η ανανέωση του Ηλεκτρονικού Φακέλου (έκδοση 2) και η υλοποίηση μιας εκπαιδευτικής παρέμβασης βασισμένη στον Ηλεκτρονικό φάκελο ως ένα σύστημα κοινωνικής δικτύωσης. Στη Μελέτη 2 (N_2=123) και Μελέτη 3 (N_3=28) σχεδιάστηκε και ελέγχθηκε πειραματικά η προσέγγιση/παρέμβαση για την Αυτο-Ρυθμιζόμενη Μάθηση βασισμένη στον Ηλεκτρονικό Φάκελο (Στάδιο Προτυποποίησης- $2^η$ και $3^η$ Επανάληψη). Στο τελικό στάδιο της αξιολόγησης, τα αποτελέσματα των τριών μελετών (Μελέτη 1, 2 και 3) παρείχαν σημαντικά ευρήματα για αναστοχασμό και μελλοντικές ερευνητικές προτάσεις.

Τα ποιοτικά και ποσοτικά αποτελέσματα αναλύθηκαν (μικτή ερευνητική στρατηγική και τριγωνοποίηση) και καταδεικνύουν ότι: Η υλοποίηση της προσέγγισης/παρέμβασης για την Αυτο-Ρυθμιζόμενη Μάθηση βασισμένη στον Ηλεκτρονικό Φάκελο και το σύστημα επηρέασαν θετικά την Αυτο-ρυθμιζόμενη μάθηση των εκπαιδευομένων. Οι εκπαιδευόμενοι αξιοποίησαν μία μεγάλη κλίμακα διαδικασιών αυτο-ρύθμισης όπως τοποθέτηση στόχων, κίνητρα, εσωτερικός και εξωτερικός προσανατολισμός κινήτρων, αξία τη δραστηριότητας, αυτο-αποτελεσματικότητα, στρατηγικές μάθησης, διαχείριση χρόνου, συνεργατική μάθηση, απόκτηση βοήθειας, τα οποία βελτίωσαν μετά τη συμμετοχή στην παρέμβαση και την πρακτική αξιοποίηση τους κατά την ακαδημαϊκή μελέτη. Επιπρόσθετα, η προσέγγιση/παρέμβαση για την Αυτο-Ρυθμιζόμενη Μάθηση βασισμένη στον Ηλεκτρονικό Φάκελο είχε θετική επίδραση στην ακαδημαϊκή επίδοση. Το επίπεδο συμφωνίας μεταξύ των τεσσάρων πηγών αξιολόγησης (εκπαιδευόμενοι, συν-εκπαιδευόμενοι, εκπαιδευτής και εξωτερικοί αξιολογητές), όπου ανεξάρτητα αποτίμησαν τα κριτήρια του εργαλείου (ο στόχος του ηλεκτρονικού φακέλου, τα τεχνουργήματα, ο αναστοχασμός στην πράξη και η ευχρηστία του ηλεκτρονικού φακέλου) ήταν υψηλό και ως εκ τούτου θεωρούνται αξιόπιστα. Επίσης, η συνοχή μεταξύ των κριτηρίων του Ηλεκτρονικού Φακέλου είναι υψηλή και έτσι κάθε κριτήριο αποτελεί έναν σημαντικό παράγοντα αποτίμησης της επίδοσης. Επίσης, η προσέγγιση/παρέμβαση για την Αυτο-Ρυθμιζόμενη Μάθηση βασισμένη στον Ηλεκτρονικό Φάκελο στην τριτοβάθμια εκπαίδευση υποστήριξε κατάλληλα τους εκπαιδευόμενους ώστε να αξιοποιήσουν και να χρησιμοποιήσουν πρακτικά τις διαδικασίες της αυτο-ρυθμιζόμενης μάθησης. Οι εκπαιδευόμενοι αποτίμησαν την παρέμβαση και συμφώνησαν ότι ο σχεδιασμός του Ηλεκτρονικού φακέλου υποστήριξε κατάλληλα την αυτο-ρυθμιζόμενη μάθηση όπου και φαίνεται να ενισχύθηκε κατά την εξέλιξη των τριών φάσεων της διαδικασία (1-προετοιμασία, 2-σχεδιασμός και έλεγχος, 3-αυτο-αναστοχασμός).

Εν κατακλείδι, τα ευρήματα της παρούσας διδακτορικής διατριβής ενισχύουν την τρέχουσα βιβλιογραφία, καθώς επισημαίνουν τους τρόπους με τους οποίους μπορεί να σχεδιασθεί ένα εννοιολογικό πλαίσιο βασισμένο στην Αυτο-ρυθμιζόμενη Μάθηση (με έμφαση σε γνωστικές, συναισθηματικές, συμπεριφορικές και κοινωνικές διαδικασίες) για τη ανάπτυξη Ηλεκτρονικών φακέλων μάθησης στην Τριτοβάθμια Εκπαίδευση και τη διαμόρφωση μίας ροής εργασίας που μπορεί να υποστηρίξει τα άτομα να αρχικοποιήσουν τις δεξιότητες Αυτο-ρυθμιζόμενης μάθησης και να διαχειριστούν το μονοπάτι της μάθησης τους. Επιπροσθέτως, η διδακτορική διατριβή συνεισφέρει στο πεδίο του Σχεδιασμού Ατομικής Ανάπτυξης, της ευεξίας και ευημερίας των ατόμων μέσω πολύτιμων ευρημάτων και προτάσεων σχετικά με την επίδραση της παρέμβασης στην αυτο-ρυθμιζόμενη μάθηση και την ακαδημαϊκή επίδοση. Τέλος, παρέχονται θεωρητικές και πρακτικές μελλοντικές προτάσεις για (μεγάλες- και μικρο-μεσαίες δράσεις) στην ακαδημαϊκή κοινότητα, στους εκπαιδευτικούς, στους σχεδιαστές εκπαιδευτικού υλικού, στους υπεύθυνους εκπαιδευτικών συστημάτων, στους σχεδιαστές ψηφιακού υλικού, στους διαχειριστές έργων και στους υπεύθυνους διαχείρισης προσωπικού.

Keywords

Self-Regulated Learning (SRL); SRL Models; SRL Assessment; Microanalytic Protocols; SRL Processes; Cognitive Processes; Affective Processes; Behavior processes; Context Processes; Goal Setting; Motivation; Goal Orientation; Self-efficacy; Learning Strategies; Time Management; Peer Learning; Help Seeking; ePortfolio; ePortfolio assessment; ePortfolio Systems; Social Network System; Social Media; Reflection; Academic Achievement; Higher Education; Undergraduate Students; Postgraduate Students; Academic Performance; Assessment; Intervention; Satisfaction.

List of Publications

The results of this research appeared in the following publications:

International Journals with Citation Index /Impact Factor

1. Alexiou, A., & Paraskeva, F. (accepted for publication). Being a student in the social media era: Exploring educational affordances of an ePortfolio for managing academic performance. International Journal of Information and Learning Technology.
2. Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192. https://doi.org/10.1504/IJLT.2019.101849
3. Souki, A. M., Paraskeva, F., Alexiou, A., & Papanikolaou, K. A. (2015). Developing personalised e-courses: tailoring students' learning preferences to a model of self-regulated learning. International Journal of Learning Technology, 10(3), 188-202. https://doi.org/10.1504/IJLT.2015.072357
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5. Paraskeva, F., Neofotistou, E., Alafouzou, A., Alexiou, A. (2019). Exploring the Educational Affordances of an Academic Eportfolio for Engineer Students Through a Self-Regulated Learning Framework. In *13th International Conference on Interactive Mobile Communication, Technologies and Learning*, IMCL 2019, Thessaloniki, Greece, 31 October – 1 November 2019. ***Best Poster award***
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Chapter 1: Introduction

1.1 Motivation and Problem Statement

In the age of artificial intelligence, production automation, globalization and changes in work models, Higher Education (HE) should equip future graduates with a set of competencies related to sustainable development. HE and organizations should focus on the sustainability of the ecological, economic and social environment (Jelonek and Urbaniec, 2019). Specifically, educational providers should put emphasis on developing skills and attitudes that focus on the well-being of individuals (Di Fabio, 2017). Well-being (physical, psychological, social and cognitive), can be seen as a desired result for individuals (students, professionals, citizens) that allow them to maintain a positive emotional state, enjoy working, manage their actions and achieve goals (Fraillon, 2004).

In parallel, empirical evidence notes that the new landscape of skills and the penetration of social media in academic life seem to challenge well-being, HE environments and academic success (Abbott-Chapman, 2011; Lau, 2017). The ubiquitous presence of technology and the uptake of social media promoting youth's culture who can learn at high-speed, multitask, process visual dynamic information, make random connections and learn new skills, hold a prominent place. Probing deeper into the issue, empirical studies examined the effects of social media on student academic performance and indicated multiple positive, neutral, or negative outcomes (Cheston, Flickinger, & Chisolm, 2013; Glogocheski, 2015; Lau, 2017). In particular, researchers explain that the usage of social media applications for non-academic purposes has negative effects on academic performance (Ravizza et al., 2014; Lau, 2017). Students use these media for discussing, sharing and searching, which are important learning trajectories but the entertainment and social functionalities of the tools distract and have a negative influence on learners' behavior (Tang, Yau, Wong, & Wong, 2015). This means, that various issues about learners' psychological functioning, well-being and academic achievement arise and need investigation, such as 'To what extent social media affect individuals' well-being?' and 'In what ways HE may employ social media affordances for helping students to excel in their studies?

It seems that the new social settings provide a plethora of opportunities for students to multitask in order to complete their activities but they create many obstacles for a successful academic life. Attempting to provide high-quality services and ensuring sustainable development, HE in the USA (Hacker & Dreifus, 2010), Australia (Coady, 2000), the United Kingdom (Hussey & Smith, 2009) and other countries has become a high-cost provider but with mediocre outcomes (e.g. high-dropout rates) (Reeves, McKenney, Herrington, 2010). Further, it is observed that the problem of declining achievement is evident in HE (Bok, 2009). This means that, students fail to use proactively their knowledge and skills so as to advance their academic achievement (Zimmerman, 1986). Also, low achievement may uncover limitations on cognitive, affective, behavioral and social processes of learning (Zimmerman, 1986; Zimmerman & Schunk, 2001). There are several examples of students who cannot find a balance between their academic and their social life, thus they fail to follow a smooth transition into HE (Postareff et al., 2017). Consequently, as students attempt to find the perfect fit between choices and their expectations they often find it difficult to manage their learning path (Azevedo et al., 2012). Research unveils that learners fail to set measurable goals, organize their academic activities, use a set of learning strategies and follow a non-structured class time (Hawkins et al. 2005; Huie, Winsler & Kitsantas, 2014). Considering these facts, a new question was recognized: '*How can HE use social media affordances to help students to manage their learning path and elevate their academic achievement?'.*

Research shows that a high level of well-being is positively related to academic achievement which in turn affects motivation, engagement and commitment (Noble et al., 2008). Towards this, it is noted that Self-Regulated Learning (SRL) can be seen as a learning theory that can be a vehicle for promoting learner's well-being (Noble et al., 2008). SRL is an active, constructive process whereby learners set goals for their learning and then attempt to plan, monitor, regulate, and control their cognition, motivation, and behavior (Pintrich, 2000; Zimmerman, 2001). In other words, an essential competence for a successful 21st century learner, is SRL (Panadero, Tapia & Huertas, 2012). Research findings suggest that SRL can be an important factor for accomplishing high achievements, advancing performance (Bandura, 1986; Pintrich & de Groot, 1990; Yang & Whang, 2002; Zimmerman, 1989; Torenbeek, Jansen & Suhre, 2013), adopting a healthy and fulfilling life (Yang & Whang, 2002) and managing life aspirations (Lee, 2012). Towards this, SRL is conceived as a sound conceptual framework that helps learners to set their goal, engage in strategic planning, self-monitor and as a consequence to contribute to high levels of well-being (Kindekens et al.,2014).

Recent studies acknowledge that there are different factors that contribute to academic achievement and success (Ning & Downing, 2015). In particular, studies demonstrate positive relationships among academic achievement and students' time investment (Torenbeek, Jansen & Hofman, 2010), motivation (Wolters, 2003), metacognitive processes (Winne, 1996), learning strategies (Malmberg et al., 2010) and self-discipline (Komarraju, Karau & Schmeck, 2009). The above facts imply that there is a need of thorough investigation among the interrelationships of learning environment, self-regulated learning, and academic achievement. When designing the learning environment, it is important to explore the predictors that contribute to high academic achievement. Thus, research should explore the predictors that ensure that learners can be motivated, use strategies effectively and manage their learning. Also, it should be examined how these predictors can positively affect students' academic achievement.

It is obvious, then, that the need for intervention programs supporting learners to uncover their misunderstandings and deficiencies in existing study tactics is pressing (Bidjerano and Dai, 2007). These programs may help individuals to manage their learning tasks, organize their schedule and nurture the skills that could turn them into successful students and candidates for future job openings. Further, the design of dynamic intervention programs that guide learners to self-monitor, enhance their metacognitive skills, promote their technological literacy and elevate academic performance is highly needed (Bowman, Waite, and Levine, 2015).

1.2 State of the Art

In these constantly changing conditions, HE should focus on providing dynamic interventions not only for strengthening students' basic study skills, but also for establishing a set of life competencies that promote well-being (e.g. Self-Regulated Learning).

SRL competency has impact on academic performance, well-being and lifelong learning but constitutes an uncharted area for the majority of HE students (Weinstein, Acee, Jung, 2011; Richardson et al.,2012; Ifenthaler, 2012). This means that research should explore the potential of designing effective interventions that encourage the use of SRL strategies through Technology-Enhanced Learning Environments (TELEs) (Alharbi, Paul, Henskens and Hannaford, 2011). Empirical evidence points out that TELEs such as: ePortfolios, blogs, wikis, virtual learning environments, personal learning environments, web 2.0, social media, intelligent tutoring systems have a rich potential for cultivating SRL (Carneiro, Steffens & Underwood, 2005; Bartolomé and Steffens, 2011). There exist various methods of SRL analysis that use students' perceptions (interviews and self-reports) or features from the systems but, unfortunately these TELEs cannot investigate directly the practice of SRL (Torrano Montalvo & González Torres, 2004; Steffens, 2006). Also, a few studies emphasize on the design and implementation of a dynamic TELE that takes into consideration different SRL processes and evaluate whether it really promotes SRL skills (Delfino et al., 2008)

Among TELEs, ePortfolio can be seen as a powerful tool that becomes popular in education (JISC, 2008; AeP, 2010). Thus, an ePortfolio system can be perceived as a TELE that is capable of supporting learners to acquire and present knowledge, skills and access to digital resources and tools, with the help of tutors and/or peers. Research indicates that ePortfolios have great potential for learning and can be effective assessment tools (Barbera, 2009; Wang and Wang, 2009; Chang & Tseng, 2011). By using these tools, learners find an effective way to document, showcase and review their learning (Tzeng & Chen, 2012). Also, they significantly facilitate various aspects of knowledge management performance such as knowledge sharing, innovation, acquisition, application, and accumulation (Chang, Tseng, Liang and Chen 2013; Chang, Chou and Liang, 2018). Further, learners have the opportunity to participate in personal development planning (PDP) (Joyes et al., 2010) through the ePortfolio and foster self-directed learning (Beckers, Dolmans and Van Merriënboer, 2016; Rezgui, Mhiri, Ghedira, 2017). In other words, this tool doesn't represent a simple repository of artifacts or accomplishments but a holistic learning approach that is known as ePortfolio-based learning approach or ePortfolio-mediated learning. The ePortfolio-based learning approach supports learners to collect learning artifacts, to monitor and evaluate their performance through a learning environment (Nguyen & Ikeda, 2015; Chang, Chou and Liang, 2018).

A question derived from the above statements is 'In what ways may interventions employ ePortfolio affordances for supporting learners to cultivate and practice SRL skills?

Acknowledging the fact that ePortfolios can enhance an individual's ability to learn in a self-regulated way and promote the development of both hard and soft skills (Wade, Abrami & Sclater, 2005; Alexiou and Paraskeva, 2010; 2019), the design of an ePortfolio intervention (as a dynamic TELE) for establishing SRL skills and measuring the interconnections among SRL process, academic achievement and the system is recommended. This research seeks to contribute to the field of Personal Development Planning (PDP) by investigating the effect of the ePortfolio intervention on SRL and academic performance.

In other words, this study envisions to examine a set of affordances that can be seen as predictors of academic achievement and SRL practice throughout an ePortfolio intervention. Based on recent findings, our research focuses on ePortfolio experience, Self-Regulated Learning, academic achievement and their interrelations that need further exploration (**Figure 1**):

- *ePortfolio experience is related to Self-Regulated Learning (SRL)*

The design and implementation of ePortfolios have been applied in several disciplines such as education, business, arts, economics, politics, arts, healthcare and so on (Güzeller, 2012). ePortfolios are considered to be important tools in Higher Education (HE), for they promote the delivery of goals as a sequential process and boost student-centered and integrated learning (Clark & Eynon, 2009; Snider and McCarthy, 2012). These systems contribute to learners' academic development and can be related to SRL (Lai & Hwang, 2016). Cheng and Chau (2013) suggest that cognitive strategies (elaboration, organization, critical thinking), metacognitive control strategies and collaborative strategies (peer learning) may contribute to an effective ePortfolio development. This means that ePortfolio systems can positively impact students' desire to learn and enhance the use of learning strategies (Meyer et al., 2010). Empirical evidence suggests that when students use an ePortfolio they may have opportunities to foster SRL and they can be intrinsically motivated so as to set measurable learning goals, utilize a repertoire of learning strategies, modify their strategies, engage in monitoring processes, assess their goals and regulate their learning efforts (Zimmerman & Schunk, 2008; Welsh, 2012).

However, despite a growing body of research highlighting the beneficial role of SRL across educational settings, little is known about the relationship between students' SRL ability and their achievement in electronic portfolio (ePortfolio) (Chang & Tseng, 2011). Recent studies note that there is a need for training learners with appropriate Self-Regulated Learning (SRL) strategies so as to enable them to display high levels of self-regulation within the context of ePortfolios (Abrami et al., 2007). Also, research should explore the effects of SRL strategy training on ePortfolio development (Cheng & Chau, 2013). Further research on ePortfolios should, therefore, design interventions for cultivating the attitudes for practicing self-regulated and lifelong learning (Welsh, 2012).

Such being the case, future research could stimulate dialogue in exploring the nature and role of SRL in ePortfolio pedagogy. Also, it should delve deeper into the effects of self-regulation on ePortfolio interventions.

- *ePortfolio experience is related to Academic Achievement*

EPortfolio systems can be seen as constructive environments that cultivate learning and encourage learners to become self-regulated and autonomous. Further, an ePortfolio is perceived as an alternative form of assessment that encourages learners to engage in an authentic and learner centered process and examine knowledge and skills (Sweat-Guy & Buzzetto-More, 2007).

In teaching education, ePortfolios can serve to measure achievement for practicum work and to foster reflection on teaching (Smith & Tillema, 2003). In medical education, students are able to formulate their own learning objectives, focus on what they need to learn, gain awareness of their learning styles, learn how to integrate information from different sources, gain confidence in what they are learning and obtain a sense of achievement (Grant et al., 2006). In nursing education, ePortfolios attest to achievement and personal professional development by providing critical analysis of its contents (Scholes et al., 2004; Butler, 2006).

It is noteworthy that ePortfolio-based assessment is pivotal in boosting learner's skills for peer assessment, motivation, self-reflection and self-reviewing (Chang and Tseng, 2009). Research findings indicated that the effect of Web-based portfolio assessment system on the performance of senior high school students that engaged in project-based learning activities, had a statistically positive effect on self-perceived learning performance (Chang & Tseng, 2011). However, it is argued that ePortfolios constitute an open research problem as far as the issues of affecting students' achievement and elevating peer assessment ability are concerned (Jimoyiannis, 2012). Also, the relationship between ePortfolio participation and academic success is examined. The results showed that students with ePortfolio artifacts had significantly higher-grade point averages, credit hours earned, and retention rates than a matched set of students without ePortfolio artifacts (Knight, Hakel & Gromko, 2008; Chang et al, 2015). Further research should consider the authenticity of ePortfolio assessment that can be altered according to various issues, such as reliability, validity, time management, rubrics criteria, student's abilities (Chang, & Tseng, 2009). Also, the investigation of the manner in which ePortfolios impact student learning and acquisition is proposed (Welsh, 2012).

All in all, there is a need of integrating quality ePortfolio implementations into the teaching practice and exploring effective ways of improving the ePortfolio process (Morales, Soler-Domínguez & Tarkovska, 2016).

- *Self-Regulated Learning (SRL) is related to Academic Achievement*

Different theoretical paradigms and methodologies consider SRL as an inherent trait or aptitude, while others as an event that follows a dynamic process (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman & Schunk, 2001; Moos and Stewart, 2013). The latter research points that SRL is detailed knowledge of a skill that involves specific cognitive, affective, behavioral and contextual processes that can be adapted to different learning tasks (Zimmerman, 2013). In other words, SRL can be seen as a multidimensional entity that consists of functional layers that empower different aspects of human learning. The functional layers constitute multiple cognitive processes, affective factors, aptitudes, beliefs and 21st century skills (flexibility, collaboration, creativity).

Research findings suggest that SRL can be seen as an important predictor that ensures high achievements and advancing performance (Zimmerman, 1989; Torenbeek, Jansen & Suhre, 2012). Various studies indicate that there are positive correlations among academic achievement and students' time investment, motivation and self-discipline (Torenbeek, Jansen & Hofman, 2010; Komarraju, Karau & Schmeck, 2009; Tangney, Baumeister & Boone, 2004). This means that there exist a number of SRL processes that contribute to academic achievement and success (Ning & Downing, 2015).

Towards this, further research needs to emphasize mixed methods studies as well as complementary measures for activating and assessing SRL as an aptitude as well as an event

(Azevedo, 2005; Greene & Azevedo, 2010; Veenman, 2007; Zimmerman, 2008). The need for intervention and assessment processes in order to shed further light on SRL effects on academic performance along the context of the study (Kramarski and Michalsky, 2013) is well established. To sum up, future research should consider the potential of SRL as a dynamic pedagogical and instructional design solution where there is a need for monitoring learner's experience, assessing learning, providing feedback and supporting online self-regulated learning skills (Korkmaz & Kaya, 2012; Ning & Downing, 2015).

All in all, researchers agree that a significant predictor of academic achievement is the quality of student's SRL processes in TELEs (Winters, Greene and Costich, 2008; Azevedo 2005). If learners have the opportunity to enhance their SRL processes, then they will be able to attain better grades and improve their performance (Schunk, 2005).

To facilitate SRL processes, learning environments should incorporate SRL (as dynamic series of events) activities and strategies for supporting learners. The figure below is a synthesis of the SRL processes used as predictors of academic achievement, as found in a large body of research (**Figure 1**).

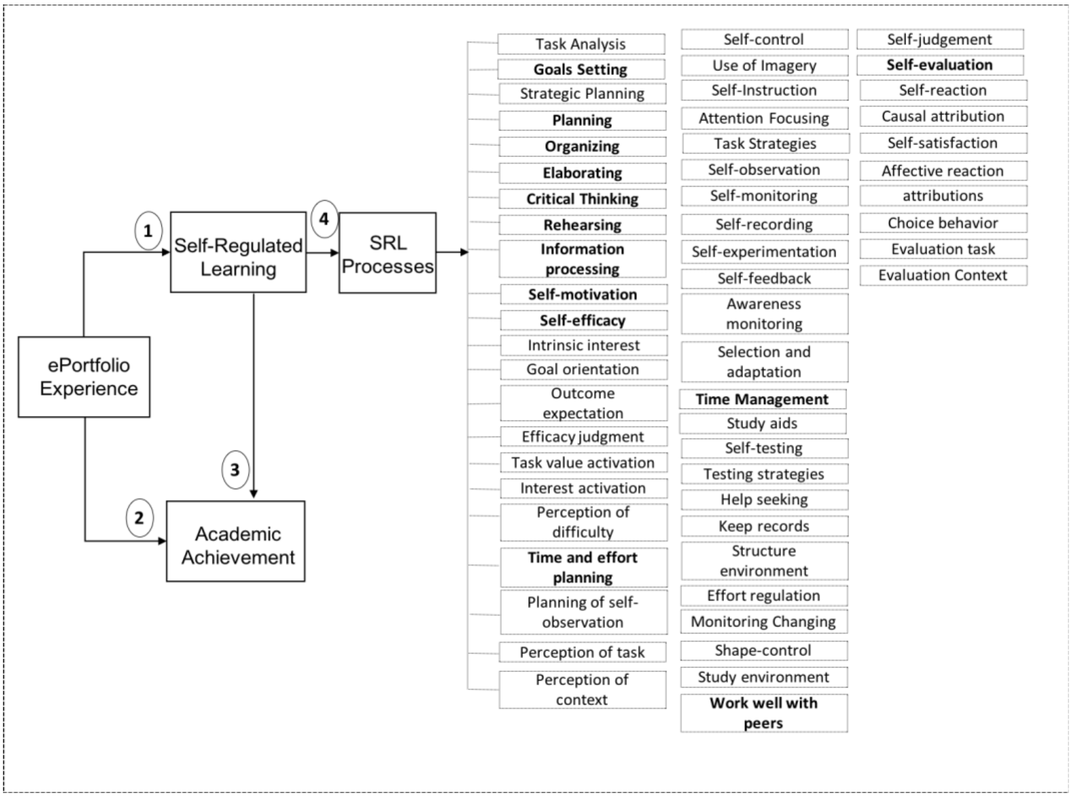

Figure 1. Illustration of SRL processes as predictors of academic achievement throughout an ePortfolio intervention

Towards this, there has been a large body of research presenting various SRL processes that have been used in educational interventions, such as:

- goal setting, time management, planning, behavioral self-motivation, cognitive self-motivation, concentration (Winne et al., 2006)
- goal setting, self-monitoring, self-reflection processes (Cleary and Zimmerman, 2004)
- goal setting (Winne & Hadwin, 1998),
- planning (Zimmerman, 2004),
- motivation (Corno, 1993; Wolters, 2003; Zimmerman, 2004),
- learning strategies (van de Broek, Lorch, Linderholm, & Gustafson, 2001; Winne, 1995),
- goal-setting, strategic planning, self-observation, self-evaluation, attributions (DiBenedetto and Zimmerman, 2013)

Research supports the idea of capturing and modeling the dynamic nature of SRL by selecting particular SRL processes from each phase of the cyclical model (DiBenedetto and Zimmerman, 2013). Also, for measuring SRL both as an aptitude and event, researchers should focus on SRL processes that are adequately represented on the intervention and can be captured when they are enacted (Cleary, Callan, Zimmerman, 2012)

*From all the above it seems that the design and implementation of an ePortfolio intervention that promote educational affordances based on SRL is a challenging idea. Specifically, the articulation of SRL processes such as goal setting, motivation, self-efficacy, learning strategies, time management, peer learning, help seeking and self-reflection to learner's mindset may contribute to academic achievement and success (***Figure 2***).*

- ePortfolio experience is related to cognitive SRL process: Goal setting

Task Analysis is a cognitive process that involves two key forms: goal setting and strategic planning. During goal setting an individual decides about the outcomes of learning or performance (Locke & Latham, 1990). Setting goals can be seen as an important process of self-regulation, that affects motivation, self-efficacy beliefs and learning (Kozlowski and Bell, 2006).

Studies in goal setting explore several issues regarding the number of goals that affect human behavior (Zhang et al., 2007), transformation of performance when goals increased, modification on certain goals based on individual's preferences (Lee, 2012). The ALTC-funded Australian ePortfolio Project (AeP) found a high level of interest in the use of ePortfolios in HE as a means of enhancing student's experience through meaningful engagement with the educational experience (Hallam et al., 2010; von Konsky & Oliver, 2012). Another research identified that when students have strong performance approach goals, they feel more enjoyment using ePortfolios as this platform can be seen as a social network for showcasing academic achievement, their creativity and interests (Huang, Yang, Chiang, & Tzeng, 2012).

Further research should emphasize the adoption of goal-setting mechanisms in ePortfolio systems to support SRL skills (Chang, Tseng, Liang & Liao, 2013). This can be achieved by enabling feedback mechanisms and diary tools that can boost performance (Arsal, 2010; Wang, 2011). Also, there is a lack of relevant studies about the environments that can facilitate the process of setting goals and attribute specific aspects (importance, proximity and difficulty) (Lee, 2012).

- ePortfolio experience is related to affective SRL process: Motivation

Motivation is an affective SRL process that is connected to an individual's desire to work towards a learning goal. Individuals that are activated toward a specific action are considered motivated (Ryan and Deci, 2000). Specifically, academic motivation is connected to learner's actions to engage in learning activities (Artino & Stephens, 2009). Various studies indicated that there are multiple effects of motivation on academic achievement (Eccles & Wigfield, 2002; Vermeulen & Schmidt, 2008; Torenbeek, Jansen & Suhre, 2013). Unfortunately, research has demonstrated that motivation influences SRL but regulation is still considered to be the teacher's responsibility (Kistner et al., 2010; De Corte, et al., 2011). Furthermore, empirical evidence indicates that there are various factors (specific goals, organized workload, advancement of skills, authentic assessment) that affect learner's motivation and SRL which in turn influence academic performance (Ning & Downing, 2012). Also, findings suggest that there are positive correlations between ePortfolios and motivation (Abrami & Barrett, 2005; Lopez-Fernandez & Rodriguez-Illera, 2009, Huang, Yang, Chiang & Tzeng, 2012).There is a need of designing learning environments (such as ePortfolios) that develop students' mindset in terms of identifying the effort to be exerted on a task, how long they will persevere when faced with difficulties, and how resilient they should be once confronted with adverse situations (Wolters, Pintrich and Karabenick, 2005). This means that ePortfolios should be designed that will help educators and instructional designers utilize methods to support their students in using SRL strategies and motivation. Further research should shed light on motivation as a predictor of achievement from the first years of university academic life (Torenbeek et al., 2012)

- ePortfolio experience is related to affective SRL process: Self-Efficacy

Self-efficacy is an affective SRL process that refers to the beliefs or thoughts about an individual's personal capacity to learn or perform effectively (Bandura, 1977). Researchers agree that self-efficacy influences learning and motivation (Pajares, 2006; Schunk, 2003). Also, self-efficacy can be an important predictor of learner's choice of activities, efforts and actions (Bandura, 1977; Pajares, 1996; Zimmerman, 1989). Specifically, perceived self-efficacy represents personal judgement of capability to do the task and presents control over the individual's learning effort (Pintrich, 1991). Self-efficacy can be developed through enactive mastery experiences, vicarious

experiences, persuasive peer feedback and psychological functions (van Dinther, Dochy & Segers, 2011). This means that people can modify their thinking and feeling by controlling their self-efficacy beliefs which in turn influence various processes such as goal setting (Zimmerman & Bandura, 1994), learning strategies (Zimmerman, Bandura, & Martinez-Pons, 1992), time management (Britton & Tessor, 1991), self-monitoring (Bouffard-Bouchard, Parent & Larivee, 1991) and self-evaluation (Zimmerman & Bandura, 1994).
Furthermore, it is observed that self-efficacy as a significant predictor of academic performance may affect SRL during training (Wilson & Narayan, 2016). Future research should adopt web-based learning practices (such as ePortfolios) that will engage learners into authentic learning activities and support them to define, address and stimulate self-efficacy beliefs (Puzziferro, 2008; van Dinther, Dochy & Segers, 2011)

- ePortfolio experience is related to behavior SRL process: Time Management

Time Management is a behavioral SRL process that refers to the ability to organize your time and allocate your workload (Effeney, Carroll, & Bahr, 2013). Time management is an important process where individuals engage in tasks for constructing personal schedules for studying, allocating their efforts and workload as well as organizing their time (McKeachie, Pintrich & Lin, 1985). Findings highlight that effective time management is related to academic achievement in HE (Kitsantas, Winsler & Huie 2008; Torenbeek, Jansen & Suhre, 2012). Time management strategies are crucial constructs of SRL and need further investigation (Daloglu & Vural, 2013). It is stated that learners should follow time management tasks in order to plan and regulate their studies (Pintrich and Ruohotie, 2000). Time management promotes certain tasks, such as scheduling their short or long-term studies, selecting the appropriate activities and controlling their effort. Also, time management is part of the resource management strategies (Pintrich, 2000). Students should, therefore, be engaged in life designing and building processes that help them acquire skills (e.g time management) and knowledge they value throughout their academic and career development and that encourage them to apply and manage such knowledge (Daloglu & Vural, 2013). It is also suggested that training in time planning and management may support learners to use their study time more effectively and enhance their time management skills. To take it a step further, the need to examine how time management, as an indicator of behavioral control, can be positively influenced through the implementation of a well-designed learning experience like ePortfolios should be well-catered for.

- ePortfolio experience is related to behavior SRL process: Learning Strategies

Learning strategies encompass a set of actions such as cognition, metacognition, motivation, affect, and behavior that engage learners into meaningful activities and support them to advance their performance (Boekaerts, Pintrich, and Zeidner, 2000; Pintrich, 2000; Schunk and Zimmerman, 2007; Zimmerman, 2000; Weinstein, Acee, Jung, 2011). Researchers found that there are meaningful positive associations between the choice and application of learning strategies and academic achievement (Pintrich & De Groot, 1990; Arsal, 2010). Also, there is strong relation among motivation, learning strategies and academic success (Korkmaz & Kaya, 2012). Towards this, the design of learning experiences is proposed that encompasses accurate goals, promote skills development and cultivate learning strategies for affecting self-regulation and academic performance (Ning & Downing, 2012).

Future research should focus on designing a framework of learning strategies that can be embedded in a learning system to promote the components of self-regulation (Pintrich, 2000; Ge, 2013). This means that ePortfolios as a web-based environment can be seen as a vehicle for providing an opportunity to learners and instructors to develop their SRL, accelerate their performance and experience success (Wang, Shannon & Ross 2013). There is a need for empirical studies that investigate the relations between SRL strategies and ePortfolio achievement in HE (Cheng & Chau, 2013).

- ePortfolio experience is related to context SRL process: Peer Learning

Peer learning is a behavioral SRL process that can be described as collaborating with others to aid one's learning (Effeney et al., 2013). Learners can collaborate with their peers in order to elevate their learning. Peers can be seen as a source of knowledge and interaction. However, activities in computer supported collaborative learning environments based on open-ended problems, have little structure, are complex, have several learning paths that lead to different correct answers (De Jong et al., 2005; Saab, 2012). Thus, more studies should investigate the relationship between SRL processes and their social context (Boekaerts, 2002).

Future research could, then, focus on studying individuals’ SRL actions in authentic learning situations (Muis, 2008), such as collaborative learning groups (Järvelä & Järvenojä, 2011) and collaborative activities in classrooms (Grau & Whitebread, 2012) so as to explore how SRL actions may be socially as well as individually oriented (Shi, Frederiksen & Muis, 2013). Furthermore, time and order in social self-regulated learning processes need to be investigated (Greene & Azevedo, 2010; Winne, 2010).

- ePortfolio experience is related to context SRL process: Help Seeking

Help seeking is a behavioral SRL process that refers to the ability to request assistance from peers, tutors or knowledgeable others (Ryan and Pintrich, 1997). It can be seen as a strategic achievement behavior. For example, one learner that participates in an online course can request help and ask for clarifications on the learning content (Richardson et al., 2012). It is noted that help seeking is a bridge that connects social and affective constructs (Karabenick, & Knapp, 1988). Research argues that learners should advance their help seeking ability. This means that when an individual finds it difficult to understand the material and feels confused and disorientated should seek assistance from a knowledgeable other (Boekaerts, Pintrich & Zeidner, 2000). Further research should investigate the relation between help seeking and online achievement (Broadbent & Poon, 2015)

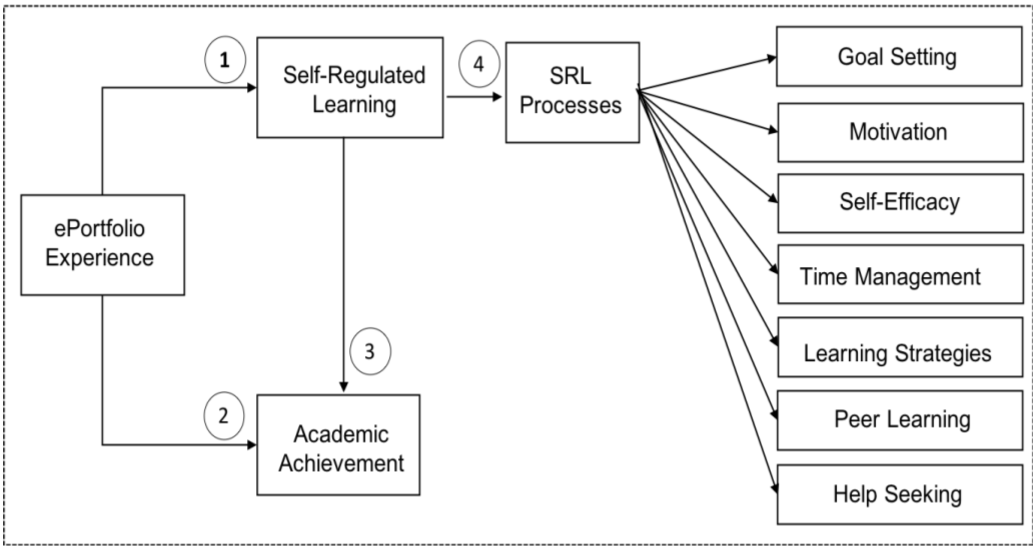

Figure 2. A set of affordances that can be seen as predictors of academic achievement and SRL practice throughout an ePortfolio intervention

A challenging issue is the design of effective environments and the delivery of dynamic interventions that promote SRL as a self-directive process where learners transform their mental abilities into academic skills. It is assumed that learners may engage in an ePortfolio intervention, follow a structured path, develop SRL processes and enhance their SRL capability. Along these lines, the implementation of an ePortfolio system as a vehicle for enabling learners to practice SRL processes, transform their behavior into measurable learning outcomes, foster their academic performance needs to be explored.

1.3 Purpose of the Study

The vision of this research is to support students in Higher Education (HE) acquire and apply Self-Regulated Learning (SRL) Competency in every day practice (academic and career orientation).

In practice, the concepts, competences, competencies and skills employed depend on the importance or the approach attributed to them or interchangeably with different definitions (Ananiadou & Claro, 2009; Voogt & Roblin, 2010). To define the concept of competence, nine distinct approaches can be followed, where competence can be treated as (Weinert, 1999): a general cognitive ability, a specialized cognitive ability, the competence-performance model, the modified competence-performance model, objective and subjective self-concepts, motivational activity tendencies, the action competence, the model of core-competencies, and as the concept of meta-competences. There is the behavioral approach (UK origins) that defines competence as the detailed description of a behavior that can be depicted as a measurable learning outcome (Norris,1991; Hager, Gonczi, & Athanasou, 1994). There is the generic approach that defines competence or competency (US origins) as the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context (Rychen and Salganik, 2003; McClelland,1973; Boyatzis & Boyatzis, 2008). Also, the term skill is defined as the ability to perform specific tasks and solve authentic problems (Cedefop, 2008). Showing consideration for the abovementioned approaches, we underline the need for Self-Regulated Learning (SRL) competency for a successful life and a well-functioning society. In this research, I will consider them as interchangeable concepts and put emphasis on SRL as a competency that can itself be learned within a favorable learning environment which corresponds to the vision of the proposed ePortfolio system.

The purpose of the present research is the design and delivery of a conceptual framework for the ePortfolio construction process based on a Self-Regulated Learning Model (ePortfolio-based Self-Regulated Learning (ePSRL) approach).

Secondly, the development of the ePortfolio system in a social networking engine is proposed in order to examine its effects on Self-Regulated Learning. This research delves deeper into the implementation of the ePSRL approach as an intervention program so as to enhance Self-Regulated Learning and support learners to manage their knowledge, skills and attitudes and develop their academic and career path.

Thirdly, the effect of the ePortfolio intervention on Self-Regulated Learning was explored in a set of three studies. Additionally, this research attempts to examine the relationships among cognitive, affective, behavioral and contextual processes (fundamental SRL constructs) when learners use ePortfolios. Towards this, the improvement of the ePortfolio's capacity for capturing self-regulated learning principles, practicing self-regulated learning cognitive, affective, behavior and context processes as well as measuring competencies is attempted.

Specifically, the following general research question is formulated: "*What is the effect of* ePortfolio intervention *on Self-regulated learning (SRL cognitive, affective, behavioral and contextual processes) and academic achievement*"?

1.4 Research Objectives and Questions

The basic objectives of this PhD were:

- To synthesize empirical knowledge about ePortfolios that can enhance Self-Regulated Learning skills in HE.
- To design a conceptual framework of SRL (cognitive, affective, behavioral and contextual processes) for ePortfolios in HE (ePortfolio based Self-Regulated Learning (ePSRL) approach).
- To tailor a workflow process that supports individuals to initiate SRL processes and manage their learning and performance path.
- To propose an ePortfolio solution to support students to promote and apply SRL skills in their academic and career development.
- To propose theoretical and practical implications for (large- and small-scale developments) faculty, educators, instructional designers, technology specialists, coaching managers, designers of training materials, project managers and human resource experts

The motivation of this research is to identify the challenges through the process of designing, implementing and evaluating an ePortfolio based Self-Regulated Learning (ePSRL) system within HE and to investigate the effects of Self-Regulated Learning (cognitive, affective, behavioral and contextual processes, as fundamental SRL constructs) on academic achievement.

The **Research Questions (RQs)** addressed in this research are as follows:

RQ1- *Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?*

- **RQ1.1-** Does the ePSRL intervention affect goal setting?
- **RQ1.2-** Does the ePSRL intervention affect self-efficacy?
- **RQ1.3-** Does the ePSRL intervention affect time management?
- **RQ1.4-** Does the ePSRL intervention affect learning strategies?

RQ2- *How does the ePortfolio intervention impact academic achievement?*

- **RQ2.1-** Are ePortfolio assessment results consistent among different evaluators (self- peer- instructor- external evaluator-) (i.e. inter-rater reliability)?
- **RQ2.2-** Are there significant differences among the four ePortfolio criteria/dimensions (i.e. ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics)

- **RQ2.3-** Are ePortfolio assessment scores appropriate to examine academic achievement? (i.e. the consistency between ePortfolio achievement scores and course grade)?
- **RQ 2.4-** How did students use the ePortfolio system:
   i. Which features did they use and why?
   ii. Which plugins did they use?
   iii. How many artifacts did they upload?
   iv. How much time did they devote to the ePortfolio system?
   v. How many messages did they send?
   vi. How many questions did they set?
   vii. Which tools did they use to structure a stand-alone ePortfolio?
- **RQ 2.5-** To what extent does the ePortfolio intervention contribute to learners' satisfaction*?*

***RQ3-** Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practise SRL processes?*

- **RQ3.1-** What are the students' perceptions of the ePortfolio-based Self-Regulated Learning (ePSRL) intervention about SRL processes?
- **RQ3.2-** Are there significant differences between low-achievers and high-achievers in terms of SRL processes?

1.5 Significance of the Study

During my PhD research, I primarily attempted to investigate the effect of ePortfolios in the Greek HE, because similar studies have not been conducted in the context of Greek tertiary education and there is a dearth of analogous studies worldwide. Therefore, this research contributes to the international body of knowledge concerning the design and implementation of ePortfolios in HE. Specifically, this research highlights the need for delivering an ePortfolio within HE and investigating the effects of Self-regulated learning (cognitive, affective, behavioral and contextual processes) and academic achievement. To this end, the major contributions of this study involve: First, this research provides a basis for understanding the need for realizing and conceptualizing the construction process of an ePortfolio in HE. This means that ePortfolios should be embedded into the curriculum of each HE institution with the support and collaboration of the academics, support staff and administrators. This study adds to the knowledge concerning the creation of a comprehensive model of SRL processes through the implementation of an ePortfolio by designing a conceptual framework of SRL (cognitive, affective, behavioral and contextual processes) for ePortfolios in HE.

Second, this study offers insights into students' SRL skills and ePortfolios' experiences. The empirical knowledge about ePortfolios that can enhance Self-Regulated Learning skills in HE tends to promote high quality learning experience and support academic and career development. Through this study, it is argued that the exploration of students' perceptions about their SRL skills and their correlations with their academic achievement through the ePortfolio implementation contributes to the uptake of elearning systems in organizations.

Finally, this research provides a student perspective on the ePorfolio, SRL skills and academic development. The outcomes may provide an empirical infrastructure so that wider ePortfolio implementations can be delivered so as to boost SRL skills and academic achievement. Furthermore, faculty, educators, instructional designers, technology specialists, coaching managers, designers of training materials, project managers and human resource experts may find valuable situated knowledge as well as an ePortfolio solution to support individuals (students and professionals) to promote and apply SRL skills in their academic and career development.

1.6 Methodology

Purpose is a desire for something in our own power, coupled with an investigation into its means.

ARISTOTLE, Nicomachean Ethics

From the ancient times to the modern world, human beings attempted to comprehend the world and discover the truth. As a researcher sailed around several beliefs about the world so as to cultivate my ontological mindset (realizing 'what' is real?), that may arise my epistemological assumptions (investigating 'how' we can know anything?), which inform the methodology (selecting 'methods' for conducting the research) that will give rise to methods employed for collecting data.

From Aristotle's formal logic contribution, to Rene Descartes's analytic method of thinking and Francis Bacon's inductive method of reasoning for the interpretation of nature, it is presented the need for describing the world through sensory experience, experiments and comparative analysis (positivist paradigm). Following the above considerations, the philosophical assumptions underlying this research come mainly from pragmatism. Pragmatism is derived from the Greek term "Pragma (πράγμα)" which means action (to do -πράττειν), from which the words 'practice' and 'practical' come. The pragmatic method of the classical pragmatists focuses on the research question or problem and examines 'what works' and what provides solutions to problems (Creswell, 2003; Mackenzie & Knipe, 2006).

According to the pragmatist philosopher John Dewey (1948; 1920 original, p. 132) "*in order to discover the meaning of the idea ask for its consequences*". Thus, pragmatism can be seen as a basis for research approaches intervening into the research process and not merely observing the process. Also, the notion of 'inter-subjectivity' follows which emphasizes the selected data collection methods, types of data, and data analysis so as to provide a deep insight into the research problem (Creswell, 2003; Mackenzie & Knipe, 2006). To this direction, it is justifiable that the methodological approach of pragmatism can be used in mixed method research (Parvaiz, Mufti & Wahab, 2016; Laughlin, 1995).

An attempt is made to use the mixed methods research as a methodology in order to analyze and understand the complex research problem, that needs more than one approach (Creswell & Plano Clark, 2011; Morse & Niehaus, 2009). The mixed method research is selected as it can combine quantitative and qualitative methods, explore the strengths from one research to offset methodological deficiencies in the other, generate quantitative and qualitative data for understanding the research problem and for allowing a great certainty in inferences, conclusions or statements (Caruth, 2013; Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2009; Ponce & Pagán-Maldonado, 2015).

The nature of this problem is multifaceted as it is attempted to delve deeper into the development and implementation of ePortfolios for enhancing Self-Regulated Learning skills. SRL encompasses a set of various cognitive, affective, behavior and context processes that cannot be addressed from the unique perspective of a quantitative or qualitative study. Thus, the complexity of the research variables guided me to select a research plan that involved quantitative and qualitative approaches to study in depth the same aspects of the research problem.

For the needs of the present research, I adopted quantitative and qualitative approaches simultaneously in the course of the study. Triangulation is a powerful way of demonstrating concurrent validity as I will attempt to bring the strengths and weaknesses of quantitative methods (large sample size, trends and generalization) with those of qualitative methods (small N, details) together (Patton, 1990; Campbell & Fiske, 1959). I placed emphasis on the convergent parallel design where the analysis and exploration of the research problem are mediated by the quantitative and qualitative approaches (Ponce & Pagán-Maldonado, 2015; Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2009) (**Figure *3***).

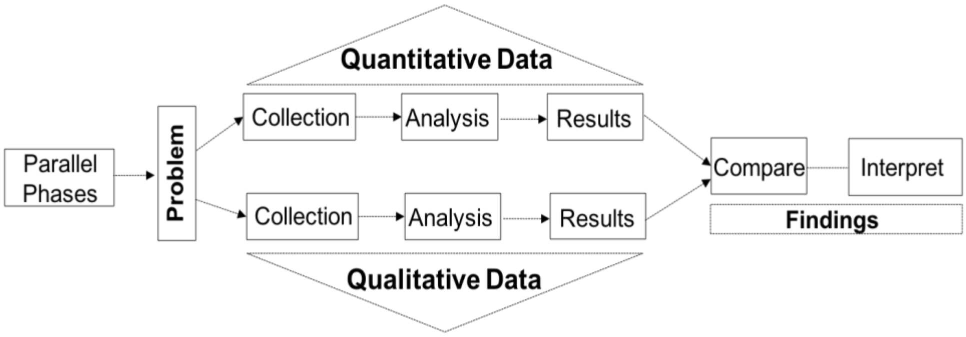

Figure 3. Triangulation design using parallel phases

Another important challenge is that when educational research is conducted in a controlled setting then the results cannot be representative (Brown, 1992). This means that should explore the potential of linking theory and practice as well as direct educational research around real-world problems (Brown, 1992; Collins, 1992; Amiel & Reeves, 2008). Towards this, it was selected an interesting research paradigm that delves deeper into complex authentic learning settings and is titled design-based research. An effort was made to follow the principles of design-based research in order to conduct my research as the latter meets the following requirements (Brown, 1992; Collins, 1992) (**Figure *4***):

- *Addresses a complex problem in an authentic context (Analysis)*
- *Integrates hypothetical design principles with technological affordances for providing effective solutions (Development)*
- *Conducts rigorous inquiry for testing learning environments and structuring design principles. (Refinement and Reflection)*

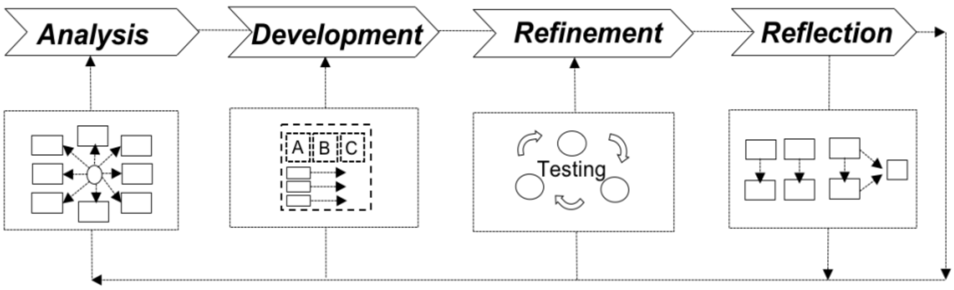

Figure 4. The process of design-based Research

Emerging design-based research is an approach for exploring educational problems, developing and designing artifacts, technological tools and furthering or developing new theories that can deliver a pedagogical outcome and support a learning environment (Wang & Hannafin, 2005; Barab et al., 2007). For conducting my PhD, I followed the three stages of design-based research (Plomp, 2007;2013; Amiel & Reeves, 2008):

Preliminary Stage: In this stage, a review of the current literature on ePortfolios, ePortfolio construction process, ePortfolio platforms, Self-Regulated Learning, Self-regulated learning models, self-regulated learning processes is undertaken (Chapter 2). Within the relevant chapter, I will expose the research problem and I will develop a conceptual framework for the study. Furthermore, my intention is to provide a verbal or visual 'construction' of knowledge that will provide a framework for depicting causal relationships between SRL factors and the ePortfolio system.

The vision is to deliver a dedicated conceptual model for:

- Creating a justification at a theoretical level**,** by indicating specific factors from the literature**,**
- Providing reasoning for SRL processes, academic achievement and ePortfolios**,** connecting research with research findings of others'
- Structuring a truthful representation of the problem being studied, by identifying relevant SRL processes and framing the problem,
- Providing connections among factors,
- Designing a system, by describing the elements, mapping the relationships among the elements and understanding their dynamic interactions.

Prototyping stage: In this stage, the designed solution (conceptual model) will be tested through a number of iterations. Each iteration can be viewed as a micro cycle where mixed-methods of data collection are used. For the needs of this research, three micro cycles are conducted as three stand-alone studies (Study 1-(Experimental Group), Study 2-(Experimental & Control Group), Study 3-(Experimental Group)) focused on various forms of data including questionnaires, rubrics, individual's reflections, log files, pre- and post-tests and student products (Barab & Squire, 2004; Ketelhut et al., 2010; Plomp, 2007) (Chapter 3 & 4). Thus, the combination of data collection strategies so as to gain a robust understanding of the model (Brown, 1992; Wang & Hannafin, 2005) is attempted.

Assessment Stage: In this stage, the delivery of findings of the research is attempted to provide reflections on the results and to conclude on how the outcomes correspond to the pre-determined specifications of solving the problem (Plomp, 2007). I also showed consideration for designing a set of recommendations for future studies as well as producing various design principles (Chapter 4, 5 and 6).

1.7 Operational Definitions

Academic achievement can be attributed to the attainment of skills and knowledge through high grades. Literature asserts that institutions may address the learned proficiency of individuals by collecting assessment grades, achievement tests and measures (McCoy et al., 2005)

Learning environment is referred to the pedagogical, psychological and social context where learning is occurring and targets learners' performance (Fraser, 2012).

Technology-Enhanced Learning Environment (TELE) is a broad approach to using Information and Communication technologies to support students acquire and present knowledge and skills, help tutors advance their teaching practice and provide access to digital resources and tools (Carneiro, Steffens & Underwood, 2005; Bartolomé and Steffens, 2011)

An electronic Portfolio (ePortfolio) is more than a digital collection of information but a holistic learning process where an individual may select, create, reflect upon and evaluate the content. They include accredited evidence for lifelong learning and skills in academic and professional contexts and can also be effective assessment tools (Chang & Tseng, 2011).

Competence or competency (US origins) as the ability to meet complex demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a particular context (Rychen and Salganik, 2003; McClelland,1973; Boyatzis & Boyatzis, 2008)

Skill is defined as the ability to perform specific tasks and solve authentic problems (Cedefop, 2008).

Intervention is an organized learning experience that provide individuals with the appropriate support for cultivating skills, enhancing knowledge and advancing performance (Lestrud, 2013)

Self-Regulated Learning is defined as an active, constructive process whereby learners set goals for their learning and then attempt to plan, monitor, regulate, and control their cognition, motivation, and behavior (Pintrich, 2000; Zimmerman, 2001).

Self-Regulated Learning Processes are a wide range of learning processes (cognitive, affective, behavior and context) that depict the areas of psychological functioning. SRL models embrace cognitive, affective, behavior and context processes that influence learning (Zimmerman, 1986; 1998; 2000; Pintrich, 1991)

Cognitive processes consist of actions for planning, organizing, self-instruction, self-monitoring and self-evaluation of learner's performance. During the SRL phases, learners should be able to adjust their cognitive states so as to apply SRL (Zimmerman, 1986; 1998; 2000; Pintrich, 1991).

Affective Processes consist of actions for planning, organizing, self-monitoring and self-evaluation of learner's affective state. During the SRL phases, learners should be able to adjust their affective states so as to apply SRL (Zimmerman, 1986; 1998; 2000; Pintrich, 1991).

Behavior processes consist of actions for self-observing and adjusting learner's behavior. During the SRL phases, learners should be able to adjust their behavior states so as to apply SRL (Zimmerman, 1986; 1998; 2000; Pintrich, 1991).

Context processes consist of actions for planning and managing the context of the learning setting. During the SRL phases, learners should be able to adjust their social states so as to apply SRL (Zimmerman, 1986; 1998; 2000; Pintrich, 1991).

Goal setting is a procedure during which an individual decides about the outcomes of learning or performance (Locke & Latham, 1990).

Self-motivation beliefs constitute the thoughts, beliefs and actions that learners perform during an activity. These beliefs can be developed consciously and intentionally for influencing their motivation (Boekaerts, 1996; Kuhl & Beckmann, 1985).

Extrinsic motivation for the task is related to extrinsic rewards or conducting positive activities and *intrinsic motivation* is related to personal interest and inner will (Kuhl, 1985; Wolters, 2003; Zimmerman and Martinez-Pons, 1986).

Self-efficacy beliefs are the thoughts about an individual's personal capacity to learn or perform effectively (Bandura, 1997).

Goal orientation emphasizes the purposes for doing a specific task (Pintrich, 2004). There are the mastery goals (mastery-approach and mastery-avoid goals) which focus on the actions for acquiring knowledge and skill based on prior performance and the performance goals (performance-approach and performance-avoid goals) which consist of the actions for demonstrating competence compared to peers (Elliot & Harackiewicz, 1996; Pintrich, 2000).

Learning Strategies can be employed by a learner for optimizing his/her learning experience and achievement. Strategies are processes and actions that have a specific purpose and direct learner's behavior for acquiring or applying a skill (Zimmerman, 1989). Learning strategies can be organized in the following categories: rehearsing, elaborating, organizing, information processing, critical thinking, planning, monitoring and regulating learning efforts (Pintrich et al., 1991, 1993).

Time management is an important process where individuals engage in tasks for constructing personal schedules for studying, allocating their efforts and workload as well as organizing their time (McKeachie et al., 1985).

Help Seeking refers to the process of requesting meaningful assistance from knowledgeable others (Ryan and Pintrich, 1997).

Work well with peers emphasizes on the ability of learners to collaborate with peers in order to elevate learning. In this process, individuals may utilize their peers as a source of knowledge and interaction (Borkowski et al., 2000).

Peer Learning refers to learner's capacity to interact and communicate (collaborate) with their peers (Pintrich et al., 1991).

Self-evaluation is the process that follows a person for assessing the output of his/her performance. Individuals should judge their performance using specific criteria (standards, earlier levels of one's functioning, achievements of others) (Bandura, 1997; Zimmerman, 2000).

Reflection and reflective ability can be defined as the detailed thinking about individual's actions (success and failure), analysis of ideas, exploration of resources and application of information in future activities (Hopkins, 1997). An ePortfolio may encompass a mechanism where learners they can explain the selection of the artifacts (Chun,2002).

Chapter 2: Literature Review

2.1 From Portfolios to ePortfolios[1]

The term portfolio originates from the Italian word portafogli (portare + foglio), which is a portable folder or a case that consists of various papers and materials (Olson, 1991; Yang, 2008). In general, portfolios are collections of a person's work (accomplishments, reflections, writings, observations) (Granberg, 2010). Traditional paper-based portfolios contain samples of the 'best work' in order to promote individual's skills and capabilities (Avraamidou & Zembal-Saul, 2002). Researchers suggest that paper-based portfolios have difficulty in re-editing, upgrading and re-using content, also they have high storage costs and retrieval problems (Montgomery and Wiley, 2004). Another interesting fact is that the nature of paper-based portfolios can't capture the process of collecting materials but only the presentation of learning outcomes (Avraamidou and Zembal-Saul, 2002). The advent of digital systems and the ubiquitous presence of technology created a new tool that is an electronic or paperless portfolio which is designed and delivered through digital systems. Electronic Portfolio (ePortfolio) is a digital folder or a container that stores multimedia content and attempts to shows individual's accomplishments for academic or professional purposes (Abrami and Barrett, 2005). There are two major digital infrastructure forms, the first form is the paperless Portfolios where individuals use text-editors, databases and the second form, is known as the ePortfolio Management System (ePMS), where individuals use integrated digital systems that enable them to manage ePortfolio's functionalities (**Figure *5***).

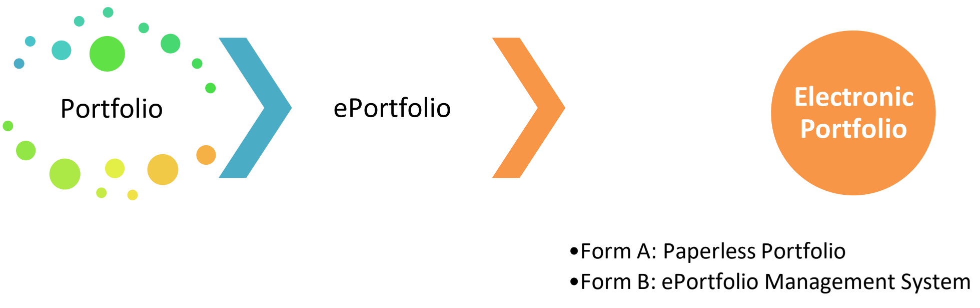

Figure 5. From Portfolio to ePortfolio

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[1] Parts of this section has been published in the following papers:

Paraskeva, F. & Alexiou, A. (2011). The development of a conceptual framework based on self-regulated learning for the implementation of an e-portfolio tool, in Bartolomé A., Bergamin P., Persico D., Steffens K., Underwood J. (eds, 2011) Self-regulated Learning in Technology Enhanced Learning Environments: Problems and Promises. Proceedings of the STELLAR-TACONET Conference, Barcellona, October 1, 2010, Shaker Verlag. ISBN 978-3-8440-0195-2

Alexiou, A. & Paraskeva, F. (2010). Enhancing self-regulated learning skills through the implementation of an e-portfolio tool, Procedia - Social and Behavioral Sciences, 2(2) p. 3048-3054

The electronic version of portfolios permits users to re-invent the process of structuring and promoting their digital identities and allows them to be flexible and innovative (Balaban, Mu, & Divjak, 2013). ePortfolios are used in a great variety of disciplines, including art, design, music architecture, engineering, literature, social work, business, marketing, health, medicine and education. In education ePortfolios can facilitate independent learning, assessment, reflection, communication and IT skills (Lai et al.,2017). Specifically, there are various initiatives in all levels of education (primary education, secondary education, post-secondary, higher education and vocational education and training) where ePortfolios are used as tools to support learning, authentic assessment (formative and summative), accreditation of prior learning, employment, quality improvement and assurance. Also, there are differences among the Portfolio terms which frequently dependent on the different academic contexts and purposes (**Figure *6***). It is noted that in this research the term ePorfolio will be related and used interchangeable to the concept of ePortfolio-based learning approach.

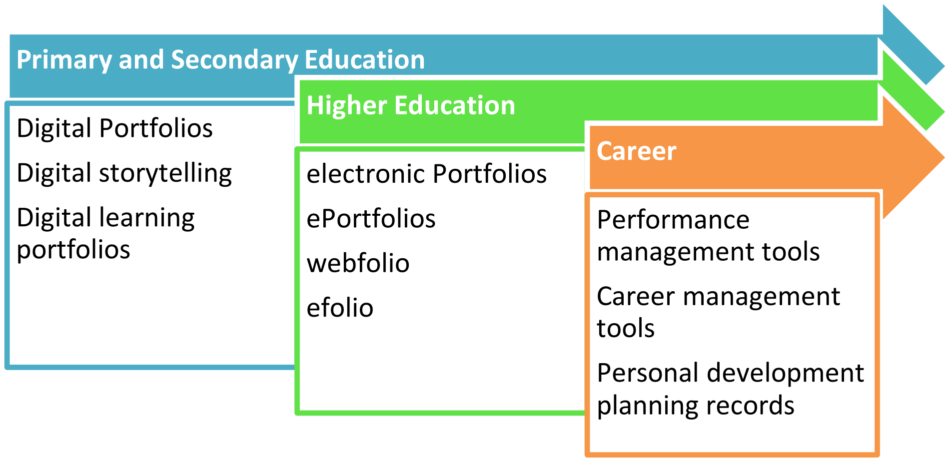


Figure 6. Differences among the Portfolio terms

The European Institute for E-Learning (EifEL) defines ePortfolio as a personal digital collection of information that describes and illustrates learning, career, experience and achievements (Slaatto, 2005). In other words, ePortfolio uses technology and serves as a repository, which allows students / teachers to collect and to organize artifacts in many forms (audio, video, images, text), to use hyperlinks, to organize material and to connect elements with the appropriate outcomes, objectives or standards (Barrett, 2007). The aforementioned definitions of ePortfolio focus on the concept of digital collections of artifacts. Our intention is, to highlight the dynamic nature of ePortfolios and to explore their potentials as a flexible applied e-learning tool, in order to enhance hard and soft skills. To this direction, the IMS ePortfolio SIG specifies ePortfolio as a product, which is produced when individuals select, collect, reflect upon, interpret and provide personal evidence to support their learning, reflection or interpretations which are presented at an audience (Cambridge, 2008).

Based on the aforesaid definitions, we could summarize on our working definition: ePortfolio is more than a digital collection of information but a holistic learning process where an individual may select, create, reflect upon, interpret, evaluate, and re-edit the content that targets on specific audiences and includes accredited evidence for lifelong learning and skills of individuals in academic and professional context. ePortfolio is envisioned as a valuable learning solution that may facilitate students' learning journey across their studies. Also, it is attempted to rebrand the ePortfolio as a rigid case of accomplishments but to structure an ePortfolio-based learning approach as a sound pedagogical framework that corresponds to the needs of digital citizens.

2.1.1 Types and Purposes of ePortfolios

Last decades, ePortfolios in education have gain great interest from the perspectives of research and practice. Specifically, institutions and organizations established communities of practice that conduct research, run ePortfolio projects, set policies, disseminate outcomes and promote ePortfolio-based learning in Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Slovenia, Spain, Sweden, United Kingdom, Canada, United States of America, Australia, China, United Emirates and Taiwan. In **Figure *7***, are depicted major initiatives that conduct research on ePortfolios (Hallam et al., 2008).

Research on ePortfolios demonstrates diversity in the terms used for the definitions, the purposes, the processes and the implementation issues.

Figure 7. Major Initiatives that conduct research on ePortfolios

Literature suggests that ePortfolios are tools that can be used by students for three broad purposes: assessment, showcase, and learning (Greenberg, 2004; Wang & Wang, 2012):

- *Assessment ePortfolios*: Consist of rubrics and evaluation forms that document student's progress and provide feedback

- *Showcase ePortfolios:* Present achievements and illustrate student's academic and professional development
- *Learning ePortfolios:* Describe the process of learning and promote reflection.

In Higher Education, there are three basic types of ePortfolio usage that corresponds to different stakeholders (Lorenzo & Ittleson, 2005):

- *Student ePortfolios*: Students from various disciplines (art, mathematics, design, engineering, business, health etc.) use ePortfolios during their studies in order to demonstrate their knowledge and skills. Also, graduate students showcase their achievements in order to communicate them to prospective employers.
- *Teaching ePortfolios:* Pre-service and in-service teachers can deliver ePortfolios for presenting their teaching accomplishments (lesson plans, courses, awards, teaching strategies) for career development.
- *Institutional ePortfolios*: Student and teaching ePortfolio may be included in this category. Institutional ePortfolios target programme assessment and accreditation purposes.

IMS Global Learning Consortium, an organization that supports standards and good practices in learning and educational technology has identified 6 main types of ePortfolios (IMS, 2005): assessment, presentation, learning, personal development planning, multiple owner and working ePortfolio. This classification indicates that ePortfolios are used to satisfy different requirements and cover multiple purposes for the construction process:

- *Assessment ePortfolios:* EPortfolio can be an instrument for recording authentic learning experiences since it allows students to collect different kinds of information (Stefani, Mason και Pegler, 2007), so it adjusts to the idea of authentic assessment and learning (Veugelers & Kemps, 2004; Elton & Johnson, 2002). It is argued that ePortfolio demonstrates the assessment process as a formative or authentic assessment (Barrett & Carney, 2005). For evaluating ePortfolios, the more common method is rubrics (Buzzetto-More & Alade, 2008).
- *Learning ePortfolios:* can be used in all educational levels. Encourage metacognition also support students to develop organization skills, to recognize how the skills developed over time, to take decisions, to present the required learning, to promote themselves properly (Lombardi, 2008; IMS, 2005). The use of ePortfolios as a learning tool considers major issues: Engagement, Reflective Learning, Goal Setting, Peer and Self-Assessment and Communication Skills (Stefani, Mason & Pegler, 2007).

- *Teaching ePortfolios*: represents the means of demonstrating teaching skills and values of individuals in the context of teachers' training (Young & Lipczynski, 2007), facilitates reflective capabilities and supports the development of personal learning histories (Finger and Russell, 2005). It is a tool that creates opportunities for connection, collaboration, reflection and evaluation (AeP,2010; Sherry & Bartlett, 2005). It is argued that the creation of e-portfolio can be a useful approach for authentic professional development (Kilbane and Milman, 2017; Young & Lipczynski, 2007).
- *Personal Development Planning EPortfolios*: Generally, personal development planning (PDP) is a structured and supported process which is followed by the student so as to reflect on his learning, performance and / or design of training and professional development (Miller et al., 2009). Personal development planning ePortfolios combine the idea of informal learning, lifelong learning and personal learning environments (Attwell, 2007). ePortfolios cover learning, performance and achievements records of individuals (IMS, 2005) also are considered as a powerful tool in the field of continuing professional development (Continuing Professional Development-CPD) especially in medical and educational professions (Attwell, 2007).

Literature review (**Table 1**) indicates that there are various types of ePortfolio but all serve to highlight the need of identifying the purpose and the target audience of the ePortfolio (Butler,2006). It is noted that ePortfolios share a basic philosophy but they differentiate as they follow certain purposes. Literature indicates a variety of ePortfolio purposes that may define the ePortfolio type, such as (Hewett, 2004; Himpsl and Baumgartner, 2009):

- Collecting artifacts
- Planning development
- Documenting a person's artifacts
- Recording learning processes
- Demonstrating competences
- Presenting aspects of self
- Reflecting on learning activities
- Evaluating learning progress

Table 1. Portfolio and ePortfolio Purposes

Authors	Portfolio and ePortfolio Purposes		
Danielson & Abrutyn, 1997	Working	Showcase	Assessment

Ketchenson, 2001	Learning	Teaching	Institutional	
Zeichner and Wray, 2001	Learning	Showcase	Learning or a credential	
Smith and Tillema, 2003	Dossier	Training	Reflective	Personal Development
Barrett, 2003	Connected	Reflective	Presentation	Working
Greenberg, 2004	Learning	Showcase	Structured	
Abrami and Barrett, 2005	Process	Showcase	Assessment	
Beetham, 2005	Process	Presentation	Assessment	
Mosely, 2005	Learning	Showcase	Credential	
Barrett, 2005	Traditional	Reflective	Higher education	
Himpsl and Baumgartner, 2009	Development	Reflection/ Presentation	Assessment	Working
Balaban, Divjak & Kopic, 2010	Development	Showcase	Assessment	Hybrid

Thorough investigation of the field highlights that the classification of ePortfolio types can be complex. It is identified that ePortfolios are used to satisfy different requirements and emerge a number of issues such as: ownership, multimedia components, reflection, evidence and multiple representations, which determine their content (Barrett, 2005). In other words, there is a need to define the objectives of ePortfolios in order to enhance their effectiveness.
According to this, ePortfolios can be categorized into three major categories:

- *Learning/Process/Development ePortfolios* are student-centered tools that encourage individual to develop skills, to cultivate reflection and to manage personal growth. Process or learning ePortfolios are based on constructivist philosophy, where students are expected to take responsibility for their own learning (Strudler and Wetzel, 2005).
- *Presentation/Showcase* ePortfolios are public relation tools that can be used to represent skills and abilities of individuals. Also, they are used to showcase achievements for job applications (Teitel, Ricci and Coogan, 1998).
- *Assessment ePortfolios* are accreditation tools that can be used by educational institutions, organizations and service providers to assure if a student has fulfilled the requirements for graduation.

It has to be noted that in academic field ePortfolios can be created in the context of a course, a department or an institution. Sometimes, ePortfolio types can be specific but during implementation can change. All in all, individuals have the opportunity to design and use hybrid ePortfolios that can be established by selecting different types of ePortfolios.

2.1.2 The artifacts of ePortfolios (characteristics)

In general, an ePortfolio can be seen as a web-based repository management system that aggregates collections of students' information (Wang & Wang, 2012). Every item, information or unit within an ePortfolio is a so-called artifact or artefact. It is argued that an ePortfolio artifact can be viewed as a learning object that represents a digital resource that facilitates learning (Wiley & Edwards, 2002). Researchers advocate that artifacts are essential elements of ePortfolio construction process. Individuals should collect specific artifacts and reflect upon them so as to deliver their ePortfolio (Strudler & Wetzel, 2005; Barrett, 2008).

An ePortfolio should be viewed as a multilevel mechanism with a great range of purposes and applications which can consist of a wide variety of content (**Table *2***). An ePortfolio-owner may select specific artifacts that are directly related to course objectives or learning goals also they can be targeted at a specific audience. Researchers suggest that an ePortfolio should allow for flexibility in artifacts management (collect, select, edit, organize, present content) (Siemens, 2004).

Table 2. ePortfolio Artifacts

Authors	ePortfolio Artifacts
Yancey, 2001	○ Educational philosophies ○ classroom management plans ○ Unit and lesson plans, ○ Video clips of practice teaching
Siemens, 2001	○ Personal information ○ Education history ○ Awards and Certificates ○ Reflections ○ Assignment, Projects ○ Teacher's comments ○ Employer comments ○ Goals and plans ○ Personal values and interests ○ Presentations ○ Volunteer work ○ Career Aspirations
	○ digital and non-digital works

IMS ePortfolio, 2005	○ ePortfolio content ○ Activities ○ Competencies ○ Achievements (with or without certification) ○ Preferences ○ Goals and plans ○ Interests and values ○ Reflections, assessments, notes ○ Results test or examinations ○ Contextual information ○ Relationships between the ePortfolio parts ○ Creation and ownership of the content
Curyer, Leeson, Mason and Williams, 2007	○ Documents ○ Pdf personal files ○ Recordings ○ Videos ○ Skills and competences ○ Levels of education
Brandes & Boskic, 2008	○ text-based work ○ reflections ○ video demonstrations ○ multimedia elements ○ blogs ○ wikis
Wang & Wang, 2012	○ academic records ○ essays ○ project reports ○ assignments ○ assessments ○ personal and professional development contents.

Several academic institutions offer ePortfolios services and allow their students to store their artifacts into institutional learning management systems. Institutions provide online storage, dynamic distribution and greater accessibility to ePortfolio owners and their artifacts (Curyer, Leeson, Mason & Williams, 2007). Also, the spreading use of learning management systems results in the use and distribution of learning objects (Singh & Ritzhaupt, 2006). Artifacts can be seen as learning objects which are based on specific libraries of metadata as proposed by Dublin

Core (DC, 2010), IEEE LTSC (IEEE LTSC, 2010), and the IMS Guide (IMS, 2005). Research suggests that ePortfolios can be a synthesis of many different components as it can be seen as a process, a product or a tool and may have various stakeholders (Siemens, 2004).

2.2 ePortfolios construction processes[2]

A key element for a successful ePortfolio is the design process (Ahn, 2004). It is noted that ePortfolios can be seen as 'a technology and a pedagogy' (Gerbic et al, 2009), but also as 'a product and the process' (Barrett, 2005; JISC, 2008). The construction of an ePortfolio is a multilateral process that relates to various stakeholders and results in the need for a common vision. EPortfolios in tertiary education are separated according to their uses and applications: course, programme and institutional ePortfolio (Stefani et al., 2007).

The construction process of an ePortfolio is very important and is directed by the purpose of the ePortfolio and the decisions about the software, the platform or the tool/environment. The purpose of the ePortfolio should be aligned to the curriculum and its objectives (Strudler & Wetzel, 2005). It is argued that ePortfolios need to find a balance between structured detailed plans, which support learning through the process of construction and as open, self-directed tools which encourage students to organize their learning (Barrett & Knezek, 2003).

Students should be introduced into the ePortfolios philosophy and to understand the exact reasons of ePortfolios implementation (Klenowski, Askew, & Carnell, 2006). Challis (2005) suggests that ePortfolios should be integrated throughout the learning process. Researchers developed various set of stages in order to depict the process of constructing paper-based Portfolios and web-based Portfolios (ePortfolios). Each approach introduces a set of stages, follows linear or non-linear order, analyzes specific ePortfolio features and supports different purposes (**Table *3***).

It is noted that the construction process of an ePortfolio consists of a number of identical actions such as: setting goals, collecting artifacts, presenting artifacts, reflecting, modifying artifacts, organizing content, self- and peer assessment, feedback (Hughes, 2008; Joyes, Gray, & Hartnell-Young, 2010; Chang, Chou and Liang, 2018)

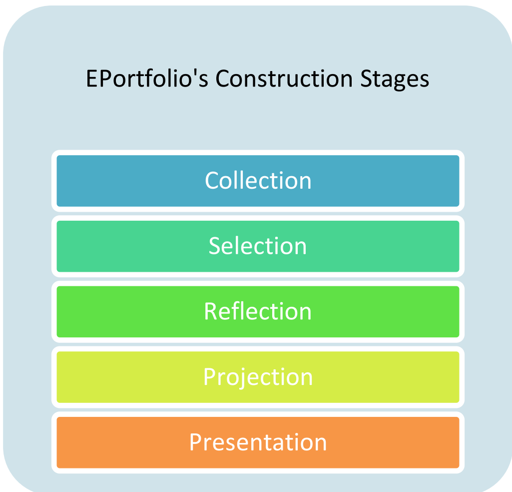
[2] Parts of this section has been published in the following papers:

Paraskeva, F. & Alexiou, A. (2011). The development of a conceptual framework based on self-regulated learning for the implementation of an e-portfolio tool, in Bartolomé A., Bergamin P., Persico D., Steffens K., Underwood J. (eds, 2011) Self-regulated Learning in Technology Enhanced Learning Environments: Problems and Promises. Proceedings of the STELLAR-TACONET Conference, Barcellona, October 1, 2010, Shaker Verlag. ISBN 978-3-8440-0195-2

Alexiou, A. & Paraskeva, F. (2010). Enhancing self-regulated learning skills through the implementation of an e-portfolio tool, Procedia - Social and Behavioral Sciences, 2(2) p. 3048-3054

Table 3. Stages of ePortfolio Construction

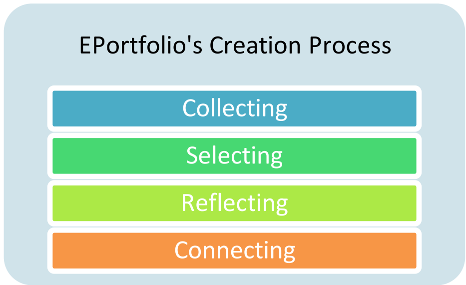
<table>
<tr><th>Stages of ePortfolio Construction</th><th>Description</th></tr>
<tr><td>


(Challis, 1999)
</td><td>This is a guide for implementing a Portfolio. The proposed stages are broad and represent a holistic approach: a. developing a framework, b. setting the prerequisites, c. introducing the portfolio principles to stakeholders, d. individual action planning, e. recognizing learning artifacts, f. collecting learning evidence, g. monitoring the learning path, h. reviewing the outcome and i. reporting</td></tr>
<tr><td>


(Danielson and Abrutyn, 1997; DiBiase, 2002; Barrett, 2007)
</td><td>This approach was initiated by Danielson and Abrutyn (1997) for the design and delivery of paper-based Portfolios. It is noted that this process can be used to electronic Portfolios in order to foster learning.
The construction process of an ePortfolio can be seen as a learning journey that occurs throughout five stages (DiBiase, 2002; Barrett, 2007). An individual should initiate the process from collection stage where he/she saves artifacts (achievements and reflections), then passes to selection stage where he/she evaluates the content based on the learning goal, further is the reflection stage where he/she articulates reflections about the content, the project stage where he/she reviews the achievements and the presentation stage where he/she presents and shares the ePortfolio.
Each stage is interconnected with the other and provides a vehicle for learners to review their performance and organize their learning journey.</td></tr>
</table>

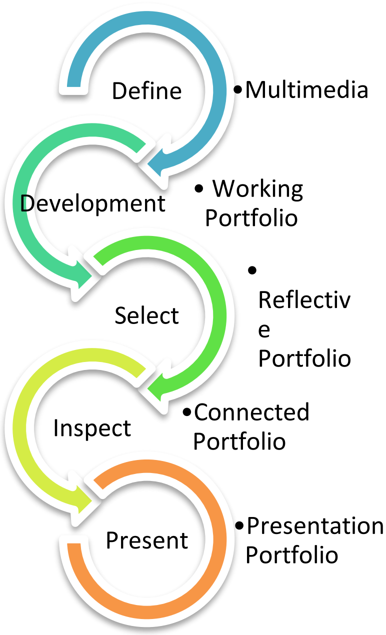
(Atwell et al., 2007)

The '*Plan-Do-Review*' cycle (Atwell, 2007; Atwell et al., 2007), reflecting Kolb's Learning Cycle (Kolb, 1984) and the theory of action learning (Brockbank & McGill, 2003). Each learner engages in the process of planning and checking his/her ePortfolio, then records learning evidence, reviews and reflects on the content, then selects appropriate artifacts and present the final deliverable. This process engages learner into the ePortfolio construction process, fosters authentic learning and supports interaction by planning, reviewing and managing learning evidence



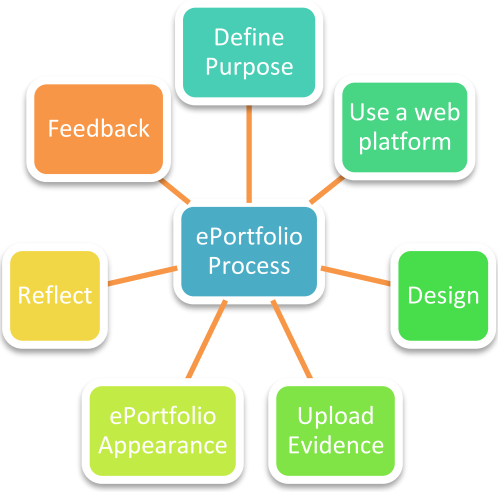
(Siemens, 2004)

This simple model consists of four general activities (Siemens, 2004). Learner collects items for the creation of his/her ePortfolio, selects specific items that promote his/her competency, reflects on the evidence and connects ePortfolio's content to personal, academic and professional experiences.



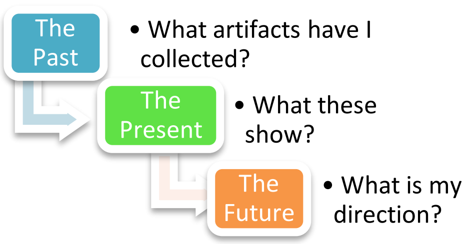
(Barrett, 2000)

The ePortfolio can be developed as a multimedia tool following 5 stages (Barrett, 2000). The ePortfolio development process is analyzed as a linear process: a. definition of the portfolio context and decisions about the multimedia, b. designing the working portfolio and planning about the multimedia, c. organizing the reflective portfolio and selecting the multimedia, d. implementing the connected portfolio and inspecting the multimedia and e. publishing the presentation portfolio and evaluating multimedia. This process emphasizes on the use of multimedia and celebrates learning through the ePortfolio development.



(Johnson and DiBiase, 2004)

The ePortfolio Process model (Penn State University Initiative) is based on the simple model 'collect, select, reflect, publish' and describes the steps that a student should do in order to create a web-based Portfolio (Johnson and DiBiase, 2004). Students collect their achievements and assignments and learn how to use a web platform, then they select the purpose of their ePortfolio, design the outline, also they reflect on their experiences, publish their outcome and seek feedback.

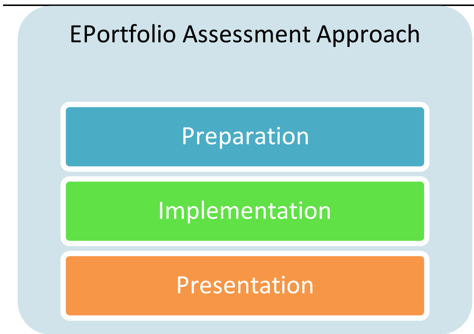


(Barrett, 2008)

The construction process of an ePortfolio should create interconnections among an individual's life stages (personal, academic and professional context) (Barrett, 2008). In other words, the construction should establish a time line that initiates from the past where the learner collects artifacts about life, work and learning, then passes to present where reflects on the artifacts and justifies he/she choices and comes to the future where the learner sets his/her future goals (LaGuardia Community College).

(Higher Education Funding Council for England, 2008)

The process of structuring an ePortfolio should follow six specific steps: setting the purpose, the type and the platform of the ePortfolios, understanding the learning outcomes, preparing stakeholders, determining strategies and actions, implementing sustainable solutions These steps are broad and can be used by an institution. Also, an individual could use this approach and internalize the procedure.



(Chang and Tseng, 2009)

The process of structuring an ePortfolio as an assessment approach involves three broad phases (Chang and Tseng, 2009): phase 1- introducing and preparing users, phase 2- setting goals, collecting artifacts, evaluating the process, interacting with peers and phase 3-presenting the ePortfolio and giving feedback. This approach focused on a broad framework of actions which prompt individuals to deliver their ePortfolio and evaluate their learning process.

Researchers argue that the use of ePortfolios in tertiary education (Higher Education and Lifelong learning Institutions) is increasing but there is a need of a robust framework and a truly immersive ePortfolio solution that will facilitate learners' journey across their academic and career life.

It is noted that HE (universities, colleges, vocational education and training institutions) should provide and support electronic services, academic staff should be capable of integrating ePortfolios processes in the design of the course and students need a range of skills so as to develop an ePortfolio and to become successful in the workplace.

Towards this, an academic institution may follow a purposeful plan for the implementation of ePortfolio project which includes specific issues (Stefani et al., 2007):

- *Stating the Purpose*: There should be a clarification of the purpose according to the learning context. The European Initiatives Co-ordination Committee distinguish 4 common types of conventional portfolio usage in different learning contexts: assessment, showcase, development, reflective.

- *Determining the scope*: The issues that influence the scope of implementation are finances (investments, funding, costs and risks), human resources (technical staff and experts) and students.

- *Relating ePortfolio implementation to the curriculum*: There are numerous issues to weigh up: the target group, the readiness for ePortfolio-based learning, the IT literacy skills, usage of the ePortfolio by students, a standardized format for the ePortfolio, a public or a private document, supporting students', reviewing and formative feedback. The overarching issue is the pedagogical principles underpinning the rationale for implementing ePortfolios into the curriculum.

- *Selecting content*: The content of the ePortfolio consists of the types of information that may be stored. The type of ePortfolio content should be aligned with the agreed purpose.

- *Preparing the users*: Implementing ePortfolio into a curriculum is dependent upon staff and students having the necessary technical skills, knowledge and appreciation of the purpose and the scope of the ePortfolio.

In addition to, a network of 24 institutions in the United States created a project named Connect to Learning (C2L) in order to promote ePortfolio projects for teaching, learning and assessment (Eynon, Gambino and Török, 2014). This national community of practice attempted to explore the ways of launching and applying effective ePortfolio implementations in the campuses. Towards this, it is proposed the Catalyst for Learning framework were an effective ePortfolio initiative should address specific core levels of campus life and learning (A), develop in interlocking sectors (B) and accommodate specific design principles (C) that aim to unify the process (Eynon, Gambino and Török, 2014). In detail:

A. *Core Levels of campus life and learning*:
   - Students and faculty
   - Departments
   - Institutional culture

B. *Interlocking Sectors*:
   - Pedagogy
   - Professional Development
   - Outcomes Assessment
   - Technology
   - Scaling Up

C. *Design Principles:*
   - Inquiry
   - Reflection
   - Integration

Also, an ePortfolio implementation study funded by JISC and developed a toolkit for providing valuable resources about ePortfolio implementations in Higher and further education as well as work-based learning. In this study contributed: 12 UK, 4 Australian and 3 New Zealand partner institutions and one professional organization (JISC, 2012). This study suggests that successful implementation of an ePortfolio across an institution encompasses five stages:

Stage 0: Prior Developments

Stage 1: Planning

Stage 2: Early adoption

Stage 3: Embedding

Stage 4: Sustaining

Thus, the ePortfolio implementation model involves a set of principles for practitioners, senior managers and ePortfolio practitioners that summarize the key issues of effective practice:

- ePortfolio purpose should be aligned to context for advancing benefit
- Learning activities should fit the purpose
- Technology and pedagogy should provide support to various ePortfolio processes
- Students should acquire ePortfolio ownership
- Careful transformation of the institution is needed.

Academic institutions in their efforts to implement ePortfolios need to make various decisions and seek answers to adopt the best ePortfolio solutions. Towards this, it is proposed the integration of ePortfolios in academic programs, following a set of guidelines (Zeichner & Wray, 2001; Jafari, 2004; Lorenzo & Ittleson, 2005; Challis, 2005): Identifying Potential Users, defining ePortfolio Purpose, Collecting Artifacts, structuring an ePortfolio, structuring an ePortfolio, organizing reflections, designing issues, providing assessment, supporting maintenance.

2.3 Integrating ePortfolio-based Learning into Higher Education

ePortfolios can be seen as effective learning environments and not as simple repositories of artifacts. Towards this, a learning approach is introduced with significant effects that supports students to collect learning artifacts, to monitor and evaluate their performance through an ePortfolio system, known as ePortfolio-based learning approach or ePortfolio-mediated learning (Nguyen & Ikeda, 2015; Chang, Chou and Liang, 2018).

Research on ePortfolio-mediated learning presents positive results and documents various challenges. It is observed that students find difficult to take responsibility of their own learning experiences and realize their learning gains (Galván-Fernández et al., 2017). In several ePortfolio implementations there wasn't robust technological infrastructure and the instructors weren't prepared while stakeholders lacked of interest and motivation (Morales, Soler-Domínguez & Tarkovska, 2016).

There is a need for a thorough investigation on learners' perceptions about the use of their ePortfolios as well as their influence on assessment and technology (Deneen et al., 2018). Students and instructors require time and training in order to understand the tool and to structure an effective environment (Morales, Soler-Domínguez & Tarkovska, 2016). It is highlighted the need for providing a set of actions and processes that will act as a guide to students and instructors for designing and implementing an ePortfolio. Further research should explore the effects of learning goals, students' reflections, achievement tests as well as peer-assessments on learning and knowledge sharing (Chang, Chou and Liang, 2018). There is a need for conducting empirical studies that provide quantitative and qualitative data based on multiple measurement approaches.

The development of an ePortfolio includes various processes that support knowledge creation and sharing as well as facilitate independent learning (Chau and Cheng, 2010). Additionally, an ePortfolio can be seen as dynamic learning environment that can be used by stakeholders as a learning or teaching strategy (Chang, Chou and Liang, 2018). This means that empirical research should emphasize on structuring well-designed ePortfolio solutions for cultivating learning outcomes (Roberts, 2018).

2.3.1 Challenges of ePortfolio-based Learning

Recent research shows the tangible benefits of the use of ePortfolios in Higher Education (HE) (**Figure *8***). Specifically, the potential of ePortfolios in various educational settings support learners and actively involve them in the process of learning and development (JISC, 2012; Joyes et al., 2010). It is noted, that the development of the ePortfolio engages learners and supports them in order to take control, manage and reflect on the ePortfolio content (Shroff, Trent, and Ng, 2013). This process cultivates a positive attitude towards learning and help students to feel more confident on developing their ePortfolios (Hussein, 2009; Shroff, Ng, & Deneen, 2011). ePortfolios give the opportunity to learners to participate in the design process, actively engage and take decisions (Deneen, 2013).

Using ePortfolios in education may enable students to upgrade their skills. ePortfolios are virtual spaces with multiple functions such as storage, management, connections, communication, development (Huang, Hood & Yoo, 2013) that support higher-order thinking skills (Wang & Wang, 2012). Hence, researchers indicate that ePortfolios can be seen as dynamic learning tools that support students' reflections and critical thinking skills (Shroff, Trent and Ng, 2013; Morales, Soler-Domínguez & Tarkovska, 2016). During the construction process of their ePortfolios, students collect their accomplishments, judge the quality of their artifacts, practice their information technology (IT) skills, seek feedback and self-reflect on their evidence (Cowan and Peacock, 2017). Moreover, researchers have focused on ePortfolio's potential on authentic assessment and on-going self-evaluation (Kabilan & Khan, 2012; Shroff, Trent, and Ng, 2013). The nature of the ePortfolio facilitates the assessment process as students create their ePortfolio they realize the assessment criteria, evaluate their products, refine their output and gain a better understanding of the final outcome. Also, comprehensive assessment ensures the development of two-way feedback and better communication among stakeholders (McLaren 2012).

When students engage in an ePortfolio project, they explore their capacity to take ownership of their learning (Morales, Soler-Domínguez & Tarkovska, 2016). Learners attempt to develop a self-portrait of their academic and professional self and cultivate a future-oriented thinking (Blom et al., 2014). Research stresses that ePortfolios represent learning vehicles through which learners can become independent and autonomous. Findings suggest that ePortfolios prompt users to plan, monitor, reflect, evaluate and refine their learning products in order to construct a digital representation of their identity. ePortfolio's use fosters independent learning and contributes to high levels of self-awareness (Chau and Cheng, 2010; Yang et al., 2016). Towards this, learners participate in personal development planning (PDP) (Joyes et al., 2010) through the ePortfolio and foster self-directed learning (Beckers, 2016; Rezgui, Mhiri, Ghedira, 2017). Previous studies indicate that students who engage in an ePortfolio project should set goals, plan their actions, develop strategies, manage their efforts, reflect upon actions and evaluate outcomes. This means that ePortfolio's processes are related to Self-Regulated Learning (SRL) and could result in major learning gains (Meyer et al., 2010; Huang et al. 2012; Morales, Soler-Domínguez & Tarkovska, 2016). Research on ePortfolios presents positive results in ePortfolios use but documents various challenges. Studies attempt to investigate critical factors about ePortfolios experience (Cheng et al., 2015; Yang, Tai, & Lim, 2016). Moreover, it is pointed out that there are various exogenous and endogenous factors that have negative effects on ePortfolio implementation. Empirical research indicated that when the institution doesn't support the ePortfolio project then the ePortfolio goals cannot be achieved. In several implementations there wasn't robust technological infrastructure also the instructors weren't prepared and stakeholders lacked of interest and motivation (Morales, Soler-Domínguez & Tarkovska, 2016). Also, it is noted that students find difficult to take responsibility of their own learning experiences and realize their learning gains (Galván-Fernández et al., 2017). Literature suggests that ePortfolios can be seen as powerful learning tools that need well-organized implementation and delivery in order to trigger positive outcomes. Various studies focus on variables such as interest, enthusiasm, potential and less comprehensively is explored the role of success variables (Cummings & Maddux, 2010; Deneen, 2013). Previous findings emphasized on the use of ePortfolios as spaces for presentation of skills and competencies (Stefani, Mason, & Pegler, 2007; Roberts, 2018).

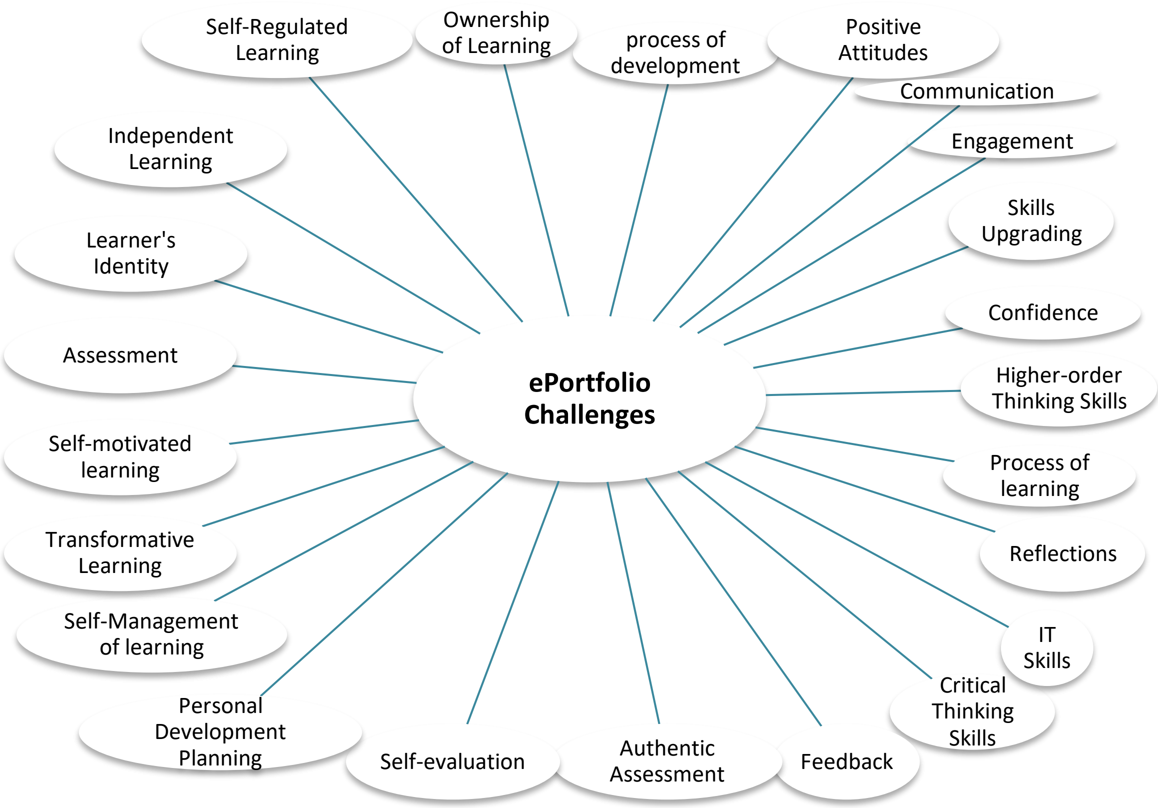


Figure 8. ePortfolios Challenges

Students and instructors need time and training in order to understand the tool and to structure an effective environment (Morales, Soler-Domínguez & Tarkovska, 2016). Furthermore, there is a need for a thorough investigation on learners' conceptions about the use of their ePortfolios as well as their influence on assessment and technology (Deneen et al., 2018). An emerging issue is the examination of ePortfolios as learning environments that support and promote student's development (Clarke, Housego & Parker, 2009). Furthermore, the literature suggests that, there is little empirical evidence about formal development methodology of ePortfolio systems (Buzzetto-More & Alade, 2008). It is highlighted the need for providing a set of actions and processes that can act as a guide to students for designing and implementing an ePortfolio. Through this process, students learn how to verbalize their creativity and cultivate their critical thinking as well as their self-assessment skills (Morales, Soler-Domínguez & Tarkovska, 2016). It is noted that a learning approach that supports students to collect learning artifacts and to monitor and evaluate their performance through an ePortfolio system, is titled ePortfolio based learning approach (ePBLA). ePortfolio studies argue that there are significant effects of ePBLA on learning and on knowledge sharing and creation (Chang, Chou and Liang, 2018). There is a need of conducting empirical studies that provide quantitative and qualitative data based on multiple measurement approaches. Results indicated that when students engaged in activities such as self-assessment, peer assessment, reflection, peer observing then they can learn how to create new ideas and maximize their knowledge creation. Further research should explore the effects of learning goals, students' reflections, achievement tests as well as peer-assessments on learning and knowledge sharing (Chang, Chou and Liang, 2018).

2.3.2 ePortfolio-based Assessment

An ePortfolio can be seen as, an alternative form of assessment that encourages learners to engage in an authentic and learner centered process and examine their knowledge as well as their skills (Sweat-Guy & Buzzetto-More, 2007). Authentic assessment involves student engagement in the evaluation process by using authentic evidences of learning processes and outcomes (Barbera, 2009; Barrett, 2007).

ePortfolio-based assessment entails a detailed examination of individual's achievements, reflections and learning progress. The assessment procedure encompasses a set of actions, such as self and peer-assessment, instructor and external evaluators assessment, reviews and feedback (Chou, 2012). Literature review indicates that the implementation of ePortfolio-based assessment establishes multiple advantages for learners, instructors, administrators and future employers (Cooper and Love, 2007). Studies indicate that ePortfolio assessment is pivotal in boosting learner's skills for peer assessment, motivation, self-reflection and self-reviewing (Chang & Tseng, 2009). The delivery of ePortfolio-based assessment maximizes the potential of effective learning, supports effective assessment processes, improves reliability and promotes automation of the tasks (Cooper and Love, 2007). There is a difference between ePortfolios and their assessment goals (assessment of learning and assessment for learning) (Barrett, 2005). Formative assessment encompasses self-assessment and peer assessment as essential elements of the learning process (Andrade & Valtcheva, 2009). ePortfolios can be seen as structures that support assessment for learning, known as formative assessment. In this context, learners can continuously evaluate their own performance, receive peer feedback, interpret the evidence and decide about their progress (Stiggins, 2002). ePortfolios that support formative assessment can be structured throughout a course and embed artifacts that correspond from present to future. On the other hand, there are ePortfolios that support summative assessment of learning and correspond to institution's aims, require extrinsic motivation and artifacts scored according to specific standards (Barrett, 2005). ePortfolios that support summative assessment can be developed at the end of a course and aggregate artifacts from past to the present. EPortfolio-based assessment should incorporate assessment methods such as teacher-assessment, student self-assessment and peer-assessment in order to assure the objectives of authentic assessment (Chang, Tseng, Chou and Chen, 2011). The evaluation process that uses authentic learning outcomes and accredited achievements is known as authentic assessment (Barbera, 2009; Barrett, 2007). Specifically, ePortfolio-based assessment can be seen as an interesting approach that provides trustworthy results (Oskay, Schallies, and Morgil, 2008). Researchers note that authentic assessment that is delivered through ePortfolios sharpens various skills such as self-monitoring strategies, self-assessment skills, self-motivation beliefs and engagement (Chang, Liang and Chen, 2013). On the other hand, the authenticity of ePortfolio assessment can be altered according to various issues, such as reliability, validity, time management, rubrics criteria, student's abilities (Chang, & Tseng, 2009).

Reliability is defined as the degree of consistency among assessment results. Specifically, in self-assessment, reliability can be achieved when assessment measurements that tested at different time intervals and in different occasions, they are consistent or stable (Chang, Tseng, Chou and Chen, 2011). Towards this, it is proposed the use of Pearson r coefficient for measuring reliability among two self-assessment results and the use of Cronbach's a for testing the inter-rater reliability of self-assessment scale (Chang, 2002; DiPerna and Derham, 2007; Gadbury-Amyot et al., 2003; Lin, Liu, & Yuan, 2001).

Validity is described as the degree of accuracy among assessment results (Yu, 2002). Researchers agree that in self-assessment validity can be achieved when there is an exterior criterion or a set of criteria that can be used for ensuring grading accuracy (Bouzidi & Jaillet, 2009; Cho, Schunn, & Wilson, 2006). Thus, high correlation between ePortfolio grades and external criteria (assessment results from knowledgeable others, teacher's ratings, external evaluator's ratings and exam results) indicate a desirable level of validity. Further, it is suggested that teachers and external evaluators should be well-trained for producing accurate and goal-specific results (Chang, 2002). Towards this, it is proposed the use of the intraclass correlation (ICC) for measuring teachers' inter-rater consistency.

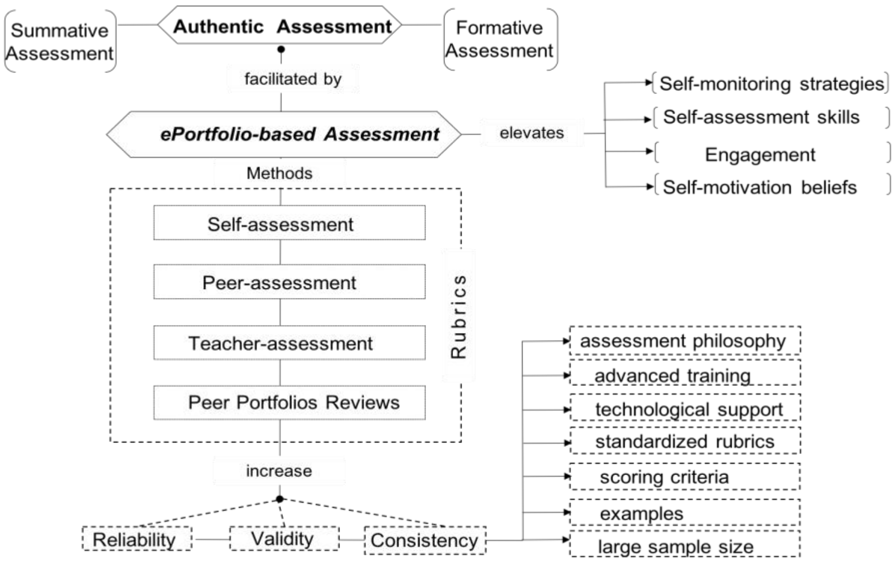


Figure 9. ePortfolio-based Assessment Methods

Self-assessment often provides acceptable levels of reliability but poor validity (Knowles, Holton and Swanson, 2005). Also, in another research is concluded that self-assessment demonstrated lower degrees of validity and reliability than peer- and teacher- assessment (Lin, Liu, and Yuan, 2001). On the other hand, other studies recognized that self- and teacher- assessment scores were consistent (Sung et al., 2005; Sadler and Good, 2006). It is concluded that, there are opposite viewpoints among researchers about self-assessment that need further investigation.

Also, research findings highlight that ePortfolio-based assessment elevates specific skills for peer assessment (Chang & Tseng, 2009). The process of peer assessment guides learners to engage in various roles, such as reviewer, supporter, encourager and reflector. Students strengthen their confidence, learn through practice, seek and receive valuable comments (Chen, 2010).

Reliability is coined as the process of examining inter-rater and intra-rater consistency over a period of time. Specifically, reliability in peer assessment can be categorized in intra-rater or external reliability and inter-rater or internal reliability. The intra-rater or external reliability corresponds to the consistency among different raters (students, peers). The inter-rater or internal reliability, addresses the consistency of scores within an individual assessor (Bouzidi & Jaillet, 2009; Cho, Schunn, & Wilson, 2006). Researchers agree that peer assessment reliability should involves statistical test such as homogeneity analysis and Kendall's coefficient of concordance in order to test external and internal reliability (Diperna and Derham, 2007).

Validity in peer assessment can be ensured by the level of accuracy against an exterior criterion. Towards this, it is proposed a large number of assessors (teachers, external evaluators, knowledgeable peers) that can be trained and provide accurate ratings. Studies suggest that self-ratings had lower validity than peer ratings (Liu et al., 2001). On the other hand, peer-assessment and teacher-assessment results were consistent (Bouzidi and Jaillet, 2009; Tsai and Liang, 2009). Towards this, it is advisable peer assessment validity to be estimated by exterior criterion (such as teacher ratings, exam scores) and test by statistical methods such as Pearson's correlation and t-test (Chang et al., 2011). Further research should investigate the validity and reliability of teacher-, self- and peer-assessment and their consistency and explore the dynamics of assessment results on learner's reflections (Chang et al., 2011)

An interesting tool that can be used to standardize assessment is a rubric that can be embedded in an ePortfolio (Buzzetto-More & Alade, 2006). Rubrics encompass a set of standards, provide valuable insights and better communicate the results over time (Sweat-Guy & Buzzetto-More, 2007). Research showed that there is a need of explicit and discrete assessment criteria as well as timely feedback to ensure reliability (Gülbahar and Tinmaz, 2006). Extended review of the literature identifies a set of criteria that should be incorporated into the assessment rubrics

(Sweat-Guy & Buzzetto-More, 2007; Chang et al.,2011). These rubrics emphasized on six pillars: the ePortfolio purpose, presentation, content, layout, mechanics, reflection and interaction (**Table *4***).

Table 4. ePortfolio Assessment Criteria

	ePortfolio Criteria						
	Purpose	**Presentation**	**Content**	**Layout**	**Mechanics**	**Reflection**	**Interaction**
Burch,1999		Portfolio presentation	Portfolio documents	Portfolio layout	Writing mechanics	Self-reflection	
Reckase, 2002	The degree to which the student grasps the subject matter	Content richness & difficulty	Portfolio contents	Organization & presentation		Reflective thinking	
Gadbury-Amyot et al., 2003; Sulzen, Young, & Hannifin, 2008		Portfolio presentation	Portfolio documents	Portfolio layout	Writing mechanics	Self-reflection	
Sweat-Guy & Buzzetto-More, 2007	Learning objective	Overall performance	Content quality			Reflection	
Schlough, S. (2010)		Design	Artifacts	Technical		Reflection	
ePortfolio Portal, 2009 Rcampus, 2010	Rationale or caption	Use of multimedia & ease of navigation	Selection of artifacts	Layout & text elements	Writing mechanics	Reflections	
Worcester, 2000		Graphics, sounds, presentation		Layout, folder structure	Mechanics	Reflection	Cooperation
Morris, 2007		Graphics Use of tools	Content relevancy	Structure	Mechanics	Captions or reflections	
Chang et al., 2011	Learning goal	Presentation	Artifact	Portfolio Creation	Attitude	Reflection	Q&A

Towards this, it was attempted the design of a comprehensive ePortfolio assessment methodology that engages students, peers, instructors and external evaluators into the process. This study tried to investigate ePortfolio's potential on authentic assessment between experimental and control group.

2.4 Classification of ePortfolio platforms[3]

EPortfolios are used to satisfy diverse requirements and cover multiple purposes which determine their content and use. Higher Education ePortfolios, in particular, are distinguished into categories according to their uses and applications, such as: course, program and institutional (Stefani et al., 2007). In the context of an academic institution, the selection of an ePortfolio system should conform to the potential needs of the institution (Sweat-Guy & Buzzetto-More, 2007) and includes a set of issues: buying, constructing, configuring an open source system or implementing a hosted or non-hosted system. It is suggested that a successful implementation of an ePortfolio project needs to highlight on several challenging factors: sustainable business plan, hardware, software, robust integrated technology architecture, advanced features and services, ease of use, usability, security, intellectual property, lifelong support, assessment, standards and transferability, long-term maintenance and factor 'X' (ePortConsortium, 2003; Jafari, 2004).

Another classification of ePortfolio systems in tertiary education (Higher Education and Lifelong learning Institutions) is based on ePortfolio platforms and university enterprise systems (ePortConsortium, 2003) (**Figure *10***):

- **Stand-alone ePortfolio platform:** The ePortfolio can be delivered as stand-alone application in a single university course
- **Single Departmental ePortfolio System:** The ePortfolio can be delivered in a university department as a stand-alone system and/or can be integrated with the Student Information System (SIS).

[3] Parts of this section has been published in the following papers:

Alexiou, A & Paraskeva, F. (2015). Inspiring key competencies through the implementation of an e-Portfolio for undergraduate students, 7th World Conference on Educational Sciences, (WCES-2015), Athens, Greece, 05-07 February, 2015.

Alexiou, A & Paraskeva, F. (2015). Managing Time through a Self-Regulated Oriented e-Portfolio for Undergraduate Students, Tenth European Conference on Technology Enhanced Learning (EC-TEL 2015), Toledo (Spain), 15 - 18 September 2015.

Alexiou, A. & Paraskeva, F. (2016). "Empowering First-Year Students to Thrive in University through a Self-Regulated Career oriented ePortfolio". Proceedings of the 14th conference on ePortfolios, Open Badges, Blockchains, Trust and Identity (ePIC 2016), Bologna, Italy, 26-28 October 2016.

- **ePortfolio System Integrated with a Content Management System (CMS):** The ePortfolio System can be embedded on top of the Content Management System (CMS) of the institution. The artifacts and the learning objects can be stored and retrieved from the CMS.
- **ePortfolio System Fully Integrated with campus system:** The institution can deploy an enterprise system that includes an authentication system, a Student Information System (SIS), a campus portal, a CMS and an ePortfolio system.

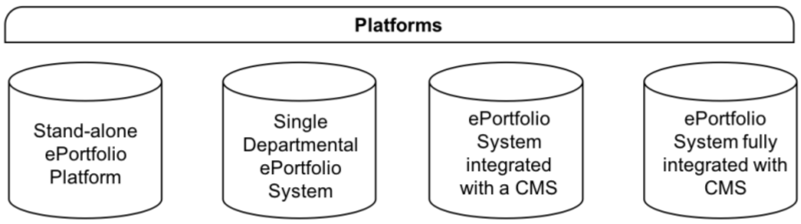


Figure 10. ePortfolio Platforms

Recent technological enhancements to ePortfolio software have broadened the available features (Strivens, 2007). It is argued that there are many strategies to implement and develop e-portfolios, depending on the choice of available software tools: Generic and Customized tools (Barrett, 2003; Gibson & Barrett, 2003)

The emerging idea for delivering the ePortfolio should be guided by technological and pedagogical considerations. The ePortfolio implementation process depends on the selection of the available software tools and systems (Schaffert & Hilzensauer, 2008; Barrett, 2007; Himps & Baumgartner,2009; Kim, Ng and Lim, 2010; JISC, 2014) (**Figure *11***):

- **Commercial ePortfolio systems:** Many elearning enterprises develop and distribute powerful ePortfolio systems. These proprietary ePortfolio systems can be advantageous due to technical support, hosting and consulting services, ease of use, customized features and upgrading support. On the other hand, there are various disadvantages, such as integration and licensing costs, less user's control and proprietary format. There is a growing list of proprietary ePortfolio systems: Digication, Pebble Pad, Seelio, Symplicity, Zovio, Concord's Scioware™ system, FolioTek, Factline ePortfolio, myeFolio, Quals Direct, PortfolioMaker, Richer Picture, Desire2Learn ePortfolio, Pathbrite, Transfolios, LiveText and TaskStream - Watermark, LiveBinders for ePortfolios, Nuventive iWebfolio, Interfolio, Chalk & Wire, Portfolio Village, Carbonmade, Portfolium, goennounce, seesaw, zovio

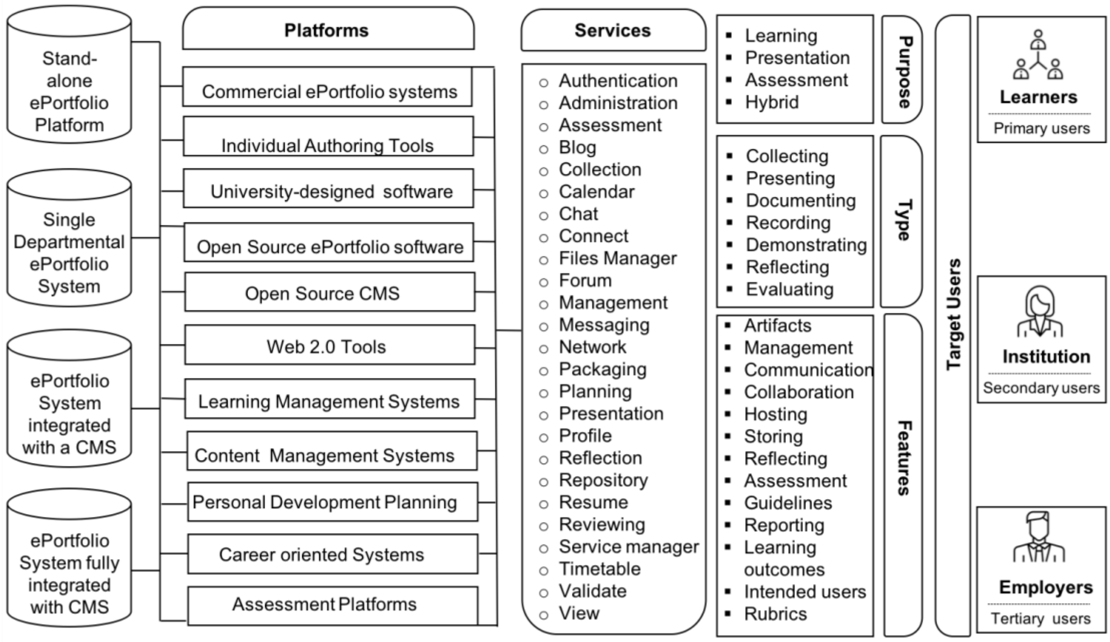


Figure 11. Classifications of ePortfolio Platforms and Services

- **Individual authoring tools:** Users can develop ePortfolios using various authoring tools that can be categorized as web design tools, graphic tools, concept mapping tools and audio & video software. Authoring tools can be advantageous due to upgrading of IT skills, flexibility, autonomous learning and requiring little infrastructure. But, users and academic staff need training and guidance, also this is a time-consuming process that needs support and resources. This is a very broad category as it integrates from simple word Processors and desktop publishing programs to online web page builders such as: Microsoft word, Open office, Adobe InDesign and Scribus, Google web designer, Adobe Dreamweaver, Microsoft Expression Web 4Rapidweaver, Kompozer, Coffeecup, Net Objects, Macaw, Open Element, Freeway GIMP, Adobe Photoshop, Cmap Tools, bubble.us, iMovie, Audacity.
- **University-designed software** is designed and developed by a university team. These homegrown solutions involve all stakeholders and provide them with total control. There is a plan for sustainability and attempt to promote knowledge building. On the other hand, the institution should develop infrastructure and provide scalability. Also, the institution should engage the community through training workshops. It is observed that homegrown applications have proprietary format in order to meet the needs of the stakeholders: Penn State University (Blogs at Penn State), University of Denver Portfolio (portfolio.du), University of Montreal (eduPortfolio 3.0), Alverno College (Diagnostic Digital Portfolio (DDP), University of Minnesota (eFolioMinnesota), Johns Hopkins

University (Johns Hopkins Digital Portfolio (DP)), University of Mary Washington (Domain of One's Own) and University of Washington (Catalyst Portfolio).

- **Open source ePortfolio software** can be customized with no or low licensing cost in the campus. Open source ePortfolios are based on source code that is adaptable for modification or distribution. It is considered that open source products fit the principles and needs of the knowledge economy (individuals are not only consumers but also creators and active participants). The implementation of an open source ePortfolio may include benefits for institutions including: low cost, product stability, security with on-campus hosting, greater functionality from local control of code and quick local support (Buzzetto-More, 2010). On the hand, there are various disadvantages, such as autonomous support and workload. There is a growing list of open source ePortfolios: OSeP, Sakai, Serensoft, OSPI, Mahara, Folio.for.me, Elgg, Googlios.
- **Web 2.0 tools** are characterized as a set of new Internet-based technologies that support user not only to consume content but also to create, edit, manage and share ideas, projects and news. There are a number of Web 2.0 services that enable users to collaborate and contribute to the community, such as blogs, wikis, multimedia sharing services, audio blogging, podcasting RSS, content syndication, social networking, aggregation services, tracking and filtering content, collaborating and desktop applications. It is argued that a serious opponent of open source ePortfolios may be social networking sites (e.g LinkedIN, Google+, Facebook) which provide free accounts, file repositories, webpages, communication functionalities. These popular social networking sites can be a stable, cost-effective and flexible solution for institutions and individuals but they fail to include the multiple ePortfolio's purposes (assessment, student learning, showcase and credentialing) and to establish an integrated ePortfolio culture. There is a growing list of web 2.0 tools: Blogs (Wordpress, TypePad), Wikis (Wikispace, PBWiki), Social Networking Sites (Orkut, Elgg, Anahita, BuddyPress, LovdByLess, Facebook, LinkedIN, Google+), website builders (Wix, Yola, GoogleSites, Weebly, Tripod), Desktop Applications (GoogleApps for Education, Google Docs).
- **Learning Management Systems (LMS)** are software applications or web-based technologies which assist planning, delivering and managing the learning processes of an academic institution or a corporate environment (Alias & Zainuddin, 2005). Users (students and academic staff) can use them to implement different tasks such as: develop and maintain content, discuss, interact, track performance, grade, integrate with the

human resource system, adhere to standards and provide security. There is a list of proprietary LMSs: Manaba, NIXTY, UserLand's Manila.

- **Open Source Learning Management System (CMS**) is a software platform that is based on open source code and can help academic institutions to create their own infrastructure. The open source LMS is open to the community to modify and personalize the source code for meeting institution's needs and prerequisites. There is a growing list of open sources LMSs: Moodle, Sakai, Atutor, Claroline, Dokeos, Ilias.
- **Content Management Systems (CMS) or Learning Content Management Systems** (LCMS) are software applications that support the learning process and can be used to create, edit, manage, store Learning Objects (LO). There is a list of CMS: Desire2Learn ePortfolio, Ingeniux CMS.
- **Open Source Content Management System (CMS**) is a software platform that is based on open source code for installation, deployment and configuration. Mostly, open source Content Management Systems are based on global communities of developers, designers, trainers and editors. The overarching goal is to create, organize, edit, publish and share content with no costs. The list of open source CMSs is growing: Drupal, Plone, WordPress, Exabis, Moodle-Blog Export Portfolios.
- **Personal Development Planning** is "a structured and supported process undertaken by an individual to reflect upon their own learning, performance and/or achievement and to plan for their personal, educational and career development" (Quality Assurance Agency, 2009, p.5). Higher education institutions consider how to embed PDP into their curriculum. Various universities use ePortfolio systems to integrate PDP within their programmes. In the ISLE Project different ePortfolio systems were selected to use at different partner institutions, such as Blackboard system, Open Source Portfolio (OSP) system, SELF system, PebblePad, the Angus in-house system and WordPress (JISC, 2014). In the FILE-PASS Project used an open source software, the Open Source Portfolio Initiative (OSPI). In the ePistle Project used two ePortfolios software the ePET and the PebblePad. Also, universities and colleges have created their own ePDP tools that support users to design and implement their own ePDP Portfolio such as (Indiana University, Queen Margaret University, Newcastle University, Glasgow Caledonian University, University of Exeter, Southampton Institute, Loughborough University (RAPID).
- **Career oriented systems** are ePortfolio systems that invite users to showcase their academic and career achievements and skills. These solutions are dynamic tools that encompass statements of work experience and segments of traditional résumé. HE

institutions deliver career oriented ePortfolio systems such as VisualCV, CareerWales, Optimal Resume.

- **Assessment Platforms** are ePortfolio systems that record authentic learning experiences and allow users to collect various types of information. This category encompasses a range of different systems that provide assessment functionalities, such as: Digication, Chalk & Wire, WayPoint, OneFile e-Portfolio, Learning Assistant.

In general, an ePortfolio system should assist individuals (students and professionals) to develop their personal learning path and promote their professional profile. This means, that an ePortfolio should provide various services and features to users for engaging them in their quest for learning (Curyer, 2007; Sweat-Guy and Buzzetto-More, 2007).

2.4.1 ePortfolios and Social Media in Higher Education

The emergence of Web 2.0 technologies guides the growth of user-control over content, where the groups of users can socialize and collaborate (Musser and O'Reilly, 2005). Furthermore, Web 2.0 has profound potential for inducing change in tertiary education due to web data-sharing and exchange mechanisms (Franklin & Van Harmelen, 2007). A Web 2.0 technology like social networking systems allow people to create networks for various purposes. The review of the literature illustrates that the mix of e-portfolios with Web 2.0 technologies offers individuals educational opportunities, combining informal and formal education (Dysthe, 2007). In addition to, Web 2.0 technologies support participation, development, students' educational planning, collaboration, reflection that fit well with the purposes and specifications of ePortfolios (Inglis and Ehlers, 2009; Roder & Brown, 2009; Paraskeva & Alexiou, 2010)

The omnipresence of social media penetrated students' everyday lives and HE capitalized on the growing interest in them (O'Brien and Torres, 2012). Despite the educational advantages, social media in academic settings entail, including the unlimited access to course content, alternative e-learning platforms with new possibilities and upgrading of students' skills (Legaree, 2015; Lau, 2017), empirical studies point to their non-academic use of social media and their negative influence on academic performance (Ravizza et al., 2014). Showing consideration for the affordances of social media in HE and the negative impact their non-academic use is associated with, further research needs to be conducted to minimize those adverse effects on the learning process. We propose the design of a Self-Regulated oriented ePortfolio that supports the benefits of Web 2.0 technologies, social media functionalities and ePortfolio affordances. It is noted that an ePortfolio is more than a digital collection of information but rather a holistic learning process where an individual may select, create, reflect upon, interpret, evaluate the content; it includes accredited evidence for lifelong learning and the individuals' skills in academic and professional contexts. HE establishes communities of practice that conduct research, run ePortfolio projects, set policies, disseminate outcomes and promote ePortfolio-based learning. The relevant literature indicates that there are various ePortfolio types but all serve the purpose of highlighting the need of identifying the aim and the target audience of the ePortfolio (Balaban, Divjak & Kopic, 2010).

It is argued that learners should design and deliver hybrid ePortfolios that can be established by selecting different types of ePortfolios. ePortfolio types can be distinguished into three major categories: Learning/Process/Development, Presentation/Showcase and Assessment ePortfolios. Furthermore, ePortfolios enable users to share content, support participation, collaboration and reflection in informal and formal settings (Roder & Brown, 2009).

On the other hand, a serious opponent of open source ePortfolios can be Social Networking Sites (SNSs) (i.e. LinkedIN, Facebook) which provide free accounts, file repositories and instant communication. Yet, although SNSs constitute a cost-effective and flexible solution for institutions and individuals, they fail to include the multiple ePortfolio purposes. Furthermore, the construction of an ePortfolio is a multilateral process that relates to various stakeholders and results in the need for a common vision. There is a great variety of available ePortfolio systems (Barrett, 2005; Gibson & Barrett, 2003): generic and customized platforms such as virtual learning environments, Web 2.0 tools, open source tools, university-designed software and stand-alone commercial products.

To meet the purpose of the present research, we propose an ePortfolio system that embraces the philosophy of a social networking community and promotes a structured learning path for managing academic development. In line with recent research findings, the use of SNSs does raise questions as to how to embed aspects of social media within ePortfolios (Roberts, 2018). The ePortfolio system used in this research was based on Elgg, an open-source social networking engine. This dynamic e-learning solution aims to integrate elements of social media platforms into various functions of the ePortfolio system. A challenging issue was the creation of an active community of learners that could support them so as to define their identities, engage in learning activities, interact through a micro-community and manage their learning path. The ePortfolio system is also based on a sound theoretical framework, the SRL theory with the aim of instilling a self-regulated learning culture in students (Alexiou and Paraskeva, 2019).

2.4.2 The Open Source Social Networking Engine: ELGG

The term Elgg comes from a town that is situated in Switzerland and it means ‘elk’ or ‘moose’ in Danish.

David Tosh and Ben Werdmuller initiated the Elgg project (started in 2004) in the company Curverider Ltd. In 2010, ‘Thematic Networks’ bought Curverider and the Elgg project was given to ‘The Elgg Foundation’ (**Figure *12***).

The ‘Elgg Foundation’ is a nonprofit organization that aims to support the vision of the Elgg as an open source project that is managed by a growing community and is promoted by contributors and supporters.

ELGG is an open source social networking engine that is available under version 2 of the GNU General Public License (GPLv2) (includes the framework and a set of plugins) and the MIT license (without the plugins) (The Elgg Foundation, 2014). It is an award-winning platform that provides a robust framework for setting collaborative environments for higher education institutions, training settings and various enterprises.

The vision is to provide an open source rapid development framework to various stakeholders, that attempt to create and use socially oriented web applications. Towards this, the Elgg is developed in PHP 7.0+ (with extensions for graphics processing – GD, for database connection- PDO, for AJAX responses- JSON, for reading plugin manifest files, for i18-multibyte string support and proper configuration and sending emails through an MTA and URL rewriting) and uses a MySQL 5.5.3+ database. The first stable release and the bugfix release support major browsers as well as mobile browsers, such as Android Browser, Google Chrome, Mozilla Firefox, Internet Explorer and Safari.

The Elgg engine is powerful, stable and multipurpose as incorporates a set of features:

- Easy and simple initiation of projects. Developers can use a well-documented core API so as to start their new project.
- Organized package about installation and maintenance of Elgg core and plugins. Stakeholders can use the package manager of choice, named composer.
- Plugins provide extended system functionality, languages and themes. There are 2.294 plugins that are produced by the Elgg community.
- Plugins can extend application’s functionality. There is a system of hooks and events that support plugins.
- Plugins can collaborate for building complex custom themes. There is an extendable system of views.
- Plugins and themes can use images, fonts, stylesheets without engine’s permission. There is a cacheable system of static assets.

- Applications can use custom authentication protocols. There are pluggable auth modules for user authentication.
- Password hashing is following the latest cryptographic approaches. There are security specifications such as CSRF validation, XSS filters and HMAC signatures.
- Easy communication with the server is ensured by a client-side API. There are used asynchronous JavaScript modules (via RewquireJS) and a built-in Ajax service.
- Applications can prototype new content and interactions among users. There is a flexible entity system.
- Developers can use a consolidated API layer for interface with the database. There is a pragmatical data model.
- Developers can create intranets (or private networks) based on granular content and set their access policies. There is access control system.
- Supporting user groups. There is a feature about groups.
- Plugins can store and manage user-generated files (no booting required). There is a flexible API that ensures file storage.
- Applications integrate other services and allow on-site and email notifications. There is a notifications service.
- Integrations with external applications and mobile clients can be achieved. There are RPC web services.
- Tsansifex (third-party service) supports the internationalization and localization of applications.

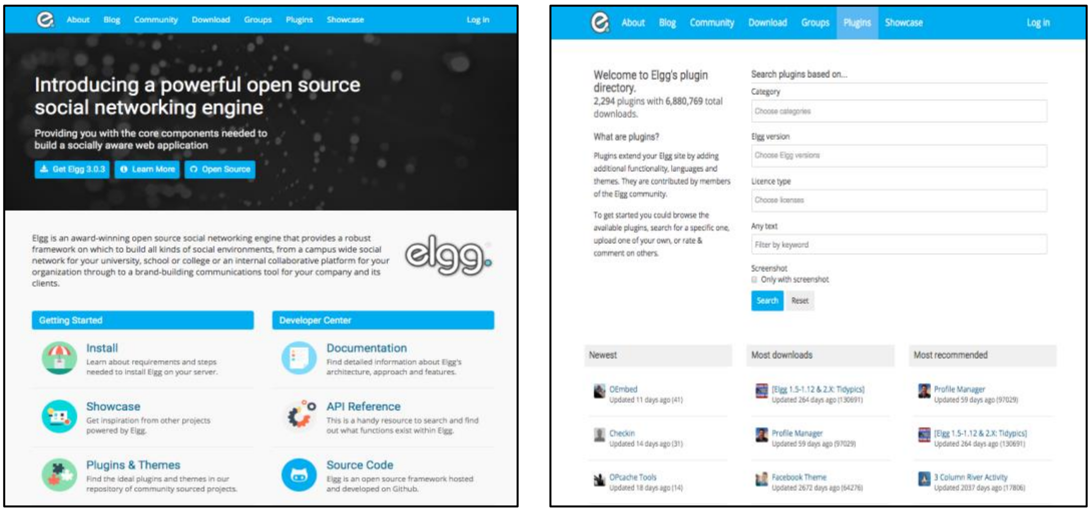


Figure 12. ELGG – The Social networking engine and the directory of plugins

Elgg is an open source project and is evolving through a community of developers, contributors, users and supporters. Elgg community builds a variety of plugins and invites users and developers to use and test them. Also, there are various good examples of Elgg platforms that embrace and promote various functionalities through the plugins:

The 'STEM TIPS: Teacher Induction and Professional Support' is a platform that supports teachers to be prepared for STEM Education. This is an instructional coaching platform that provides preparation STEM courses for school teachers (**Figure *13***).

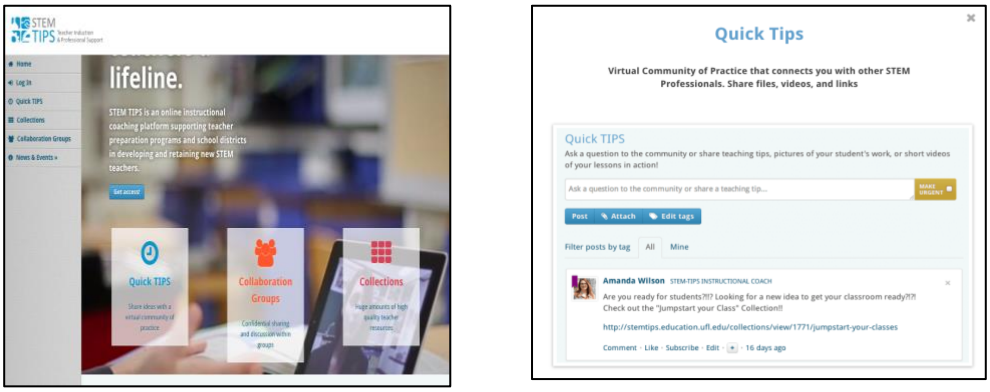


Figure 13. ELGG Example – The 'STEM TIPS'

The 'Exercise Friends' is a social network site for people that exercise and want to interact and share their experiences. Users register, create a community of exercise buddies and communicate. Also, the 'Spotwork' is a French social network site that gives users the opportunity to promote their talents, ideas and skills. This site used UI/UX applications for designing the layout (**Figure *14***).

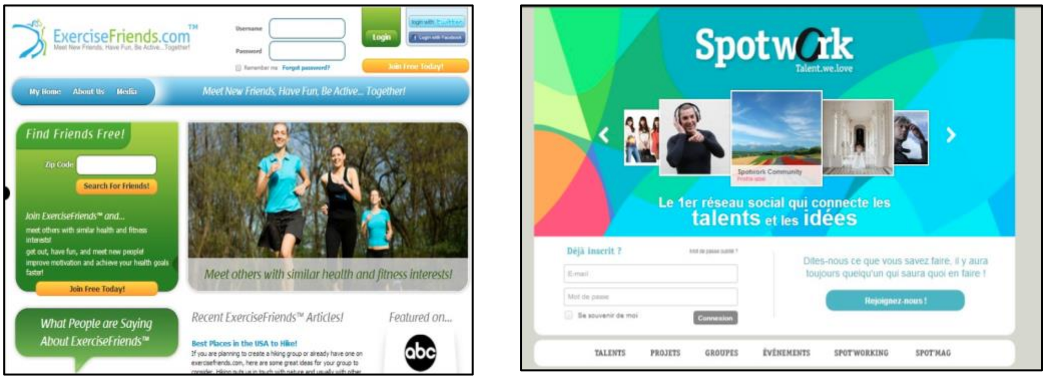


Figure 14. ELGG Example – The 'Exercise Friends'

The 'Athabasca University Landing' is developed for Canada's open university, the Athabasca University. This a social site for students and staff of the university and encompasses a variety of collaborative tools

The 'Wiley Faculty Network' is a social network that aims to connect Wiley staff. In this network, colleagues have the opportunity to create discussion groups, to share resources, attend virtual and live events.

2.5 Self-Regulated Learning[4]

The area of Self-Regulation (SR) is based on the theoretical background of Bandura's (1977, 1986) social cognitive theory (Zimmerman, 1986). Specifically, the theory emphasizes on the person-environment-behavior interaction and highlights the importance of regulation on specific aspects of human behavior (Bandura, 1986; Oppezzo & Schwartz, 2013). This means that the system of SR is located on a crossroad of several paths of psychological factors. The personal, behavioral, and environmental factors are transforming throughout the learning process: In covert SR, learners monitor and modify their cognitive and affective processes of learning, in behavioral SR learners self-observe and strategically arrange their performance processes and in environmental SR, learners observe and modify the environmental processes (Zimmerman, 2000).

Different definitions illustrate the multidimensional approach of the concept, such as Kuhl defines SR as "post decisional processes that energize and control the maintenance and enactment of intended actions" (Kuhl & Beckmann, 1985, p. 90) as well as Zimmerman refers to SR as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000), continuing Boekaerts and Corno involve in the definition of SR multiple constructs such as 'cognition, problem solving, decision making, metacognition, conceptual change, motivation, and volition' (Boekaerts & Corno, 2005). In addition to, researchers agree that the nature of SR is to regulate and monitor multiple learning processes consisting of components such as cognition, metacognition, motivation (Oppezzo & Schwartz, 2013). This is encompassed in the definition of SR "higher order control of lower order processes responsible for the planning and execution of behavior and emotional control" (Efklides, 2006). To sum up, SR can be described as "the reciprocal determinism of the environment on the person, mediated through behavior. Person variables include the distinct self-processes that interact with the environment through one's actions" (Dinsmore et al., 2008).

As Zimmerman indicates, he began his initial research on SRL in the early 1980s, but the first defining attempts were disappointing as were based on personal learning experiences in sports (Zimmerman, 2013). In the mid 1980s, educational and developmental psychologists proposed various constructs that involved in the nature of SRL and published these ideas in a special issue of Contemporary Educational Psychology (Zimmerman, 1986). Continuing into the 1990s, there

[4] This section is an adapted copy of the following journal paper:

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192. https://doi.org/10.1504/IJLT.2019.101849

are significant differences and important similarities between various theoretical foundations that define and attempt to model Self-Regulated Learning (SRL).

A group of researchers (Monique Boekaerts, Lyn Corno, Steve Graham, Karen Harris, Mary McCaslin, Barbara McCombs, Judith Meece, Richard Newman, Scott Paris, Paul Pintrich, Dale Schunk, Barry Zimmerman and others) set the foundations of SR in a symposium at the American Educational Research Association annual meeting in 1986. The outcome of the symposium was the integration of important aspects of SR such as learning strategies, metacognitive monitoring, self-concept perceptions, volitional strategies, and self-control and a definition of Self-Regulated Learning (SRL) as "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 1986). The thorough investigation of literature illustrates the different constructs of SRL that interact in the learning process. One definition suggests that SRL is "an effort put forth by students to deepen and manipulate the associative network in content areas, and to monitor and improve that deepening process" (Corno and Mandinach, 1983 p. 95). Another definition "refers to the degree to which students engage in the learning process using metacognition and proper motivation" (Zimmerman & Martinez-Pons, 1988; You & Kang, 2014). Additionally, Pintrich (2000) describes SRL as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment". Researchers emphasize on SRL as "a cognitively and motivationally active approach to learning" (Winne & Hadwin, 1998; Winne, 2010; Winne & Hadwin, 2013).

The abovementioned definitions signify a *working definition about SRL that is a multidimensional entity and consists of functional layers that empowering different aspects of human learning. The functional layers constitute multiple cognitive processes, affective factors, aptitudes, beliefs and 21st century skills (flexibility, collaboration, creativity, problem solving etc). In the context of SRL, each learner should conceptually orchestrate his/her own layers in order to transform his behavior into a measurable learning outcome. A self-regulated learner should activate his/her internal traits and follow context-specific processes for attaining academic, professional, personal and social goals.*

2.6 Models of Self-Regulated Learning[5]

From initial research on Self-Regulated Learning in the early 1980s until now, various significant researchers conducted research, designed theoretical models and delivered educational

[5] Part of this section has been published in the following journal paper:

implications (Puustinen & Pulkkinen, 2001; Panadero, 2017). Several models of SRL have been proposed, the majority of which derives from socio-cognitive theory of Bandura (1986). Researchers represented different approaches of SRL in order to model multiple cognitive, motivational, behavioural and contextual factors that affect the learning process (Zimmerman, 1986; Schunk, 1989; Winne & Hadwin, 1998; Zimmerman, 2000; Boekaerts & Niemivirta, 2000; Pintrich, Wolters & Baxter, 2000; Winne, 2001; Greene & Azevedo, 2007).

Researchers built different approaches of SRL in order to model multiple cognitive, motivational, behavioral and contextual factors that affect the learning process (Zimmerman, 1986; Winne & Hadwin, 1998; Zimmerman, 2000; Boekaerts et al., 2000; Pintrich, 2000; Winne, 2001; Zimmerman & Schunk, 2001; Greene & Azevedo, 2007). Different SRL models organize these factors in phases and suggest a cyclical sequence order but there are other models that propose factors without a strict order of application (Zimmerman 2000; Winne 2001; Borkowski and Dukewich, 1996; Bannert, Reimann & Sonnenberg, 2014). The comparison of fundamental SRL models in education illustrates that each model focus on slightly different components of SRL. For example, Corno indicates volitional features of SRL, whereas Winne indicates the cognitive features of SRL and McCaslin and Hickey focus on the sociocultural features of SRL (Pintrich, 2000). The important issue is that in all different models of SRL, it is shared the same assumption about students' actively regulation of cognition, motivation or behavior in order to perform better (Zimmerman, 1989).

A review that presents and compares the latest models of SRL, including those by Boekaerts (Boekaerts & Niemivirta, 2000), Borkowski and Dukewich (1996), Pintrich (2000), Winne (Winne & Hadwin, 1998) and Zimmerman (2000) indicates that that theoretical background is an important differentiating feature (Puustinen & Pulkkinen, 2001). Only two authors (i.e. Pintrich and Zimmerman) based on the same background theory, the social cognitive theory and identify SRL as a goal-oriented process (Puustinen & Pulkkinen, 2001).

All in all, various SRL models are following different architectural sequences and embrace various learning factors (Zimmerman, 2013). SRL models organize these factors in phases and suggest a cyclical sequence order but there are other models that propose factors without a strict application order (Zimmerman 2000; Winne 1998; Borkowski & Dukewich, 1996; Bannert et al., 2014). Considering that the present research seeks to deliver a dynamic SRL conceptual framework that involves important cognitive, motivational, behavioural and contextual factors that may affect the learning process, two major SRL approaches need to mentioned. The first one

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192. https://doi.org/10.1504/IJLT.2019.101849

encompasses SRL models which introduce a top-down, goal-oriented, approach to learning, one that guides learners to follow a specific set of steps throughout their learning attempts. During the learning effort, individuals activate cognitive and affective processes and try to adjust their actions for accomplishing their goals. Models that encompass specific phases in a cycle of learning, such as 'The Cyclical Model of SRL' (Zimmerman, 2000), 'The Cyclical Self-Regulatory Model for Study Skill instruction' (Zimmerman, Bonner and Kovach, 1996) and 'The Process Model of Self-regulated Learning (Perels et al., 2005) fall into this approach. Within the second approach, models that combine aspects of the social-cognitive theory and information processing, can be noticed.

These models embrace bottom-up processes and the sequence of the phases does not follow a linear order. During the learning attempt, individuals activate cognitive, metacognitive, affective, behavioral and contextual processes. Instances of such models include the 'General Model of SRL' (Pintrich, 2000; Pintrich & De Groot, 1990; Pintrich et al., 1993), 'The Information Processing Model of SRL' (Winne & Hadwin, 1998, 2013; Winne & Perry, 2000), the 'Adaptable Learning Model of SRL' (Boekaerts, 1996; 1999; Boekaerts & Niemivirta, 2000) and the 'Metacognitive Affective Model of SRL (MASRL model)' (Efklides, 2011) (**Figure *15***).

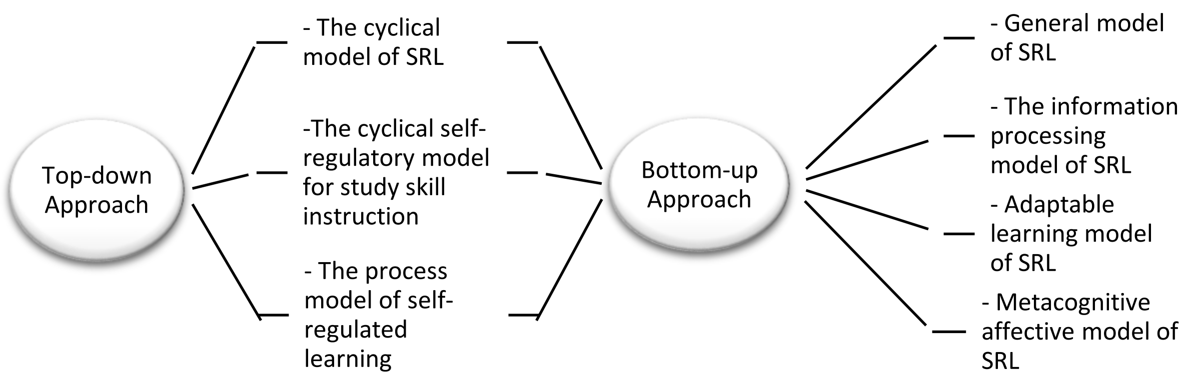


Figure 15. Top-down and Bottom-up approach of various SRL Models

The empirical evidence indicates that most of the SRL models encompass various processes that overlap in different conceptual frameworks. Another interesting observation is that SRL models embrace various processes that influence learning and well-designed SRL interventions can facilitate students' learning. Therefore, there is a need for designing learning environments based on well-organized SRL frameworks to support individuals' actions towards learning (Rosário et al., 2013) and enable their engagement in skill development activities and procedures (Panadero, 2017).

The intention is to guide the learner through a regulatory path so as to engage in SRL activities. There are several SRL models that are following the same sequence of architecture. The idea is the delineation of cyclical phases that embrace different processes of SRL. An important issue is the differences between the models in terms of highlighting different aspects of learning: cognitive, metacognitive, affective, behavior or context.

2.6.1 The general model of Self-Regulated Learning

Pintrich (2000) proposed a conceptual framework of SRL, which incorporates aspects from social cognitive theory and information processing. According to Pintrich, the SRL model is illustrated as a table with rows and columns. Rows represent the four phases of SRL and columns depict processes of learning. The alignment among the rows and columns of the table opens a range of areas that individual could engage on learning activities that may or may not require SR. One characteristic of this model is the sequence of the phases that doesn't follow a linear order. It is argued that individuals can engage in different phases each time as well as may follow more than one phase in each learning activity.

Pintrich's model extends the process of SRL to four phases (rows of the table), namely: (1) Forethought, planning, activation, (2) Monitoring, (3) Control/Management and (4) Reflection. These phases aligned to different areas of regulation (columns of the table): cognition, motivation/affect, behavior, and context. According to this model, an individual interacts with the learning activity/task across the different phases of SRL and the areas of regulation: cognition, motivation/affect, behavior, and context. Although there are learning instances where individuals select to learn in a more implicit manner and they don't follow SRL phases.

Specifically, each phase of the model encompasses different processes of learning:

(1) Forethought, planning, activation: This phase consists of specific processes for initiating the task, such as: planning, goal-setting, activation of perceptions, developing a sense about the interactions between task and self and understanding of the required knowledge of the task.

(2) Monitoring: This phase encompasses several monitoring processes for cultivating metacognitive awareness on elements of the self, the task and the context.

(3) Control/Management: This phase consists of several regulation and control strategies for calibrating elements of the self, the task and the context.

(4) Reflection: This phase encompasses several types of reactions such as evaluations, reflections, judgments and attributions for elements of the self, the task and the context. The reactions of this phase are the response in the learning process.

The proposed phases are aligned to areas of regulation. This means that an individual has the opportunity to define, control, monitor and assess his learning experience regulating the areas of psychological functioning.

In detail, an individual can regulate the following areas:

Cognition: Across the four phases of SRL several cognitive processes are interacting. These are general types of planning or activation, which consists of target goal setting, activation of relevant prior content knowledge, and activation of metacognitive knowledge. Another important component is cognitive monitoring, which encompasses metacognitive judgments and monitoring. There are two specific types of the metacognitive awareness and monitoring, which involve judgments of learning (JOLs) and comprehension monitoring (Nelson & Narens, 1990) and the feeling of knowing (Koriat, 1993). Furthermore, there is cognitive control and regulation which guides the selection and application of cognitive strategies for memory, learning, reasoning, problem solving, and thinking. Finally, there are the processes for cognitive judgments, evaluations and attributions for performance.

Motivation/affect: The regulation of motivation suggests the application of affective processes across the phases of SRL. An important aspect that guides regulatory processes is the adoption of various goal orientations such as mastery orientation approach (other related terms are learning goal, task goal, task-involved goal) or avoidance and performance orientation approach or avoidance (other related terms are performance goal, ego-involved goal, self-enhancing ego orientation, relative ability goal). Another important area for regulation is the planning and activation of motivation, which involves judgments of efficacy to perform a task as well as the ease of learning judgments (EOL), which are based on metacognitive awareness of the past performance on the task. This SR area encompasses task value beliefs, which aggregate the perceptions about the utility and the importance of activities and personal interest as a positive anticipatory affect as well as anxiety or fear as negative anticipatory affects. Also, there is the area where individuals start to monitor their motivation and affect and then there are various strategies for controlling motivation and affect. Individuals can control self-efficacy and negative affect using positive self-talk strategies; also they can increase extrinsic motivation by giving rewards and they can use defensive pessimism and self-handicapping as motivational strategies. Next, there is an area of SR for motivational reaction and reflection, where individuals make attributions (Success or failure) and reactive emotions (pride, anger, shame, guilt) for the completed tasks.

Behavior: The regulation of behavior suggests the modification of overt behavior across the phases of SRL. In this area of SR, there are involved processes for planning and activation through self-observation, behavioral record keeping and time management. As the process of SRL evolves, there is the area of behavioral monitoring and awareness through formal self-observation techniques and self-experimentation. Continuing there is the area of behavioral control and regulation where individuals may regulate time as well as effort and engage in strategies such as persistence, self-handicapping (as procrastination), help seeking, defensive pessimism (increase in effort). Also, there is the behavioral reaction and reflection.

Context: The regulation of context suggests the management of context across the phases of SRL. In this area of SR, individuals develop their perceptions about the task, the context, the setting, and the climate in order to collect the contextual domain knowledge. Next, there is the area of awareness and monitoring where individuals should identify the opportunities and constraints of the social system in order to adapt. Towards this, there is the area of SR for contextual control and regulation, where individuals attempt to shape, adapt, or control the learning setting (change or leave context or task). Finally, there is the area of SR for contextual reaction and reflection, where individuals evaluate the task or the context/learning setting.

Concluding Facts about the general model of Self-Regulated Learning (Pintrich, 2000)

The background: The social cognitive theory of Bandura (1986) and information processing (Zimmerman & Schunk, 2001).

The definition: In the context of SRL, learners engage in an active learning procedure where they set learning goals and try to regulate their cognition, motivation, behavior and context.

The Model: This is a four phases model namely: (1) Forethought, planning, activation, (2) Monitoring, (3) Control/Management and (4) Reflection. These phases aligned to different areas of regulation (columns of the table): cognition, motivation/affect, behavior, and context. This model doesn't follow a linear order.

The empirical research: Research emphasizes on cognitive/metacognitive, motivation/affective, behavior and context processes.

The instrument: Motivated Strategies for Learning Questionnaire or MSLQ is a self-report instrument that measures (Likert-type items) the level of cognitive strategy use and their motivation (Pintrich , 1991; Pintrich & De Groot, 1990; Pintrich et al., 1993).

2.6.2 The cyclical model of Self-Regulated Learning

Zimmerman (1986, 1998, 2000) proposed the first model of SRL based on social cognitive theory, which was encompassing three phases in a cycle of learning. In 2003, and in 2009 the model was re-envisaged including more processes and analyzing the interaction between the processes (Zimmerman & Campillo, 2003; Zimmerman & Moylan, 2009). The intention was to deliver a cyclical SRL model, which emphasizes on the interactions between processes, motivational beliefs and learning outcomes. The cyclical SRL model was delineated into three different phases (Zimmerman, 2000, 2013):

Forethought Phase is the foundational stage of the learning process. This phase consists of the efforts that each individual should design and organize in order to be ready to act. There are two foundational processes of forethought phase: task analysis and self-motivational beliefs.

Performance or volitional control Phase is the active stage of the learning process. This phase consists of the efforts that occur during the motoric implementation. There are two processes that affect attention and action: self-control and self-observation

Self-reflection Phase is the evaluation stage of the learning process. This phase consists of the efforts that fulfill the learning process and involve the development of experiential thoughts for individual's actions. There are two processes of self-reflection phase: self-judgment and self-reactions.

According to this model, learning performance follows a cyclical structure of phases where learner activates and applies his learning processes, and then he/she takes feedback and makes adjustments in order to initiate new learning efforts. This means that SRL processes are interrelated and affect learner's performance and achievement. Furthermore, the outcome of one SRL cycle can be transformed into input for a new SRL cycle.

Concluding Facts about the cyclical model of Self-Regulated Learning

The background: The social cognitive theory of Bandura (1986)

The definition: SRL is an organized procedure that guides learners through their goals.

The Model: This is cyclical model comprised of three interrelated phases: Forethought, Performance or volitional control and Self-reflection.

The empirical research: Research emphasizes on cognitive/metacognitive factors such as strategy use and affective factors such as motivational and self-efficacy beliefs.

The instrument: Self-regulated Learning Interview Schedule (SRLIS) is a structured interview method for measuring students' use of learning strategies (Zimmerman & Martinez-Pons,1986; 1988).

2.6.3 Other Self-Regulated Learning Models

2.6.3.1 The cyclical Self-Regulatory Model for Study Skill instruction: Zimmerman, Bonner, Kovach

Zimmerman, Bonner and Kovach (1996) introduce the cyclical model of self-regulating academic studying. It is indicated that self-regulation of studying is based on the repetition of learning efforts. These efforts will guide learner to develop higher level of performance (Zimmerman, 1998).

The proposed model follows four cyclical phases and highlights the need for strengthening individual's awareness on his own academic study skills (what and how to learn from the learning content). This model depicts learning as a trial procedure where individual self-monitor his actions, set goals and strategies, internalize strategies and evaluate his actions. In detail:

Step one – Self-evaluation and monitoring: Individuals (students) observe their behavior and try to evaluate their progress and the outcome of their study methods. In this step individuals concentrate their focus on their deficiencies.

Step two – Goal setting and strategic planning: Individuals try to define specific goals, which are related on their identified deficiencies. For attaining these goals individuals should select the appropriate learning strategy from their repertoire.

Step three – Strategy implementation and monitoring: Individuals attempt to apply and monitor a learning/study strategy. Through this procedure students try to identify the valuable aspects of the strategy.

Step four – Strategic outcome monitoring: Individuals monitor their progress and evaluate their learning outcomes. The process of evaluation suggests that each person should internalize his strategies and produce attributions for his outcomes.

2.6.3.2 The Information Processing Model of SRL: Winne and Hadwin

Winne and Hadwin (1998) proposed a model SRL, which emphasizes on cognitive and metacognitive processes. This model embraces the theoretical background of information processing theory and includes four phases: (1) learners define the task, (2) set and plan their goals, (3) study on their tactics, (4) adapt on metacognition (Winne & Hadwin, 1998; Winne, 2010; Greene & Azevedo, 2007; Winne & Hadwin, 2013). This model doesn't suggest a typical sequential order among the phases but the learning process follows a cyclical process through the cognitive structure.

The architecture of the model involves variables at the person level and processes at the task × person level (Winne, 2004). Each phase describes the interaction of an individual's Conditions, Operations, Products, Evaluations, and Standards. These processes are encompassed in the acronym COPES in order to depict the events that occur during each phase. More specifically:

Conditions are divided in Cognitive and Task types, which illustrate the resources and constraints to a task. In detail, cognitive conditions encompass all the past learning experiences and include domain knowledge, knowledge of study process, dispositions, learning styles, beliefs and motivation (internal elements). Task conditions consist of the context, resources, instructional guidelines and time (external elements). The composition of conditions (external and internal) structure a setting in which operations deliver products (Winne & Hadwin, 1998; Winne, 2010)

Operations are cognitive SMART (searching, monitoring, assembling, rehearsing, and translating) processes, which occur in the learning procedure (Winne, 2001). Operations are primitive in nature and consist of tactics and strategies.

Products are the deliverables that are generated through the four phases of this model. These products are cognitive in nature.

Evaluations promote the monitoring of the process. This means that, individuals evaluate their products against specific standards so as to test the fulfillment of their objectives.

Standards are indicators of effective completion of individual's operation within the phases of SRL. Each standard is measured through criteria, which describe the optimal performance of individual's operations.

The architecture of this SRL model suggests a linear but recursive movement among the phases of learning (cognitive and behavioral activity) and multiple alterations among the processes of learning. This means, that successful performance is the outcome of thorough monitoring, control and multiple modifications in conditions, operations, products, evaluations and standards (Winne, 2001). This model expanded later by Winne and Perry (2000).

<u>Concluding Facts about The Information Processing Model of SRL</u>

The background: The social cognitive theory of Bandura (1986), the information processing (Zimmerman & Schunk, 2001) and the Cyclical Model of SRL Zimmerman (1998, 2000)

The definition: In the context of SRL, learners define the task, set and plan their goals, study on their tactics and adapt on metacognition.

The Model: This model doesn't suggest a typical sequential order among the four phases but the learning process follows a cyclical process through the cognitive structure. In each of the four phases (1-learners define the task, 2-set and plan their goals, 3-study on their tactics, 4-adapt on metacognition) is described the interaction of an individual's Conditions, Operations, Products, Evaluations, and Standards (depicting the events that occur during each phase.)

The empirical research: Research emphasizes on cognitive and metacognitive processes and is principally strategy oriented

The instrument: A trace methodology. This is an interesting type of assessment methodology for instructional designers and data analysts.

2.6.3.3 The Adaptable Learning Model of SRL: Boekaerts

Boekaerts introduce a three-layered model (Boekaerts, 1996,1999; Boekaerts & Niemivirta, 2000), which emphasizes on the type of goals that individuals-students attain. This model guides individuals to set and accomplish growth goals as well as support individuals to structure emotional well-being (Boekaerts & Corno, 2005). Boekaerts suggests that this is a model of classroom SR as it guides students so as to direct their learning actions through all the areas of SRL. The proposed model consists of three layers, where individuals attempt:

(1) To regulate aspects of self. This is the core layer, which functions as the foundation. Each individual should set specific learning goals, to value these goals, to select resources, to take decisions and to set future learning tasks. This layer is interrelated with the following layers.

(2) To regulate the learning process. This is the intermediate layer where each individual should enrich a repertoire of metacognitive strategies (planning and monitoring) so as to modify the learning process.

(3) To regulate the processing modes. This is the task-specific layer where each individual should develop a repertoire of cognitive strategies so as to manage the learning process.

<u>Concluding Facts about The Adaptable Learning Model of SRL</u>

The background: The Action Control Theory of Kuhl (1985) and the Transactional Stress Theory by Folkman and Lazarus (1984)

The definition: SRL is a goal-oriented process.

The Model: This model is more situated and introduces three interrelated layers: the regulation of self, the learning process and processing modes.

The empirical research: Research emphasizes on motivational factors and on academic achievement

The instrument: An on-line motivation questionnaire (OMQ) for measuring learner's cognitions and affects (Boekaerts, 1996)

2.6.3.4 The Process-oriented Model of Metacognition: Borkowski, Chan, Muthukrishna

Borkowski, Chan and Muthukrishna (2000) introduce the process-oriented model of metacognition. Their research focused on the characteristics of 'Good Information Processing' (Pressley & Ghatala,1990), which in turn influence components of metacognition. Researchers advocate that through well-organized learning experiences metacognitive components (cognitive, motivational, personal, and situational) of the learner can be developed throughout the life span.

Towards this, the process-orientated model of metacognition illustrates the process of developing, applying, conceptualizing and generalizing strategies.

In detail:

1- Specific Strategy Knowledge: individual starts to learn the attributes (effectiveness, application with a variety of tasks) and the application of a learning strategy.

2- Specific Strategy Knowledge is enlarged: individual familiarize with different strategies and decides which strategy is appropriate for each learning situation.

3- the beginning of SR: individual starts to select consciously the appropriate strategies for different learning situations (higher-order thinking and adaptive learning).

4- the accumulation of general strategy knowledge: Individual recognizes the effectiveness of each strategy and initiates to shape internal affective processes (self-efficacy, motivation beliefs, attributions).

5- the deployment of SR: individual associates the reasons for being strategic with his capacity of being self-efficacious. This process involves the meaningful monitoring and decision-making.

6- General knowledge about the world: individual emphasize on domain-specific knowledge without the use of strategies

7- Crystalized Visions into the future: Individual organize short-term goals so as to achieve general long-term future goals.

Concluding Facts about the Process-oriented Model of Metacognition

The background: From the information processing theory to metacognition (Flavell, 1979; Sternberg 1998)

The definition: SRL is based on metacognitive theory and emphasizes on the selection and application of learning strategies.

The Model: This model is strategy oriented where individual follows a process-orientated path for strategy use. Each learner initiates with lower lever cognitive skills and gradually engages in higher-level skills.

The empirical research: Research emphasizes on training children to learn how to select and apply strategies. The instructional processes support self-efficacy beliefs and motivation.

2.6.3.5 The process model of self-regulated learning: Schmitz

Schmitz (2001) based on social cognitive theory and developed a process-oriented model where there are three different phases of learning. The proposed phases follow a cyclical order and consist of interactive learning episodes. In detail, this model delineates the process of learning in three consecutive phases (Schmitz & Wiese, 2006):

(1) Preaction phase: In this phase the task is set and learner tries to define the goals taking into consideration the environmental conditions and the task context. Important aspects of learner's behavior are emotions (attitude), motivation and self-efficacy. These aspects have an effect on the selection of learner's strategies and the planning of the process.

(2) Action phase: In this phase the task is elaborated and learner tries to manage the time and the learning strategies for accomplishing specific outcomes (good performance). During this phase the learner, select cognitive, metacognitive, resource-oriented and volitional strategies (Pintrich, Smith, Giarcia, & McKeachie, 1993). In addition to, learner tries to self-monitor his performance through standardized diaries (self-observation process).

(3) Post-action phase: In this phase learner tries to compare his goals and the outcome performance by developing self-reflections. These reflections constitute self-judgment and self-reaction thoughts that guide learner to self-evaluate his goals and strategies. The outcome of this judgment is connected with positive or negative emotions.

Concluding Facts about the process model of self-regulated learning

The background: From the theories and models of Zimmerman (2000), Bandura (1997), Kuhl (1985), and Schmitz and Wiese (2006).

The definition: SRL encompasses the process of compiling different learning episodes so as to fulfill specific learning goals.

The Model: This model analyzes the learning process into three phases. The learner should follow each phase so as to achieve different learning episodes. This means that each day a learner can complete multiple cycles of SRL in order to pursue his goals.

The empirical research: Research emphasizes on training kindergarten teachers to help their students to develop SRL skills.

2.6.3.6 Metacognitive Affective Model of SRL (MASRL model): Efklides

The Metacognitive Affective Model of SRL (MASRL model) integrates important aspects of extant models of SRL but emphasizes on the correlations of metacognition and motivation/affect during SRL functioning. This model consists of different levels of SRL, which interact and inform each other according to specific situations and context. In detail (Efklides, 2011):

The Task: The learning task is an entity that can be embedded in a specific learning situation and context. Moreover, a learning task “can be objectively defined based on task features such as novelty, complexity, conceptual requirements, mode of presentation and on instructional goals” (Efklides, Papadaki, Papantoniou, & Kiosseoglou, 1997). The task has an impact on the levels of SRL but is independent in nature.

The Person Level: This level represents the stable characteristics-traits (cognitive, metacognitive, motivational, affective, and volitional), which can interact and may direct decisions (top-down self-regulation). Especially, person characteristics constitute specific components, which develop inner correlations that may affect SRL in person level. The components identified are: cognition (the ability, knowledge and skills of an individual), motivation (the expectancy-value beliefs and the achievement goal orientation), self-concept (the self-competence indicator), affect and emotions (the cognitive, affective and behavioral attitudes as well as different kinds of emotions in relation to learning), volition (the perception of control), metacognition-MK (Metacognitive Knowledge can be translated as the knowledge of self, tasks, goals and others), metacognition-MS (Metacognitive Skills with strategies can be seen as the use of learning strategies in order to monitor and control learning).

The Task × Person Level: This is the level of SRL functioning where hands-on, online, or microlevel task is processed (Efklides, 2001; Greene & Azevedo, 2009). In this level, there are four basic functions: cognition, metacognition, affect, regulation of affect and effort. Under the function ‘Cognition’ there are three phases for task processing:

Phase A. Task Representation: It initiates the perception of the task and sets goal setting and planning processes.

Phase B. Cognitive Processing: It encompasses the non-analytic processes that follow the automatic task representation and memory retrieval that occur during the task processing.

Phase C. Performance: This phase begins when cognitive processing is completed and the response is produced then it is triggered the estimation of solution correctness and feelings of confidence and satisfaction (Efklides, 2002).

Concluding Facts about the Metacognitive Affective Model of SRL

The background: This model is based on the classic socio-cognitive theory of self-regulation (Bandura, 1986) and various SRL models.

The definition: SRL consists of two different processes: the top-down process, which is based on general person's characteristics and is goal-oriented (Zimmerman, 1998, 2008) and the bottom-up process, which is data-driven, and supports the monitoring of task.

The Model: The Metacognitive and Affective Model of SRL lay emphasis on the self-regulation of cognition and motivation/affect.

2.6.3.7 Model of cognitive and metacognitive activities in historical inquiry (The CMHI Model): Poitras & Lajoie

The CMHI model encompasses a set of domain-specific attributes of SRL by organizing theoretical frameworks of historical reasoning and problem-solving (Nokes et al. 2007; van Drie and van Boxtel, 2008) with the Information Processing Theory (IPT) of SRL in text-studying (Winne 2001, 2004; Winne and Hadwin, 1998; Hadwin et al., 2010).

The CMHI model of SRL consists of lower and higher order processes, such as: cognition, metacognition, and regulation (Poitras & Lajoie, 2013). The lowest order processes are cognitive activities which encompass the basic strategies that are involved in processing information, such as elaborating, storing, and recalling information. Then, there are the metacognitive activities, emphasizing on monitoring and controlling cognitive processes (Veenman & Alexander, 2011). Finally, there are the highest order processes, the regulatory activities which consist of activities such as goal-setting, monitoring, and controlling (Boekaerts et al. 2000; Pintrich, 2000; Zimmerman, 2000, 2001; Zimmerman and Schunk, 2011).

According to this model, learning is accomplished through an inquiry process of three phases where the learner tries to regulate and understand why an event is occurred. These phases are:

Phase A. In this phase, the learner participates in regulatory activities for understanding why an event is occurred (condition: event's causes are unknown). In this situation, the conditions of the historical events aren't known.

Phase B. In the second phase, the learner engages in regulatory activities for updating the level of understanding. The learner initiates to investigate the causes of an historical event and perform inquiries. Towards this, the learner attempts to attain the goal by applying procedural knowledge, strategies, motivation and interest in an iterative sequenced manner.

Phase C. In the last phase, the learner assesses and judges the outcomes and understandings of the causes for the event. Then the learner can choose to engage in learning activities for the same topic or other relevant topics.

<u>**Concluding Facts about the Model of cognitive and metacognitive activities in historical inquiry**</u>

The background: This model is based on theoretical constructs from models of SRL (Winne 2001, 2004; Winne and Hadwin 1998, 2010) and historical reasoning (Nokes et al. 2007; van Drie and van Boxtel, 2008). Researchers attempted to clarify and expand the domain-specificity assumption of SRL.

The definition: It is argued that SRL might differ in a specific topic, such as history. Towards this, SRL encompasses superordinate (i.e., metacognitive activities) and subordinate constructs (i.e., cognitive activities) that can characterize it as a constituent structure.

The Model: The CMHI model provides a domain-specific account of SRL and engages learners in activities so as to understand why historical events occurred.

2.7 Towards a multidimensional Self-Regulated Learning Model

From early school years, students attempt to succeed academically and later on, as adults, they struggle to be successful in their professional life. For their aspirations to be met with success, the educational environment needs to provide effective methodologies that will support learners in their attempt to acquire hard and soft skills and qualities to manage their academic path. An emerging question that each individual should ask is "What do I need to know about myself in order to manage my limitations during my efforts to learn?" (Zimmerman, 2002). This means that learners should have the opportunity to realize that learning isn't just a covert event that occurs when they follow a specific teaching module. Furthermore, they should discover their mental abilities, identify their skills and embrace their individual differences. Put differently, learners should follow formal and informal learning instances and be able to self-regulate their learning.

Various theoretical paradigms and methodologies developed through thorough research on Self-Regulated Learning (SRL), which consider SRL as an inherent trait or aptitude and other as an event that follows a dynamic process (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman & Schunk, 2001; Moos and Stewart, 2013). It is suggested that SRL is a detailed knowledge of a skill that involves specific cognitive, affective, behaviour and context processes that can be adapted to different learning tasks (Zimmerman, 2013).

The need for intervention and assessment processes in order to shed further light on SRL effects on academic performance along the context of the study (Kramarski and Michalsky, 2013) is well established. Also, further research needs to emphasize mixed methods studies as well as complementary measures for activating and assessing SRL as an aptitude as well as an event (Azevedo, 2005; Greene & Azevedo, 2010; Veenman, 2007; Zimmerman, 2008).

A challenging issue is the design and delivery of dynamic methodologies that promote SRL as a self-directive process where learners transform their mental abilities into academic skills. Research considers that SRL may vary across different contexts as well as various tasks (Cleary, Callan, Zimmerman, 2012), so there is a need for a multidimensional framework that embraces the dynamic process, combines the important components and assesses the constructs of SRL (Cleary, 2011; Winne & Perry, 2000; Zimmerman, 2008). There is also a need for exploring and utilizing various assessment measures for capturing the regulatory constructs of the continuum. Therefore, this research attempts to investigate the differences and similarities among emerging SRL models and to provide valuable insights so as to deliver a dynamic SRL conceptual framework that involves important cognitive, motivational, behavioral and contextual factors that may affect the learning process.

Consistent with most models of self-regulation, the proposed conceptual framework represents SRL as a cyclical process that focuses on the impact of various self-regulatory processes (cognitive, motivational, behavioral and contextual).

2.7.1 Processes of Self-Regulated Learning: A Holistic Approach[6]

The present research is based on the social cognitive theory and on the theoretical and empirical work of two emerging SRL researchers (i.e. Zimmerman and Pintrich) in order to provide a dynamic model that supports the learner during his/her learning efforts. Our intention is to combine Zimmerman's (1986; 1998; 2000) cyclical SRL model with Pintrich's (1991; 2000) four phases' model that follows a more loose order and has four areas of regulation. The proposed model follows the cyclical order of three major phases of SRL, namely: [1] Forethought, [2] Performance Control and [3] Self-Reflection. Each phase encompasses a wide range of cognitive, affective, behavior and context processes that support the learner during his/her learning efforts. An individual has the opportunity to follow a structured path where he/she activates a wide range of learning processes (cognitive, affective, behavior and context) that depict the areas of psychological functioning. Learners learn how to regulate their processes in order to boost their academic performance. A challenging issue that needs further research is to measure to what

[6] Part of this section has been published in the following journal paper:

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192. https://doi.org/10.1504/IJLT.2019.101849

extent SRL capability or capacity can be optimized through the proposed SRL model. In detail, the model includes the following three phases (**Table 5**):

Table 5. Proposing a multidimensional Self-Regulated Learning Model: A holistic approach

SRL Model as a Holistic approach	Phase [1] Forethought	Phase [2] Performance Control	Phase [3] Self-Reflection
Cognitive Processes	Task Analysis Goal Setting Strategic Planning Planning Organizing Elaborating Critical Thinking Rehearsing Information Processing	Self-Control Use of Imagery Self-Instruction Attention Focusing Task Strategies Self-Observation Self-monitoring Self-recording Self-Experimentation Self-Feedback	Self-Judgement Self-Evaluation Self-Reaction Causal Attributions Self-Satisfaction
Affective Processes	Self-Motivation Belief Self-Efficacy Intrinsic Interest/Value Goal Orientation Outcome Expectations Efficacy Judgement Task Value & Activation Interest Activation Perception of Difficulty	Awareness Monitoring Motivation and Affect Selection and Adaptation Strategies for Managing Motivation and Affect	Affective Reaction Attributions
Behavioral Processes	Time and Effort Planning Planning of Self-Observation	Time management Study Aids Self-testing Test Strategies Help Seeking Keep records Structure Environment Effort Regulation	Choice Behaviour

Context Processes	Perception of Task Perception of Context	Monitoring Changing Task Context Conditions Shape-Control Learning Environment Study Environment Work Well with Peers	Evaluation Task Evaluation Context

Forethought phase [1]:

This is the introduction phase during which individuals learn how to activate their functions. This means that the learner should engage in actions for planning, designing, organizing and managing his/her learning efforts before the initiation of the task. This phase precedes any learning attempt and needs measurable analysis and thorough elaboration. During the forethought phase, learners should be able to adjust their cognitive, affective, behavioral and contextual states so as to apply SRL. It is assumed that an individual may follow a structured path to develop these processes and enhance his/her SRL capability. In the forethought phase, an individual may develop a wide range of processes:

- ***Cognitive processes*** consist of actions for planning, organizing, self-instruction, self-monitoring and self-evaluation of learner's performance. A detailed analysis of the cognitive processes is provided for the delivery of a sound conceptual framework.

First of all, *Task Analysis* is a wide process that that involves two key forms: goal setting and strategic planning. *Goal setting* is a procedure during which an individual decides about the outcomes of learning or performance (Locke & Latham, 1990). Goals are standards of performance and can be categorized as proximal goals which follow a short-term path and distal goals that have a long-term orientation. Learners attempt to set task-specific goals, to follow strategic and conscious efforts and to accomplish their tasks (Schunk, 2005). A challenging issue is the syntax of an effective goal, which should be specific, elaborated, tangible proximal and challenging (Bandura, 1986). Strategic planning, is based on the notion that "for a skill to be mastered or performed optimally, learners need methods that are appropriate for the task and the setting" (Weinstein, 1987). It is argued that strategies are processes and actions that have a specific purpose and direct learner's behavior for acquiring or applying a skill (Zimmerman, 1989). This means that, an individual should select, design or create a strategy for bolstering his/her performance during the learning process (Zimmerman, 2000). Research suggests that when the learner selects and applies strategies aids his/her cognitive state, controls affect and directs behavior. There is a wide set of cognitive strategies that can be employed by a learner for optimizing his/her learning experience and achievement. Examples of cognitive strategies can include rehearsing, elaborating, organizing, information processing and can support learner during the acquisition of knowledge. An important set of strategies is also critical thinking which emphasizes the analysis and evaluation of information as well as the application of prior knowledge for solving problems. Metacognitive strategies are planning, monitoring and regulating learning efforts. These strategies are related to learners' self-awareness about their own planning of strategies' use, monitoring the effectiveness of the strategies and regulating their actions and efforts (Pintrich et al., 1991, 1993).

 Affective Processes refer to actions for planning, organizing, self-monitoring and self-evaluating a learner's affective state. The self-motivation belief is connected to an individual's desire to work towards a learning goal. These beliefs can be developed consciously and intentionally for influencing their motivation (Boekaerts, 1996). There are several determinants of these beliefs such as the need for achievement, anxiety of failure, intrinsic/extrinsic goals and time limits (Ruohotie, 2002). Extrinsic motivation for the task is related to extrinsic rewards or conducting positive activities and intrinsic motivation is related to personal interest and inner will (Kuhl, 1985; Zimmerman and Martinez-Pons, 1986; Wolters, 2010). Supporting learners to maintain their motivation can be accomplished through different motivation strategies, such as: self-talk, self-consequating, relative ability, interest enhancement, environmental structuring. Self-efficacy beliefs are the thoughts about an individual's personal capacity to learn or perform effectively (Bandura, 1997). It is argued that self-efficacy can be an important predictor of learner's choice of activities, efforts and actions (Bandura, 1997; Pajares, 1996; Zimmerman, 1989). Specifically, perceived self-efficacy represents personal judgement of capability to do the task and presents control over the individual's learning effort (Pintrich, 1991). Self-efficacy can be developed through enactive mastery experiences, vicarious experiences, persuasive peer feedback and psychological functions (van Dinther, Dochy & Segers 2011). This means that people can modify their thinking and feeling by controlling their self-efficacy beliefs which in turn influence various processes such as goal setting (Zimmerman & Bandura, 1994), learning strategies (Zimmerman, Bandura, & Martinez-Pons, 1992), time management (Britton & Tessor, 1991), self-monitoring (Bouffard-Bouchard, Parent & Larivee, 1991) and self-evaluation (Zimmerman & Bandura, 1994).

Intrinsic interest refers to learners' actions for valuing an activity. Interest can be seen as a psychological predisposition that empowers and urges individuals to engage in activities for its inherent properties (Pintrich, 1991).

Goal orientation emphasizes the purposes for doing a specific task (Pintrich, 2004). There are the mastery goals (mastery-approach and mastery-avoid goals) which focus on the actions for acquiring knowledge and skill based on prior performance and the performance goals (performance-approach and performance-avoid goals) which consist of the actions for demonstrating competence compared to peers (Elliot & Harackiewicz, 1996; Pintrich, 2000).

Outcome expectations are the results of one's actions. An individual can estimate how an activity fits into his/her personal plans and how the environment is responsive to their actions (Bandura, 1997). It is argued that outcome expectations can foster or eliminate learners' academic achievement (Pintrich, 1991).

Efficacy judgement includes learner's belief about personal abilities of controlling and performing tasks. It is argued that this is an expectancy component that encompasses individual's beliefs about their capacity to do activities (Pintrich, 1991).

Task value and activation correspond to a learner's self-perceived beliefs about the importance, the utility and relevance of a specific task. A value can be seen as an 'ideal' and has a permanent meaning. During the learning process, individuals should value the importance of their tasks so as to set and accomplish effective goals and to choose to perform them. Literature suggests that value consists of four classes, namely attainment value, interest value and benefit value and cost (Ruohotie, 2002). This means that an individual should try to boost the task value of a learning experience by attempting to find useful information or helpful connections to their academic and career path (Wolters, 1998). Also, task value is related to goal orientation, selection of activities and the intensity of behavior (Eccles & Wigfield, 2002).

Interest activation refers to the process of fostering concern for a specific activity or topic. There are interest enhancement strategies that may support learners to enhance their intrinsic motivation and interest. It is important individuals to show genuine interest and search actively for learning occurrences (Pintrich, 1991).

Perception of difficulty refers to the level of awareness about the difficulty as well as the prerequisites of a task. It is suggested that learner should examine the conditions of difficulty as this can affect the volitional control. When the task is hard, then learners can boost their effort according to their goals or they can decrease effort (Zimmerman, 1998).

- ***Behavior processes*** consist of actions for self-observing and adjusting αlearner's behavior. They involve time and effort planning (time management). The former refers to a learner's efforts to regulate his/her own study environment. It is argued that individuals should attempt to create study schedules, plan their time and allot time for different activities (Pintrich, 1991). Planning of self-observation consists of the actions that the learner performs for assessing and regulating his/her progress. It is suggested that the most powerful self-observational technique is the use of self-recording (Zimmerman & Paulsen, 1995). The effectiveness of self-observation can be determined from the in-time feedback, the level of informativeness of feedback, the accuracy of self-observation and the valence of the behavior (Bandura, 1986).

- ***Context processes*** consist of actions for planning and managing the context of the learning setting. They include the perception of task which involves the activation of perceptions about the task, suggesting that learners need to realize the norms of the context through analyzing and understanding the objectives of the task (Pintrich, 2000). They also involve the perception of the context which refers to the activation of perceptions about the context. Individuals should engage in activities for developing perceptions about learning environment features, types of tasks, grading and climate environment setting (Pintrich, 2000).

Performance Control phase [2]:

This is the action phase where individuals learn how to act and to utilize their psychological functions for accomplishing their task. This phase occurs during the learning process and involves individuals in dynamic implementation of their learning tasks. In performance control phase, an individual may develop a wide range of processes:

- ***An analysis of the cognitive processes*** is provided for the delivery of a sound conceptual framework:

Self-control is an important feature that supports learners to focus on a specific activity, guide their actions and advance their progress. When the learner uses various sources of self-control this in turn optimize the use of strategic adjustments and self-beliefs. It is argued that self-control acquires the use of several methods or strategies that were picked during the forethought phase. This process may include the use of self-instruction, imagery, attention focusing and task strategy (Zimmerman, 2000).

Use of imagery (a self-control technique) refers to the formation of mental pictures for supporting the process of encoding and elevating performance. This can be achieved through the use of mnemonics and the process of encoding/decoding and retrieving the information. Learners should visualize the correct application of strategies; mentally construct their planned actions in order to enhance performance (Zimmerman, 1998). This could be achieved through several strategies like paraphrasing, summarizing, outlining, networking, constructing tree diagrams, and note taking (Weinstein, 1987).

Self-Instruction refers to the method overtly or covertly of describing the process when the learner execute an activity. This process involves the verbalization of learner's thinking when they execute a task (Schunk, 1989). It is argued that self-instruction supports learners through orientation, organizing, structuring behavior, problem definition and focusing attention (Meichenbaum, 1977).

Attention focusing, is a process where individuals attempt to eliminate the external or covert events and the distractions in the environment in order to organize their concentration and focus on their learning (Corno, 1993). There are techniques for optimizing attention focus and control such as attention control, slow-motion task execution and rehearsal strategies.

Task Strategies are techniques and methods that support learner to boost his/her performance by dividing a task to simple components and then rearranging the components in a meaningful way (Zimmerman and Martinez-Pons, 1988). Researchers highlight the need of using a wide set of task strategies for guiding the learning process (Weinstein, 1987; Woloshyn & Stockley, 1995). Task strategies include various study strategies, (e.g note taking, test preparation, and reading for comprehension), performance strategies (e.g writing techniques, problem solving, elocution), motivation strategies (e.g self-consequences, environmental structuring, interest enhancement, self-observation, self-instruction) (Wolters & Rosenthal, 2000).

Self-observation is the process of tracking and realizing the outcomes, conditions and effects from performing specific behavior (Zimmerman & Paulsen, 1995). It is argued that learners should self-record their actions or self-experiment for discovering the causes and effects of their actions (Zimmerman, 1989). Researchers suggest that self-observation has a set of features that affect it's effectiveness, such as the temporal proximity, self-feedback, informativeness of performance feedback, the accuracy of observation and the valence of behavior (Bandura, 1986; Lehmann & Ericsson, 1997; Kirschenbaum & Karoly, 1977). It is important to guide individuals to engage in self-observation processes through setting hierarchical goals and self-recording so as to enable them to keep track of their functioning and increase awareness of their actions (Zimmerman & Paulsen, 1995).

Self-monitoring is a procedure where the learner records his/her progress by cognitive tracking (Zimmerman, 2000). It is highlighted that self-monitoring is a covert aspect of self-observation and supports learner's self-beliefs as well as mediates strategic modifications. Learners can use self-monitoring techniques such as self-questioning, keep records with their grades and journal keeping for observing their performance and alter their actions.

Self-recording refers to the process of capturing personal information, structuring it in a meaningful way and creating a repository of valuable information. The use of self-recording may enhance the quality of feedback (proximity, informativeness, accuracy and valence) (Zimmerman & Kitsantas, 1996). Learners can utilize self-recording as a self-observation technique in order to be able to recognize their errors (Zimmerman, 2000).

Self-experimentation can be used as a consequence of self-observation (Bandura, 1991). The process of self-experimentation encompasses the actions of the learner in order to discover the cause of specific actions. This means that individuals can experiment on various aspects of their functioning (Zimmerman, 2000).

Self-feedback refers to the information that a learner can provide on his/her own in order to affect the knowledge domain. This means, that an individual should be able to manage and reconstruct the new information in memory (Butler and Winne, 1995). It is argued that the type of feedback that learners may receive can influence their reflections and the level of information on learning outcomes (Ruohotie, 2001). When individuals use feedback from previous learning efforts then they are able to make changes on their goals and their strategy use (Puustinen & Pulkkinen, 2001).

- ***Affective Processes*** consist of actions for planning, organizing, self-monitoring and self-evaluation of learner's affective state.

Awareness monitoring motivation and affect refers to processes that can be obtained for regulating the learning effort. This means that an individual should be able to select and utilize strategies for controlling his/her learning, thinking and emotions. A challenging issue is the recognition of emotions as 'multifaceted phenomena involving coordinated psychological processes, including affective, cognitive, physiological, motivational, and expressive components' (Scherer, 2009).

Selection and adaptation strategies for managing motivation and affect consist of various methods that can support individual to promote learning and manage his/her emotions. Research states that positive achievement emotions (enjoyment, hope, pride) affect interest and intrinsic motivation whereas negative emotions (anger, anxiety, shame, hopelessness) have a negative effect on the same affective processes (Pekrun et al., 2004). It is suggested that positive emotions (enjoyment of learning) can be related to active learning strategies such elaboration, organizing and critical thinking, on the other hand, negative emotions (anxiety) should facilitate the use of more simple strategies such rehearsing. Also, when the learner has deactivating emotion (relaxation, boredom) then he/she can follow a simple information processing strategy (Pekrun et al., 2010).

 Behavior processes consist of actions for self-observing and adjusting learner's behavior. An analysis of the behavior processes is provided for the delivery of a sound conceptual framework:
Time management is an important process where individuals engage in tasks for constructing personal schedules for studying, allocating their efforts and workload as well as organizing their time (McKeachie et al., 1985; Pintrich et al., 1987). It is stated that learners should follow time management tasks in order to plan and regulate their studies (Ruohotie, 2002). Time management promotes certain tasks, such as scheduling their short or long-term studies, selecting the appropriate activities and controlling their effort. Also, time management is part of the resource management strategies (Pintrich, 2000).
Study aids refer to the appropriate ways of using additional content for studying. When individuals try to learn new concepts, they can engage in techniques, use material or resources that support them to save and retrieve new content. This construct derives from 'Learning and Study Strategies Inventory (LASSI)', which involves components of strategic learning (Weinstein, Zimmermann, and Palmer, 1988).
Self-testing is a function where an individual studies specific content and self-assess his/her learning efforts. Individuals may use monitoring techniques for review their level of comprehension. This construct derives from 'Learning and Study Strategies Inventory (LASSI)', specifically from the self-regulation (Weinstein, Zimmermann, and Palmer, 1988).
Test Strategies encompass various techniques for supporting learners in test preparation as well as during an examination procedure. Individuals should be capable of applying test taking strategies. This construct derives from 'Learning and Study Strategies Inventory (LASSI)', specifically from the self-regulation (Weinstein, Zimmermann, and Palmer, 1988).
Help Seeking refers to the process of requesting meaningful assistance from knowledgeable others (Ryan and Pintrich, 1997). Learners should be able to identify when they find difficult to understand the material and feel confused and disorientated (Boekaerts, Pintrich & Zeidner, 2000). Help seeking, is a strategic achievement behavior (Ames & Lau, 1982) and highlights the interplay between social and affective constructs.
Keep records refers to strategies and techniques where learners organize their performance and record their learning outcomes. This technique may support learners to eliminate their errors or the sources of errors, as well as reduce inefficiency and confusion (Zimmerman & Paulsen, 1995).
Structure Environment is a process where learner decides about the specifications of an effective study environment. This means, that learners may adapt to a specific environment or they are able to modify an environment for fulfilling their goals (Ruohotie, 2002).

Effort Regulation refers to the process of controlling and managing learning efforts. It is important, students to realize when to foster their learning attempts, persist on activities and maximize their efforts (Pintrich and McKeachie, 2000).

- **Context processes** consist of actions for planning and managing the context of the learning setting. An analysis of the context processes is provided for the delivery of a sound conceptual framework:

Monitoring changing task context conditions (change tasks and context) encompasses the process of controlling and structuring the environment. Specifically, individuals engage in monitoring tasks so as to accomplish their goals and complete their activities (Corno, 1993; Kuhl, 1985).

Shape-control learning environment refers to the processes of regulating the learning context (Pintrich, 2000)

Study environment consists of actions for shaping the learning environment (Pintrich et al., 1991). Learners should be able to monitor their environment for distractions and restructure the setting in order to make it more appropriate for studying and facilitate learning. There are techniques that support learners to manage the external conditions such as removing distractions, organizing their setting, selecting a specific study space (Zimmerman, 1998).

Work well with peers emphasizes on the ability of learners to collaborate with peers in order to elevate learning. In this process, individuals may utilize their peers as a source of knowledge and interaction. This means that learners should attempt to participate in a discussion and share ideas so as to construct their knowledge base (Borkowski et al., 2000).

<u>Self-Reflection phase [3]:</u>

This is the completion phase where individuals learn how to monitor and evaluate their actions. This phase occurs after learning and motivates learners to reflect and self-evaluate the learning behaviour and actions. In this phase, individuals have the opportunity to make adjustments and to take new decisions about their learning in order to apply them in future learning tasks. In self-reflection phase, an individual may develop a wide range of processes:

- **An analysis of the *cognitive processes*** is provided for the delivery of a sound conceptual framework:

Self-judgement encompasses the actions of self-evaluating one's performance as well as discovering and providing specific attributions about the outcomes and its' causes (Zimmerman, 2000).

Self-evaluation is the process that follows a person for assessing the output of his/her performance. Individuals should judge their performance using specific criteria (standards, earlier levels of one's functioning, achievements of others) (Bandura, 1997; Zimmerman, 2000). It is argued that when learners engage in self-evaluation activities then attempt to interpret the outcome and provide attributions and judgements for their success or failure which in turn can lead to positive or negative self-reactions (Pintrich, 2000).

Self-reaction refers to forms of behavior responses after specific human functioning. There are various types of self-reactions, such as the feelings of self-satisfaction, positive emotions and adaptive/defensive responses (Schunk, 2005). When learners use support from their environment (individuals select their rewards or praise) then they can boost their self-reactions and in turn they can enhance self-efficacy, outcome expectations, goal orientation and intrinsic interest (Pintrich, 2000)

Causal attributions encompass the perceived causes of human functioning (Weiner, 1986). These attributions are based on internal cognitive elaboration of self-evaluation's outcomes and affect learner's motivation. The promotion of causal attributions helps individuals to realize and interpret the possible causes for learning errors or difficulties and support them to discover and apply appropriate learning strategies. This means that self-evaluation is correlated to causal attributions in order to explain if a performance is poor due to limited ability, strategy use or effort (Zimmerman, 2000).

Self-satisfaction includes perceptions about how satisfied or dissatisfied one feels regarding his/her actual performance. It is argued that self-satisfaction can be viewed as the positive reaction which leads to positive realizations that may foster motivation and increase self-efficacy beliefs (Bandura, 1991; Pajares & Schunk, 2001). This means that individuals should give direction to their function and be able to value their level of self-satisfaction (Bandura, 1997).

- ***An analysis of the affective processes*** is provided for the delivery of a sound conceptual framework:

Affective Reaction is the way an individual respond to a task. This component consists of positive or negative emotional reactions to the task or self as well as their evaluation. These reactions can be doubts, lack of confidence, cognitive conflicts, test anxiety, emotions of accomplishments and self-worth (Zimmerman, 2000).

Attributions follow the completion of a task and refer to individual's reactions and personal judgements about the outcome (Weiner, 1986). The process of attributing causes on learning attempts is an important component of regulation (Pintrich, 2000). Individuals should be able to control the quality of their attributions, as this has an effect on the quality of their emotions and the creation of new emotions (pride, anger, shame, and guilt). It is suggested that when learners realize their success or failure then they are able to protect their self-worth and manage the use of ineffective strategies (Pajares & Schunk, 2001).

 An analysis of the *behavior processes* is provided for the delivery of a sound conceptual framework:

Choice Behavior refers to the actions that the learner follows for completing a task. This process consists of various learning efforts (persistence, help-seeking, and choice behaviors) that guide individuals to accomplish their activities (Pintrich et al., 1991).

 An analysis of the *context processes* is provided for the delivery of a sound conceptual framework:

Evaluation Task refers to the process of assessing the objectives, the procedure and the learning outcome. Individuals should reflect on and assess the components of the assigned activity (Pintrich et al., 1991).

Evaluation Context refers to the process of assessing the learning setting of the assigned task. Individuals should reflect on and assess the variables that affect the study environment (Pintrich et al., 1991).

2.7.2 Self-Regulated Learning Assessment Measures

The proposed multidimensional framework combines the important constructs of SRL and follows a cyclical process of phases. The vision is to highlight the nature of SRL as a stable construct (aptitude) that evolves to a more dynamic process (event). Towards this, it is proposed the use of various assessment measures for capturing the regulatory constructs of the model. Researchers suggest that there is a need for dynamic frameworks that can be tested and provide empirical evidence regarding the reliability and validity of the proposed instruments (Pintrich, 2004). The state of art highlights the need for exploring different methods of assessments (combination of instruments) to investigate improvements on various indicators of SRL processes and on general academic performance (Boekaerts and Corno, 2005). Towards this, it is proposed a combination of assessment methods so as to interpret and measure the SRL repertoire of learners. Assessment measurements of SRL can capture the level of SRL processes through interventions that prompt individuals to recall and judge their actions (SRL as an Aptitude) or engage learners in specific learning activities or instances and monitor his/her performance as well as invite him/her to report deliberately (SRL as an Event) (Winne, 2010). Towards this, there are various assessment methods that can be used to assess SRL capacity as an aptitude and as an event (DiBenedetto & Zimmerman, 2013) (**Table *6***):

- **SRL as an Aptitude includes measurements such as:**

Self-reports refer to measurements that ask learners to report on specific statements where individuals should assess different levels of self-regulated learning capacity (Cleary, Callan and Zimmerman, 2012). This instrument is based on the fact that learners' SRL is consistent across time, contexts but it faces various limitations such as response biases, cognitive malfunctions and memory discrepancies (Perry & Rahim, 2011; Winne and Perry, 2000).

Interviews prompt individuals to analyze their thoughts and experiences. This is a quantitative measurement for gathering data and record specific attitudes. There are unstructured, semi-structured and structured interviews that provide different levels of guidance during the process. *Unstructured and semi-structured interviews* consist from minimal to medium guidance that follows specific criteria; also structured interviews consist of fixed set of criteria (Perry, 2002; Zimmerman & Martinez-Pons, 1992).

Microanalytic Protocols target the process of learning (prior to, during, and after the process) and evaluate learners' statements in relation to specific learning situations. This methodology proposed from Bandura so as to measure self-efficacy beliefs (Bandura, 1986). SRL microanalytic protocols can measure cognitive, affective, behavior and context processes in authentic learning environments. Also, SRL microanalysis can be seen as a structured interview and refers to a well-organized set of questions and criteria (simple, short, accurate, context-specific, time-ordered) (Cleary, 2011; DiBenedetto & Zimmerman, 2013).

- **SRL as an Event includes measurements such as:**

Think Aloud Protocols prompt learners to engage in a specific activity and verbalize their thoughts about their actions (Boekaerts & Corno, 2005). This method evaluates the level of SRL awareness as individuals decide about the learning process and attempt to communicate their mental states (Winne, 2010).

Structured personal diaries and logs refer to process of self-recording thoughts and beliefs about learning efforts in an authentic context. This means, that this measurement captures SRL process on the fly and provide valuable insights (Klug et al., 2011). As long as, this method doesn't follow a specific structure there are difficulties in establishing construct validity (Winne, 2010).

Trace Logs are automatic approaches of investigating the physical evidence of students' actions and learning efforts (Winne et al., 2006). It is argued that this assessment should be used accompanied to other measurements, as there are certain variables that may not leave a trace or this trace cannot be assessed (Winne & Jamieson-Noel, 2002).

Direct observations encompass the process of recording the general verbal and non-verbal behaviour of the learner in order to accomplish a task (Winne and Perry, 2000). This measurement consists of an organized plan and a set of criteria (coding system and scoring procedures). An important aspect of observations is that they can assess ongoing and context specific actions through quantitative and qualitative methods of analysis (Boekaerts & Corno, 2005).

Table 6. Self-Regulated Learning Assessment Measurements

SRL Model as a Holistic approach	Phase [1] Forethought	Phase [2] Performance Control	Phase [3] Self-Reflection
	SRL Assessment Measurements		
SRL as an Aptitude	Self-Reports Interviews (unstructured, semi-structured and structured) Microanalytic Protocols		
SRL as an Event	Think Aloud Protocols Structured personal diaries Trace Logs Direct observations		

To sum up, it is suggested that SRL should be viewed as a multidimensional construct that encompasses dynamic processes (Hadwin, Järvelä, and Miller; 2011). Towards this, it is proposed the selection of various measurements that can capture specific variables and aspects of SRL processes. Empirical research is needed for testing a combination of assessment methodologies so as to achieve higher levels of reliability and validity (DiBenedetto & Zimmerman, 2013). Our vision is to investigate individuals' SRL skills and examine theirs effects on learning using a set of assessment tools for capturing with greater precision learning outcomes.

2.8 Supporting Self-Regulated Learning in ePortfolios

In the digital decade, learners are transformed from simple knowledge receptors into knowledge creators and users of new technologies, devices, and applications. To respond to this shift, learning environments should focus on building skills and competencies for life, increasing students' involvement in learning and adapting positively to rapidly changing environments (Tan et al., 2008). In order to fulfill this contemporary demand, we should support students in order to learn how to become self-regulated learners and engaged actively and constructively in a meaningful process of learning where they can proactively adapt their thoughts, feelings, and actions (Boakaerts & Corno, 2005; Boekaerts, Pintrich, & Zeidner, 2000). This statement is underpinned by the fact that SRL can be successfully taught to students of all grade levels and that the skills acquired through the process of SRL lead to academic development (Borkowski, Chan, & Muthukrishna, 1995; Zimmerman & Schunk, 2001).

Technology-Enhanced Learning Environments (TELEs) enable students to select their mode of learning, to use the appropriate technologies, and to obtain their knowledge so as to become successful (Wilen-Daugenti, 2007). It seems that in TELEs learners should develop and utilize SRL skills in order to eliminate factors such as familiar learning situation, and group pressure (Schunk, 2005). It is argued, that is difficult to find hard evidence for the impact of the new technologies on learning outcomes and it is even harder to find research on the impact of TELEs on SRL (Steffens, 2008). Research should focus on how students self-regulate when learning with TELEs in order to examine the underlying processes of SRL (Azevedo & Cromley, 2004; Azevedo, 2009; Greene & Azevedo, 2010). Among TELEs, ePortfolios can be seen as a powerful tool that becomes popular in teaching practice. Empirical research indicates that ePortfolio experience has a strong connection to an individual’s capacity to self-regulate learning and promotes the acquisition of hard and soft skills (Wade, Abrami & Sclater, 2005; Alexiou & Paraskeva, 2010;2013;2015;2019).

Researchers and educators suggest that SRL can be aligned with the purposes and processes of ePortfolios. It is argued that ePortfolios are connected with student’s ability to self-regulate his/her own learning and to enhance competencies, skills and abilities (Wade, Abrami & Sclater, 2005). Various studies investigated the use of ePortfolio systems as vehicles to provide students with opportunities to foster their SRL skills (Cheng & Chau,2013). Specifically, recent studies indicate that when ePortfolios are based on Self-Regulated Learning (SRL) theories, they have a statistically positive effect on SRL skills (Nguyen & Ikeda, 2015). Findings indicate that the ePortfolio use can positively related to SRL processes (cognition, motivation/affect, behavior, and context) (Abrami et. al., 2013; Huang, Yang, Chiang & Tzeng, 2012). Other studies examined the relationship between ePortfolio participation and student success. The results showed that undergraduate students with rich ePortfolio deliverables had significantly higher-grade point averages, credit hours earned, and retention rates than students without ePortfolio deliverables (Chang et al, 2015). EPortfolio users assume that this tool is effective as it can assist them to document, showcase, reflect upon and review their learning (Tzeng & Chen, 2012). It is noted that ePortfolios should transformed into interactive learning environments that attempt to strengthen learners’ motivation and support them in developing a repertoire of strategies.

The process of ePortfolio implementation supports student as it assumes more responsibility, provides better understanding of strengths and limitations (Abrami et al., 2007). Also, it is argued that the process of the ePortfolio allows students to think critically, and to act in an independent and self-regulated manner. Researchers believe that teaching SRL skills within an ePortfolio requires commitment, purpose and strategies (Abrami et al., 2007).

Consistent with previous studies on ePortfolio-mediated learning (Chau & Cheng, 2010; Wade, Abrami & Sclater, 2005), ePortfolio development is a complex process that cannot simply be driven by a surface learning approach, one that is less likely to engender satisfactory or competent engagement with ePortfolio activities. Instead, students would profit from appropriate SRL strategy training for effective ePortfolio development (Cheng & Chau, 2013). One study investigated the use of an ePortfolio system as a vehicle to provide students with opportunities to foster self-regulation in learning. The findings indicated that good self-regulated learners can be intrinsically motivated so as to set better learning goals, utilize a repertoire of learning strategies, modify their strategies, engage in monitoring processes, assess their goals progress better, set a productive learning environment, seek help more often, regulate their learning efforts and set new updated goals when present ones are completed (Welsh, 2012). Another study indicates that cognitive strategies (i.e. elaboration, organization, critical thinking), metacognitive control strategies (i.e. self-regulation) and collaborative strategies (i.e. peer learning) may contribute to an effective ePortfolio development (Cheng & Chau,2013). Also, a study examined the relationship between ePortfolio participation and student success. The results showed that undergraduate students with ePortfolio artifacts had significantly higher-grade point averages, credit hours earned, and retention rates than a matched set of students without ePortfolio artifacts (Chang et al, 2015).

However, despite a growing body of research highlighting the beneficial role of SRL across educational settings, little is known about the relationship between students' SRL competency and their ePortfolio achievement (Artino & Jones, 2012; Cheng & Chau, 2013).

Continued research is essential to explore ePortfolio and its potential to support and develop self-regulated learners with varied learning styles (Muhammad et al., 2017). Further research is required to investigate the impact of the ePortfolio on scaffolding of reflection, feedback and goal-setting (Lamont, 2007). Also, another future direction of research is the precise mechanisms of SRL (Strijbos, Meeus & Libotton, 2007).

It is noted that further research should focus on designing a conceptual framework that will promote SRL processes (Ge, 2013) and investigate the effects of SRL on ePortfolio achievement (Cheng & Chau, 2013). Besides, there is a need for testing an ePortfolio based on a quasi-experimental procedure with two groups (experimental and control) and exploring the effects of learning goals, students' reflections, achievement tests as well as peer-assessments on learning and knowledge sharing (Chang, Chou and Liang, 2018).

2.9 Intervention Programs for developing SRL Skills

SRL capacity can be seen as a stable construct (aptitude) and as a dynamic process (event). (DiBenedetto & Zimmerman, 2013). Researchers focus on assessment measures that can capture the level of SRL processes through interventions that prompt individuals to recall and judge their actions (SRL as an Aptitude). In addition, there are assessment procedures that engage learners in specific learning activities or instances and monitor their performance as well as invite them to report deliberately (SRL as an Event) (Winne, 2010).

Towards this, it is highlighted the need of developing interventions programs that teach and assess SRL as a holistic event that occurs during the learning process (Cleary, Callan, and Zimmerman, 2012).

Considering intervention programs in SRL as an event, researchers suggest that interventions can be tailored for all age groups and to specific skill domains.

In the field of SRL, studies were conducted in various age groups, such as: university students (Schmitz, 2001; Schmitz & Wiese, 2006), PhD students (Schmidt, 2009) and professionals (Landmann, Pöhnl & Schmitz, 2005) that provided useful results. An effective intervention can follow two implementation variations: a direct intervention program that targets specific participants (e.g. postgraduate students) and an indirect intervention that corresponds to teachers' needs that can influence their students' behaviors (Klug et al.,2011).

Also, SRL interventions may implemented in specific learning context, such as: mathematics (De Corte, Mason, Depaepe, and Verschaffel, 2011), science (Cleary, Platten, and Nelson, 2008), writing (Graham and Harris, 2005) and reading (Guthrie et al., 2004). In this occasion, the intervention should follow a long-term design plan for gathering and processing data (Klug et al.,2011).

Over the past few decades researchers developed various SRL interventions attempted to develop SRL skills, draw meaningful conclusions and transfer findings to various settings (Boekaerts and Corno, 2005):

- *Intervention programs that attempt to depict the shift from behavior to cognition*

This category represents types of classroom interventions that target specific maladaptive processes and modify them to more adaptive and fruitful ones. These interventions are: stress inoculation Therapy, mental simulations, manipulation of learners' motivation in school subjects, classroom environment modification (e.g. Ames's TARGET program).

- *Intervention programs that attempt to directly train or develop SRL skills*

This category encompasses interventions that aim to teach strategies to students for using SRL in their study. This intervention is known as academic strategy instruction and focus on the learning process on the individual level and not on a social and interactive context.

- *Intervention programs that attempt to support SRL, considering learners' interactions, the context and the subject-matter.*

This category is based on sociocultural theory and represents interventions that support SRL during the learning process, such as cognitive apprenticeships, peer apprenticeships, computer-mediated learning environments, scaffolding strategies, learning communities and school-wide interventions.

- *Intervention programs that attempt to teach students how to follow cyclical SRL process and apply regulatory processes in academic tasks*

This category represents intervention programs that focus on train learners to familiarize to the SRL cycle, learn SRL processes that precede, organize, and evaluate learning in context (e.g. writing, mathematics, studying) (Cleary and Zimmerman, 2012). These interventions are: Self-Regulated Strategy Development (SRSD) (Graham & Harris, 2005; Graham, Harris, & Troia, 1998), Strategic Content Learning (SCL) (Butler, Beckingham, & Lauscher, 2005) and Self-Regulation Empowerment Program (SREP) (Cleary et al., 2008; Cleary & Zimmerman, 2004).

In general, SRL as a conceptual framework can serve as a foundation that can help future research to deliver intervention programs that encompass the cyclical three phases of SRL and measure the changes of the SRL processes as they occur using SRL microanalytical protocols (Cleary and Zimmerman, 2012). Another interesting issue is the introduction of effective interventions that encourage the use of SRL strategies through TELEs (e.g. ePortfolio) (Alharbi, Paul, Henskens and Hannaford, 2012). According to Chang, Tseng, Liang, Liao, (2013) future research should focus on delivering educational interventions that use ePortfolios (blog or microblog types of ePortfolios) for facilitating SRL skills.

The ePSRL intervention program anchored on ePortfolio as a vehicle and SRL as a conceptual framework. The intervention program aims to train students (undergraduates and postgraduates) on how to cope with the obstacles resulting from social media distractions, academic decisions, intensive workload, career orientation and emphasizing on managing their academic performance and achieving their goals. The ePSRL intervention program target students' academic achievement and well-being.

Chapter 3: Methodology

3.1 Background

HE should equip graduate with skills and attitudes related to sustainable development and specifically to focus on well-being of individuals (Di Fabio, 2017). In parallel, recent research pinpoints that the ubiquitous present of technology, the penetration of social media and the new landscape of skills seem to threat the balance among individual's well-being, performance and academic achievement (Abbott-Chapman, 2011; Lau, 2017).

Over the past decade, Greece has faced an economic, political and social crisis that affected education. Specifically, the OECD Programme for International Student Assessment (PISA) showed that the average students' performance in science and reading is below OECD average levels (OECD, 2016). Also, 15-year-old students' levels of life satisfaction and well-being are lower than the OECD average (OECD, 2017). At the same time, in HE, the OECD Survey of Adult Skills (PIAAC) noted that individuals (tertiary-educated individuals) have low proficiency in basic skills (literacy and numeracy) and problem solving in TELEs (OECD, 2018). It is therefore worrying that future labor force doesn't feel satisfaction with the education system and believes that there are weak links between Greek HE and career requirements. Between 2008-2014 an estimated 500.000 Greeks were young professionals that left Greece to seek work in other countries (Labrianidis and Pratsinakis, 2016; OECD, 2018).

On the other hand, a positive trend that should be highlighted is the improvement of educational attainment of young individuals (25-34-year-olds). This means that Greek HE needs high-quality interventions that will target youth's knowledge, hard and soft skills, achievement as well as, competencies to use TELEs for solving problems and bolster their well-being.

Considering these facts, a question that recognized is 'In what ways an educational intervention may contribute to high academic achievement and students' well-being?'. Also 'Is it possible a well-designed intervention supported by a TELE to help learners to set meaningful goals, manage their learning tasks, organize their schedule and nurture the skills that could turn them into successful students and candidates?'

Research should explore the potential of designing and implementing interventions that encompass a dynamic learning model (e.g. Self-Regulated Learning) and a student-centered TELE (e.g. ePortfolio). Therefore, this research focus on ePortfolio experience, Self-Regulated Learning, academic achievement and their interrelations that need further exploration.

This study envisions to examine a set of affordances that can be seen as predictors of academic achievement and SRL practice throughout an ePortfolio intervention. My intention is to investigate to what extent:

- *ePortfolio experience is related to Self-Regulated Learning (SRL)?*
- *ePortfolio experience is related to Academic Achievement?*
- *Self-Regulated Learning (SRL) is related to Academic Achievement?*
- *ePortfolio experience is related to cognitive SRL process: Goal setting?*
- *ePortfolio experience is related to affective SRL process: Motivation?*
- *ePortfolio experience is related to affective SRL process: Self-Efficacy?*
- *ePortfolio experience is related to behavior SRL process: Time Management?*
- *ePortfolio experience is related to behavior SRL process: Learning Strategies?*
- *ePortfolio experience is related to context SRL process: Peer Learning?*
- *ePortfolio experience is related to context SRL process: Help Seeking*?

3.2 Purpose of the Research

The purpose of the present research is the design and delivery of a conceptual framework for the ePortfolio construction process based on a Self-Regulated Learning Model (ePortfolio-based Self-Regulated Learning (ePSRL) approach).

Secondly, the development of the ePortfolio system in a social networking engine is proposed in order to examine its effects on Self-Regulated Learning. This research delves deeper into the implementation of the ePSRL approach as an intervention program so as to enhance Self-Regulated Learning and support learners to manage their knowledge, skills and attitudes and develop their academic and career path.

Thirdly, the effect of the ePortfolio intervention on Self-Regulated Learning was explored in a set of three studies. Additionally, this research attempts to examine the relationships among cognitive, affective, behavioral and contextual processes (fundamental SRL constructs) when learners use ePortfolios. Towards this, the improvement of the ePortfolio's capacity for capturing self-regulated learning principles, practicing self-regulated learning cognitive, affective, behavior and context processes as well as measuring competencies is attempted.
Specifically, the following general research question is formulated: "*What is the effect of* ePortfolio intervention *on Self-regulated learning (SRL cognitive, affective, behavioral and contextual processes) and academic achievement"?*

3.3 Research Questions

The **Research Questions (RQs)** addressed in this research are as follows (**Figure *92***):
RQ1*- Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?*

- **RQ1.1-** Does the ePSRL intervention affect goal setting?
- **RQ1.2-** Does the ePSRL intervention affect self-efficacy?
- **RQ1.3-** Does the ePSRL intervention affect time management?
- **RQ1.4-** Does the ePSRL intervention affect learning strategies?

RQ2*- How does the ePortfolio intervention impact academic achievement?*

- **RQ2.1-** Are ePortfolio assessment results consistent among different evaluators (self- peer- instructor- external evaluator-) (i.e. inter-rater reliability)?
- **RQ2.2-** Are there significant differences among the four ePortfolio criteria/dimensions (i.e. ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics)
- **RQ2.3-** Are ePortfolio assessment scores appropriate to examine academic achievement? (i.e. the consistency between ePortfolio achievement scores and course grade)?
- **RQ 2.4-** How did students use the ePortfolio system:
    - i. Which features did they use and why?
    - ii. Which plugins did they use?
    - iii. How many artifacts did they upload?
    - iv. How much time did they devote to the ePortfolio system?
    - v. How many messages did they send?
    - vi. How many questions did they set?
    - vii. Which tools did they use to structure a stand-alone ePortfolio?
- **RQ 2.5-** To what extent does the ePortfolio intervention contribute to learners' satisfaction*?*

RQ3- *Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practise SRL processes?*

- **RQ3.1-** What are the students' perceptions of the ePortfolio-based Self-Regulated Learning (ePSRL) intervention about SRL processes?
- **RQ3.2-** Are there significant differences between low-achievers and high-achievers in terms of SRL processes?

3.4 Participants and context

The participants in **study I** included 86 university students (71 males and 15 females). The sample of the study involved, undergraduate students (Semester 1) at a computer science department of a Greek university. The sample were first-year students (One-Group Only Research) that voluntarily signed up for acquiring new knowledge and enriched experiences through the implementation of the ePortfolio Project. Since all participants had no experience with creating an ePortfolio, they attended a session of workshops in order to understand the fundamental characteristics of ePortfolios.

The participants in **study II** were 123 university students (85 males and 38 females). The sample of study II, were undergraduate students (Semester 6) at a computer science department of a Greek university. Students were on their third year of their studies and were assigned to the intervention for achieving their academic and career aspirations through the process of implementing an the ePortfolio Project. Students were divided into two groups, labelled Experimental Group and Control Group. Students assigned to the experimental group (N_E=70) followed a structured process and got involved in specific activities, such as setting meaningful goals, adopting dynamic strategies for managing these goals, monitoring the learning process, managing time, attributing meaning to outcomes, self-evaluating the learning path followed. On the other hand, students assigned to the control group (N_C=53) structured their ePortfolio only following the basic guidelines of the workshops.

The participants in **study III** were 28 higher education students (18 males and 10 females). The sample of study III comprised postgraduate students (One-Group Only Research) at a computer science department of a Greek university. The sample of the study voluntarily signed up for acquiring new knowledge and enriched experiences through the implementation of the ePortfolio Project.

3.5 Research Design

Research should explore the potential of designing and implementing interventions that encompass a dynamic learning model (e.g. Self-Regulated Learning) and a student-centered TELE (e.g. ePortfolio). Therefore, this research focus on ePortfolio experience, SRL processes, academic achievement that need further exploration. Thus, design-based research is selected, as the latter meets the following requirements and supports investigation in an authentic learning environment (Brown, 1992; Collins, 1992) (See Chapter 1: Introduction–**Figure 4**):

- *Analysis: This research addresses a complex problem in an authentic context*

The problem of declining achievement is evident in HE (Bok, 2009). It is observed that HE in the USA (Hacker & Dreifus, 2010) Australia (Coady, 2000), the United Kingdom (Hussey & Smith, 2012) and other countries has become a high-cost provider but with mediocre outcomes. HE should deliver teaching and learning approaches that promote the articulation of a repertoire of generic skills and simultaneously advance their self-regulated learning skills as the latter are considered as indirect triggers of any one graduate skill (Boekaerts & Cascallar, 2006).

- *Development: This research integrates hypothetical design principles with technological affordances for providing effective solutions*

Generic skills (e.g Self-Regulated Learning skils) can be developed by drawing learners' attention to the benefits of monitoring, evaluating and managing their own learning experience (Tsai, 2013) through the curriculum and specifically through the use of electronic portfolio (ePortfolio) (Abidin, Uden & Alias, 2013). ePortfolios, through e-learning mechanisms and information technology, provide a new means to assess learning and can be embedded within the framework of constructivism, authentic learning and self-regulated learning. This means that, this research should emphasize the design of an *ePortfolio based Self-Regulated Learning (ePSRL) system* within HE and investigate the effects of SRL (cognitive, affective, behavioral and contextual processes) and academic achievement.

- *Refinement and Reflection: This research conducts rigorous inquiry for testing learning environments and structuring design principles*

The vision of this research is to develop and test the *ePortfolio based Self-Regulated Learning (ePSRL) system* for HE so as to support students (future graduates) to enhance their generic skills (e.g Self-Regulated Learning skills) in order to manage their academic and career path. Thus, this study will attempt to produce new design principles about ePortfolios in HE, to enhance future implementation and to reflect on the learning outcomes

For the needs of this research, I followed the three stages of design-based research (Plomp, 2007;2013; Amiel & Reeves, 2008) (**Figure *16***): Preliminary, Prototyping, Assessment. In the preliminary stage, I tried to identify the challenges through the process of designing an ePortfolio intervention (conceptual framework and system). Further, in the prototyping stage, I attempted to implement the ePortfolio intervention within HE and investigate the effects of SRL (cognitive, affective, behavioral and contextual processes) on academic achievement and ePortfolio experience. Finally, in Assessment stage, I tried to evaluate ePortfolio intervention for producing theoretical and practical implications for academic and business settings (See Chapter 1: Introduction –1.6 Methodology)

The above considerations highlighted the fact that the nature of this problem is multifaceted and there exist many interconnections among SRL processes, academic achievement and the ePortfolio system that should be examined. Therefore, the complexity of the research variables guided me to select a research plan that would combine quantitative and qualitative approaches to study the same aspects of the research problem in depth (Ponce & Pagán-

Maldonado, 2015; Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2009; Cohen, Manion & Morrison, 2007).

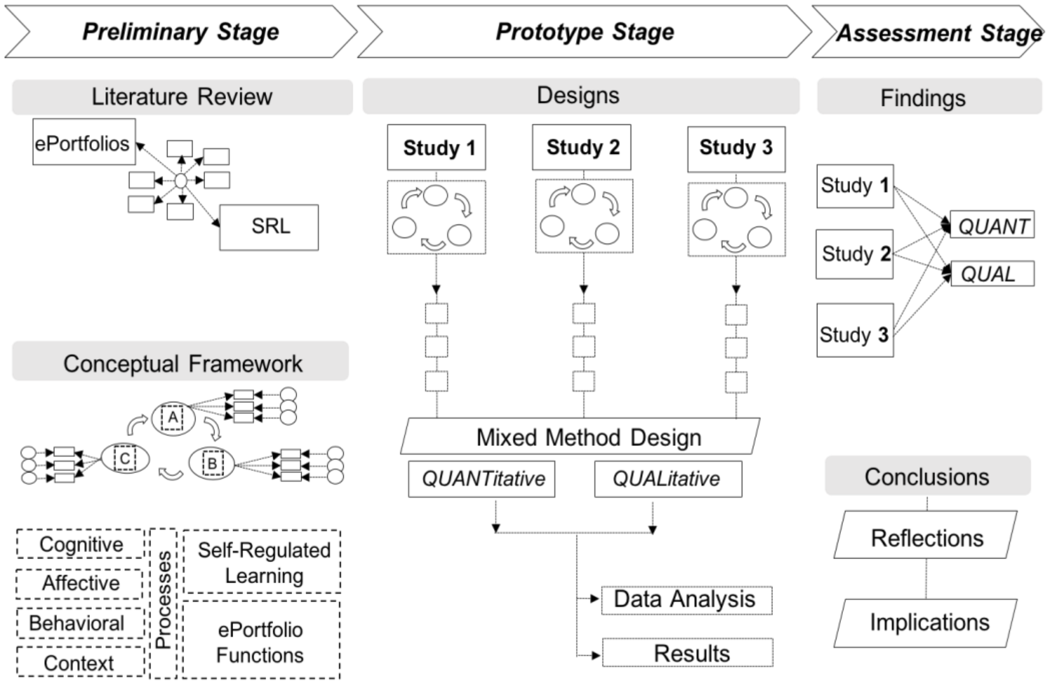


Figure 16. The three stages of design-based research

A mixed methods research was employed as the methodology that generates quantitative and qualitative data and allows a great certainty in inferences and conclusions (Caruth, 2013; Creswell & Plano Clark, 2011; Morse & Niehaus, 2009).

In addition, it was used the triangulation design with parallel phases where quantitative (numeric) and qualitative (text) data, were converged (Creswell & Plano Clark, 2011). This research aims to explore the potential of triangulation design by mixing quantitative and qualitative data in order to ensure concurrent validity (Patton, 1990; Johnson & Onwuegbuzie, 2004) (**Figure *16***).

3.6 Data Collection and Analysis

The intention of this section is to describe the process of deciding on the most appropriate instruments for data collection and analysis. For the needs of this research, we gathered two different sources of data: quantitative and qualitative so as to deliver a coherent and robust result (**Figure *17***).

It is selected the emerging triangulation design with parallel phases where we will converge both quantitative (numeric) and qualitative (text) data (Creswell & Plano Clark, 2007). The quantitative data were gathered by questionnaires and rubrics and tabulated in numbers so as to perform statistical analysis (such as correlations, frequencies, means) (Hittleman and Simon, 1997).

<u>*Quantitative data collection*</u>

- *Questionnaire about SRL skills*

In this research we highlight the analysis of quantitative data from self-report questionnaires. Participants completed an adapted web-based version of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991). The aim of MSLQ is to measure motivation, self-efficacy beliefs and learning strategies. MSLQ was selected as it is a validated tool that has been extensively used to evaluate students' self-regulated skills in various disciplines (Cheng & Chau, 2013).

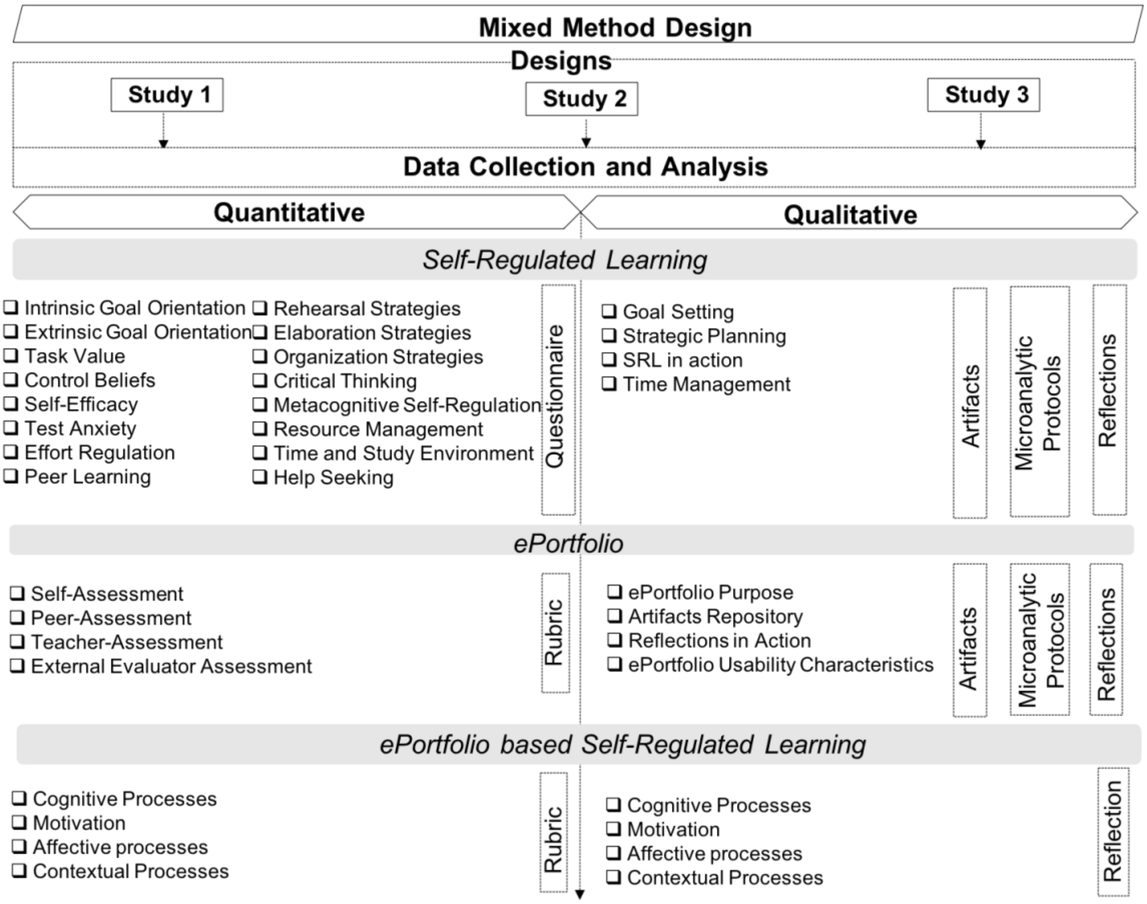


Figure 17. Quantitative and Qualitative data and analysis

Specifically, this instrument has been validated within HE context and has strong reliability and sound validity (Pintrich et al, 1993; 1991). This research focuses on the measurement of research variables before and after the intervention through the experimental procedure. The items used in the present research were similar to the ones included in the original MSLQ; however, some of them had to be re-worded to reflect the online nature of the ePortfolio system. The questionnaire was reviewed by the researchers and instructors to assure the appropriateness of each item.

A 5-point Likert-type questionnaire (from 1 = “Strongly Disagree” to 5 = “Strongly Agree”) was, hence, designed, consisting of 31 (Part A: Motivation) and 50 items (Part B: Learning Strategies) respectively (APPENDIX A: Questionnaire about SRL skills)

The “Motivation” scale was further divided in sub-scales (1. Value Components: a. Intrinsic Goal Orientation, b. Extrinsic Goal Orientation, c. Task Value, 2. Expectancy Components: a. Control Beliefs, b. Self-Efficacy and 3. Affective Components: a. Test Anxiety).

The subscales used in the research included:

- a 4-item *intrinsic motivation scale* intended to measure the intrinsic goal orientation towards different learning tasks (e.g., challenging tasks, learning that arises curiosity),
- a 4-item *extrinsic motivation scale* to measure the extrinsic goal orientation towards different learning tasks (e.g., getting good grades, showing my abilities),
- a 6-item *task value scale* designed to measure students’ perceptions of the interest in the ePortfolio can trigger, its perceived usefulness and value.
- a 4-item *control of learning beliefs scale* intended to identify learners’ perceptions about their level of understanding and evaluate their learning efforts so as to complete an effective ePortfolio.
- a 8-item *self-efficacy for learning* intended to assess perceptions success expectancy and confidence in one’s ability to perform all activities in ePortfolio system.
- a 5-item *test anxiety* attempted to measure the level of worry, cognitive concern and emotionality that is related to test performance. Specifically, the process of elaborating ePortfolio components can be seen as a testing procedure where learners attempt to use effective strategies so to elevate their performance.

The “Learning Strategies” scale was also divided in sub-scales (1. Cognitive and Metacognitive Strategies: a. Rehearsal, b. Elaboration, c. Organization, d. Critical Thinking, e. Metacognitive Self-regulation, 2. Resource Management Strategies: a. Time and Study environment, b. Effort Regulation, c. Peer Learning, d. Help Seeking)

The subscales used in the research included:

- a 4-item *Rehearsal Strategies scale* intended to measure the process of reciting or naming concepts for activating the working memory. Learners activate their attention in simple tasks throughout the construction process of the ePortfolio (e.g influence their encoding process).
- a 6-item *Elaboration Strategies scale* designed to measure the level of integration of new information with prior knowledge. Learners attempted to collect and design artifacts

using elaboration strategies such as summarizing, note taking, paraphrasing, creating analogies.

- a 4-item *Organization Strategies scale* intended to engage learner in the ePortfolio process and construct connections among the content. Learners attempted to manage artifacts using organization strategies such as outlining, clustering and selecting.
- a 5-item *critical thinking scale* attempted to measure the degree to which learners apply knowledge to implement their ePortfolio, to make decisions, to critical evaluate their artifacts, to select their outcomes.
- a 9-item *metacognitive self-regulation scale* attempted to measure a set of self-regulatory activities such as: planning, monitoring and regulating. Planning involves goal setting and task analysis that guide the learner to activate his/her self and organize their learning actions. Monitoring involves attention focusing and self-questioning that support the learner to understand and select the appropriate content. Regulating involves the process of learning adjustment and assist learners to check and correct their actions.
- an 8-item *time and study environment scale* attempted to measure time management that encompasses planning, scheduling and managing study time. Learners attempted to construct their ePortfolio and they set learning goals and a specific study schedule with strategies. Also, this scale involves the measurement of study environment management. Learners attempted to measure the characteristics of their study environment (an ideal study environment should be organized, quiet and free of visual distractions or noise)
- a 4-item *Effort regulation scale* intended to measure learners' ability to focus on a specific task (e.g. the construction process of the ePortfolio). Learners attempted to manage their efforts (self-management), strengthen their goal commitment and use their learning strategies so as to complete their ePortfolios.
- a 3-item *Peer Learning scale attempted* to measure the level of collaboration and interaction between peers so as to attain their goals. Learners engage in discussions, communicate their ideas and explain their insights.
- a 4-item *help seeking scale* attempted to measure their level of understanding and their need to seek assistance. Learners attempted to self-evaluate their actions and seek peer help, peer tutoring or the support of a knowledgeable other.

- *ePortfolio Rubric*

EPortfolio-based assessment should incorporate assessment methods such as teacher-assessment, student self-assessment and peer-assessment in order to assure the objectives of authentic assessment (Chang, Tseng, Chou and Chen, 2011). Extended review of the literature identifies a set of criteria that should be incorporated into the assessment rubrics (Sweat-Guy & Buzzetto-More, 2007; Chang, Tseng, Chou and Chen, 2011). The rubric adopted was revised from an instrument that was designed by researchers at Pennsylvania State University (Portfolios at Penn State) (DiBiase, 2002). The aim is to deliver a holistic instrument that can be used by students, peers, instructors and external evaluators that correspond to their needs.

There was a total of 22 items (4 items were open-ended questions that excluded from the instrument) in the rubric, with 4 indicators for ePortfolio Purpose, 5 indicators for Artifacts Repository, 4 indicators for Reflection in Action and 9 indicators for ePortfolio Usability characteristics. The four criteria comprised of measurable indicators so as to evaluate the creation of the ePortfolio, the content, the reflective ability and the usability features (APPENDIX B: ePortfolio Rubric). Researchers, instructors and external evaluators (were professionals in the field of elearning and ePortfolios) assured the accuracy of the indicators. Each indicator was given a score:1-(Lacking), 2-(Satisfactory), 3- (Exemplary). The higher the score, the more an individual agreed with the indicator. The ePortfolio Rubric consists of four criteria such as: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics. At the end of the experimental procedure, students, peers, instructor and two external evaluators (four sources of raters/evaluators) attempted to evaluate the process, the content and the outcomes of the ePortfolio (**Table 121**).

- ePortfolio-based Self-Regulated Learning Rubric

The ePortfolio based Self-Regulated Learning Rubric was developed based on an instrument that is designed for the needs of European Project TELEPEERS, entitled 'Self-regulated Learning in Technology Enhanced Learning Environments at University Level: A Peer Review', (Grant agreement 2003-4710-/001-001 EDU-ELEARN). The aim of the TELEPEERS project was to conduct a peer review on Technology Enhanced Learning Environments (TELEs) that support and promote Self- Regulated Learning (SRL). The tools that developed throughout the project are freely available by the TACONET (Targeted Cooperative Network on Self-Regulated Learning in Technology Enhanced Learning Environments) network (Dettori, Giannetti & Persico, 2006; Bartolomé, Bergamin, Persico, Steffens, & Underwood, 2010; Carneiro et al., 2011; Carneiro and Steffens, 2013).

The proposed instrument (ePortfolio-based Self-Regulated Learning Rubric) is a rubric that can be used a priori or a posteriori by teachers, instructors, researchers and experts that attempt to evaluate TELEs as effective platforms that promote SRL. The instrument was based on the cyclical

SRL model that encompasses three phases: forethought, performance-control and self-reflection (Zimmerman, 1998; 2000). For each phase various SRL processes were highlighted such as: cognitive, motivational, affective and contextual. Participants submitted the ePortfolio based SRL Rubric at the end of the process. In detail, the ePortfolio based Self-Regulated Learning Rubric consists of 43 items that are based on a 5-point Likert-type scale (from 1 = "Strongly Disagree" to 5 = "Strongly Agree") (APPENDIX C: ePortfolio-based Self-Regulated Learning Rubric). Raters are invited to assess their level of agreement with the items.

The subscales used in the research included:

Phase A: Planning

- a 7-item *Cognitive Processes scale* intended to measure whether the ePortfolio system has the potential for supporting cognitive processes such as task analysis, goal setting, strategic planning, learning strategies
- a 8-item *Motivational Processes* scale attempted to measure whether the ePortfolio system has the potential for supporting motivational processes such as self-motivation beliefs, task value and intrinsic interest.
- a 3-item *Affective Processes* scale intended to measure whether the ePortfolio system has the potential for supporting affective processes such as self-efficacy, goal orientation, efficacy judgement, perception of difficulty.
- a 3-item *Contextual Processes* scale attempted to measure whether the ePortfolio system has the potential for supporting contextual processes such as perception of task and time and effort planning

Phase B: Performance-Control

- a 4-item *Cognitive Processes scale* intended to measure whether the ePortfolio system has the potential for supporting cognitive processes such as self-control, task strategy, self-observation, self-monitoring, self-recording.
- a 2-item *Motivational Processes* scale attempted to measure whether the ePortfolio system has the potential for supporting affective processes such as awareness monitoring motivation and outcome expectations.
- a 2-item *Affective Processes* scale intended to measure whether the ePortfolio system has the potential for supporting affective processes such as selection and adaptation strategies for managing affect.
- a 3-item *Contextual Processes* scale attempted to measure whether the ePortfolio system has the potential for supporting contextual processes such as study environment, time management, help seeking, work well with peers.

Phase C: Self-Reflection

- a 5-item *Cognitive Processes scale* intended to measure whether the ePortfolio system has the potential for supporting cognitive processes such as self-judgement, self-evaluation, self-reaction and self-satisfaction.
- a 1-item *Motivational Processes* scale attempted to measure whether the ePortfolio system has the potential for supporting motivational processes such as attributions
- a 1-item *Affective Processes* scale intended to measure whether the ePortfolio system has the potential for supporting affective processes such as affective reaction
- a 4-item *Contextual Processes* scale attempted to measure whether the ePortfolio system has the potential for supporting contextual processes such as evaluation task and evaluation context.

Qualitative data collection

The ePortfolio based self-regulated learning (ePSRL) approach has a twofold aim the delivery of a stand-alone ePortfolio and the articulation of a set of meaningful tasks and elaborated reflections about academic and career development through the ePortfolio system. Learners initiate the ePortfolio construction process and get involved in the learning modules through the ePortfolio system. The qualitative data gathered by learner's artifacts, submitted activities, reflections and microanalytic protocols that derived throughout the interventions. Qualitative data are represented as descriptive narrations that should be organized (coding and searching for patterns) and describe the learner's behavior.

- *Student's level of cognitive development*

During the process, learners engage in a set of activities so as to deliver their own ePortfolio. For each activity we tried to examine student's level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009). Activities were designed in order to represent measurable student outcomes as competency statements about the actions associated with the intended cognitive process (remember, understand, apply, analyze, evaluate and create). Also, each activity produced an artifact that depicted learner's achievement. Our aim was to measure the degree of achievement on the continuum of the learning outcomes throughout the ePortfolio construction process.

Our intention is to express the level of expertise required to milestone activities, such as:

Activity 2 (A2): Presenting Myself

Activity 3 (A3): Goal Setting

Activity 5 (A5): Familiarize with Myself as a Student

Activity 7 (A7): Time Management

- *SRL Microanalytic Protocols*

Throughout the ePortfolio construction process, learners engage in a set of activities in order to produce artifacts. Each activity was accompanied by a reflective task as a way of facilitating SRL. Towards this, it was designed a written reflection activity following the principles of microanalytic methodology for assessing SRL (Cleary & Zimmerman, 2004; Zimmerman & Kitsantas, 2002). Each 'Reflection Activity' consists of open-ended questions that measure the effects of SRL processes across the phases of the ePortfolio system. The reflection activity included brief questions about: Self-regulated learning processes and activity judgement.

- *ePortfolio Reviews*

At the end of ePortfolio construction process, learners manage their artifacts and publish their own ePortfolios. At the end of the experimental procedure, students and peers evaluated the content and the outcomes of the ePortfolio. Specifically, it was designed an ePortfolio reflection activity (ePortfolio Review) following the principles of microanalytic methodology for assessing SRL. Students and peers reflected on the content of the ePortfolio. The ePortfolio review based on the four criteria of the ePortfolio rubric: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics and consisted of open-ended questions that highlighted SRL processes.

- *ePortfolio based Self-Regulated Learning Review*

At the end of the experimental procedure, we investigated participants' written reflections about the design of the ePortfolio system. Specifically, learners assess if the proposed ePortfolio system supports and promotes Self- Regulated Learning (SRL). It was designed a reflection activity (ePortfolio based Self-Regulated Learning Review) following the principles of microanalytic methodology for assessing SRL. The ePortfolio based Self-Regulated Learning Review based on the three phases of Zimmerman's Model: forethought, performance-control and self-reflection and consisted of open-ended questions that embedded SRL processes.

- Pre and Post Rubrics

For the needs of this research, it was attempted to explore participants perceptions about ePortfolios and their level of satisfaction (APPENDIX D: Pre and Post Rubrics).

Before the intervention, students invited to fill in 9 close-ended questions (Yes/No) and one open-ended question (Prior ePortfolio Experience Rubric). The goal of this instrument is to identify if students have prior ePortfolio experience and to discover students' expectations about the project. This is a web-based instrument that is designed by the researcher for the needs of this study. Before the initiation of the ePortfolio process, the 'Prior ePortfolio Experience Rubric' was sent to participants.

After the completion of the experimental procedure, participants completed a 'Post ePortfolio-Intervention Review', that consisted of six open-ended questions. The goal of this instrument is to record students' perceptions about the ePortfolio process and the levels of satisfaction/dissatisfaction. This is a web-based instrument that is designed by the researcher for the needs of this study.

3.7 Validity and Reliability of the Research

The complexity of the research variables guided me to select a research plan that would combine quantitative and qualitative approaches to investigate the effectiveness of an ePortfolio intervention to help learners enhance SRL competency and foster academic achievement. Further, I intent to study SRL as an aptitude and event as well as emphasize on SRL that is adequately represented on the ePortfolio intervention and can be captured when it is enacted. In order to evaluate that the proposed ePortfolio intervention meet its objective, a triangulation approach can be useful. Triangulation is a powerful way of increasing validity of the study, supporting inferences and facilitating transferable conclusions (Teddlie & Tashakkori, 2009). I adopted the convergent parallel design where quantitative (numeric) and qualitative (text) data were collected (Creswell & Plano Clark, 2011): *Quantitative data collection* (Questionnaire about SRL skills, ePortfolio Rubric, ePortfolio based Self-Regulated Learning Rubric) and *Qualitative data collection* (Student's level of cognitive development, SRL Microanalytic Protocols, ePortfolio Reviews, ePortfolio based Self-Regulated Learning Review, Pre and Post Rubrics).

This study aims to combine a set of instruments for assessing the effects of SRL competency throughout the ePortfolio intervention. In accordance with the state of the art, the level of research's reliability and validity is high, when different assessment methods and data result in similar findings (Cleary, Callan, and Zimmerman, 2012). Then the researcher can be reasonably certain to articulate inferences and conclusions.

In this research, Cronbach's alpha coefficient (α) examined the internal consistency reliability among various subscales of the instruments (Instrument 1: Questionnaire about SRL skills (MSLQ) and Instrument 2: ePortfolio based Self-Regulated Learning Rubric).

A reliability analysis was conducted to measure instruments' internal consistency. Cronbach's alpha reliability coefficient (α) normally ranges between 0 and 1 (Nunnally & Bernstein, 1994). The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale. Specifically, research suggest that the size of alpha may range: $\alpha > 0.9$ – Excellent, $\alpha > 0.8$ – Good, $\alpha > 0.7$ – Acceptable, $\alpha > 0.6$ – Questionable, $\alpha > 0.5$ Poor, and $\alpha <0 .5$ – Unacceptable (George and Mallery, 2003).

The present study attempts to highlights the merits of authentic assessment, through an ePortfolio intervention. Empirical evidence suggests that ePortfolio-based assessment should incorporate assessment methods such as teacher-assessment, student self-assessment and peer-assessment in order to ensure validity and reliability (Chang, Tseng, Chou and Chen, 2011). Also, research showed that there is a need of explicit and discrete assessment criteria as well as timely feedback to ensure reliability (Gülbahar and Tinmaz, 2006).

For ensuring content validity, the ePortfolio rubric was created with reference to relevant literature (see Chapter 3), also content modifications were made according to the comments from ePortfolio experts. The ePortfolio rubric aims to measure ePortfolio achievement and consists of four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics. Researchers (2), instructors (2) and external evaluators (2) (were professionals in the field of elearning and ePortfolios) assured the accuracy of the indicators.

Validity is described as the degree of accuracy among assessment results (Yu, 2002). Thus, high correlation between ePortfolio grades and external criteria (assessment results from knowledgeable others, teacher's ratings, external evaluator's ratings and exam results) indicate a desirable level of validity. Based on the fact that validity can be estimated by exterior criterion (such as teacher ratings, exam scores) and tested by statistical methods such as Pearson's correlation and t-test (Chang et al., 2011)

Pearson correlation coefficient (r) was performed to understand the relationships among the 4 assessment methods and ePortfolio criteria. Pearson (r), may range between −1 and +1 and indicates the strength and the direction of the relationships.

Further, it was selected the Intraclass Correlation Coefficient (ICC) test for measuring the inter-rater reliability (IRR). According to, Sulzen, Young and Hannifin (2008) reliability can be improved when there is a large number of assessors and can be achieved sufficient validity. Towards this, the ICC based on the answers of four assessment methods (students, peers, instructor and external evaluators) so as to measure consistency (Instrument: ePortfolio Rubric). All raters/evaluators completed the ePortfolio rubric in order to assess the ePortfolio achievement.

The IRR attempts to quantify the level of agreement among assessors that independently rate the constructs of a scale.

In the present study, it was selected a two-way random ICC for providing explanations about the differences in scores, the way raters use the constructs and estimate possible measurement error (Nunnally & Bernstein, 1994). Also, it was performed an ICC analysis of consistency for the criteria of the ePortfolio achievement: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics. The ICC may be interpreted in terms of agreement between raters and among the four ePortfolio assessment criteria and the ICC size may range (Koo, 2016): ICC > 0.90 – Excellent, 0.75-0.90– Good, 0.50-0.75– Fair, ICC < 0.50 – Poor.

3.8 Description of the ePortfolio System

The principles of design-based research are followed in order to conduct my research. In the preliminary stage, the review of the current literature on SRL and ePortfolios facilitated the inception of a conceptual framework that depicts the causal relationships between SRL factors and the ePortfolio system. Further, I integrated ePortfolio's design principles with technological affordances for providing an effective solution. In the prototype stage, the ePortfolio system was tested through three iterations (Study 1, 2 and 3). In the assessment stage, the delivery of findings of the studies (1-3) is attempted to provide reflections on the results and to conclude on how the outcomes correspond to the specifications.

3.8.1 Prototype Stage-Description of the ePortfolio System (Version 1)[7]

3.8.1.1 Designing the Conceptual Framework (Version 1)

This section outlines the design of the ePortfolio system (Version 1) for HE in order to support students (future graduates) to enhance their SRL skills and manage their academic path. Towards this, the conceptual framework and the ePortfolio system (v.1) designed and tested in Study 1 (Prototype Stage -Iteration 1)

The vision of the Conceptual Framework (Version 1) is to highlight the nature of SRL as a stable construct (aptitude) that evolves to a more dynamic process (event). It was combined Zimmerman's (1986; 1998; 2000) cyclical SRL model with Pintrich's (2000) four phases' model that follows a flexible order and has four areas of regulation. The proposed conceptual framework follows the cyclical order of three major phases of SRL, namely: Forethought, Performance Control

[7] Part of this section has been published in the following journal paper:

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192. https://doi.org/10.1504/IJLT.2019.101849

and Self-Reflection. Each phase encompasses a wide range of cognitive, affective, behavioural and context processes that support learners during their learning efforts. The conceptual framework (v.1) invited learners to engage in a set of learning tasks in order to construct their own ePortfolio and promote their academic development. Individuals initiate the ePortfolio construction process as they enter the SRL cycle following a cyclical order of three major SRL phases and gets involved in the following activities (APPENDIX E: ePSRL Conceptual Framework (Version 1.)

The 'Forethought' phase [A] consists of specific processes for initiating and analyzing the process of structuring an ePortfolio. This phase includes a set of activities for supporting learners to comprehend the task objectives and activate their cognitive, affective, behavioral and context processes so as to move to the next phase. Users follow a learning path, consisting of 4 learning activities in a fixed order.

During the first phase, the learner should, thus, perform "Activity 1: Identifying Personality Characteristics and Skills" which invites them to discover their skills, beliefs, attitudes, interests, knowledge, values and relate their individual characteristics to personal academic choices. Then, in "Activity 2: Presenting MySelf" users attempt to explore and visualize aspects of their academic, professional and social self in order to construct an effective presentation. Then, they proceed to "Activity 3: Goal Setting" which encourages setting specific, measurable, achievable, realistic and time specific goals in order to accomplish short and long-term activities in an academic, professional and personal context. This phase is completed with "Activity 4: Strategic Planning" which gets users involved in selecting learning strategies and techniques to accomplish their goals.

The 'Performance Control' phase [B] consists of the processes for elaborating on and delivering specific tasks that can be embedded in the ePortfolio. This phase encompasses various activities for prompting learners to dynamically utilize SRL aspects to accomplish their learning activities. Users continue their learning path which is composed of 4 learning activities. Learners have the opportunity to select the order of the proposed activities that support them to advance their academic performance and strengthen their ePortfolio.

Therefore, while in this phase, learners engage in "Activity 5: Familiarize with MySelf as a Student" and try to explore the benefits of learning strategies, study tactics and develop a personal learning strategy repertoire for boosting their academic performance. In "Activity 6: Boosting the Strategy of Note Taking" learners attempt to discover the advantages of note taking, identify note-taking techniques and make use of note taking for effective planning and organization of their own ePortfolio. In "Activity 7: Time Management" learners investigate the benefits of managing time, organize their tasks and plan their activities (at an individual, academic and professional level) to complete their ePortfolio. This phase also includes "Activity 8: Creating My Curriculum Vitae" which prompts users to engage in the process of job search and start designing their professional profile. In this phase, learners have the opportunity to select specific artefacts to structure their own ePortfolios.

'Self-reflection' phase [C] consists of processes for self-monitoring and self-evaluating. This phase enables self-judgement through the use of self-assessment rubrics. The phase consists of 3 learning activities (without a fixed order). In this view, learners engage in "Activity 9: Self-Assessing My Time Management" by means of which they can evaluate and reflect on their time management skills during the ePortfolio construction. In "Activity 10: Self-Assessing My SRL Skills/Competences" learners evaluate their SRL skills and reflect on SRL processes through the process of implementing the ePortfolio. Finally, in "Activity 11: Self-Assessing the ePortfolio" users evaluate their performance throughout the ePortfolio implementation. Upon completion of this phase, the SRL cycle is also completed and a new one can be initiated. Learners have the opportunity to recalibrate their goals and perform tasks in order to bolster their academic performance.

In parallel, learners engage in "Activity 0: Implementation of ePortfolio", which is a holistic process of designing and implementing a customized ePortfolio that is a stand-alone application prompting users to collect and present appropriate artefacts for structuring their academic and professional profile. This activity takes place throughout the three SRL phases and aims to strengthen learners' potential for recognizing their abilities and skills, for enabling them to manage time, set demanding and meaningful goals, design personal action plans, create a curriculum vitae, activate prior knowledge, develop communication skills, reconsider competences, self-evaluate actions in a digital environment and, ultimately, design an efficient ePortfolio (**Table *122***).

3.8.1.2 Designing the ePortfolio System (Version 1)

For the needs of the research, it was selected the open social network platform, ELGG as the mechanism that enabled the delivery of an ePortfolio system. Developed in PHP using a MySQL database, a dynamic ePortfolio is designed for use in Higher Education. The vision was the establishment of an ePortfolio system that promotes SRL and social interaction through an interactive web-based platform (**Figure *18***). Further, it was attempted the design of an ePortfolio system as a social networking service/site (SNS), where users could interact, communicate, share their goals, follow the schedule and exchange ideas. The system served as a means to establish a learning community where users could manage their self-identity, collaborate (e.g. forum, chat, comment), share media and aggregate content. Learners had the opportunity to create a learning community and exploit the benefits of social media for academic purposes.

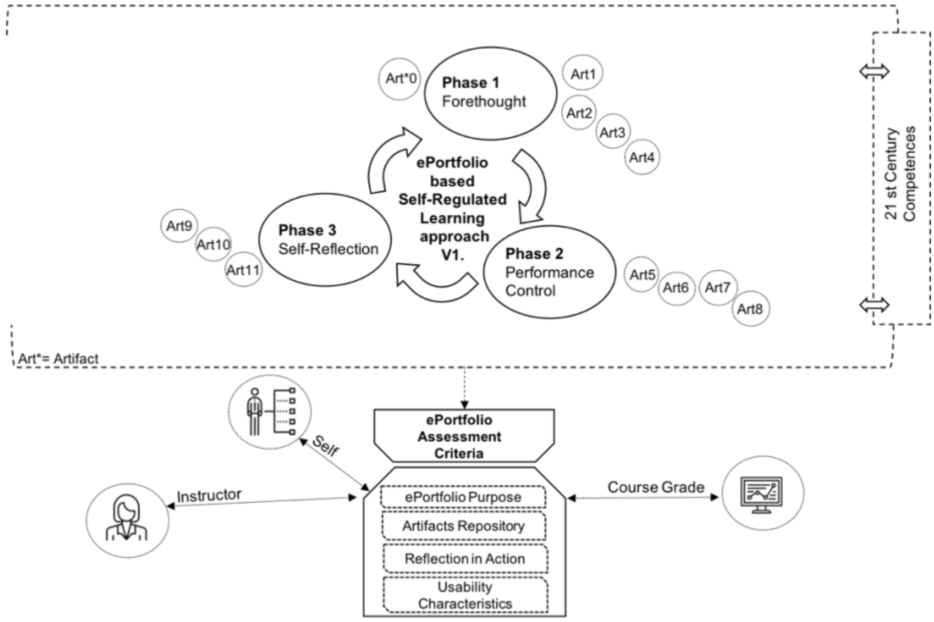


Figure 18. The design of the ePortfolio system (version 1.)

The ePortfolio system (Version 1) comprises a set of functionalities (**Figure *19***): a setting and a dashboard panel, a profile section where users can create, change, delete and manage their self-identity, communication tools (messages, groups, the wire, friends) and personal workspace (pages).

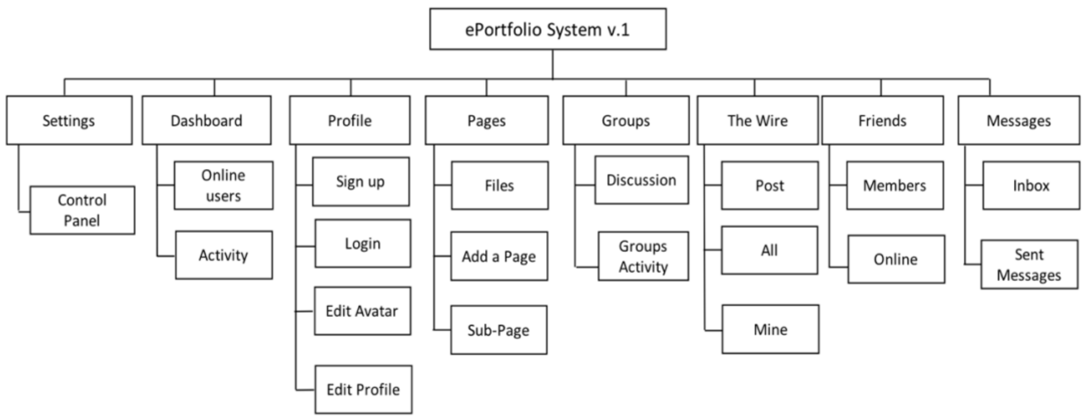


Figure 19. The workflow of the ePortfolio system (version 1.)

Learners enter the ePortfolio system (v.1), familiarize with the environment and read about the objectives and the procedure of this training course; they can also set up their own profile, connect to other users in order to create their own learning community (**Figure 20**). Students and instructors (users) create their profiles and establish a learning community for advancing SRL and delivering ePortfolios.

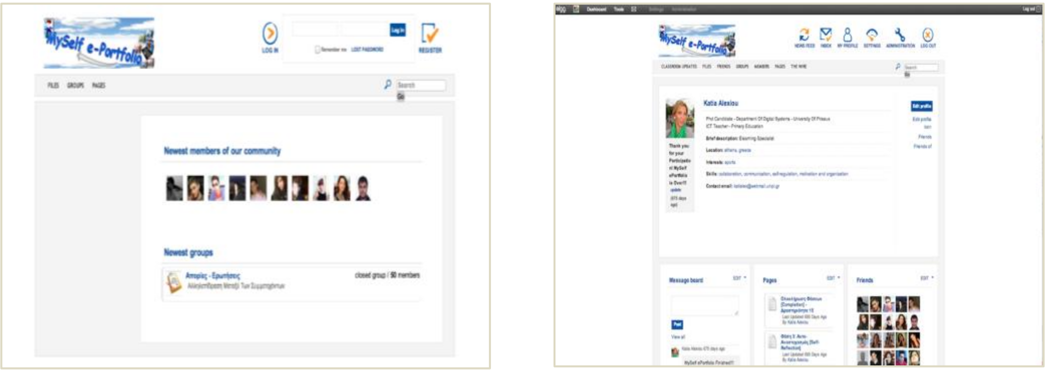


Figure 20. The Login Page and Navigation Panel of the ePortfolio System (version 1.)

Learners create their accounts for the ePortfolio and can navigate throughout its different sections or/and engage in its learning tasks. Each user reads the activities, elaborates on the learning content, analyses the tasks and uploads his/her deliverables to the 'Pages' tool (personal workspace). The ePortfolio system allows users to customize their 'Pages' and enables them to edit their activities in order to present an effective outcome (**Figure *21***). Each learner attempts to complete all the learning activities and upload his/her artifacts on the ePortfolio system (APPENDIX E: ePSRL Conceptual Framework (Version 1.))

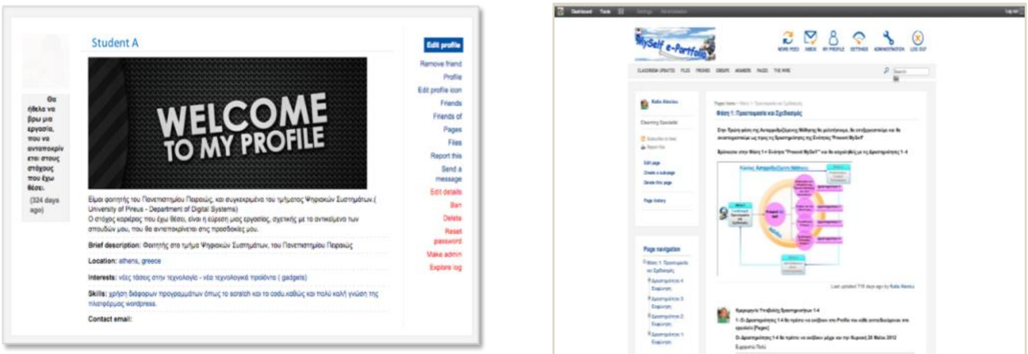


Figure 21. The Profile Section and activities of the ePortfolio System (version 1.)

The ePortfolio system (v.1) informs users about the timetable and the order of the activities through micro-blogging tools and calendar updates. Participants have the opportunity to create a community of peers and instructors for interacting, exchanging ideas and learning. The overarching learner's goal is to engage in the proposed learning activities (conceptual framework v.1) for delivering an ePortfolio and fostering SRL skills (**Figure 21**).
Towards this, it was conducted Study#1 for testing the ePortfolio System (v.1) (prototype stage). In the first iteration, the aim was to investigate to what extent:

- Participants engaged in the proposed learning activities (conceptual framework (v.1)
- The ePortfolio (v.1) intervention affected SRL

- The ePortfolio (v.1) intervention had an impact on academic achievement

The findings of the first testing of the ePortfolio System (v.1), provided me with valuable insights about the re-design of the conceptual framework and the delivery of an updated ePortfolio system (Version 2).

3.8.2 Prototype Stage-Description of the ePortfolio System (version 2): The ePortfolio based Self-Regulated Learning (ePSRL) system[8]

3.8.2.1 Re-designing the Conceptual Framework: ePortfolio-based Self-Regulated Learning (ePSRL) approach (Version 2)

Considering that this is a design-based research that address a complex problem in an authentic context then it is important to conduct rigorous inquiry for updating the initial system design and re-testing the ePortfolio system. The aim is to design the second prototype of the ePortfolio system (v.2) for HE in order to support future graduates to advance their SRL skills and boost academic achievement. Thus, the conceptual framework and the ePortfolio system (v.2) designed and tested in Studies 2 and 3 (Prototype Stage -Iterations 2-3). The intention is to re-design the Conceptual Framework (Version 2) for capturing and highlighting:

- ✓ the nature of SRL as a stable construct (aptitude) that evolves to a more dynamic process (event)
- ✓ the ePortfolio-based learning approach (ePBLA) that can be used by stakeholders as a learning or teaching strategy
- ✓ the merits of social networking services/sites that enable interaction, self-awareness and co-regulation
- ✓ the benefits of intervention programs that promote academic achievement, career development and in turn elevate individuals' well-being

It is proposed the re-design of conceptual framework (Version 1) and the establishment of the *ePortfolio-based self-regulated learning (ePSRL)* approach [conceptual framework (Version 2)] that can be applied in an ePortfolio system for supporting users to advance their SRL skills, cultivate their academic achievement and boost their career aspirations.

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[8] Part of this section has been published in the following journal paper:

Alexiou, A., & Paraskeva, F. (accepted for publication). Being a student in the social media era: Exploring educational affordances of an ePortfolio for managing academic performance. International Journal of Information and Learning Technology.

EPSRL approach is structured in compliance with the principles of Self-Regulated Learning and aspects of career development. Through this approach, learners engage in the process of developing an ePortfolio by following the cyclical order of three major phases of SRL, namely: Forethought, Performance Control and Self-Reflection. This is a structured learning path that prompts learners to engage in various cognitive, affective, behavioural and context activities that depict the areas of psychological functioning. The proposed aspects of learning are combined with a set of career management competencies. It was designed a repository of learning activities based on SRL processes (cognitive, affective, behavioural and context) and the three areas of career management competencies (Area A: personal management, Area B: learning and work exploration and Area C: career building) (MCEECDYA, 2010). The ePSRL approach is organized based on four discrete learning modules that activate aspects of SRL and target career competencies (Module 1 'Discovering and Presenting Myself', Module 2 'Managing my learning identity', Module 3 'Exploring my career path' and Module 4 'Evaluating my actions and evolving to the next stage'). Each module consists of artifacts and reflections that are aligned to specific career management competencies. Under ePSRL, learners attempt to implement their artifacts, verbalize their reflections, learn how to manage their progress and collect a set of competencies for academic, career, personal and social well-being (APPENDIX F: ePSRL Conceptual Framework (Version 2.))

The ePSRL approach is delivered as an intervention program that invites learners to initiate the ePortfolio construction process, get involved in the learning modules and develop artifacts. It follows a linear pre-fixed order of tasks, where learners have the opportunity to adapt to the proposed path or to select their own sequence of learning activities. Learners get involved in ePSRL approach through Module 1-4 which consists of a set of Artifacts (2-24) that assist individuals to recognize their identity and skills, manage their self, explore their learning identity, discover future career aspirations and build their future career profile. In parallel, learners initiate the design and implementation of Artifact 1 'Implementation of a stand-alone ePortfolio' which is a holistic process that prompts participants to collect and manage artifacts for structuring their academic profile and their career aspirations. Artifact 1 takes place throughout the ePSRL approach (Module 1-4) and attempts to motivate learners to deliver and assess their own customized ePortfolio that is a stand-alone application (Artifact 1 & 25). The ePSRL intervention finishes when participants complete one SRL cycle and articulate the appropriate artifacts and tasks. Specifically, individuals may initiate the ePSRL intervention as they enter the SRL cycle and get involved in the following activities (**Table *7***):

In Module 1, learners activate their cognitive, affective, behavioural and context processes through a specific learning path where they attempt to discover aspects of their self and present their skills. Learners engage in a set of activities in order to develop artifacts and write meaningful reflections about the process, in detail:

- Artifact 2 'Personality Characteristics and Skills' guides the learner to discover his/her skills, beliefs, attitudes, interests, knowledge, values and manage personal characteristics for supporting personal academic choices.
- Artifact 3 'Goal Setting' encourages the learner to set specific, measurable, realistic and time specific goals in order to accomplish his/her personal, academic and career tasks.
- Artifact 4 'Exploring my Motivations' invites the learner to realize the hierarchy of needs, to align his/her goals to a set of needs and to orientate his/her goals based on motivations.
- Artifact 5 'Strategic Planning' gets users involved in selecting learning strategies and techniques to accomplish their goals.
- Artifact 6 'Becoming a specialist in decision making' directs learner to experience a hypothetical authentic learning situation and follow a path of activities about decision making.
- Artifact 7 'Presenting Myself' supports the learner to explore and visualize aspects of his/her academic, professional and social self in order to construct an effective presentation.
- Artifact 8 'Visualizing my life plan' invites learner to think his/her future self and design a life plan.

Table 7. EPortfolio System (version 2.) is based on the EPSRL approach which consists of specific SRL processes (C: Cognitive, A: Affective, B: Behavior, Cx: Context)

SRL Model - Phases ePortfolio Activities	**Forethought** [A]	**Performance Control** [B]	**Self-Reflection** [C]	***ePortfolio Artifacts***
A1: Implementation of a stand-alone ePortfolio	C: Task Analysis	C: Self-Observation	C: Self-satisfaction C: Self-evaluation	*Website deliverable*
Module 1 Discovering and Presenting Myself				
A2: Personality Characteristics and Skills	A: Self-Efficacy A: Efficacy Judgement			*Presentation*
A3: Goal Setting	C: Goal Setting A: Goal Orientation			*Document*
A4: Exploring my Motivations	A: Self-motivation beliefs			*Document*
A5: Strategic Planning	C: Strategic Planning			*Document*

	A: Task Value & Activation B: Planning of Self-Observation			
A6: Becoming a specialist in decision making	A: Intrinsic Interest A: Interest Activation Cx: Perception of Task Context			*Concept map*
A7: Presenting Myself	A: Self-Efficacy A: Efficacy Judgement			*Presentation*
A8: Visualizing my life plan	A: Outcome Expectation B: Time and effort planning			*rubric*
Module 2 Managing my learning identity				
A9: Time Management		B: Time management		*Web-based application*
A10: Familiarize with MySelf as a Student		B: Study Aids B: Self-testing B: Test Strategies		*Presentation*
A11: Boosting the Strategy of Note Taking		C: Use of Imagery C: Self-Instruction		*Web-based application*
A12: Regulating my study environment		B: Structure Environment Cx: Attention Focusing Cx: Shape-Control Environment Change Context		*Web-based application*
A13: Effective Conflict Management		Cx: Work well with peers		*Concept map*
Module 3 Exploring my career path				
A14: Articulating my career path		C: Self-observation		*Web-based application*
A15: Self-Regulating the process of career search		C: Self-feedback B: Help Seeking B: Effort Regulation		*Web-based application*
A16: Creating My CV		C: Self-monitoring C: Self-recording	B: Choice Behavior	*Document*
A17: Networking		A: Self-control		*Web-based application*
A18: Career and stereotypes		A: Awareness monitoring motivation and affect A: Selection and Adaptation strategies for managing motivation & affect		*document*
Module 4 Evaluating my actions and evolving to the next stage				

A19: Managing my Artifacts		C: Self-feedback B: Help Seeking B: Effort Regulation	*Web-based application*
A20: Preparing for life changes		A: Perception of Difficulty	*document*
A21: Trying to enhance my positive Self-image		A: Self-judgment A: Self-reaction	*Online Assessment Tool*
A22: Self-Assessing My Time Management		C: Self-reaction C: Causal attributions A: Affective Reaction A: Attributions	*Online Assessment Tool*
A23: Becoming an Advisor		A: Intrinsic Interest C: Self-satisfaction	*document*
A24: Self-Assessing My SRL Skills/Competences		C: Self-evaluation B: Choice Behavior	*Online Assessment tool*
A25: Self-Assessing ePortfolio		Cx: Evaluation Task Cx: Evaluation Context	*Online Assessment Tool*

Learners continue their ePortfolio construction through Module 2: 'Managing my learning identity' discover their learning strategies, regulate their skills and boost their performance through various artifacts. Learners are able to select specific artifacts based on preferences and their learning needs:

- Artifact 9 'Time Management' supports the learner to explore the benefits of managing time, organize his/her actions and plan his/her workload (at an individual, academic and professional level) to complete the ePortfolio. This artifact starts in Module 2 and ends in Module 3 'Exploring my career path' for allowing learners to plan and manage their time throughout the ePortfolio project.
- Artifact 10 'Familiarize with Myself as a Student' invites the learner to recognize the benefits of learning strategies, study tactics and create a personal learning strategy repertoire for boosting his/her academic performance.
- Artifact 11 'Boosting the Strategy of Note Taking' get the learner to explore the advantages of note taking apply note taking strategies for designing and organizing his/her ePortfolio.
- Artifact 12 'Regulating my study environment' invites the learner to discover the parameters that determine an effective work and study environment and select strategies for controlling the quality of his/her academic, personal and professional environment.

- Artifact 13 ‘Effective Conflict Management’ prompts the learner to engage in authentic hypothetical scenarios and apply conflict resolution strategies. Learners should realize that there are various factors that influence behavior (motivation, values, emotional status, intentions, verbal and non-verbal communication) but they should be prepared to handle conflict situations, to adopt positive attitudes and propose conflict resolution strategies.

In Module 3 ‘Exploring my career path’, learners can structure artifacts for designing their academic and career path. Through this process, learners could select specific artifacts that correspond to their academic expectations, motivations and career aspirations. In Module 3, learners attempt to articulate their academic and career path, structure their knowledge, interests and goals as well as to advance their competencies, through various artifacts:

- Artifact 14 ‘Articulating my career path’ gets the learner to analyze the concepts that are related to academic and career planning and supports the learner to structure an academic and a future career plan that is based on his/her skills, beliefs, attitudes, interests, knowledge and values. Learners have the opportunity to use Artifact 2 ‘Personality Characteristics and Skills’ so as to manage their personal characteristics and make decision.
- Artifact 15‘Self-Regulating the process of career search’, invites the learner to engage in a career search process where he/she selects search strategies to find the best career path in order to manage his/her academic and career development.
- Artifact 16 ‘Creating My Curriculum Vitae’ prompts the learner to start understanding the basic parts of an effective Curriculum Vitae, design his/her academic and professional profile and evaluate the process.
- Artifact 17 ‘Networking’ involves the learner in a networking activity, known as informational interview. Learners familiarize with the process of networking and identify the merits of a dynamic network of people.
- Artifact 18 ‘Career and stereotypes’ invites learner to analyze the terms related to stereotypes and support academic and career decisions that eliminate constraints based on stereotypes. This artifact is optional.

Learners complete ePSRL approach through Module 4 ‘Evaluating my actions and evolving to the next stage’ learners reflect on the artifacts that created throughout the process. This module enables self-judgement through the use of self-assessment rubrics. Learners elaborate and complete all the artifacts (without a fixed order) in order to assess their performance and control their goals.

- Artifact 19 ‘Managing my Artifacts’ supports learner to aggregate and organize his/her artifacts in order to build a dynamic profile. Learners should design a sitemap for presenting their academic and career profile through the ePortfolio system.
- Artifact 20 ‘Preparing for life changes’ prompts the learner to engage in authentic hypothetical scenarios and realize changes that may occur in each life stage. Learners should decide, deal with changes and design a life plan. This artifact is optional.
- Artifact 21 ‘Trying to enhance my positive Self-image’ guides the learner to assess his/her performance throughout the construction process of the ePortfolio. Learners attempt to evaluate their learning behaviour and strengthen their self-image.
- Artifact 22 ‘Self-Assessing My Time Management’ guides the learner to evaluate and reflect on his/her time management skills during the ePortfolio construction.
- Artifact 23 ‘Becoming an Advisor’ prompts the learner to participate in a collaborative activity where he/she should assess Artifact 16 ‘Creating My Curriculum Vitae’. Learners co-review artifact 16 in order to judge and reflect upon the design of his/her academic and professional profile.
- Artifact 24 ‘Self-Assessing My SRL Skills/Competences’ invite the learner to evaluate his/her SRL skills and reflect on SRL processes through the process of structuring the ePortfolio.
- Activity 25 ‘Self-Assessing the ePortfolio’ prompts the learner to assess his/her performance throughout the ePortfolio implementation.

3.8.2.2 Designing the ePortfolio-based Self-Regulated Learning (ePSRL) system (Version 2)

Considering the findings of system’s testing (Iteration 1 – Study#1), I re-designed the ePortfolio system and attempted to establish a learning environment that aggregates the merits of a social networking platform, the functionalities of a learning management system and promotes the interaction between learner and instructor and among learners.

Once again, it was selected the open social network platform, ELGG as the mechanism that enabled the design and delivery of a dynamic ePortfolio system. This open source tool has many advantages, a wide range of plugins that provide functionalities and robust infrastructure (Himps & Baumgartner,2009). The vision was the delivery of an ePortfolio system (v.2) that engages learners to manage their learning path, construct an ePortfolio for academic and career development and form an interactive learning community.

The ePortfolio system (Version 2), namely ePSRL system comprises a set of updated functionalities and tools that inform users about content statistics and management functions (**Figure 22**). Learners, peers, instructors and external evaluators may register, create their profiles and navigate in different sections of the ePSRL System.

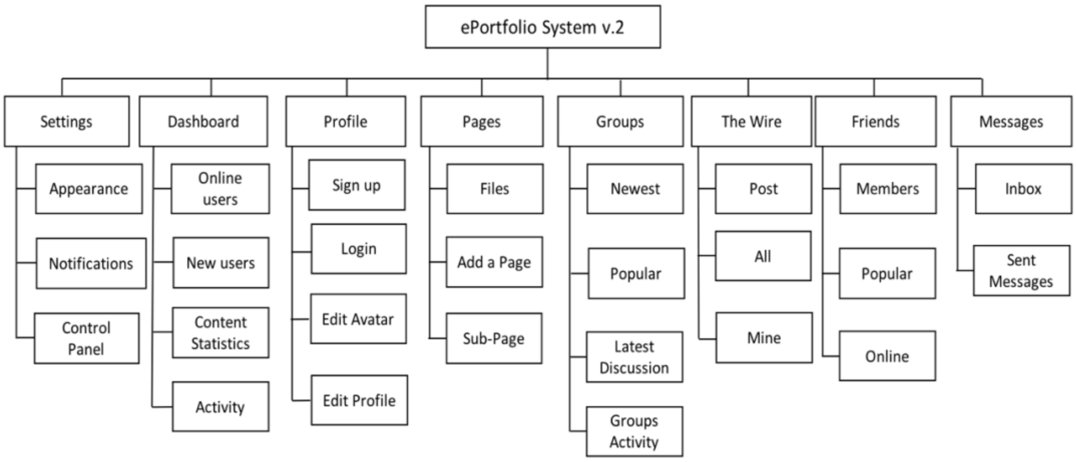

Figure 22. The workflow of the ePSRL System (ePortfolio system- version 2.)

Stakeholders can use the ePSRL System as (**Figure 23**):

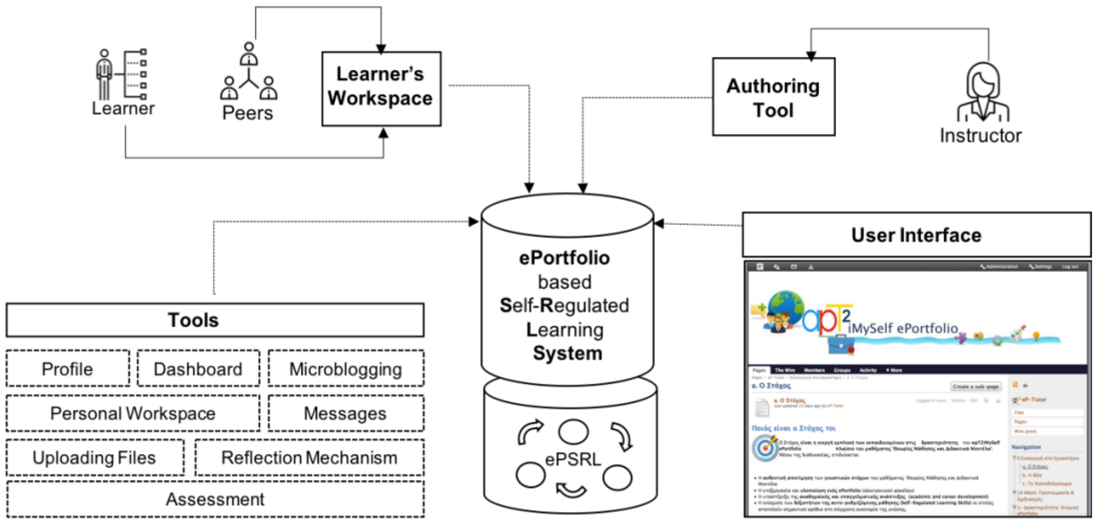

Figure 23. The architecture of the ePSRL system (version 2.)

- An authoring tool: Individuals can use the personal workspace (Pages) for designing and presenting content and information.
- An ePortfolio system: Individuals can collect, design and manage artifacts for academic and career development (personal workspace, assessment, uploading files).

- A social network site/service: Individuals can use the ‘Friends’ functionality to structure groups and create social bonds (Profile, Messages).
- A learning community: Individuals can structure a social network, share ideas and media, interact and co-create knowledge (Microblogging functionality).
- An intervention program: Individuals can follow the ePSRL approach for advancing their SRL skills (Dashboard functionality, Reflection mechanism, assessment, uploading files).

Students, peers, instructors and external evaluators (stakeholders/users) create their profiles and establish a learning community for advancing SRL and delivering an ePortfolio (**Figure *24***).

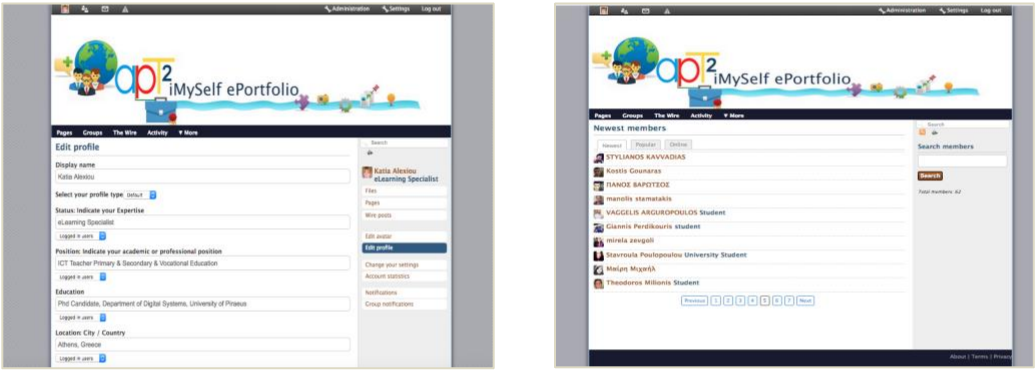

Figure 24. The Profile Section and the learning community of the ePSRL system (version 2.)

Students and peers enter the ePSRL System (v.2), familiarize with the environment and read about the objectives and the procedure of the ePortfolio intervention; they can also navigate on the learning content, connect to other users and exchange ideas and communicate about their interests, academic choices and career aspirations (**Figure *25***).

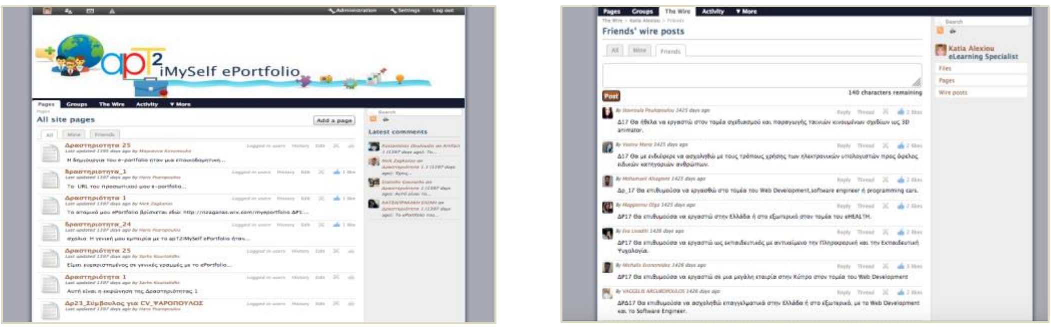

Figure 25. The Navigation Panel and the Microblogging tool of the ePSRL system (version 2.)

Participants are invited to initiate the intervention and to follow a learning path, select artifacts, analyze the tasks and elaborate their artifacts so as to upload their deliverables on their personal workspace (the 'Pages' functionality).

Each learner enters the ePSRL system, navigates in the learning material, reads about the artifacts and their objectives. Users attempt to design their personal workspace where they structure their artifacts, write their reflections, provide argumentations and interact with peers. Thus, each user may customize his/her 'Pages', create hierarchical structure of artifacts and present a dynamic set of deliverables for articulating his/her academic profile.

Also, participants can be informed about the timetable and the order of the learning tasks through the calendar updates. Learners also can participate in discussion with all participants and instructors of the module and post queries, ideas or comments about the learning content. Instructors can view, evaluate user's artifacts and provide feedback following a set of criteria. Learners can also observe their peers ePortfolio's pages and artifacts and can engage in self-assessment and peer assessment.

The ePortfolio system guides learners to enter the learning path and strengthen SRL processes through the ePSRL approach. EPortfolio integrates social media functions, thus participants enter the ePortfolio system, set up their own profile, connect to their peers and articulate a learning community. Learners are invited to participate in a set of learning tasks (ePSRL approach – Artifacts 1-25) for structuring their own ePortfolio, manage their academic and career development and advance their SRL skills. They can read about the objectives, the procedure of the ePSRL approach and the intended learning outcomes (**Figure *26***).

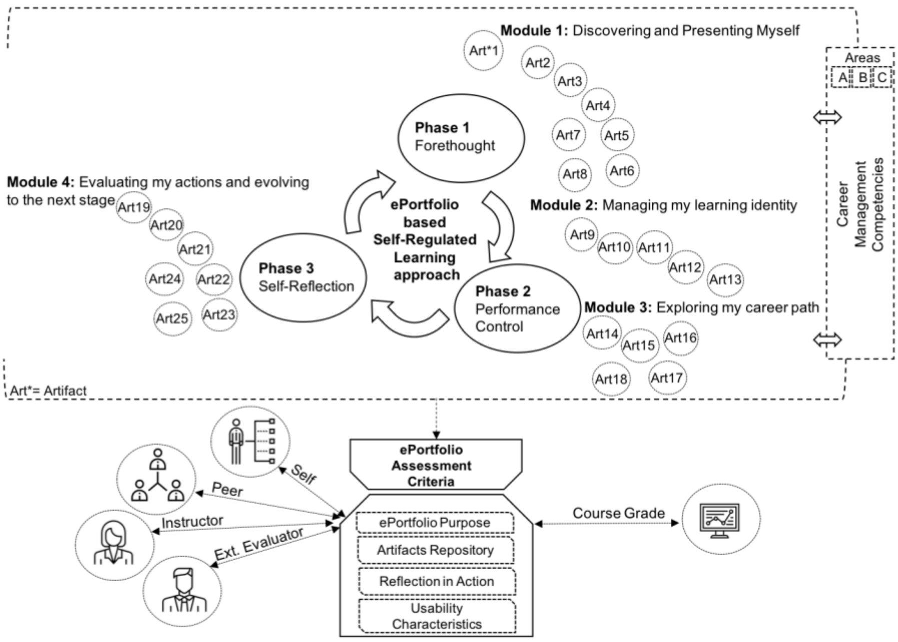

Figure 26. Presentation of the ePortfolio based Self-Regulated Learning system (version 2.)

In addition, the ePSRL system (v.2) supports instructors to guide and manage learners during their engagement in the ePSRL approach. ePortfolio resembles to a management platform as it is a repository of artifacts.

The instructor can create a specific learning path of the ePSRL approach and assign artifacts to learners. Also, he/she can observe learner's actions, make suggestions and provide feedback. Both instructors and administrators may create and manage sections, view learners' progress, initiate discussions and assess the process.

3.9 Working Definitions

Electronic Portfolio (ePortfolio) is defined as a digital collection of information and a holistic learning process where an individual may select, create, reflect upon, interpret, evaluate, and re-edit the content that targets on specific audiences and includes accredited evidence for lifelong learning and skills of individuals in academic and professional context.

Academic achievement is defined as a level of proficiency in ePortfolio-based learning. In this research, academic achievement is based on ePortfolio assessment methodology (i.e. four assessment methods- student/self-assessment, peer-assessment, teacher assessment and external evaluator- assessment). ePortfolio achievement was divided into four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics.

Self-Regulated Learning is a multidimensional entity and consists of functional layers that empowering different aspects of human learning. The functional layers constitute multiple cognitive processes, affective factors, aptitudes, beliefs and 21st century skills (flexibility, collaboration, creativity, problem solving etc). In the context of SRL, each learner should conceptually orchestrate his/her own layers in order to transform his/her behavior into a measurable learning outcome.

EPortfolio-based Self-Regulated Learning (ePSRL) approach/intervention is an educational intervention that encompasses a dynamic learning model (i.e. Self-Regulated Learning) and a student-centered TELE (i.e. ePortfolio). Learners get involved in ePSRL approach which consists of a set of artifacts that engage learners in the process of structuring the ePortfolio. The ePSRL approach/intervention was designed for participants (Study1, Study 2-experimental and Study 3) that followed a structured process (ePSRL approach) and got involved in various activities.

EPortfolio Intervention is a training learning program that supports learners to create a well-organized and responsive ePortfolio. The ePortfolio intervention was designed for participants (Study1, Study2-Experimental and Study3) that followed a structured process and got involved in specific activities for structuring and evaluating their ePortfolio as well as for participants (Study 2-Control) that structured their ePortfolio only following the basic guidelines of workshops.

Self-regulated processes are a wide range of cognitive, affective, behavior and context processes. A self-regulated learner should activate his/her internal traits and follow context-specific processes for attaining academic, professional, personal and social goals. For the needs of the research, it was designed a repository of learning activities based on SRL processes (i.e. setting meaningful goals, adopting dynamic strategies for managing these goals, monitoring the learning process, managing time, attributing meaning to outcomes, self-evaluating the learning path followed.

Satisfaction is linked to satisfying ePortfolio experience, academic achievement, SRL competency and well-being. This research designed an evaluation rubric to assess participants satisfaction degree for the proposed ePortfolio intervention.

Chapter 4: An overview of the studies

4.1 Study#1[9]

This section outlines the implementation of the ePortfolio system (Version 1) for HE in order to support students (future graduates) to enhance their SRL skills and manage their academic path. Towards this, the conceptual framework and the ePortfolio system (v.1) designed and tested in Study 1 (Prototype Stage -Iteration 1). The conceptual framework (v.1) invited learners to engage in a set of learning tasks in order to construct their own ePortfolio and promote their academic development. Individuals initiate the ePortfolio construction process as they enter the SRL cycle following a cyclical order of three major SRL phases and gets involved in the following activities. In addition, it was attempted the design of an ePortfolio system (v.1) as a social networking service/site (SNS), where users could interact, communicate, share their goals, follow the schedule and exchange ideas.

4.1.1 Purpose of Study#1

The purpose of Study#1 was to empower students to self-regulate their learning, develop their sense of time management, and achieve their academic aspirations through the process of implementing the ePortfolio Project. Towards this, it was conducted Study#1 for testing the ePortfolio System (v.1) (prototype stage). In the first iteration, the aim was to investigate to what extent: "Participants engaged in the proposed learning activities [conceptual framework (v.1)]?", "The ePortfolio (v.1) intervention affected SRL?" and "The ePortfolio (v.1) intervention had an impact on academic achievement?".

Thus, Study#1 will attempt to produce new design principles and valuable insights about the re-design of the conceptual framework and the delivery of an updated ePortfolio system (Version 2) for boosting future implementation.

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[9] Part of this section has been published in the following journal and conference papers:

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192.

Alexiou, A. & Paraskeva, F. (2018). Triggering Students' Ability to Influence Their Motivation and Affect Through a Self-Regulated Career-Oriented ePortfolio, American Educational Research Association (AERA 2018 Annual Meeting), New York April 13 –17 April 2018.

Alexiou, A. & Paraskeva, F. (2016). "Empowering First-Year Students to Thrive in University through a Self-Regulated Career oriented ePortfolio". Proceedings of the 14th conference on ePortfolios, Open Badges, Blockchains, Trust and Identity (ePIC 2016), Bologna, Italy, 26-28 October 2016

Alexiou, A & Paraskeva, F. (2014). 'MySelf e-Portfolio' and 'the World' on a Deserted Island, AAEEBL 5th Annual Conference: Boston, MA, USA, July 28-31, 2014.

4.1.2 Study#1: Research Questions

The **Research Questions (RQs)** addressed in this research are as follows:

- **RQ1**- Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?
- **RQ2-** How does the ePortfolio intervention impact academic achievement?
- **RQ3-** Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practice SRL processes?

4.1.3 Research Design

The principles of design-based research are followed in order to conduct my research as this study meets the requirements and consists of three stages (Brown, 1992; Collins, 1992; Plomp, 2013; Amiel & Reeves, 2008): preliminary, prototype and assessment. Study#1 describes the first cycle of testing the ePortfolio intervention and refinement (Prototype Stage).

The complexity of this research problem is high as there are different indicators that correlate to the ePortfolio development, such as SRL and academic achievement. Furthermore, SRL encompasses a set of various cognitive, affective, behavior and context processes that cannot be addressed from the unique perspective of a quantitative or qualitative study. Towards this, it is selected the research approach that involves mixing quantitative and qualitative data (Mixed Method Design). Further, the data analysis will be based on the triangulation design using parallel phases for converging both quantitative (numeric) and qualitative (text) data (**Figure *27***).

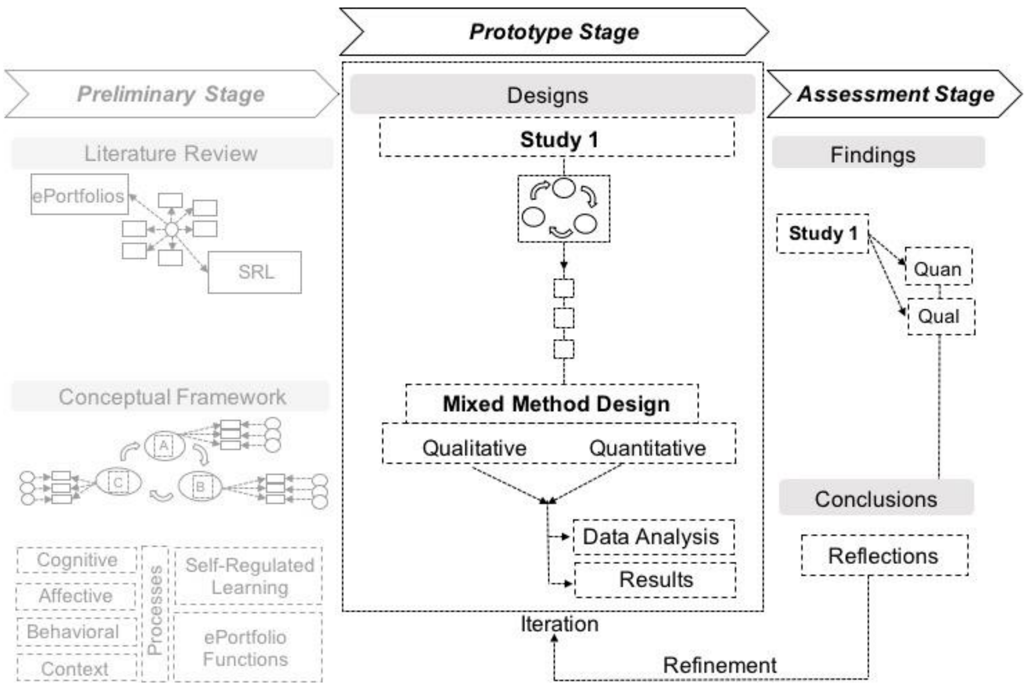


Figure 27. Study#1: Description of the Mixed Methods Research Design

The nature of the research problem is multifaceted as an effort is made to delve deeper into the development and implementation of ePortfolios for enhancing Self-Regulated Learning skills. Towards this, I generated quantitative and qualitative data for understanding the research problem and for allowing a great certainty in inferences and conclusions.

In Study#1, the quantitative data were gathered by questionnaires and rubrics and tabulated in numbers so as to perform statistical analysis (such as means, correlations, ANOVA, t-tests frequencies). Data gathering procedures performed before or/and after the intervention and consisted of a set of instruments:

- Questionnaire about SRL skills
- ePortfolio Rubric
- ePortfolio based Self-Regulated Learning Rubric

The qualitative data gathered by learner's artifacts, submitted activities, reflections and microanalytic protocols that derived throughout the intervention. Qualitative data are represented as descriptive narrations that should be organized (coding and searching for patterns) and describe the learner's behavior. Further, quantitative data were tabulated in number for performing statistical analysis (ICC, frequencies, ANOVA, correlations). Data gathering procedures performed before or/and during or/and after the intervention and consisted of a set of instruments:

- Student's level of cognitive development
- SRL Microanalytic Protocols
- ePortfolio Reviews
- ePortfolio based Self-Regulated Learning Review
- Pre and Post Rubrics

4.1.4 Participants

The participants in **study I** included 86 university students (71 males and 15 females). The sample of the study involved, undergraduate students (Semester 1) at a computer science department of a Greek university. Their average age was 19 years. The sample were first-year students (One-Group Only Research) that voluntarily signed up for acquiring new knowledge and enriched experiences through the implementation of the ePortfolio Project. For this study, the total number of participants in the ePortfolio process were 90 students. However, only 86 of them managed to submit all the activities and complete the questionnaires properly.

The sample of the study voluntarily signed up for acquiring new knowledge and enriched experiences through the implementation of the ePortfolio project. The participation wasn't a prerequisite for passing course or taking credits (ECTS).

Since all participants had no experience with creating an ePortfolio, they attended the ePortfolio training program (blended learning mode) to familiarize themselves with the ePortfolio system functionalities. Students engaged in a learning scenario '*You are a future graduate student and you are invited to deliver an ePortfolio for requesting a position on a global educational provider*'.

4.1.5 Experimental Design and Procedure

Study#1 adopted a design with one-Group (e.g. Experimental Group), as well as pre-testing, during and post testing, as shown in ***Table 8***. The purpose of the experimental design was to test the ePortfolio intervention (Iteration 1), provide valuable insights about the process, the activities and re-calibrate the ePortfolio system.

Table 8. Study#1: Description of the Experimental Design

Group	*Subject Numbers*	*Pretest*	*Intervention*	*Posttest*	*Duration*
Experimental Group	86	Questionnaire about SRL skills Prior ePortfolio experience	Engaging in the ePortfolio activities and using the ePortfolio system	Questionnaire about SRL skills ePortfolio Rubric ePortfolio based Self-Regulated Learning Rubric ePortfolio Reviews ePortfolio based Self-Regulated Learning Review	10 Weeks
		During			
		Student's level of cognitive development SRL Microanalytic Protocols			

During the experimental procedure, participants followed the SRL phases in the context of an intervention program (duration: 10 weeks), which consisted of several learner-centred activities, reflective questions and face-to-face workshops. The ePortfolio system is based on the proposed SRL conceptual framework which consists of a specific SRL processes (APPENDIX E: ePSRL Conceptual Framework (Version 1.)). For each learning activity, it was designed a reflective review activity that was based on a set of criteria that corresponded to SRL cognitive, affective, behavioral and context processes. Finally, activities were evaluated against competency statements that derived from the revised Bloom's Taxonomy (remember, understand, apply, analyse, evaluate and create) (Krathwohl and Anderson, 2009). In detail, the experimental procedure (**Figure *28***):

Week# 1

Students invited to participate in a face-to-face workshop so as to introduce to the ePortfolio system functions, familiarize with the process and register in the ePortfolio system.

Weeks# 2-4

Student enter the ePortfolio system set up their own profile, connect to other users in order to create their own learning community. EPortfolio system informs users about the timetable and the order of the activities through micro-blogging tools and calendar updates. Students initiate the ePortfolio construction process as they enter the SRL cycle following a cyclical order of three major SRL phases and gets involved in a set of activities:

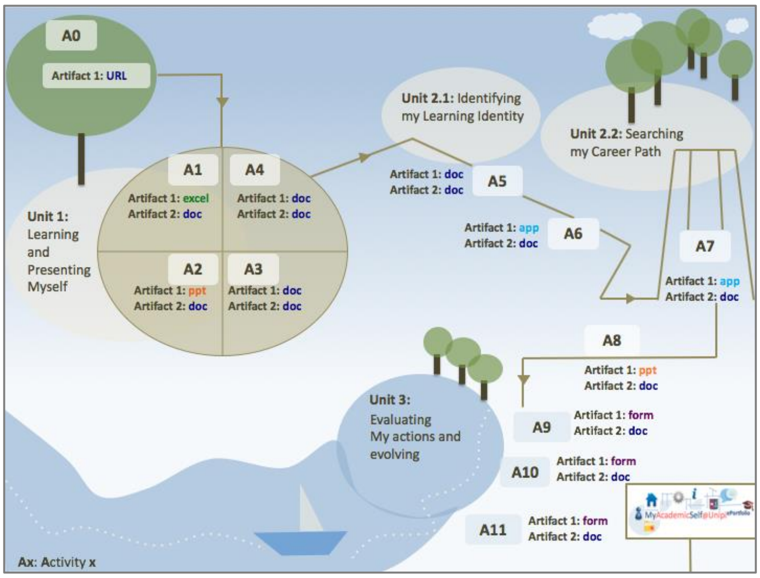


Figure 28. Study#1: The workflow of the learning activities

Phase A - The 'Forethought' phase consists of specific processes for initiating and analysing the process of structuring an ePortfolio. This phase consists of a set of activities for supporting learners to comprehend the task objectives and activate their cognitive, affective, behavioural and context processes so as to move to the next phase. Users follow a learning path, consisting of 4 learning activities in a fixed order.

During the first phase, the learner should, thus, perform "Activity 1: Identifying Personality Characteristics and Skills" which invites them to discover their skills, beliefs, attitudes, interests, knowledge, values and relate their individual characteristics to personal academic choices. Then, in "Activity 2: Presenting MySelf" users attempt to explore and visualize aspects of their academic, professional and social self in order to construct an effective presentation (**Figure *29***). For instance, in the ‘Activity: Presenting Myself’ students had to create the portrait of themselves and present it in their social, academic and professional environment. Therefore, students delivered a presentation about themselves, uploaded it to their ePortfolio system and filled in a reflection rubric so as to self-evaluate their work and performance toward learning (**Figure *29***).

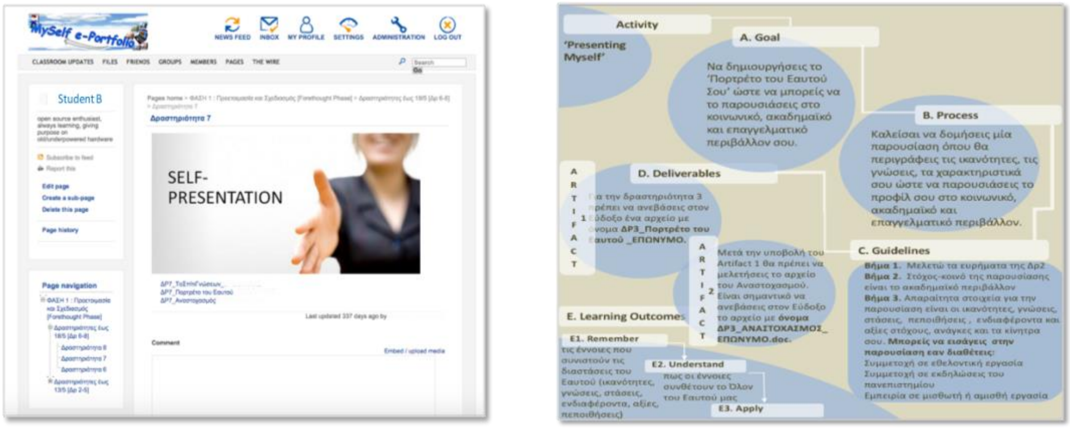


Figure 29. Study#1: Illustration of the ePortfolio Activity: ‘Presenting Myself’

Then, they proceed to “Activity 3: Goal Setting” which encourages setting specific, measurable, achievable, realistic and time specific goals in order to accomplish short and long-term activities in an academic, professional and personal context. This phase is completed with “Activity 4: Strategic Planning” which gets users involved in selecting learning strategies and techniques to accomplish their goals.

Week# 5

Students participated in a face-to-face workshop so as to familiarize with the ePortfolio principles and engage in a questions-answers session.

Weeks# 6-7

Each user enters the ePortfolio system, reads the activities, elaborates on the learning content, analyses the tasks and uploads his/her deliverables on the ‘Pages’ tool. The system allows users to customize their ‘Pages’ and enables them to edit their deliverables in order to present an effective outcome. Then, students follow the SRL cycle and enter *Phase B- The ‘Performance Control’* phase which consists of the processes for elaborating on and delivering specific tasks that can be embedded in the ePortfolio. This phase encompasses various activities for prompting learners to dynamically utilize SRL aspects to accomplish their learning activities. Users continue their learning path which is composed of 4 learning activities. Learners have the opportunity to select the order of the proposed activities that support them to advance their academic performance and strengthen their ePortfolio.

Therefore, while in this phase, learners engage in “Activity 5: Familiarize with MySelf as a Student” and try to explore the benefits of learning strategies, study tactics and develop a personal learning strategy repertoire for boosting their academic performance. In “Activity 6: Boosting the Strategy of Note Taking” learners attempt to discover the advantages of note taking, identify note-taking techniques and make use of note taking for effective planning and organization of their own ePortfolio. In “Activity 7: Time Management” learners investigate the benefits of managing time, organize their tasks and plan their activities (at an individual, academic and professional level) to complete their ePortfolio. This phase also includes “Activity 8: Creating My Curriculum Vitae” which prompts users to engage in the process of job search and start designing their professional profile. In this phase, learners have the opportunity to select specific artefacts to structure their own ePortfolios.

Weeks# 8-9

In Phase C - *‘Self-reflection’ phase* which consists of processes for self-monitoring and self-evaluating. This phase enables self-judgement through the use of self-assessment rubrics. The phase consists of 3 learning activities (without a fixed order). In this view, learners engage in “Activity 9: Self-Assessing My Time Management” by means of which they can evaluate and reflect on their time management skills during the ePortfolio construction. In “Activity 10: Self-Assessing My SRL Skills/Competences” learners evaluate their SRL skills and reflect on SRL processes through the process of implementing the ePortfolio. Finally, in “Activity 11: Self-Assessing the ePortfolio” users evaluate their performance throughout the ePortfolio implementation. Upon completion of this phase, the SRL cycle is also completed and a new one can be initiated. Learners have the opportunity to recalibrate their goals and perform tasks in order to bolster their academic performance.

Week# 10

In parallel (Weeks#2-10), learners engage in “Activity 0: Implementation of ePortfolio”, which is a holistic process of designing and implementing a customized ePortfolio that is a stand-alone application prompting users to collect and present appropriate artefacts for structuring their academic and professional profile.

This activity evolves throughout the three SRL phases and aims to strengthen learners’ potential for recognizing their abilities and skills, for enabling them to manage time, set demanding and meaningful goals, design personal action plans, create a curriculum vitae, activate prior knowledge, develop communication skills, reconsider competences, self-evaluate actions in a digital environment and, ultimately, design an efficient ePortfolio.

Finally, students invited to attend the final face-to-face workshop where they complete the post-test rubrics and interact with their tutor and peers for exchanging opinions about the intervention and their performance.

4.1.6 Results

For the statistical analysis of the data the 'Statistical Package for Social Sciences (SPSS) v. 20.0' was used. Before the intervention, students invited to fill in 9 close-ended questions (Yes/No) and one open-ended question (Prior ePortfolio Experience Rubric). The goal of this instrument is to identify if students had prior ePortfolio experience and discover students' expectations about the project. In **Figure *30***, there are students' positive answers (Yes) about their prior ePortfolio experience and their expectations of the project. The majority of the participants (99%) highlighted that they participate for supporting their academic development and the 89 % of the students indicate that they will gain new knowledge. The 98% of the students believe that the ePortfolio is a very useful tool and the 84% of the learners suggest that they have a positive first impression and feel confident for the process (85%). Only the 15% of the students have prior experience in ePortfolios and the 9% of the participants searched for information about ePortfolios.

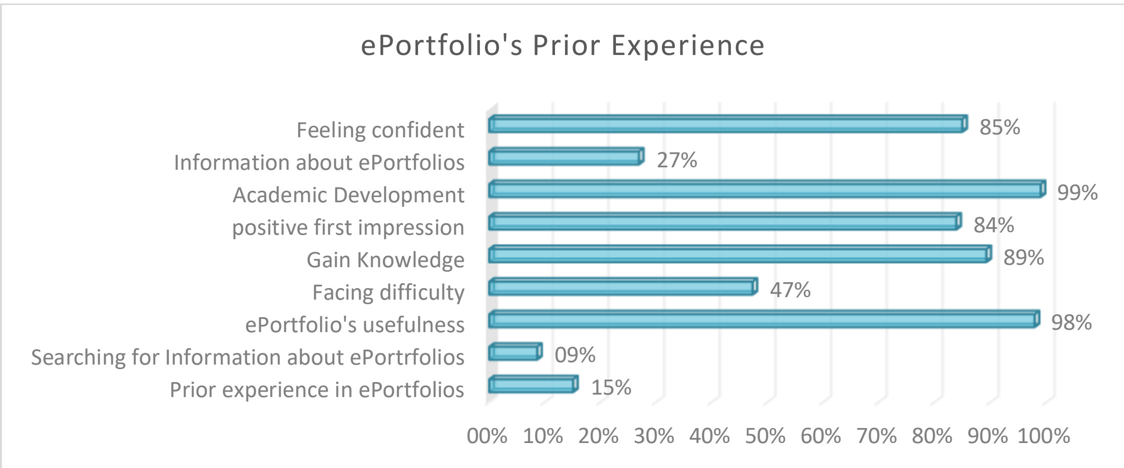


Figure 30. Study#1: ePortfolio's Prior Experience

Also, students answered the open-ended question 'Why do you participate in the ePortfolio Lab?' (**Figure *31***). The 47% of the participants admitted that they want to gain knowledge and advance their skills. It is interesting that only the 15% of the participants indicated that they participate for taking better course grades.

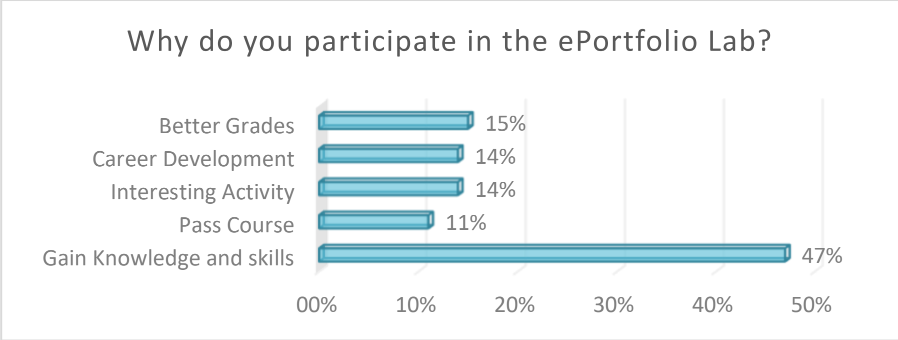


Figure 31. Study#1: 'Why do you participate in the ePortfolio Lab?'.

4.1.6.1 Reliability Analysis for quantitative data (RQ1)

A reliability analysis was conducted to measure the instrument's (Questionnaire about SRL skills-MSLQ) internal consistency (Pintrich et al., 1991). Cronbach's alpha reliability coefficient normally ranges between 0 and 1 (Nunnally & Bernstein, 1994) (**Table *9***).

Table 9. Study#1-Cronbach's a coefficient of Questionnaire about SRL skills

Questionnaire about SRL skills - MSLQ		
Scales	**Items**	**α**
Scale A: Motivation	31	.883
Value Components	16	.869
Intrinsic Goal Orientation	4	.709
Extrinsic Goal Orientation	4	.713
Task Value	8	.804
Expectancy Components	12	.878
Control Beliefs	4	.659
Self-Efficacy	8	.868
Affective Components	5	.688
Test Anxiety	5	.688
Scale B: Learning Strategies	50	.969
Cognitive and Metacognitive Strategies	31	.946
Rehearsal	4	.690
Elaboration	6	.793
Organization	4	.723
Critical Thinking	4	.829
Metacognitive Self-Regulation	12	.847
Resource Management Strategies	19	.883
Time Management	8	.740
Effort Regulation	4	.711
Peer Learning	3	.657

Help Seeking	4	.746

Along these lines, Scale A: Motivation, had a high reliability (Cronbach's Alpha=.88) and Scale B: Learning Strategies measure also had a high reliability (Cronbach's Alpha=.97) with all subscales displaying a Cronbach alpha of at least 0.65.

4.1.6.2 Research Question 1- Quantitative Analysis

Initially, the assumption of normality is based on central limit theorem, considering that this research consists of dependent, ordinal scale variables and the size of the sample (N) is 86 (N>30) (Rouaud, 2013; Norusis, 2008). This means that sampling distribution of the sample mean approaches a normal distribution, therefore paired samples t-test (pre and post-test) was selected. The paired samples t-test calculates the differences between all pairs. Descriptive statistics was employed to describe the data collected. In general, **Table *10*** indicates that the experimental group appeared to have a significant increase on the means across all the variables of Scale A: Motivation.

Table 10. Study#1: Paired Samples t-test – Scale A: Motivation

Paired Differences										
		Pre -Test		**Post -Test**						
Variables	**N**	**M**	**SD**	**M**	**SD**	**95% CI for Mean Difference**		**p-value**	**t**	**df**
Scale A: Motivation	86	3.37	.437	3.99	.442	-.744	-.497	.000	-10.00	85
Value Components	86	3.48	.486	4.18	.444	-.824	-.575	.000	-11.18	85
Intrinsic Goal Orientation	86	3.75	.676	4.23	.529	-.630	-.318	.000	-6.03	85
Extrinsic Goal Orientation	86	3.21	.778	4.11	.579	-1.095	-.719	.000	-9.59	85
Task Value	86	3.48	.531	4.20	.487	-.858	-.576	.000	-10.13	85
Expectancy Components	86	3.59	.529	4.03	.474	-.592	-.304	.000	-6.18	85
Control Beliefs	86	3.76	.615	4.06	.512	-.475	-.135	.000	-3.57	85
Self-Efficacy	86	3.42	.610	4.01	.541	-.749	-.431	.000	-7.36	85
Affective Components	86	3.03	.774	3.99	.586	-1.167	-.740	.000	-8.88	85
Test Anxiety	86	3.03	.774	3.99	.586	-1.167	-.740	.000	-8.88	85

Specifically, **Table *10*** indicates that the experimental group appeared to have a significant increase on the means across the Scale A: Motivation $t(85) = -10.00$, $p < 0.01$. This finding is consistent with accounts from prior studies that there is a positive relationship between motivation and ePortfolio (Lopez-Fernandez & Rodriguez-Illera, 2009, Huang et al., 2012). A detailed observation indicates that the experimental group appeared to have a significant increase on the means across Value

Components: Intrinsic Goal Orientation, Extrinsic Goal Orientation, Task Value, Expectancy Components: Control Beliefs, Self-Efficacy and Affective Components: Test Anxiety.

The contrast in the 'Intrinsic Goal Orientation' between the pre-test and post-test was significant, t (85) = -6.03, p < 0.01. Results indicate that after the completion of the ePortfolio implementation, students' intrinsic motivation improved. This means that students displayed interest in the ePortfolio workload for reasons such as challenge, curiosity, enjoyment and mastery. Furthermore, the contrast in the 'Extrinsic Goal Orientation' between the pre-test and post-test was significant, t (85) = -9.59, p < 0.01. Results indicate that post to the completion of the procedure, students' extrinsic motivation also improved. A significant indicator of extrinsic motivation is the acquisition of excellent grades and achieving high performance. The results indicate that the experimental group appeared to have a significant increase on the means across 'Task Value' t(85) = -10.13, p < 0.01. Results indicate that after the intervention, students showed that the process of constructing their ePortfolio was a meaningful process and helped them realize their own process of learning. Participants also believed that the learning content was meaningful and well-organized, and they could apply what they had learned during their academic studies.

Table *11* indicates that the experimental group appeared to have a significant increase on the means across the Scale B: Learning Strategies namely: Cognitive & Metacognitive Strategies: Rehearsal, Elaboration, Organization, Critical Thinking, Metacognitive Self-Regulation and Resource Management Strategies: Time Management, Effort Regulation, Peer Learning, Help Seeking.

Table 11. Study#1: Paired Samples t-test – Scale B: Learning Strategies

Paired Differences										
		Pre Test		**Post Test**						
Variables	**N**	**M**	**SD**	**M**	**SD**	**95% CI for Mean Difference**		**p-value**	**t**	**df**
Scale B: Learning Strategies	86	3.15	.350	3.92	.451	-.893	-.642	.000	-12.16	85
Cognitive & Metacognitive Strategies	86	3.25	.397	3.94	.460	-.821	-.562	.000	-10.62	85
Rehearsal	86	3.30	.677	4.00	.503	-.887	-.520	.000	-7.60	85
Elaboration	86	3.23	.532	3.90	.535	-.825	-.512	.000	-8.48	85
Organization	86	3.19	.659	3.97	.553	-.971	-.569	.000	-7.61	85
Critical Thinking	86	3.28	.564	3.87	.547	-.728	-.449	.000	-8.37	85
Metacognitive Self-Regulation	86	3.26	.334	3.99	.442	-.839	-.619	.000	-13.16	85
Resource Management Strategies	86	3.05	.381	3.90	.476	-.982	-.704	.000	-10.00	85
Time Management	86	3.18	.424	3.94	.486	-.912	-.617	.000	-11.18	85
Effort Regulation	86	2.90	.481	3.92	.607	-1.196	-.845	.000	-6.03	85
Peer Learning	86	2.99	.808	3.79	.640	-1.004	-.585	.000	-9.59	85

Help Seeking	86	3.15	.597	3.94	.595	-.986	-.601	.000	-10.13	85

The results suggest that the experimental group appeared to have a significant increase on the means across the Scale B: Learning Strategies t (85) = -12.16, $p < 0.01$. This finding is consistent with accounts from prior studies that students need training to learn how to use strategies and display a high level of SRL in their ePortfolios (Abrami et al., 2007; Cheng & Chau, 2012).

Furthermore, the Pearson's correlation approach was also performed to examine the relationships between the SRL processes and ePortfolio assessment level as well as between SRL processes and the course grade. Our intention was to examine whether our variables were linearly related in order to promote learning and support students for structuring their ePortfolios. ***Table 12*** and ***Table 13*** revealed that correlation coefficients for all the items were significant, which meant that each item possessed adequate internal consistency.

Table 12 shows various highly significant intercorrelations between constructs in Scale A: Motivation. The most significant intercorrelations are between Value components and Motivation (0.83) and Expectancy Components and Motivation (0.86). Also, Intrinsic Goal orientation and Value components (0.85), Task Value and Value components (0.87), Expectancy Components and Control Beliefs (0.89), Expectancy Components and Self-efficacy (0.91).

Table 12. Study#1: Pearson r Correlations – Scale A: Motivation

Variables	1	2	3	4	5	6	7	8	9	10	A	B
(1) Motivation	1											
(2) Value Components	.833**	1										
(3) Intrinsic Goal Orientation	.747**	.854**	1									
(4) Extrinsic Goal Orientation	.629**	.786**	.431**	1								
(5) Task Value	.718**	.873**	.737**	.495**	1							
(6) Expectancy Components	.860**	.797**	.741**	.572**	.696**	1						
(7) Control Beliefs	.791**	.792**	.638**	.655**	.696**	.895**	1					
(8) Self-Efficacy	.760**	.648**	.696**	.383**	.562**	.907**	.623**	1				
(9) Affective Components	.679**	.583**	.539**	.434**	.492**	.611**	.506**	.592**	1			
(10) Test Anxiety	.679**	.583**	.539**	.434**	.492**	.611**	.506**	.592**	1.000**	1		
(A) ePortfolio Assessment	-.052	-.048	-.092	-.013	-.016	-.101	-.118	-.066	.038	.038	1	
(B) Course Grade	-.173	-.124	-.104	-.085	-.126	-.146	-.100	-.162	-.124	-.124	.125	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

Table 13 shows various highly significant intercorrelations between constructs in Scale B: Learning Strategies. The most significant intercorrelations are between learning strategies and cognitive and metacognitive strategies (0.96) and learning strategies and metacognitive self-regulation

(0.92), learning strategies and resource management strategies (0.96). Also, cognitive & metacognitive strategies and elaboration (0.92), critical thinking and cognitive & metacognitive strategies (0.92), metacognitive self-regulation and cognitive & metacognitive strategies (0.92).

Table 13. Study#1: Pearson r Correlations – Scale B: Learning Strategies

Variables	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**A**	**B**
(11) Learning Strategies	1													
(12) *Cognitive S*	.962**	1												
(13) Rehearsal	.847**	.882**	1											
(14) Elaboration	.882**	.921**	.756**	1										
(15) Organization	.785**	.823**	.632**	.664**	1									
(16) Critical Thinking	.862**	.917**	.770**	.855**	.651**	1								
(17) Metacognitive SR	.923**	.918**	.792**	.827**	.699**	.804**	1							
(18) *RM Strategies*	.965**	.856**	.751**	.781**	.691**	.747**	.861**	1						
(19) Time Management	.825**	.767**	.634**	.714**	.610**	.707**	.767**	.821**	1					
(20) Effort Regulation	.839**	.737**	.670**	.654**	.643**	.614**	.716**	.876**	.731**	1				
(21) Peer Learning	.764**	.669**	.630**	.569**	.518**	.573**	.716**	.801**	.571**	.548**	1			
(22) Help Seeking	.734**	.639**	.523**	.637**	.499**	.569**	.627**	.773**	.450**	.597**	.461**	1		
(A) ePortfolio Assessment	-.031	.028	-.003	.076	.036	.052	-.052	-.086	-.077	-.038	-.084	-.083	1	
(B) Course Grade	-.188	-.188	-.027	-.186	-.242*	-.199	-.173	-.174	-.164	-.037	-.182	-.190	.125	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Study#1 is a part of on-going research that aspires to re-design the conceptual framework of the proposed ePortfolio, embed the present findings, and test the ePortfolio system in order to investigate the relations among ePortfolio assessment level SRL processes and course grades.

4.1.6.3 Research Question 1- Qualitative Analysis

During the ePortfolio intervention, participants engaged in a set of learning tasks (Conceptual Framework v.1: Activities 1-11) in order to construct their own ePortfolio and promote their academic development (**Figure *32***). We selected activities 2, 3, 5, and 7 of the ePortfolio so as to explore the use of SRL processes and achievement in ePortfolio use. The selected activities are representative of the procedure and can be used to express the levels of achievement of specific SRL processes. For each activity we tried to examine student's level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009). Our intention is to express the level of expertise required to achieve each activity. Furthermore, we examined the written reflections on activities 2, 3, 5 and 7 of the ePortfolio.

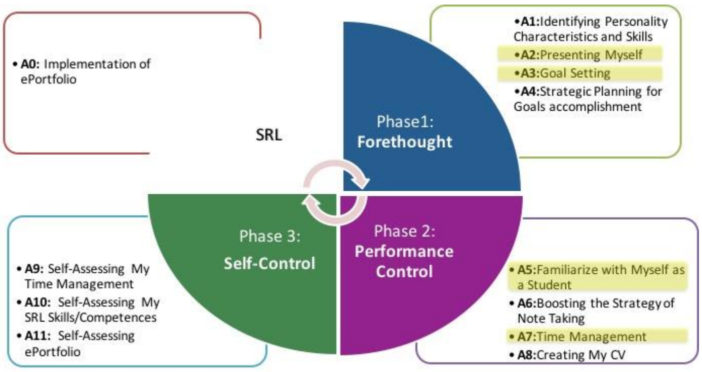
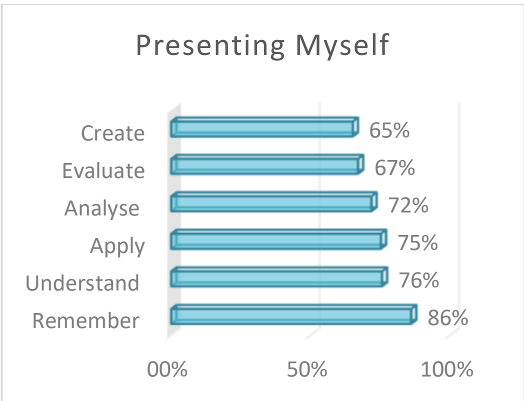


Figure 32. Study#1: Quantitative Analysis in specific activities of the ePortfolio intervention (version.1)

For each activity, it was attempted to represent measurable student outcomes as competency statements about the actions associated with the intended cognitive process (remember, understand, apply, analyze, evaluate and create).

In *"Activity 2: Presenting Myself (A2)"* participants attempt to explore and visualize aspects of their academic, professional and social self in order to construct an effective presentation. **Figure *33*** shows the degree to which participants understand, use concepts, demonstrate skills and create their learning outcome. the process developing their lower order thinking skills to higher order thinking skills.



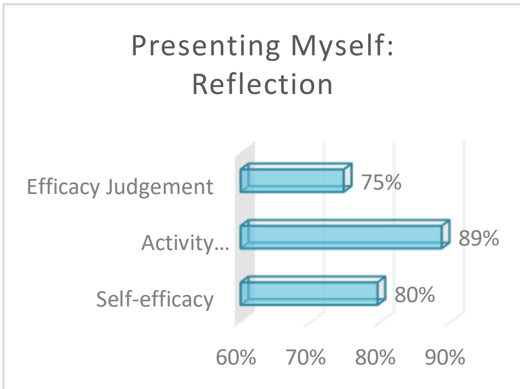


Figure 33. Study#1: Quantitative Analysis of Activity 2: Presenting Myself

The results suggest that the experimental group appeared to have a significant increase on the first levels of the continuum of the learning outcomes. This finding is consistent with accounts from prior research where students need to master the first levels of the taxonomy before the next one can take place. Participants who completed "Activity 2: Presenting Myself (A2)" were able to:

- 86% of the students remember the aspects of self (knowledge, skills, attitudes, interests, values, beliefs)

- 76% of the students understand their aspects of Self (knowledge, skills, attitudes, interests, values, beliefs)
- 75% of the students apply their aspects of Self into a personal project
- 72% of the students analyse their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self)
- 67% of the students evaluate their personal identity and their self-image
- 65% of the students create a presentation about their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self) and set a specific career goal

Specifically, students achieved better on the first levels of the continuum (Remember, Understand, Apply, Analyze) while they faced difficulty on the higher levels of continuum (Evaluate and Create). This means that participants were able to recognize, interpret and manage the aspects of self but they need more training in order to monitor and construct detailed self-presentations.

Also, it was attempted to promote reflection on activities for facilitating Self-Regulated Learning processes. Towards this, it was designed a written reflection activity following the principles of microanalytic methodology for assessing SRL (Cleary & Zimmerman, 2004; Zimmerman & Kitsantas, 2002). Each 'Reflection Activity' consists of open-ended questions that measure the effects of SRL processes across the phases of the ePortfolio intervention (v.1). Specifically, the reflection of "*Activity 2: Presenting Myself (A2)"* examines the effect of affective SRL processes (**Table *14***). The 'Reflection Activity' attempted to investigate specific SRL processes (self-efficacy, efficacy judgement) and perceptions about the activity (activity judgement).

Table 14. Study#1: Microanalytic Protocols of "Reflection Activity 2: Presenting Myself (A2)"

Reflection Activity 2: Presenting Myself (A2)- Microanalytic Protocols	
SRL Processes	**Reflective Questions**
Efficacy Judgement	○ Do you think you should change some parts of your presentation about the aspects of your academic, professional and social self?
Activity Judgement	○ Do you think that the activity helped you realize your skills, knowledge, attitudes, interests and values (Aspects of Self)?
Self-Efficacy	○ Do you think that you possess the appropriate skills, knowledge, attitudes, interests and values to achieve your career goal?

Figure 34 shows that students' self-efficacy is high as they believe that they possess the appropriate skills, knowledge, attitudes, interests and values. Also, the 89% of the participants reported that the activity helped them realize the their 'Aspects of Self'. Only the 75% of the

experimental group think that they should make changes on their presentations. This means that students need to strengthen their efficacy judgement and practice on activities for identifying and boosting their skills, knowledge, attitudes, interests and values. The results suggest that students' judgments of their capability to do the activity were weak.

In *"Activity 3: Goal Setting (A3)"* participants set specific, measurable, achievable, realistic and time specific goals in order to accomplish short and long-term activities in an academic, professional and personal context. ***Figure 34*** suggests that the experimental group appeared to have differences among the levels of the continuum of the learning outcomes.

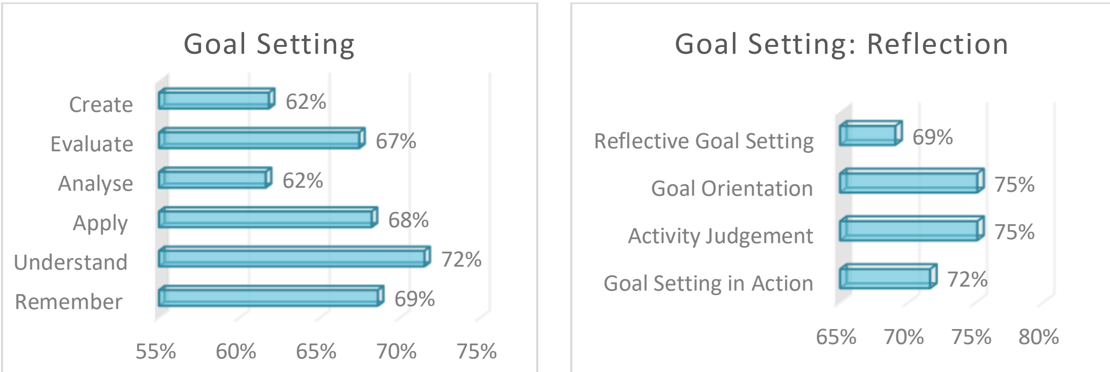


Figure 34. Study#1: Quantitative Analysis of Activity 3: Goal Setting

Specifically, from the students who completed "Activity 3: Goal Setting (A3)":

- 69% of the students remember to use the syntax of a S.M.A.R.T goal.
- 72% of the students understand the basic components of a S.M.A.R.T (Specific, Measurable, Attainable, Realistic, Timely). This means that students couldn't recall the basic concepts of goal setting but they understood the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely).
- 68% of the students apply and set their S.M.A.R.T goals.
- 62% of the students analyse the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely). The results show that students find difficult to analyse their intended outcomes and produce elaborated plans.
- 67% of the students evaluate their capability of setting sustainable goals
- 62% of the students create Specific, Measurable, Attainable, Realistic, Timely goals.

It is observed that students faced difficulty on the higher levels of continuum (Evaluate and Create), which means that students need more time and support for creating specific, measurable, and realistic goals.

The written reflection of "*Activity 3: Goal Setting (A3)*" examines the effect of SRL processes and shows how processes assessed by specific reflective questions (Microanalytic Protocols- **Table *15***). The 'Reflection Activity' attempted to investigate specific SRL processes (Goal Setting in Action, Goal Orientation, Reflective Goal Setting) and perceptions about the activity (activity judgement).

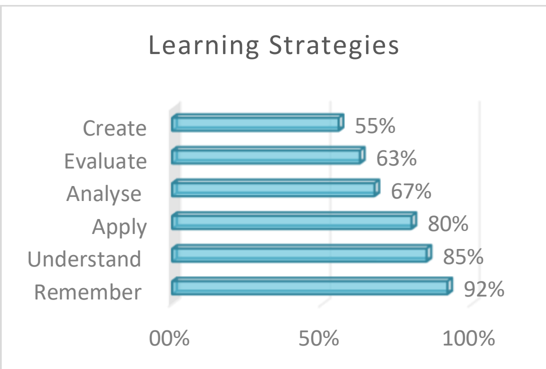
Table 15. Study#1: Microanalytic Protocols of "Reflection Activity 3: Goal Setting (A3)"

Reflection Activity 3: Goal Setting (A3)-Microanalytic Protocols

Affective Processes	**Reflective Questions**
Goal Setting in Action	○ Do you think the goal setting process is a realistic way to help you achieve your dreams?
Activity Judgement	○ Do you believe that the information you have studied and the activity you completed have helped you understand the process of goal setting?
Goal Orientation	○ Stefanos aims to attend the Erasmus program in Sweden. Help Stefanos to analyze his general goal into more detailed sub-goals (learning and/or achievement goals).
Reflective Goal Setting	○ How you can use the goal setting process in order to gain high grades during the exams period?

Figure 34 shows that students' goal setting is high as they believe that is a valuable procedure. Also, the 75% of the participants reported that the activity helped them understand how to set goals and categorize learning and achievement goals. But, only the 69% were able to set goal in authentic learning context. This means that students need to engage in goal setting activities in order to boost their skills.

In "*Activity 5: Familiarize with MySelf as a Student*" participants try to explore the benefits of learning strategies, study tactics and develop a personal learning strategy repertoire for boosting their academic performance. **Figure *35*** suggests that the experimental group appeared to have a significant increase on the first levels of the continuum of the learning outcomes.



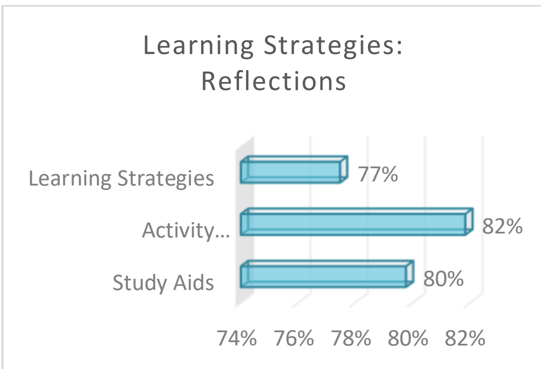


Figure 35. Study#1: Quantitative Analysis of Activity 5: Familiarize with MySelf as a Student (Learning Strategies)

Specifically, from the students who completed “Activity 5: Familiarize with Myself as a Student (Learning Strategies) (A5)”:

- 92% of the students remember concepts associated to learning strategies
- 85% of the students understand the need for using learning strategies.
- 80% of the students apply a repertoire of learning strategies in their academic study. This means that students
- 67% of the students analyse learning strategies in order to know when to use them in their academic study
- 63% of the students evaluate, select and control their learning strategies
- 55% of the students create a detailed repertoire of learning strategies which is orchestrated by web-based tools.

The findings illustrate that students’ competency decrease in the higher level of learning objectives continuum (Analyze, Evaluate and Create). These results suggest that students realized the need of acquiring learning strategies but they need a long-term plan for applying them in their academic study.

The written reflection of “Activity 5: Familiarize with MySelf as a Student (Learning Strategies) and shows how processes assessed by specific reflective questions (Microanalytic Protocols- **Table *16***). The ‘Reflection Activity’ attempted to investigate specific SRL processes (Learning strategies and Study Aids) and perceptions about the activity (activity judgement).

Table 16. Study#1: Microanalytic Protocols of “Activity 5: Familiarize with MySelf as a Student (Learning Strategies) (A5)”

Reflection Activity 5: Familiarize with MySelf as a Student (A5)- Microanalytic Protocols

SRL Processes	**Reflective Questions**
Study Aids	○ How you will use specific learning strategies in a course that you find difficult to understand? Explain
Activity Judgement	○ Do you think that the activity and the information you studied were helpful?
Learning Strategies	○ Invite individuals to acquire and use a repertoire of learning strategies. Explain

Figure 35 shows that the 80% of the experimental group was able to select and apply specific learning strategies for supporting their cognitive state and directing their behavior. On the other hand, only the 77% of the students admitted that they feel capable to use the appropriate

strategies or study aids for learning and retrieving new content. Finally, the 82% of participants agreed that the activity was very useful.

In *"Activity 7: Time Management"* learners investigate the benefits of managing time, organize their tasks and plan their activities (at an individual, academic and professional level) to complete their ePortfolio. **Figure *36*** suggests that the experimental group appeared to have low scores across the continuum of learning outcomes. Specifically, from the participants who completed "Activity 7: Time Management (A7)":

- 80% of the students remember terms related to time management.
- 77% of the students understand the necessity for effective time management
- 69% of the students apply techniques for effective time management
- 61% of the students analyse various methods and techniques for time management
- 53% of the students evaluate the efficacy of time schedules
- 50% of the students create effective time management plans

The findings underline that participants do engage in time management activities and try to allocate their effort but they fail to deliver effective schedules and take appropriate decisions.

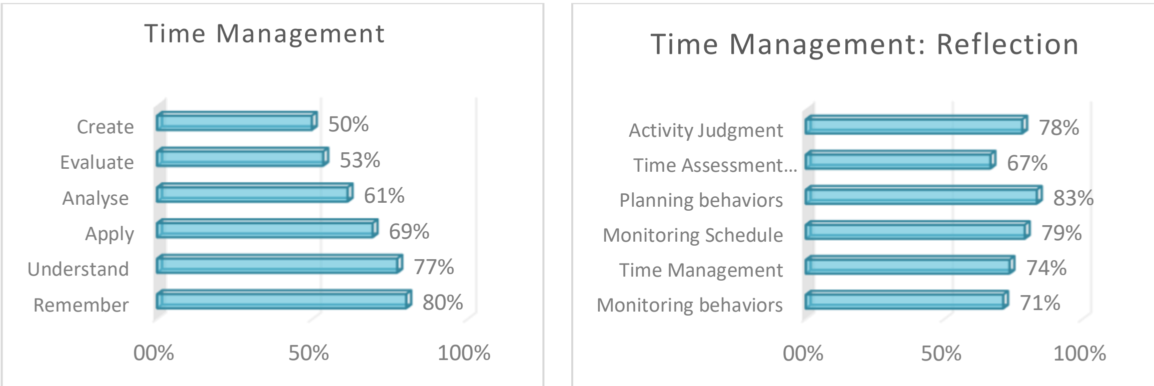


Figure 36. Study#1: Quantitative Analysis of Activity 7: Time Management (A7)

The written reflection of "*Activity 7: Time Management (A7)*" (**Table *17***) shows how processes assessed by specific reflective questions. The 'Reflection Activity' attempted to investigate specific SRL processes (Monitoring behaviors, time management, Monitoring Schedule, Planning behaviours, Time Assessment Behaviours) and perceptions about the activity (activity judgement).

Table 17. Study#1: Microanalytic Protocols of "Activity 7: Time Management (A7)"

Reflection Activity 7: Time Management(A7)- Microanalytic Protocols	
SRL Processes	**Reflective Questions**

Monitoring behaviours	○ Do you think that you are able to manage and allocate you study time? Explain
Time Management	○ Is it feasible to follow an organized time schedule? Explain
Monitoring Schedule	○ Is it necessary to monitor my time schedule so as to manage my workload?
Planning behaviours	○ Is it necessary to devote time in order to develop an effective time schedule?
Time Assessment Behaviours	○ Do you believe that an application (e.g. remember the milk™) may help you reduce procrastination, lack of discipline and minimize opportunities for interruptions?
Activity Judgement	○ Do you think that the activity and the information you studied help you manage time effectively?

Figure *36* shows that the 71% of the experimental group was able to manage and allocate their study time. Also, the 74% of the students agree that they can follow an organized time plan. This means that, students should engage in time management activities in order to strengthen their skills and monitor their actions. In addition to, the 79% of the students agree that monitoring schedule is necessary and the 83% indicate that planning is a key concept in time management. On the other hand, only the 67% of the students believed that an application can help them assess and change their behavior. Finally, the 78% of participants agreed that time management activity was very useful.

4.1.6.4 Reliability Analysis for quantitative data (RQ2)

For the needs of the research, ePortfolio achievement is measured by the ePortfolio Rubric (see APPENDIX B: ePortfolio Rubric). EPortfolio achievement is divided into four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics (**Table 121**).

At the end of the intervention, students and one instructor completed the ePortfolio rubric in order to assess the ePortfolio. EPortfolio's participants self-evaluated their ePortfolio (self-report rubric) and one instructor assessed students' ePortfolios. Each ePortfolio criterion was given a score:1-(Lacking), 2-(Satisfactory), 3- (Exemplary).

Firstly, it was attempted to examine if the proposed ePortfolio rubric is a reliable assessment method. Thus, it was selected the two-way random Intraclass Correlation Coefficient (ICC) for providing explanations about the differences in scores, the way raters use the constructs and estimate possible measurement error (Nunnally & Bernstein, 1994). So, it was conducted the (ICC) test for ensuring the inter-rater reliability (IRR).

In Study#1, the ICC based on the answers of two raters (students and instructor) so as to measure consistency.

The ICC analysis for consistency can be considered not significant (ICC)= 0.089 also the ICC value can be excluded from the population with a probability greater than 95% ($F (85, 85) = 1.098$, $p=0.334>0.005$). Unfortunately, the ICC indicator isn't significant as there are only 2 raters and there is a great difference between their means scores.

Also, we attempted to perform an ICC analysis of consistency for the criteria of the ePortfolio achievement: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics (**Table *18***). Results yielded that the ICC wasn't significant and there wasn't agreement between students and tutors among the four ePortfolio assessment criteria.

Table 18. Study#1: Intraclass Correlation Coefficient test measured the inter-rater reliability of the two raters

ePortfolio Criteria	Self- Tutor Assessment ICC (2,2) 95%CI	Significance (Sig.)
ePortfolio Purpose	0.191 (85, 85)	.165
Artifacts Repository	0.156 (85, 85)	.218
Reflection in Action	0.004 (85, 85)	.493
ePortfolio Usability characteristics	0.006 (85, 85)	.488

Further, we attempted to explore the relationships between the ePortfolio assessment raters. A Pearson's correlation was run to determine the relationship between self-assessment and tutor's assessment. **Table *19*** yielded that there is a moderate to weak correlation between self and tutor assessment ($r = .050$) as well as between self-assessment and course grade ($r = .069$) and tutor's assessment and course grade ($r = .125$). These findings are consistent to ICC indicator and problematized us about the internal consistency of the ePortfolio assessment.

Table 19. Study#1: Pearson's r Correlations between the ePortfolio assessment raters

Variables	Self-Assessment	Tutor's Assessment	Course Grade
ePortfolio Self-Assessment	1	-.050	-.069
ePortfolio Tutor's Assessment		1	.125
Course Grade			1

Furthermore, we investigated the existence of correlations between the ePortfolio criteria of students' ePortfolio assessment (**Table *20***). Results indicated that when students evaluated their ePortfolio developed strong positive correlations between ePortfolio's purpose and artifacts, reflection, usability and course grade, also there is a positive relationship between artifacts and reflections and usability. Students realized the purpose of the ePortfolio and attempted to deliver a robust ePortfolio following usability principles, also they selected artifacts and then reflected upon them.

Table 20. Study#1: Pearson's r Correlations among ePortfolio criteria of self-assessment

Self-Assessment ePortfolio Criteria	ePortfolio Purpose	Artifacts Repository	Reflection in Action	Usability characteristics	Course Grade
ePortfolio Purpose	1				
Artifacts Repository	.747**	1			
Reflection in Action	.579**	.826**	1		
Usability characteristics	.651**	.548**	.498**	1	
Course Grade	.221*	.046	.067	.120	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Also, we examined the correlations between the ePortfolio criteria of tutor's ePortfolio assessment (**Table *21***). Results yielded that there are strong correlations between ePortfolio's purpose and artifacts, reflection and usability, also there is a positive relationship between artifacts and reflections and usability. These findings are consistent to students' pattern of correlations. This means that the tutor agrees with students' actions and perhaps we can assume that they are following the same pattern of assessing their ePortfolio.

Table 21. Study#1: Pearson's r Correlations among ePortfolio criteria of tutor's assessment

Tutor-Assessment ePortfolio Criteria	ePortfolio Purpose	Artifacts Repository	Reflection in Action	Usability characteristics	Course Grade
ePortfolio Purpose	1				
Artifacts Repository	.513**	1			
Reflection in Action	.492**	.632**	1		
Usability characteristics	.311**	.187	.237*	1	
Course Grade	.065	-.076	-.108	.007	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Also, an independent-samples t-test was employed to explore statistical differences between ePortfolio's self and tutor assessment. Results showed that the difference between students' self-assessment of the ePortfolio (M=2.07, SD=0.22) and tutor's assessment (M=1.76, SD=0.32) were statistically significant, t(85)=-7.556, p=.000< 0.05. Specifically, students' self-assessment of the ePortfolio and tutor's assessment on the Purpose, the artifacts and the reflections were statistically significant (p< 0.05) (**Table *22***). There isn't significant difference on usability characteristics between students and tutor's assessment.

Table 22. Study#1: Results of independent-samples t-test for ePortfolio Assessment criteria by rater

	Assessment						95% CI for Mean Difference		
	Self			Tutor					
	M	SD	n	M	SD	n		t	Sig.
ePortfolio Purpose	2.22	0.39	86	2.07	0.53	1	-.287, -.016	-2.21	0.029*
Artifacts Repository	2.18	0.43	86	1.57	0.44	1	-.741, -.484	-9.48	0.000*
Reflection in Action	1.97	0.49	86	1.49	0.46	1	-.618, -.330	-6.52	0.000*
Usability characteristics	2.41	0.19	86	2.43	0.37	1	-.071, 0.108	0.413	0.681

*p < .05.

These findings support the claim that students' perceptions weren't in alignment to tutor's viewpoints. It was observed various differences between students and tutor on the ePortfolio assessment and the ePortfolio criteria. Perhaps, students' age or level of expertise is an important indicator for further investigation. The sample was first year students that they didn't have experience on large scale projects and probably they didn't realize the level of endeavor's difficulty. This inconsistency between tutor's and students' assessment denotes that the ePortfolio system needs further modifications for improving the levels of reliability and validity of the process. In addition to, we can increase the number of the assessors and the type of the raters (Sulzen et al., 2008) for ensuring higher reliability and sufficient validity.

4.1.6.5 Research Question 2- Quantitative Analysis

In this study, ePortfolio achievement is measured by the ePortfolio Rubric (see APPENDIX B: ePortfolio Rubric). At the end of the intervention, students and one instructor completed the ePortfolio rubric in order to assess the ePortfolio.

Further, at the end of the semester students participated in the final exams for testing their knowledge of the subject matter. The written examination consisted of open-ended and multiple-choice questions, or/and exercises (failing grade<5, passing grade=5, excellent grade=10).

Firstly, descriptive statistics was employed to describe the data collected; in the tables to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted (**Table *23***). Students' course grades (Mean = 6.78) indicate that students studied the course material, understood the learning content and achieved a good or very good performance. Accordingly, in the ePortfolio self-assessment (Mean = 2.08) there is an accordance in their beliefs and their course grades. On the other hand, tutor's ePortfolio assessment is severe and lower than the course grade (Mean = 1.76)

Table 23. Study#1: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of academic achievement

Study#1	**Academic Achievement**		
	M	**SD**	**n**
ePortfolio Assessment			
Course Grade	6.78	1.75	86
ePortfolio Self-Assessment	2.08	0.22	86
ePortfolio Tutor's Assessment	1.76	0.32	86

Figure *37* shows that students evaluated higher their own ePortfolios compared to the tutor's assessment index. In addition, students' academic achievement (Course Grade: 68%) and ePortfolio self-assessment (69%) were similar, which means that students had a good to very good performance. On the other hand, the instructor is more skeptical about the ePortfolio implementation and provided lower grades to students.

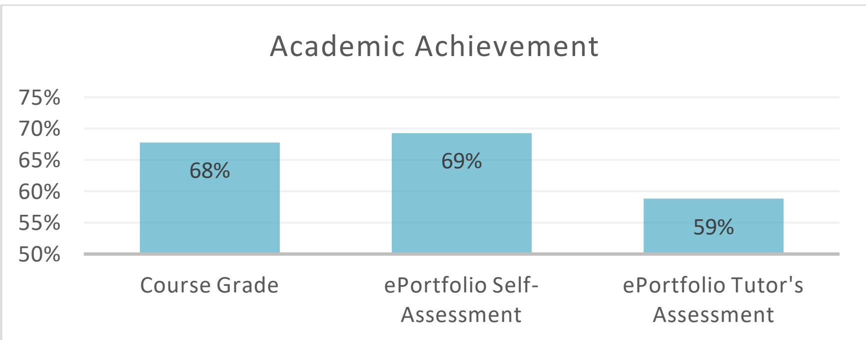


Figure 37. Study#1: Students' Academic Achievement Measurements

All in all, it is noted that students' perceptions about their performance and their course grades are equivalent. It can be assumed that students internalized SRL processes and applied them during their academic study. Thus, learners realized the learning content and were able to monitor and evaluate their academic achievement.

Secondly, descriptive statistics was employed to describe the data of the ePortfolio assessment rubric. After the completion of the ePortfolio construction process, each student and the instructor evaluated the ePortfolio criteria: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics for measuring the level of ePortfolio achievement. The results indicate that students assigned higher scores on the ePortfolio criteria compared to tutor's grades (**Table *24***).

Table 24. Study#1: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of aspects of ePortfolio Assessment criteria

Study#1	Self			Tutor		
	M	SD	n	M	SD	n
ePortfolio Criteria						
ePortfolio Purpose	2.22	0.39	86	2.07	0.53	1
Artifacts Repository	2.18	0.43	86	1.57	0.44	1
Reflection in Action	1.97	0.49	86	1.49	0.46	1
ePortfolio Usability characteristics	2.41	0.19	86	2.43	0.37	1

This means that students were more enthusiastic about their actions and they felt positive about the final learning outcome. Also, learners felt confident about their ePortfolio implementation and they thought that they achieved their goals. Contrary to researcher's expectations, students displayed several misconceptions and higher expectations about the process. Probably, they didn't internalize the SRL process and had difficulties in using the SRL strategies properly throughout the process (**Figure *38***)

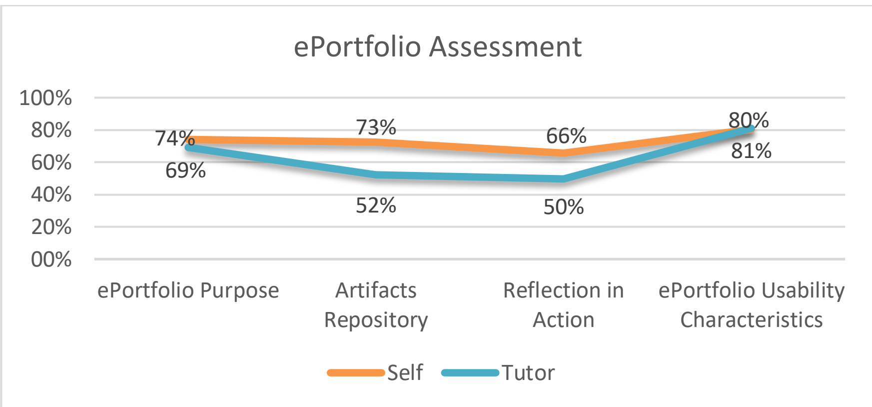


Figure 38. Study#1: Comparing Self's and Instructor's ePortfolio Assessment among the criteria

We support that students realized the merits of SRL but they need time in order to internalize and develop a repertoire of SRL skills. Also, the majority of the students didn't have prior experience on ePortfolios and they didn't search about the ePortfolio terms, so they were a set of novice participants that this was their first large-scale project in their academic life. It is noted that students weren't familiar to ePortfolio construction process and they needed time to realize that they should devote time and effort in order to manage their actions and decide upon their tasks. Thus, it is recommended that learners should engage in the ePortfolio process throughout an academic year and actively participate in face-to-face and online sessions. Also, the ePortfolio system needs further modifications for improving SRL processes and providing support to learners for managing their academic learning path.

4.1.6.6 Research Question 2- Qualitative Analysis

During the intervention, learners engaged in "Activity 0: Implementation of ePortfolio". This activity evolves throughout the three SRL phases and aims to strengthen learners' potential for developing a customized ePortfolio as stand-alone application. When students completed their holistic process of designing and implementing their own ePortfolio ("Self-reflection' phase [C]) engaged in the processes of self-monitoring and self-evaluating. Specifically, students completed self-assessment rubrics and devoted time to self-reflect and articulate their self-judgements about their actions and the process. Specifically, students self-evaluated their ePortfolio (Activity 11: Self-Assessing the ePortfolio, Instrument: ePortfolio rubric). They reflected upon their performance and verbalized their perceptions about the purpose of their ePortfolio, the selected artifacts, the analysis of their reflections and the usability characteristics of the environment (Reflections). Also, it was attempted to investigate student's level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009). Our intention is to express the level of expertise required to deliver an effective ePortfolio. For the needs of this research, we defined six competency statements about the intended cognitive process (remember, understand, apply, analyze, evaluate and create). Each statement is a measurable learning outcome that measures the degree to which participants understand, analyze, use the concepts, demonstrate skills and create learning outcomes.

Figure *39* shows the degree to which participants who completed "Activity 0: Implementation of ePortfolio" were able to:

- Remember the basic concepts of an ePortfolio (artifacts, systems, ownership, reflections)
- Understand the necessity of delivering a dynamic and effective ePortfolio
- Apply an integrated ePortfolio project

- Analyse the aspects and the tools of an ePortfolio project
- Evaluate the levels of sustainability and usability of an ePortfolio Project
- Create a well-organized and responsive ePortfolio based on SRL principles

Findings yielded that students achieved better on the first levels of the continuum (Remember= 88%, Understand=86%, Apply=82%, Analyze=77%) while they faced difficulty on the higher levels of continuum (Evaluate=69% and Create=61%). This means that participants were able to remember, understand and apply the basic concepts of an ePortfolio but they need more training in order to implement their own ePortfolio. **Probably, students acquired more time so as to feel comfortable with the new learning tasks and create an integrated ePortfolio in order to market themselves to future employers.**

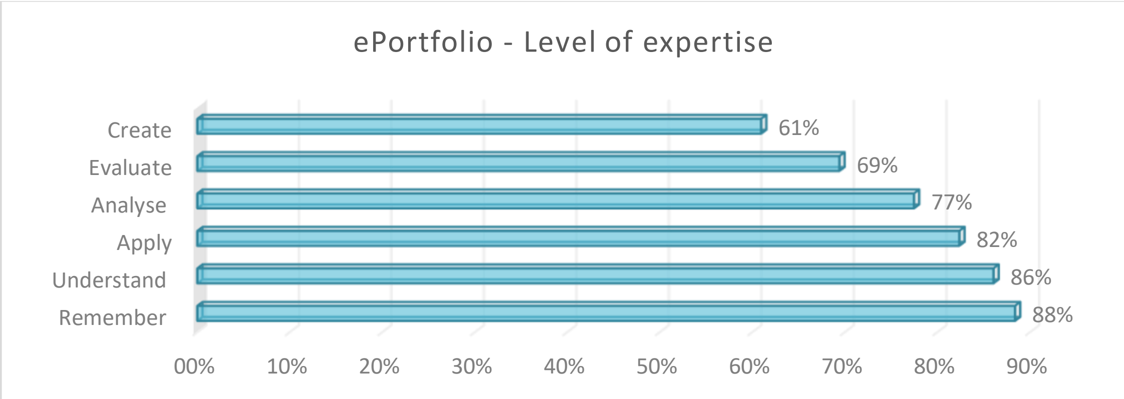


Figure 39. Study#1: Quantitative Analysis of Activity 0-Implementation of ePortfolio

The reflection of "Activity 0: Implementation of ePortfolio" explores learners' perceptions about the construction process of the ePortfolio and the final learning outcome (e.g ePortfolio Project) (**Figure *40***).

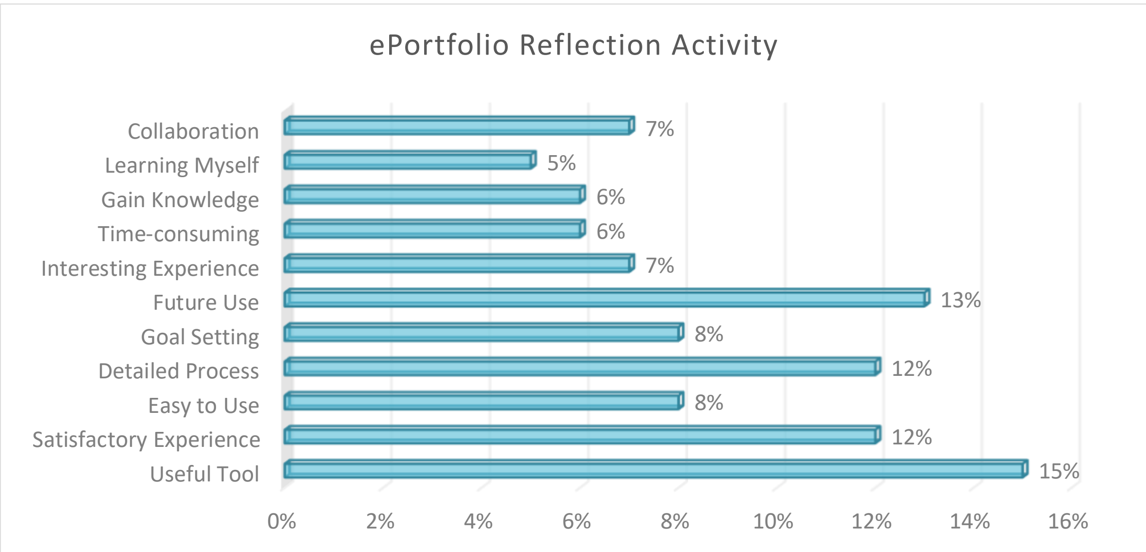


***Figure* 40**. Study#1: Quantitative Analysis of students' reflections about 'Activity 0: Implementation of ePortfolio'

Students invited to answer one open-ended question "How do you feel about your performance during the ePortfolio development? Reflect on your actions and write a short comment about your ePortfolio experience."

Figure *40* shows that the 15% of the participants believed that their ePortfolio is 'a useful tool' and the 13% admitted that they will 'use to in the future'. The 12% agreed that this project was 'a satisfactory experience' and supported them as it was very detailed and provided useful information. On the other hand, only the 5% of the students believed that through the project they were able to learn and manage their self. This means that, the majority of the students admire the use of the ePortfolio project and validate it as a useful tool but they fail to realize the benefits of ePortfolio as a tool for strengthening SRL skills (e.g. goal setting, time management, task value, self-monitoring).

4.1.6.7 Reliability Analysis for quantitative data (RQ3)

The goal is to examine the ePortfolio system as an effective platform that bolsters SRL processes and investigate the relationship between the ePortfolio use and SRL competency.

First, general observations about the survey results are presented. A reliability analysis was, hence, conducted to measure the instrument's (ePortfolio based Self-Regulated Learning Rubric) internal consistency.

Cronbach's alpha reliability coefficient normally ranges between 0 and 1 (Nunnally & Bernstein, 1994). Along these lines, Scale-Phase A [Forethought Phase], had a high reliability (Cronbach's Alpha=.897), Scale Phase B [Performance Control] had a high reliability (Cronbach's Alpha=.853) and Scale Phase C [Self-Reflection] measure also had a high reliability (Cronbach's Alpha=.827) (**Table *25***).

Table 25. Study#1: Cronbach's a coefficient of ePortfolio based Self-Regulated Learning Rubric

Constructs	Items	Study#1 Experimental Group
Phase A [Forethought Phase]	19	.897
Phase B [Performance Control]	11	.853
Phase C [Self-Reflection]	10	.827

4.1.6.8 Research Question 3- Quantitative Analysis

When students completed their holistic process of designing and implementing their own ePortfolio (“Self-reflection’ phase [C]) engaged in the processes of self-monitoring and self-evaluating. Participants completed self-assessment rubrics and devoted time to self-reflect and assess their SRL processes. Students-Raters were invited to assess their level of agreement with the items. The goal is to evaluate ePortfolio’s potential for supporting SRL and discover the affordances that might stimulate SRL skills (Activity 10: Self-Assessing My SRL Skills/Competences, Instrument: SRL based on ePortfolio based Self-Regulated Learning rubric). Also, they reflected upon their SRL competency and verbalized their perceptions about their SRL (Reflections).

Firstly, descriptive statistics was employed to describe the data collected; in **Table *26*** to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted.

Table 26. Study#1: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio based Self-Regulated Learning Rubric

ePortfolio based Self-Regulated Learning Rubric	**Experimental Group Study#1**		
	M	**SD**	**n**
Phase A [Forethought Phase]	3.53	0.50	86
Phase A. Cognitive Processes	3.56	0.55	86
Phase A. Motivation Processes	3.50	0.60	86
Phase A. Affective Processes	3.67	0.64	86
Phase A. Context Processes	3.41	0.79	86
Phase B [Performance Control]	3.56	0.58	86
Phase B. Cognitive Processes	3.55	0.64	86
Phase B. Motivation Processes	3.41	0.77	86
Phase B. Affective Processes	3.44	0.83	86
Phase B. Context Processes	3.74	0.77	86
Phase C [Self-Reflection]	3.64	0.52	86
Phase C. Cognitive Processes	3.63	0.62	86
Phase C. Motivation Processes	3.89	0.75	86
Phase C. Affective Processes	3,65	0.80	86
Phase C. Context Processes	3.58	0.65	86

The most interesting result is that the ePSRL system received mean values of above 3.0 across the three SRL phases, which means that the ePortfolio supported SRL quite well. Also, the findings indicate that in the first phase of SRL (Forethought) students (Mean= 3.53) were not ready to practice SRL skills participants but in the last phase of SRL (Self-reflection) they internalized SRL processes and were able to practice SRL (Mean=3.64)

Pearson's correlation was run to determine the relationship among SRL phases and ePortfolio assessment (**Table *27***). The coefficients of Pearson's correlation revealed that Phase A [Forethought] was positively related to Phase B [Performance Control] and Phase C [Self-Reflection] which indicates that ePSRL system facilitated the cyclic nature of SRL and conceptualized it as a process.

Table 27. Study#1: Pearson's r Correlations between ePortfolio based Self-Regulated Learning and ePortfolio assessment

Variables- Study#1	[1]	[2]	[3]	[4]	[5]	[6]
[1] Phase A [Forethought Phase]	1					
[2] Phase B [Performance Control]	689**	1				
[3] Phase C [Self-Reflection]	.672**	.832**	1			
[4] ePortfolio Self-Assessment	.117	.075	.034	1		
[5] ePortfolio Tutor's Assessment	.045	.081	-.025	.091	1	
[6] Course Grade	.009	.060	-.015	-.015	.177	1

The correlation coefficient between SRL phases and ePortfolio Tutor's Assessment, Self-Assessment and course grade was small and failed to reach statistical significance. This means that further investigation is highly need.

4.1.6.9 Research Question 3- Qualitative Analysis

At the end of the intervention, students attempted to reflect upon their SRL competency and verbalized their perceptions about their SRL. The reflection of "Activity 10: Self-Assessing My SRL Skills/Competences," investigates learners' perceptions about the development of their SRL skills in the context of the ePortfolio system (**Figure *41***). Students engaged in a reflective activity where they provided they following open-ended question 'Do you think that the ePortfolio system support you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write a few recommendations to someone that could become an effective self-regulated student.' ***Figure 41*** shows that the 14% of the students agreed that their ePortfolio system supported them to understand and apply the process of 'goal setting' and the 12% admitted that this intervention actively engaged them in organizing their 'learning path'. The 11% agreed that the ePortfolio system helped them realize many things about their self, manage their skills and value their 'self-efficacy beliefs'. Also, the 11% of the participants admitted that the ePortfolio reminded them to engage in the evaluation. On the other hand, only the 5% of the students believed that through the ePortfolio process they were able to 'reconsider their mistakes' and to 'collaborate'.

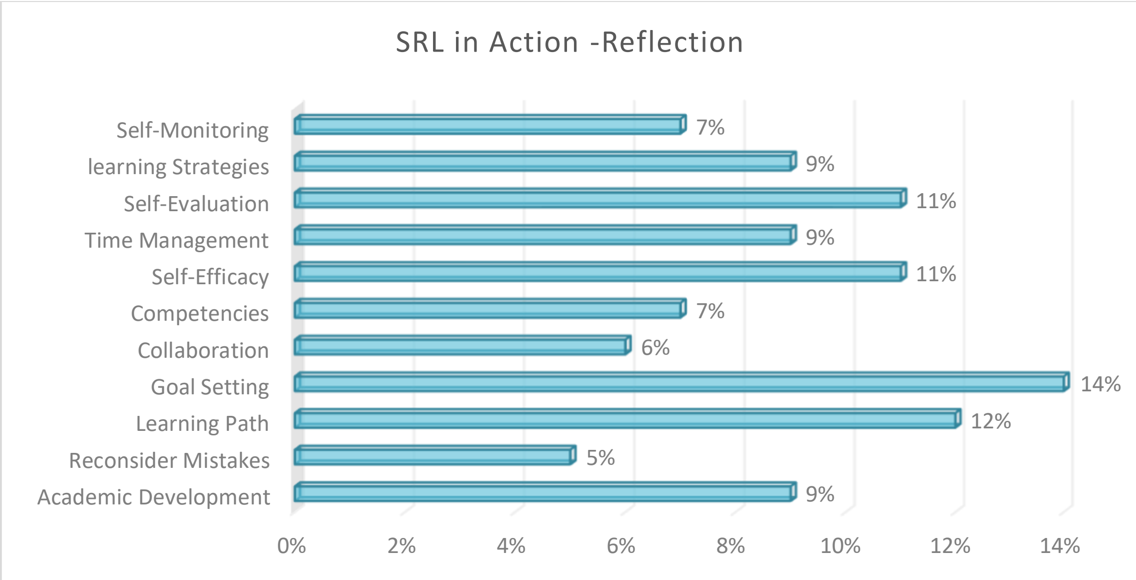


Figure 41. Study#1: Quantitative Analysis of students' reflections about 'Activity 10: Self-Assessing My SRL Skills/Competences'

This means that, the majority of the students agreed that the use of the ePortfolio system provided a well-organized manner to engage in SRL processes (e.g. goal setting, self-efficacy, self-evaluation) but probably they need more time or different activities so as to internalize the concepts and apply in everyday practice.

Table *28*, illustrates students written reflections about their SRL skills. At the end of the process, students attempted to answer the following question: 'Do you think that the ePortfolio system supports you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write a few recommendations to someone that could become an effective self-regulated student.' Many students expressed their gratitude for participating in the ePortfolio project and valued this learning experience. They felt that the ePortfolio project supported them to understand and set meaningful goals for managing their academic development.

Table 28. Study#1: Students' written reflections about their SRL Skills

Students	**Study#1- Reflections 'Activity 10: Self-Assessing My SRL Skills/Competences'**
Student G. A. - Male	*The ePortfolio system helped me on regulating my study and advancing my performance. Also, the ePortfolio helped me to boost self-control and to trust myself.*
Student F. M. - Male	*The ePortfolio wasn't just a project but a source of inspiration, knowledge and learning. From the beginning, I realized the importance of the ePortfolio as a tool for presenting and developing skills but I was surprised to find out that I knew so little about myself.*

Student K. V. - Female	I *think the whole process worked positively because I learned to assess my skills, to activate my time management skills and organize my efforts for achieving my goals. Also, these activities boosted me to use study strategies*
Student K. A. - Male	*I feel that the process of designing and implementing ePortfolio was very pleasant and interesting. Also, the activities activated my interest and kept me curious in order to continue and see what was the final outcome.*
Student M. S. - Male	*I think that the ePortfolio helped me to identify what is self-regulated learning and how can I use goal setting and learning strategies. I believe that knowing about SRL is a challenging endeavor. Is the freedom that inspires, realizes and articulates a goal. This goal is a personal challenge that you should organize yourself for achieving it.*
Student M. E. - Female	*I believe that the ePortfolio project helped me realize the necessity of setting goals for my academic and career development. Also, I learned how important is to reflect upon your tasks or your learning efforts or everyday activities.*
Student T. A. - Female	It is interesting that I reconsidered the process of setting goals. I changed my mindset and set specific, measurable and organized goals. Also, I separated my goals and put a time schedule for assessing them. I realized the assets of evaluation.

After the completion of the experimental procedure, participants completed a 'Post ePortfolio-Intervention Review', that consisted of six open-ended questions. The goal of this instrument is to record students' perceptions about the ePortfolio process and the levels of satisfaction (**Figure *42***).

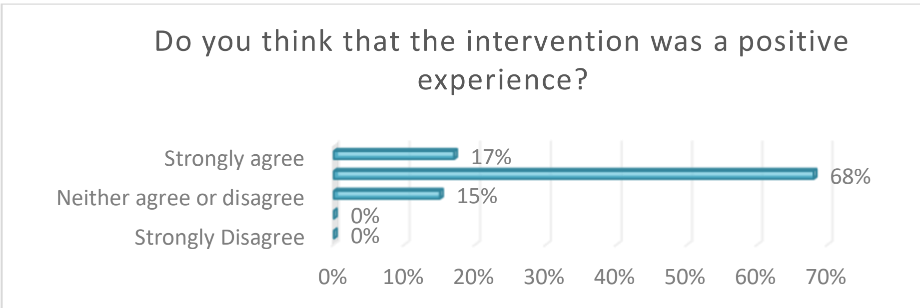


Figure 42. Study#1: Students' perceptions about the ePortfolio intervention and the levels of satisfaction

The 68% and the 17% of the participants admitted that they hold a positive viewpoint about the ePortfolio process. At the end of the intervention, the majority of the students has a positive attitude towards the ePortfolio experience.

Students were invited to record the positive characteristics of the ePortfolio process and explain 'Why this was a positive experience?'. The 14% of the students admitted that the ePortfolio construction process supported their academic and career path. Also, the 13% of the participants agreed that this was an effective procedure for presenting their profiles and a tool for organizing their studies. The 11% of the learners highlighted that the ePortfolio project helped them to learn how to set goals and manage time (**Figure *43***).

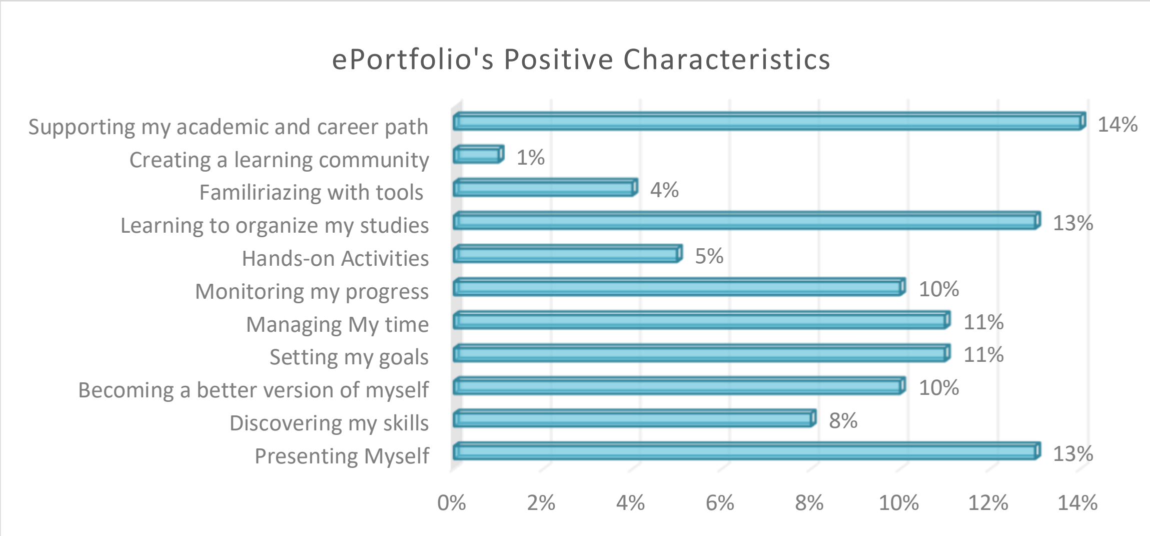


Figure 43. Study#1: Positive Characteristics of the ePortfolio intervention

Also, students answered the question ‘Do you think that the intervention was a negative experience?’. The 43% and the 36% of the participants disagreed, that the ePortfolio Project was a negative experience. It is interesting, that the 19% of the participants were neutral (**Figure *44***). Students were invited to record the negative characteristics of the ePortfolio process and explain ‘Why this was a negative experience?’. The 28% of the experimental group agreed that the workload was pressing and the time schedule had short-term deadlines. Also, the 12% of the participants found difficulties in collecting and managing their artifacts. On the other hand, the 22% of the students agreed that the ePortfolio implementation didn’t have negative characteristics. Also, the same cohort of students admitted that they didn’t want to propose changes or modifications (**Figure *44***).

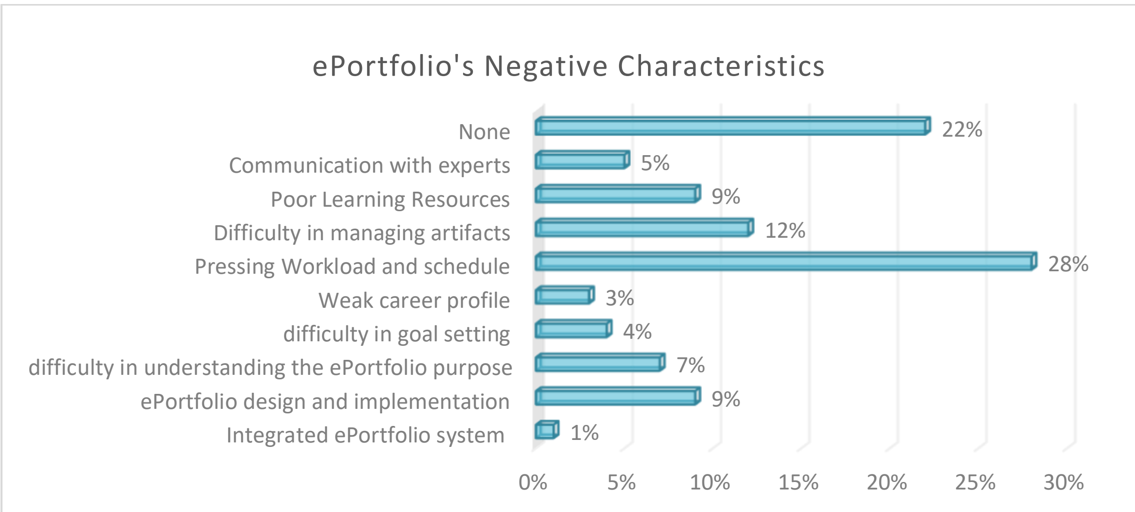


Figure 44. Study#1: Negative Characteristics of the ePortfolio intervention

Participants invited to submit a comment 'What do you think should be added, changed or removed from the ePortfolio Project?' (**Figure *45***). The 17% of the students believed that the project should be re-designed so as to remove activities and follow a more flexible workload. Also, students thought (10%) that the process of answering reflective questions was often difficult and repetitive and they wanted more strategies and techniques for managing their academic studies (10%). On the other hand, the 27% indicated that the ePortfolio Project was well-organized and they didn't have the expertise to think for future suggestions.

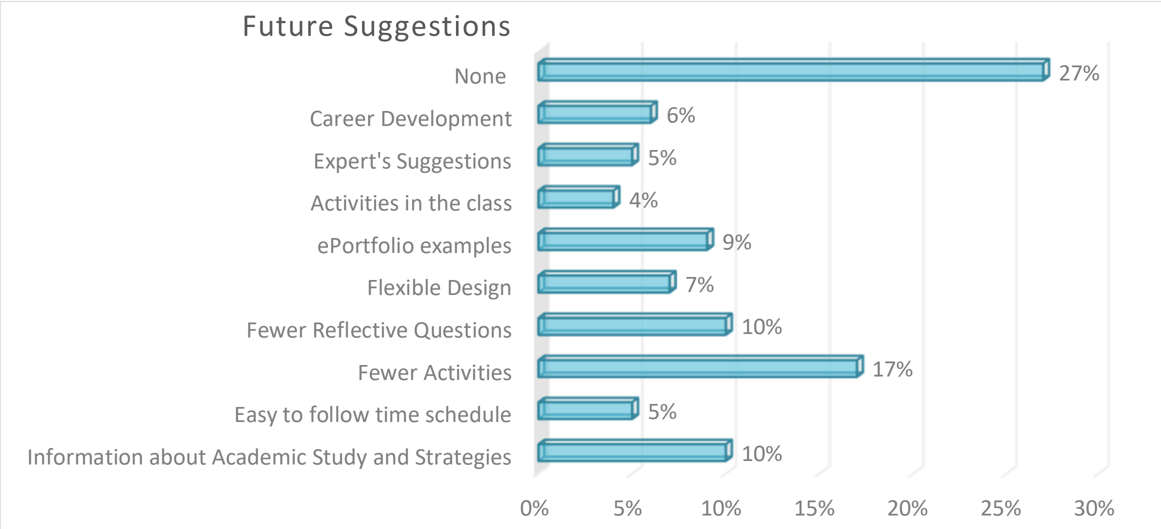


Figure 45. Study#1: Future Suggestions about ePortfolio Intervention

The 93% of the experimental group agreed that the teachers, administrators and tutors were very helpful and positive (**Figure *46***). The ePortfolio interaction was very positive among stakeholders. Participants noted that the active communication and continuous feedback supported them to complete their projects.

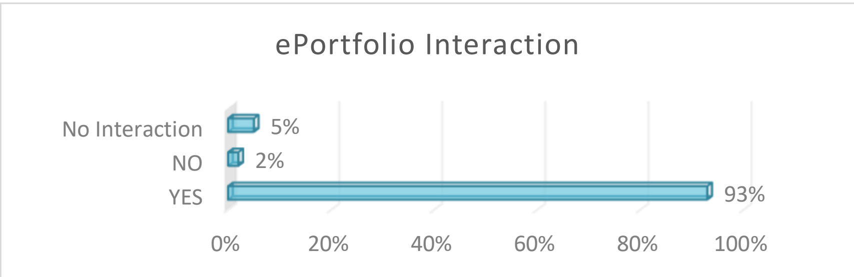


Figure 46. Study#1: ePortfolio's Interaction and feedback

Finally, the 62% of the participants highlighted that they would like to continue using their ePortfolio. Also, they indicated that this is a valuable tool that will help them to organize their studies, manage their skills and market themselves to future employers (**Figure *47***).

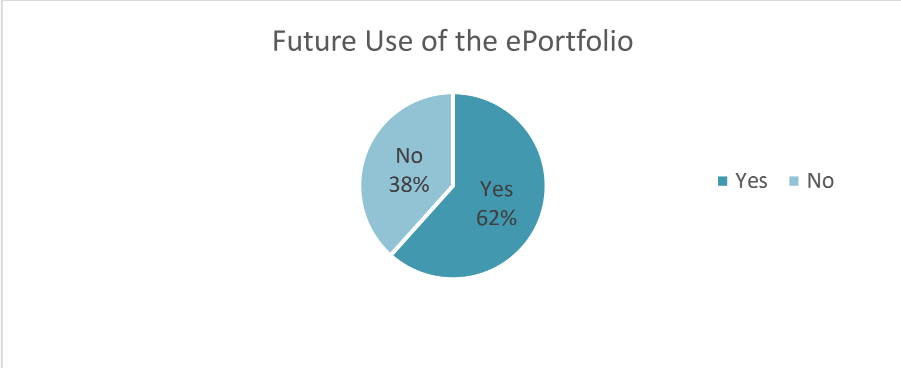


Figure 47.Study#1: Future Use of the ePortfolio

Table 29, illustrates students written reflections about their ePortfolio experience. At the end of the intervention, students attempted to analyze their thoughts and write a final remark: 'Write your final comment, idea or concluding remark about the ePortfolio construction process.'

Table 29. Study#1: Students' written reflections about their ePortfolio experience

Students	**Study#1: Concluding Remarks**
Student B. D. - Male	*I think it was a beautiful experience and a challenging tool that I will remember throughout my academic studies.*
Student A. C. - Male	*This is a helpful tool but needs time and effort.*
Student B. T. - Female	*I'm very happy for participating in this workshop and I would like to monitor the progress of my ePortfolio.*
Student K. A. - Male	*It was a delightful experience and I hope it helped me to advance my skills and earn excellent grades*
Student F. C. - Male	*I really think that this is a meaningful learning process but I think it is time-consuming and difficult for first-year students.*
Student S. D. - Female	*The ePortfolio Project introduced me to university's workload and helped me realize a few things about academic life.*
Student Z. L. - Male	*I didn't believe that a university course will help me to recognize aspects of myself and my skills.*

4.2 Study#2[10]

This section outlines the implementation of an ePortfolio intervention (ePortfolio System-Version 2) for HE in order to support individuals (students and future graduates) to enhance SRL skills, manage their knowledge, skills, attitudes and develop their academic and career path. Towards this, the conceptual framework and the ePortfolio system (v.2) re-designed and tested in Study#2 (Prototype Stage -Iteration 2). Specifically, Study#2 describes the second cycle of testing and refinement the ePortfolio intervention.

4.2.1 Purpose of Study#2

Based on Study's #1 findings, design principles and insights, I tried to re-design the ePortfolio intervention (conceptual framework and ePortfolio system- version 2).

Study#1 noted that a challenging issue, is the delivery of an ePortfolio intervention for HE in order to support students and future graduates to identify aspects of self, analyse their skills, foster SRL skills, manage academic achievement and develop their career path.

The purpose of Study#2 is the re-design, development and implementation of an ePortfolio intervention (conceptual framework and ePortfolio system- version 2) in a social networking engine for enhancing SRL and boosting academic achievement. Therefore, it was conducted Study#2 for testing the ePortfolio System (v.2) (Prototype stage). In second cycle of testing and refinement, it was attempted to tailor a workflow process that supports individuals to initiate SRL processes, manage SRL skills and organize their learning path through the ePortfolio intervention.

[10] Part of this section has been published in the following journal and conference papers:

Alexiou, A., & Paraskeva, F. (accepted for publication). Being a student in the social media era: Exploring educational affordances of an ePortfolio for managing academic performance. International Journal of Information and Learning Technology.

Alexiou, A., & Paraskeva, F. (2019). Examining self-regulated learning through a social networking ePortfolio in higher education. International Journal of Learning Technology, 14(2), 162-192.

Alexiou, A & Paraskeva, F. (2014). Implementing a Self-Regulated Oriented e-Portfolio: The design of an Affective Goal-Setting Plugin, 14th IEEE International Conference on Advanced Learning Technologies - ICALT2014, Athens, Greece, 7-9 July 2014.

Alexiou, A. and Paraskeva, F. (2013). Exploiting Motivation and Self-efficacy through the Implementation of a Self-Regulated Oriented e-Portfolio, The International Conference on E-Learning in the Workplace, NY, USA, June 2013.

4.2.2 Study#2: Research Questions

The **Research Questions (RQs)** addressed in this research are as follows:

RQ1- *Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?*

RQ2- *How does the ePortfolio intervention impact academic achievement?*

RQ3- *Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practise SRL processes?*

4.2.3 Research Design

For the needs of this study, design-based research was selected as it addresses the complex problem of declining achievement in HE and the need of empowering learners to manage their skills through a meaningful authentic intervention. Design-based research consists of three separate stages (Plomp, 2013; Amiel & Reeves, 2008): preliminary, prototyping and assessment. Specifically, Study#2 describes the second cycle of testing the ePortfolio intervention and refinement (Prototype Stage) (**Figure *48***). The high complexity of the research problem and the correlations of the indicators need a combination of quantitative and qualitative methods for providing valuable insights. Thus, the mixed methods research was employed as the methodology for investigating the effects of ePortfolio intervention on SRL and academic achievement. Further, in parallel phases, quantitative and qualitative data will be collected and then analyzed. The triangulation of the data will be used for converging the data and provide valuable conclusions.

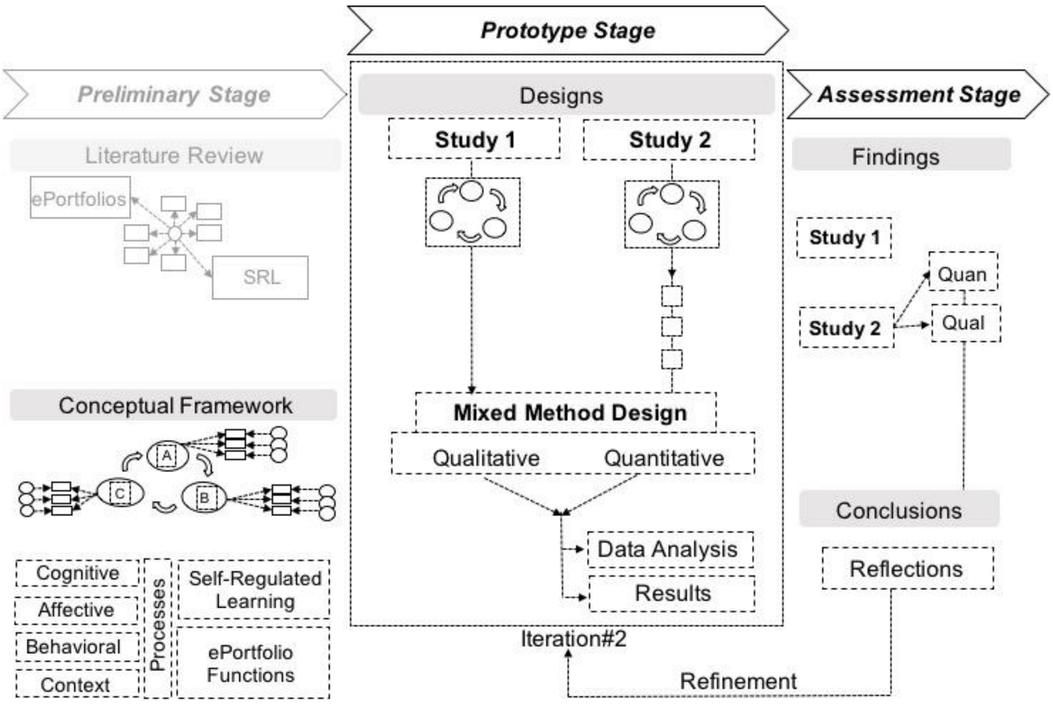


Figure 48. Study#2: Description of the Mixed Methods Research Design

In Study#2, the quantitative data were gathered by questionnaires and rubrics and tabulated in numbers so as to perform statistical analysis (such as means, correlations, ANOVA, t-tests frequencies). Data gathering procedures performed before or/and after the intervention and consisted of a set of instruments:

- Questionnaire about SRL skills (pre- and post-test)
- ePortfolio Rubric (post-test)
- ePortfolio based Self-Regulated Learning Rubric (post-test)
- Log Files (during intervention)

The qualitative data gathered by learner's artifacts, submitted activities, reflections and microanalytic protocols that derived throughout the intervention. Qualitative data are represented as descriptive narrations that should be organized (coding and searching for patterns) and describe the learner's behavior. Further, quantitative data were tabulated in number for performing statistical analysis (ICC, frequencies, ANOVA, correlations). Data gathering procedures performed before or/and during or/and after the intervention and consisted of a set of instruments:

- Student's level of cognitive development (during intervention)
- SRL Microanalytic Protocols (during intervention)
- ePortfolio Reviews (post-test)
- ePortfolio based Self-Regulated Learning Review (post-test)
- Pre and Post Rubrics

4.2.4 Participants

The participants were 123 university students (38 females and 85 males). The sample of the study were undergraduate students at a computer science department of a Greek university and voluntarily signed up for supporting their academic and career development. Students were on their third year of their studies and their average age was 20 years old.

The sample of the study voluntarily signed up for acquiring new knowledge and advancing skills through the ePortfolio intervention. Students were aware that their participation wasn't a prerequisite for passing courses or taking credits (ECTS).

Students were randomly divided into two groups, labelled Experimental and Control Group. There was a total of 70 students, with 28 females and 42 males, in the experimental group. Students assigned to the experimental group followed a structured process and got involved in specific activities, such as setting meaningful goals, adopting dynamic strategies for managing these goals, monitoring the learning process, managing time, attributing meaning to outcomes, self-evaluating the learning path followed. On the other hand, students assigned to the control group structured their ePortfolio only following the basic guidelines of the workshops. In the control group there were a total of 53 students, with 10 females and 43 males. The duration of the study was a 12-week period.

4.2.5 Experimental Design and Procedure

Study#2 adopted a quasi-experimental design, with an experimental and a control group and pre- during and post-test measurements. It was carried out concurrently for both groups (non-equivalent groups) and the duration was 12 weeks.

The purpose of the experimental design was to test the ePortfolio intervention (Iteration 2) and examine to what extent the ePortfolio intervention affects SRL and impacts academic achievement. Also, it was to attempted to measure the differences on SRL and academic achievement between experimental and control group.

In general, both groups (experimental and control) attempted to create and disseminate an ePortfolio in order to articulate and promote their academic and career profile. For the needs of this study, one instructor guided both groups through the procedure and provided timely feedback.

The experimental group (N_E=70) engaged in the ePortfolio intervention (ePortfolio-based self-regulated learning (ePSRL) approach) through a social networking ePortfolio system and got involved in specific learning activities. The ePSRL approach (conceptual framework – version 2) is designed in compliance with SRL and aspects of career development. Participants can follow a linear pre-fixed order of tasks, where they have the opportunity to adapt to the proposed path or to select their own sequence of learning tasks. On the other hand, students assigned to the control group (Nc=53) structured their ePortfolio only following the basic guidelines of the workshops (**Table *30***).

Table 30. Study#2: Description of the Experimental Design

Group	*Subject Numbers*	*Pretest*	*Intervention*	*Posttest*	*Duration*
Experimental Group	70	Questionnaire about SRL skills Prior ePortfolio experience	Engaging in the ePortfolio-based self-regulated learning approach (ePSRL) through a social networking ePortfolio system	Questionnaire about SRL skills ePortfolio Rubric ePortfolio based Self-Regulated	12 Weeks

				Learning Rubric ePortfolio Reviews ePortfolio based Self-Regulated Learning Review	
		During			
		Student’s level of cognitive development SRL Microanalytic Protocols Log Files			
Control Group	53	Questionnaire about SRL skills Prior ePortfolio experience	Participating in the workshops for delivering an ePortfolio	Questionnaire about SRL skills ePortfolio Rubric ePortfolio based Self-Regulated Learning Rubric ePortfolio Reviews	12 Weeks
		During			
		Log Files			

Since all participants had no experience with creating an ePortfolio, they attended the ePortfolio intervention (training program) to familiarize themselves with the ePortfolio system functionalities. The experimental procedure is delivered as an intervention program and is organized following the ePSRL approach and is based on four discrete learning modules: Module 1 ‘Discovering and Presenting Myself’, Module 2 ‘Managing my learning identity’, Module 3 ‘Exploring my career path’ and Module 4 ‘Evaluating my actions and evolving to the next stage’ (**Figure *49***). In detail:

Week# 1

All students invited to participate in a face-to-face workshop so as to introduce to the requirements of the intervention program. Participants completed a web-based questionnaire about their prior ePortfolio experience. The instructor informed participants about the four learning modules and the ePortfolio construction process. Then, the sample of the study randomly assigned to experimental and control group and were informed about the concepts of Module 1 'Discovering and Presenting Myself'.

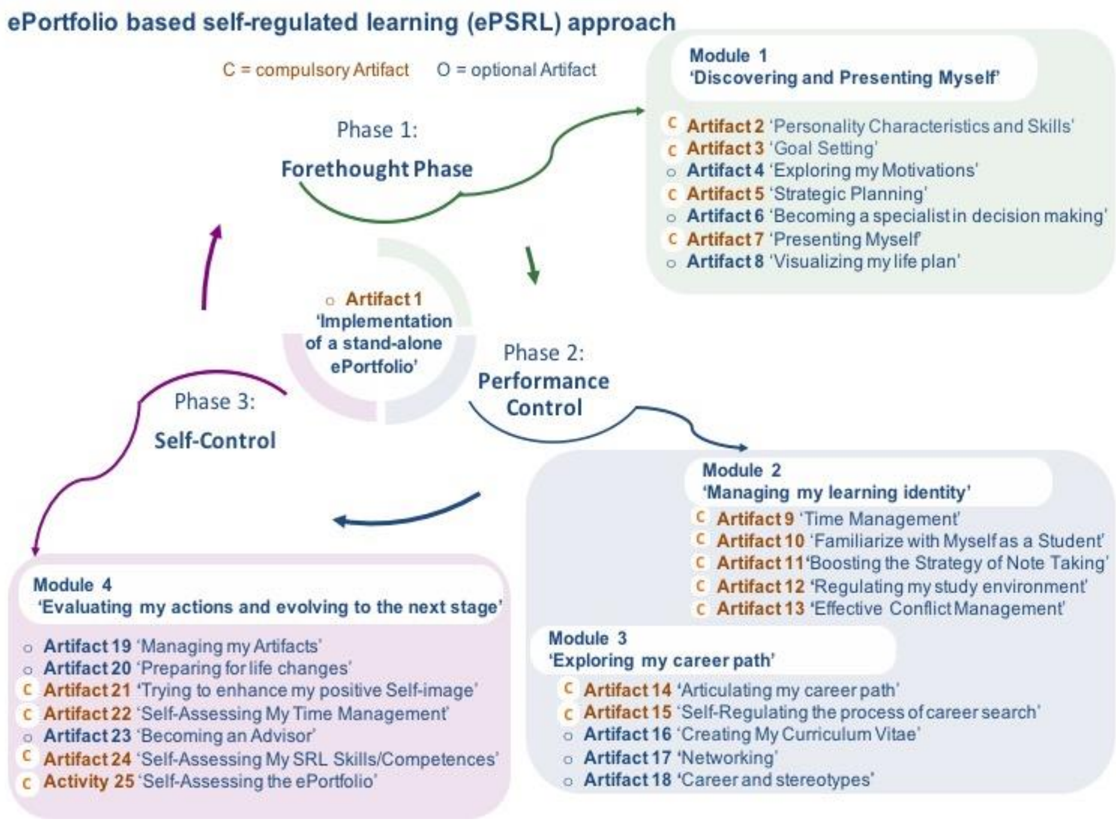


Figure 49. Study#2: The workflow of the ePortfolio Intervention (ePSRL approach) – version 2.

Weeks# 2-3

The experimental group registers in the ePortfolio system and followed SRL phases in the context of the ePSRL approach. Students familiarize with the system, set up their profiles, change their profile pictures, write about their skills and interests, connect to peers and create their learning community. The ePortfolio system informs users about the timetable and the order of the activities through micro-blogging tools and calendar updates. Specifically, the experimental group initiates the ePortfolio construction process as enters the SRL cycle following a cyclical order of three major SRL phases and gets involved in a set of activities (See Chapter 3 – Section 3.7): *Phase A - The 'Forethought' phase* consists of specific activities based on the concepts of Module 1 'Discovering and Presenting Myself'.

In Module 1, learners activate their cognitive, affective, behavioral and context processes through a specific learning path where they attempt to discover aspects of their self and present their skills. Learners engage in a set of activities in order to develop artifacts and write meaningful reflections about the process (Artifacts 2-8). The artifacts guide learners to realize, understand and use various SRL processes such as to discover their skills and personal characteristics, to set their goals, to select strategies for accomplishing their goals, to explore their motivations, to learn how to be dynamic decision makers and to organize their life plan. Students elaborate and upload their artifacts on the ePortfolio system then they edit their personal workspace (individual mode). The control group attends one face-to-face workshop for introducing in Module 1 and understanding ePortfolio basic elements. Students can take notes about the process and make the first ePortfolio prototype.

Weeks# 4-5

The experimental group enters the ePortfolio system (individual mode) in Phase A - The 'Forethought' and continues to elaborate on activities about Module 1 'Discovering and Presenting Myself'. Students can post questions and interact with peers and their Portfolio tutor and their teacher via the ePortfolio system.

The control group studies the learning content and designs the first ePortfolio prototype.

Week# 6

All students invited to participate in a face-to-face workshop so as to learn about the new learning modules. The ePortfolio tutor informs the participants about the concepts of Module 2 'Managing my learning identity' and Module 3 'Exploring my career path'. Also, the tutor supports learners through the process and helps them to familiarize with the terms.

The experimental group enters the ePortfolio system (individual mode) in Phase B - 'Performance Control' and starts viewing activities. The control group continues to design the ePortfolio prototype.

Weeks# 7-10

The experimental group follows the SRL cycle and enters *Phase B- The 'Performance Control'* phase which consists of the processes for elaborating on and delivering specific tasks (individual and group mode) that can be embedded in the ePortfolio. The ePortfolio tutor only observes the procedure and answers to questions on the forum. Learners continue their ePortfolio construction through Module 2: 'Managing my learning identity' were they develop artifacts that advance their academic performance. Learners are able to select specific artifacts based on preferences and their learning needs. In Module 2, learners attempt to discover their learning strategies, regulate their skills and boost their performance (Artifacts 9-13). In Module 3 'Exploring my career path', learners can structure artifacts for designing their academic and career path. Through this process, learners could select specific artifacts that correspond to their academic expectations, motivations and career aspirations (Artifacts 14-18). Each user enters the ePortfolio system, reads the activities, elaborates on the learning content, analyses the tasks and uploads his/her deliverables on the 'Pages' tool. The system allows users to customize their 'Pages' and enables them to edit their deliverables in order to present an effective outcome. The control group works individually and attempts to develop an effective ePortfolio based on the learning resources (Module 2: 'Managing my learning identity' and Module 3 'Exploring my career path').

Weeks# 11-12

The experimental group follows the SRL cycle and enters in Phase C - *'Self-reflection' phase* which consists of processes for self-monitoring and self-evaluating. Students complete ePSRL approach through Module 4 'Evaluating my actions and evolving to the next stage' and reflect on the artifacts that created throughout the process. This module enables self-judgement through the use of self- and peer-assessment rubrics. Thus, they reflect upon the artifacts and the learning decisions. Learners elaborate and complete all the artifacts (without a fixed order) in order to assess their performance and control their goals (Artifacts 19-25). The ePortfolio tutor only observes the procedure.

The control group completes the ePortfolio construction process. Students publish their ePortfolio projects as stand-alone applications.

Week# 12

In parallel (Weeks#2-12), the experimental group engaged in "Activity 1: Implementation of a stand-alone ePortfolio". This activity is a holistic process that support students to manage their learning identity and design their academic and career path. Specifically, the experimental group is invited to collect and manage artifacts for structuring a stand-alone ePortfolio that is customized based on individuals' preferences and aspirations.

4.2.6 Results

For the needs of Study#2, we gathered two different sources of data: quantitative and qualitative so as to deliver coherent result and produce robust conclusions. The statistical analysis of the data conducted with the 'Statistical Package for Social Sciences (SPSS) v. 20.0'.

Before the intervention, students invited to fill in 9 close-ended questions (Yes/No) and one open-ended question (Prior ePortfolio Experience Rubric). The goal of this instrument is to identify if students had prior ePortfolio experience and discover students' expectations about the project. **Figure *50*** presents students' positive answers (Yes) about their prior ePortfolio experience and their expectations of the intervention. The experimental group noted that they choose to participate in the intervention as they feel that the ePortfolio is a useful tool (100%). Also, the 99% of the students highlighted that they participate for supporting their academic development and the 97% indicated that they have a positive first impression, feel confident for the process and they will gain knowledge.

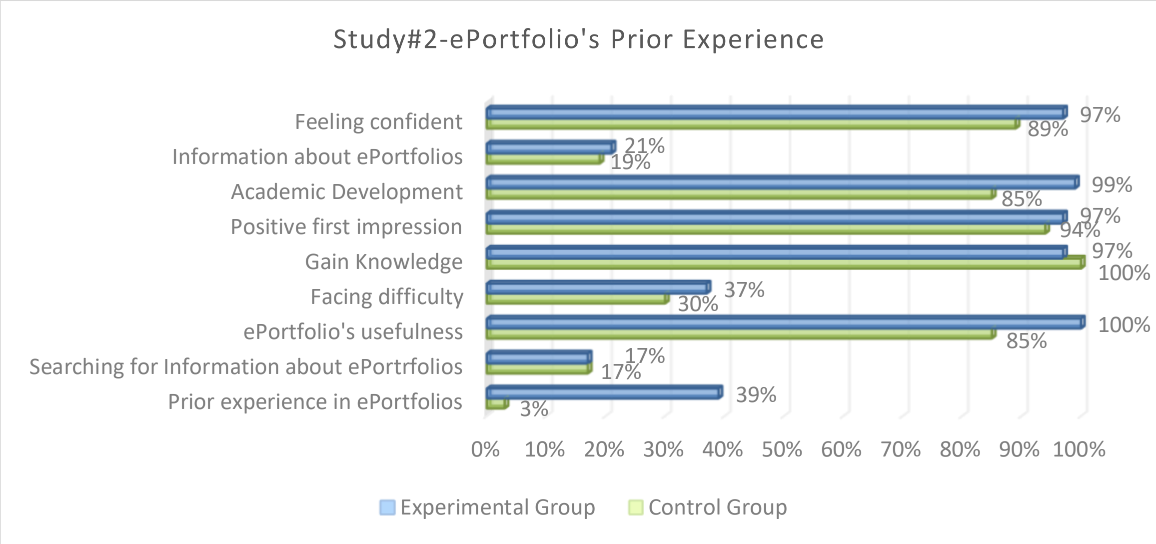


Figure 50. Study#2: ePortfolio's Prior Experience differences in experimental and control group

On the other hand, the control group highlighted that they participate for gaining knowledge (100%) and the 94% of the learners suggest that they have a positive first impression and feel confident for the process (89%). The experimental group feels more confident and expresses the enthusiasm about the process. Also, the 39% of the students indicated that they are familiar with ePortfolio basics. On the other hand, the control group is more skeptical about the process and they would like to support their academic development.

Also, students answered the open-ended question 'Why do you participate in the ePortfolio Lab?' (**Figure *51***).

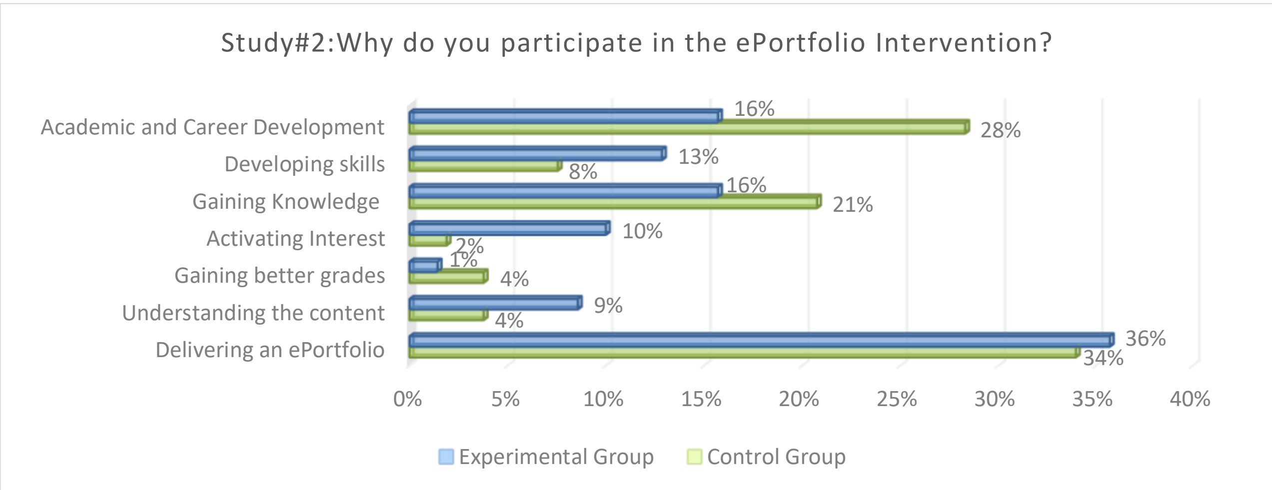


Figure 51. Study#2: Open-ended question 'Why do you participate in the ePortfolio Lab?'

The 36% of the experimental group and the 34% of the control group admitted that they would like to deliver and maintain an ePortfolio. The 28% of the experimental group indicated that they participated in the intervention in order to elevate the academic and career development. On the other hand, the 21% of the control group admitted that they participate for gaining new knowledge.

4.2.6.1 Reliability Analysis for quantitative data (RQ1)

Research Question (RQ1) addressed in this research is 'Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?

To answer RQ1 set within the context of the present research four types of quantitative analysis were conducted and are presented in this section. The goal is to examine whether the use of the ePSRL system influences students' SRL and explore the relationship between SRL processes and ePortfolio experience.

First, general observations about the survey results are presented. A reliability analysis was, hence, conducted to measure the instrument's (Questionnaire about SRL skills- MSLQ) internal consistency (Pintrich et al., 1991). The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale (Nunnally & Bernstein, 1994).

Along these lines, Scale A: Motivation, had a high reliability (Cronbach's Alpha=.88) and Scale B: Learning Strategies measure also had a high reliability (Cronbach's Alpha=.93) (**Table *31***). Cronbach's a for Value Components, Expectancy Components, Affective Components, Cognitive and Metacognitive Strategies and Resource Management Strategies in this study were .79, .72, .63, .92 and .82, respectively, exceeding the threshold of .5. The Cronbach's coefficient alpha values for five subscales were all larger than 0.70, presenting an acceptable reliability for each scale (Nunnally, 1978).

Table 31. Study#2-Cronbach's a coefficient

Questionnaire about SRL skills- MSLQ		
Scales	**Items**	**α**
Scale A: Motivation	31	.883
Value Components	16	.795
Intrinsic Goal Orientation	4	.554
Extrinsic Goal Orientation	4	.618
Task Value	8	.808
Expectancy Components	12	.720
Control Beliefs	4	.426
Self-Efficacy	8	.741
Affective Components	5	.636
Test Anxiety	5	.636
Scale B: Learning Strategies	50	.937
Cognitive and Metacognitive Strategies	31	.920
Rehearsal	4	720

Elaboration	6	.655
Organization	4	.547
Critical Thinking	4	.737
Metacognitive Self-Regulation	12	.810
Resource Management Strategies	19	.829
Time Management	8	.515
Effort Regulation	4	.730
Peer Learning	3	.556
Help Seeking	4	.515

4.2.6.2 Research Question 1- Quantitative Analysis[11]

Descriptive statistics was employed to describe the data collected. In **Table *32***, the number of subjects (n), the Mean (M) and the Standard Deviation (SD) of SRL processes between experimental and control group illustrated.

Table 32. Study#2: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of SRL processes

Study#2	**Experimental Group**					**Control Group**				
Variables	**Pre-Test**			**Post -Test**		**Pre-Test**			**Post-Test**	
	N	***M***	***SD***	***M***	***SD***	***N***	***M***	***SD***	***M***	***SD***
Scale A: Motivation	70	3.50	.372	4.15	.375	53	3.43	.390	4.00	.498
Value Components	70	3.64	.477	4.16	.365	53	3.59	.417	3.88	.392
Intrinsic Goal Orientation	70	3.77	.619	4.20	.463	53	3.83	.516	3.91	.460
Extrinsic Goal Orientation	70	3.46	.727	4.04	.602	53	3.32	.724	3.68	.636
Task Value	70	3.68	.575	4.23	.418	53	3.64	.592	4.04	.479
Expectancy Components	70	3.67	.435	4.09	.374	53	3.55	.411	3.85	.293
Control Beliefs	70	3.76	.496	4.03	.539	53	3.64	.527	3.84	.402
Self-Efficacy	70	3.58	.637	4.15	.378	53	3.45	.465	3.86	.323
Affective Components	70	3.19	.758	3.74	.724	53	3.14	.752	3.27	.814
Test Anxiety	70	3.19	.758	3.74	.724	53	3.14	.752	3.27	.814
Scale B: Learning Strategies	70	3.29	.389	4.02	.385	53	3.25	.364	3.94	.537
Cognitive and Metacognitive Strategies	70	3.37	.451	4.13	.378	53	3.28	.413	4.03	.520
Rehearsal	70	3.51	.690	4.26	.460	53	3.42	.541	4.20	.657
Elaboration	70	3.33	.721	4.15	.418	53	3.15	.680	3.93	.549
Organization	70	3.37	.648	4.10	.559	53	3.22	.660	4.05	.537

[11] Parts of this section has been published in the following papers:
Alexiou, A., & Paraskeva, F. (accepted for publication). Being a student in the social media era: Exploring educational affordances of an ePortfolio for managing academic performance. International Journal of Information and Learning Technology

Critical Thinking	70	3.25	.622	4.01	.557	53	3.38	.506	3.98	.616
Metacognitive Self-Regulation	70	3.38	.433	4.15	.375	53	3.24	.398	4.00	.498
Resource Management Strategies	70	3.20	.403	3.90	.434	53	3.23	.378	3.85	.573
Time Management	70	3.23	.412	3.87	.410	53	3.29	.372	3.72	.518
Effort Regulation	70	3.13	.529	3.78	.709	53	3.22	.513	3.76	.800
Peer Learning	70	3.25	.734	4.06	.585	53	3.17	.639	4.01	.606
Help Seeking	70	3.19	.604	3.90	.592	53	3.23	.609	3.90	.613

The results suggest that the experimental group felt confident about their self and their learning actions and assessed positive their SRL processes. On the other hand, the control group was more skeptical about their SRL capabilities and evaluated with lower degrees the SRL processes.

It was conducted a two-way repeated-measures analysis of variance (ANOVA) with Bonferroni post-hoc test to examine if there is a difference on self-perceived SRL processes of the experimental and control group, prior and after the intervention.
We used a 2x2 mixed factorial ANOVA design where one factor was within individuals and had two levels of measurements: before the intervention (pre-test) and after the interventions (post-test) (Factor 1) and among individuals with two categories: the experimental and the control group (Factor 2). Also, it was measured the interaction (Factor 3) between Factor 1 and Factor 2 for gaining valuable insights (**Table *33*** and **Table *34***).

Table 33. Study#2: A 2x2 mixed factorial ANOVA design for Scale A: Motivation

	Mean Difference Post -Pre Test		**Mean Difference Experimental-Control Group**					
	Exper.. Group	*Control Group*	*Post Test*	*Pre Test*	*Factor 1*	*Factor 2*	*Factor 3*	*N*
Scale A: Motivation	.496***	.239**	.330***	.073	84.412***	14.511***	10.352**	123
Value Components	.524***	.282**	.283**	.041	92.536***	6.570*	8.355***	123
Intrinsic Goal Orientation	.436***	.080	.293**	-.062	28.314***	1.989	13.446***	123
Extrinsic Goal Orientation	.582***	.363**	.364***	.145*	58.863***	5.745*	3.157	123
Task Value	.555***	.403**	.192	.040	87.604***	2.151	2.216	123
Expectancy Components	.417***	.307***	.237***	.126	82.741***	9.875**	1.925	123
Control Beliefs	.261**	.203**	.181	.123	16.488**	4.659*	0.257	123
Self-Efficacy	.573***	.410***	.293**	.130*	108.656***	8.159***	2.978	123
Affective Components	.546***	.127	.470***	.051	18.831**	5.118*	7.284	123
Test Anxiety	.546***	.127	.470***	.051	18.831**	5.118*	7.284	123

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

In detail, the statistical analysis revealed that the main effect for Motivation was significant ($F(1, 121) = 84.412$, $p = .000$, $\eta^2 = .411$) and there is a great difference on the perceptions of experimental and control group, before and after the intervention (**Table *33***). This means that, the process of structuring an ePortfolio engaged both groups into a meaningful learning experience where they attempted to regulate their motivation. Both groups invited to decide about their own ePortfolio artifacts and listened their perceptions and personal aspirations for structuring their academic profile. During the intervention, students felt responsible and autonomous and activated their motivations for accomplishing their goal. Before the intervention we found no significance difference between groups perceptions about their Motivation. But the experimental group (Factor 2) did significantly better than the control group on advancing their motivation beliefs on post-test ($F(1, 121) = 14.511$, $p = .000$, $\eta^2 = 107$). Also, the interaction effect between the time of the intervention and the group was significant ($F(1, 121) = 13.446$, $p = .000$, $\eta^2 = .10$). Overall, the 2x2 factorial ANOVA showed that before the intervention (pre-test), both groups (experimental and control – Factor 2) were equivalent. Both groups had the same perceptions about SRL processes and their effect on academic performance. We found no significant difference on the main effect of the intrinsic goal orientation, learning strategies, time management, peer learning and help seeking between the experimental and control group. Also, the analysis yielded that both groups improved significantly from pre- to post-test (Factor 1). All participants engaged in a meaningful learning experience for structuring their own ePortfolio which in turn activated their SRL processes. After the completion of the intervention, the experimental group emphasized on the purposes for doing the activities and attempted to attain their goals (mastery and performance) for acquiring new knowledge and delivering an effective ePortfolio (Pintrich, 2004). On the other hand, the control group didn't focus on valuing the goal setting process for its own merits rather attempted to complete their task.

Table 34. Study#2: A 2x2 mixed factorial ANOVA design for Scale B: Learning Strategies

	Mean Difference Post -Pre Test		**Mean Difference Experimental-Control Group**					
	Exper. Group	*Control Group*	*Post Test*	*Pre Test*	*Factor 1*	*Factor 2*	*Factor 3*	*N*
Scale B: Learning Strategies	.732***	.686***	.080	.033	165.599***	1.126	0.181	123

Cognitive & Metacognitive Strategies	-.764***	.751***	.103	.090	169.388***	3.198*	0.013	123
Rehearsal	.750***	.781***	.066	.099	111.386***	1.070	0.052	123
Elaboration	.826***	.777***	.227*	.178	103.149***	37.080*	0.098	123
Organization	.721***	.830***	.049	.158	101.680***	1.745	0.500	123
Critical Thinking	.754***	.604***	.027	-.123	112.237***	0.326	1.379	123
Metacognitive Self-Regulation	.768***	.759***	.147	.138	186.165***	7.112*	0.006	123
Resource Management Strategies	.701***	-.620***	.056	-.025	143.047***	0.066	0.532	123
Time Management	-.645***	-.432***	.154*	-.059	111.874***	0.056	14.384*	123
Effort Regulation	.643***	.538**	.016	.090	75.929***	0.148	0.602	123
Peer Learning	.810***	.843***	.083	.049	103.720***	0.600	0.042	123
Help Seeking	.707***	.670***	.004	.034	84.292***	0.034	0.062	123

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Furthermore, the study attempted to explore whether SRL processes were linearly related so as to strengthen learners to control their actions, manage their performance and deliver and effective ePortfolio. After the completion of the intervention, we run a Pearson's correlation so as to measure the strength of the linear relationships between the paired variables. Specifically, Pearson's correlation coefficient (r) revealed the relations and the strengths of the relationships between SRL processes and portfolio assessment.

In the experimental group, the findings revealed that Pearson's coefficient was significant for many items (**Table *35***).

Table 35. Study#2: Experimental Group- Pearson's r Correlations between Scale A: Motivation

Variables	1	2	3	4	5	6	7	8	9	10	A	B
(1) Motivation	1											
(2) Value Components	.420**	1										
(3) Intrinsic Goal Orientation	.410**	.710**	1									
(4) Extrinsic Goal Orientation	.150	.677**	.020	1								
(5) Task Value	.429**	.859**	.724**	.312**	1							
(6) Expectancy Components	.364**	.532**	.458**	.236*	.547**	1						
(7) Control Beliefs	.199	.319**	.252*	.153	.335**	.877**	1					
(8) Self-Efficacy	.436**	.597**	.546**	.247*	.603**	.728**	.308**	1				
(9) Affective Components	-.042	.023	-.029	.086	-.031	.066	.096	-.005	1			
(10) Test Anxiety	-.042	.023	-.029	.086	-.031	.066	.096	-.005	1.000**	1		
(A) ePortfolio Assessment	.115	.206	.122	.068	.307**	.124	.009	.232	.029	.029	1	
(B) Course Grade	.145	.119	.133	-.039	.220	-.028	-.081	.060	.116	.116	.585**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed

There was a very strong, positive correlation between motivation and learning strategies (r=.838, p<.01), peer learning (r=.649, p<.01) and help seeking (r=.445, p<.01). Also, it is revealed that were strong positive relationships between learning strategies and peer learning (r=.813, p<.01) as well as between learning strategies and help seeking (r=.745, p<.01) (**Table *36***).

Table 36. Study#2: Experimental Group: Pearson r Correlations between Scale B: Learning Strategies

Variables	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**A**	**B**
(11) Learning Strategies	1													
(12) *Cognitive S*	,940**	1												
(13) Rehearsal	.789**	.844**	1											
(14) Elaboration	.753**	.799**	.600**	1										
(15) Organization	.752**	.814**	.660**	.568**	1									
(16) Critical Thinking	.651**	.702**	.441**	.494**	.314**	1								
(17) Metacognitive SR	.838**	.855**	.714**	.593**	.696**	.491**	1							
(18) *RM Strategies*	.955**	.796**	.665**	.639**	.626**	.543**	.741**	1						
(19) Time Management	.548**	.459**	.386**	.422**	.312**	.317**	.429**	.573**	1					
(20) Effort Regulation	.730**	.613**	.504**	.408**	.481**	.427**	.662**	.761**	.228	1				
(21) Peer Learning	.813**	.725**	.571**	.582**	.587**	.523**	.649**	.811**	.313**	.454**	1			
(22) Help Seeking	.745**	.569**	.517**	.519**	.465**	.346**	.445**	.825**	.407**	.431**	.632**	1		
(A) ePortfolio Assessment	.054	.047	.020	.004	.133	-.073	.115	.055	.100	.098	.072	-.097	1	
(B) Course Grade	.015	.014	-.001	.057	.052	-.143	.145	0.02	.075	-.031	.095	-.069	.585**	1

In the control group, the findings indicated strong. positive correlations between various SRL processes (**Table *37***). The correlations showed that motivation was positively related to learning strategies (r=.918, p<.01). peer learning (r=.852, p<.01), time management (r=.721, p<.01) and help seeking (r=.812, p<.01).

Table 37. Study#2: Control Group- Pearson's r Correlations between Scale A: Motivation

Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**A**	**B**
(1) Motivation	1											
(2) Value Components	.275*	1										
(3) Intrinsic Goal Orientation	.279*	.836**	1									
(4) Extrinsic Goal Orientation	.196	.705**	.323*	1								
(5) Task Value	.148	.717**	.664**	.094	1							
(6) Expectancy Components	.559**	.422**	.359**	.172	.462**	1						
(7) Control Beliefs	.451**	.370**	.274*	.200	.379**	.850**	1					
(8) Self-Efficacy	.452**	.304*	.311*	.062	.366**	.756**	.297*	1				
(9) Affective Components	.412**	.287*	.117	.536**	-.119	.056	-.017	.122	1			
(10) Test Anxiety	.412**	.287*	.117	.536**	-.119	.056	-.017	.122	1.00**	1		
(A) ePortfolio Assessment	.095	.027	.014	.034	.007	-.174	-.249	-.005	.173	.060	1	
(B) Course Grade	-.076	-.026	-.164	.164	-.123	-.199	-.194	-.120	.129	-.079	.610**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed

Also, learning strategies were found to had strong correlation to self-efficacy (r=.574, p<.01), time management (r=.577, p<.01), peer learning (r=.619, p<.01) and help seeking (r=.884, p<.01) (***Table 38***.). The findings revealed that the control group had positive perceptions about their capabilities and high self-efficacy beliefs.

Table 38. Study#2: Control Group: Pearson r Correlations between Scale B: Learning Strategies

Variables	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**A**	**B**
(11) Learning Strategies	1													
(12) *Cognitive S*	.982**	1												
(13) Rehearsal	.922**	.924**	1											
(14) Elaboration	.814**	.861**	.694**	1										
(15) Organization	.894**	.929**	.798**	.807**	1									
(16) Critical Thinking	.913**	.930**	.833**	.764**	.831**	1								
(17) Metacognitive SR	.918**	.897**	.849**	.661**	.800**	.781**	1							
(18) *RM Strategies*	.985**	.936**	.892**	.745**	.834**	.870**	.910**	1						
(19) Time Management	.849**	.807**	.754**	.646**	.670**	.857**	.721**	.861**	1					
(20) Effort Regulation	.917**	.865**	.848**	.655**	.774**	.784**	.870**	.935**	.729**	1				
(21) Peer Learning	.893**	.862**	.863**	.644**	.786**	.767**	.852**	.894**	.677**	.803**	1			
(22) Help Seeking	.884**	.834**	.736**	.748**	.763**	.744**	.812**	.903**	.751**	.779**	.732**	1		
(A) ePortfolio Assessment	.060	.040	.087	-.023	.066	-.039	.095	.077	-.032	.073	.114	.106	1	
(B) Course Grade	-.079	-.101	-.096	-.072	-.150	-.066	-.076	-.056	-.047	-.039	-.123	.001	.610**	1

For both groups, there was a strong positive correlation between ePortfolio assessment and course grade. This indicates that the ePortfolio construction process was a reliable measurement that can be used as a vehicle for presenting learner's performance.

4.2.6.3 Research Question 1- Qualitative Analysis

To answer RQ1 set within the context of the present research qualitative analysis was conducted and is presented in this section.

During the ePortfolio intervention, the experimental group engaged in a set of learning tasks (Conceptual Framework v.2- ePortfolio based self-regulated learning (ePSRL) approach: Artifacts 1-25) in order to learn how to self-regulate their actions, to construct their own ePortfolio and promote their academic development (***Figure 49***).

We selected Artifacts A3, A7, A9, A10 and A15 of the ePortfolio based self-regulated learning (ePSRL) approach for investigating the use of SRL processes and the levels of achievement in ePortfolio use. The selected artifacts are representative of the procedure and can be used to express the levels of achievement of the SRL processes. Each artifact was aligned to a written reflective activity (e.g. Artifact 2 and Artifact 2.1), where learners were prompted to reflect on their learning actions and outcomes (**Figure *49***).

It was attempted to explore student’s level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009). My intention is to express the level of expertise required to complete ePortfolio based self-regulated learning (ePSRL) approach and deliver an effective ePortfolio. For the needs of this research, we defined six competency statements about the intended cognitive process (remember, understand, apply, analyze, evaluate and create).

Each statement is a measurable learning outcome that measures the degree to which participants understand, analyze, use the concepts, demonstrate skills and create learning outcomes. Furthermore, the written reflections that accompanied artifacts A3.1, A7.1, A9.1, A10.1 and A15.1. were examined.

In “*Artifact 3: Goal Setting (A3)*” participants set specific, measurable, achievable, realistic and time specific goals in order to accomplish short and long-term activities in an academic, professional and personal context. ***Figure 52*** suggests that the experimental group appeared to have differences among the levels of the continuum of the learning outcomes. Specifically, from the students who completed “Activity 3: Goal Setting (A3)”:

- 84% of the students remember to use the syntax of a S.M.A.R.T (Specific, Measurable, Attainable, Realistic, Timely) goal.
- 91% of the students understand the basic components of a S.M.A.R.T. This means that students couldn’t recall the basic concepts of goal setting but they understood the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely).
- 91% of the students apply and set their S.M.A.R.T goals.
- 87% of the students analyse the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely). The results show that students find difficult to analyse their intended outcomes and produce elaborated plans.
- 82% of the students evaluate their capability of setting sustainable goals
- 81% of the students create Specific, Measurable, Attainable, Realistic, Timely goals.

It is observed that students of the experimental group achieved high levels of expertise across the continuum of the learning outcomes. This activity seems to support learners to understand and apply S.M.A.R.T goals. In comparison, students faced difficulty on the higher levels of continuum (Evaluate and Create), which means that the goal setting process is a challenging task that needs more time and support for creating measurable and realistic goals.

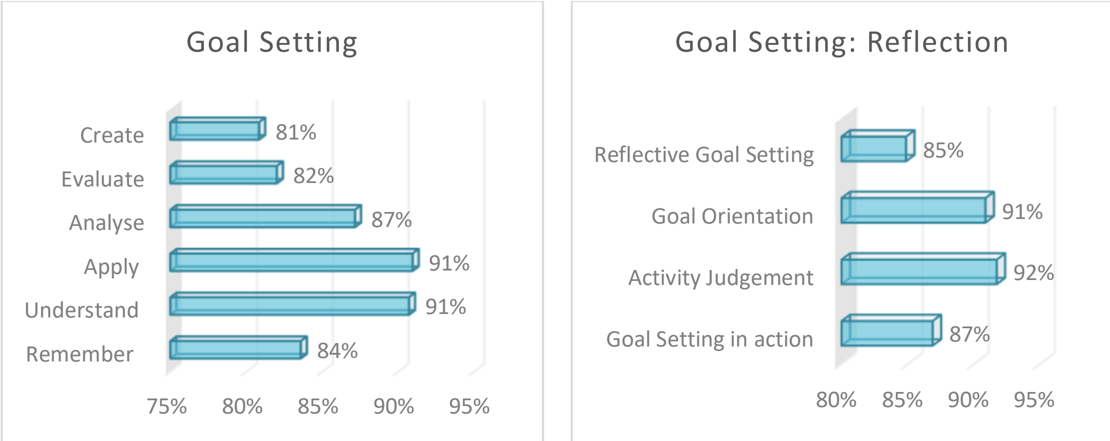


Figure 52. Study#2: Quantitative Analysis of Artifact 3: Goal Setting

When students completed "Artifact 3: Goal Setting (A3)", they invited to record their perceptions on a written reflective activity (Artifact 3.1). The 'Reflection Activity' consists of open-ended questions that measure the effects of SRL processes across the ePortfolio based self-regulated learning (ePSRL) approach. The reflective activity is linked to the objectives and context of Artifact 3: Goal Setting and attempts to measure specific self-regulatory processes (Microanalytic Protocols-***Table 39***). The coding of the questions is facilitated with a structured scoring rubric.

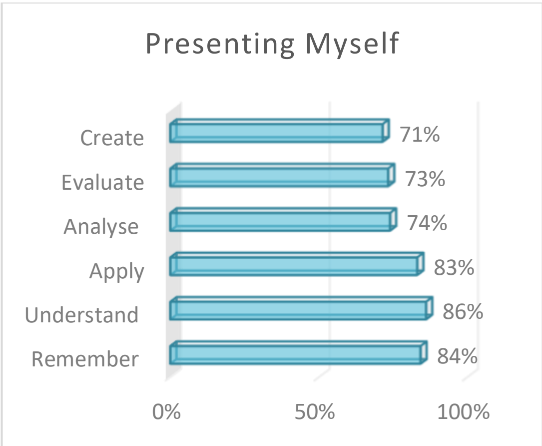
Table 39. Study#2: Microanalytic Protocols of Goal Setting (A3.1)

Written Reflective Activity: Goal Setting (A3.1)-Microanalytic Protocols		
Cognitive - Affective Processes	**Reflective Questions**	**Scoring**
Goal Setting in action	○ Analyse the goal setting processes that you will follow for accomplishing your academic and career goals?	5
Activity Judgement	○ Do you believe that the information you have studied and the activity you completed have helped you understand the process of goal setting?	5
Goal Orientation	○ Stefanos aims to attend the Erasmus program in Sweden. Help Stefanos to analyze his general goal into more detailed sub-goals (learning and/or achievement goals).	5
Reflective Goal Setting	○ How you can use the goal setting process in order to gain high grades during the exams period?	5

Figure 52 shows that students realized the process of goal setting and can analyze their goals (87%). Also, the 91-92% of the experimental group reported that the activity helped them understand how to set goals and categorize learning and achievement goals. Also, the 85% were

able to set goal in authentic learning context. This means that students need effective training for learning how to set effective goals and adjust their processes for accomplishing the tasks.

In "*Artifact 7: Presenting Myself (A7)*" participants attempt to explore and visualize aspects of their academic, professional and social self in order to construct an effective presentation. **Figure *53*** shows the degree to which participants understand, use concepts, demonstrate skills and create their learning outcome. the process developing their lower order thinking skills to higher order thinking skills.



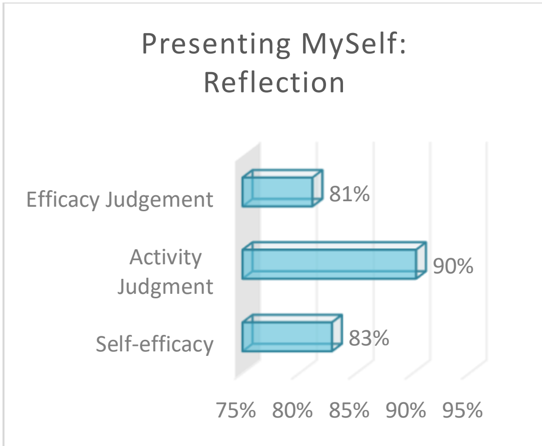


Figure 53. Study#2: Quantitative Analysis of Artifact 7: Presenting Myself

The results suggest that the experimental group appeared to have a significant increase on the first levels of the continuum of the learning outcomes. This finding is consistent with accounts from prior research where students need to master the first levels of the taxonomy before the next one can take place. Participants who completed "Artifact 7: Presenting Myself (A7)" were able to:

- 84% of the students remember a set of aspects of that describe their self (knowledge, skills, attitudes, interests, values, beliefs)
- 86% of the students understand their aspects of Self (knowledge, skills, attitudes, interests, values, beliefs)
- 83% of the students apply their aspects of self into a personal project
- 74% of the students can analyse their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self)
- 73% of the students evaluate their personal identity and their self-image
- The 71% of the students can create a presentation about their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self) and set a specific career goal.

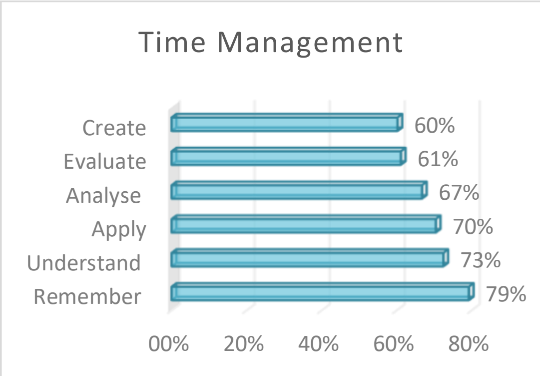
Specifically, students achieved better on the first levels of the continuum (Remember, Understand, Apply) while they faced difficulty on the higher levels of continuum (Analyze, Evaluate and Create). This means that participants were able to recognize, interpret and manage the aspects of self but they need more training in order to monitor and construct detailed self-presentations. Specifically, students were able to create a detailed presentation in order to describe their knowledge, skills, attitudes, interests, values, beliefs but they found difficult to analyse and reflect on the concepts. When students completed 'Artifact 7: Presenting Myself (A7)', they invited to record their perceptions on a written reflective activity (Artifact 7.1). The reflective activity is linked to the objectives and context of Artifact 7: Presenting Myself and attempts to measure specific self-regulatory processes (Microanalytic Protocols- **Table *40***). The coding of the questions is facilitated with a structured scoring rubric.

Table 40. Study#2: Microanalytic Protocols of Presenting Myself (A7.1)

Written Reflective Activity: Presenting Myself (A7.1)-Microanalytic Protocols		
SRL Processes	**Reflective Questions**	**Scoring**
Self-Efficacy	○ Do you think that you should enhance or modify some parts of your presentation for describing aspects of academic, professional and social self?	5
Activity Judgement	○ Do you think that the activity helped you realize your skills, knowledge, attitudes, interests and values (Aspects of Self)?	5
Efficacy Judgement	○ Do you think that you possess the appropriate skills, knowledge, attitudes, interests and values to achieve your career goal?	5

Figure 53 shows that students' self-efficacy is moderate (83%) as they feel that they should make changes on their presentations as they need feedback also they indicated that they they don't have working experience and they don't think that they ready to present their self. On the other hand, the 90% of the students reported that the activity helped them realize the their 'Aspects of Self'. Also, the 81% of the participants admitted that they possess the appropriate skills, knowledge, attitudes, interests and values. The results highlight that students' judgments about their ability to complete an organized self-presentation were good. This means that students need time to realize and strengthen their efficacy judgement. Also, it is challenging to engage student on activities for identifying and boosting their skills, knowledge, attitudes, interests and values.
In "*Artifact 9: Time Management (A9*)" learners investigate the benefits of managing time, organize their tasks and plan their activities (individual, academic and professional level) to complete their ePortfolio. ***Figure 54*** suggests that the experimental group appeared to have low scores across the continuum of learning outcomes. Specifically, from the participants who completed "Artifact 9: Time Management":

- 79% of the students remember terms related to time management.
- 73% of the students understand the necessity for effective time management
- 70% of the students apply techniques for effective time management
- 67% of the students analyse various methods and techniques for time management
- 61% of the students evaluate the efficacy of time schedules
- 60% of the students create effective time management plans



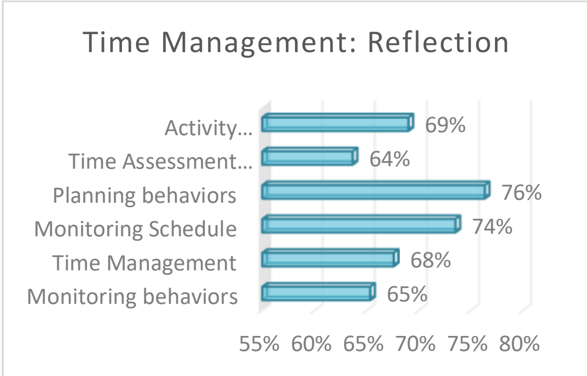


Figure 54. Study#2: Quantitative Analysis of Artifact 9: Time Management

The results indicate that the activity helped students to understand and apply the basic principles of effective time management. Also, the findings underline that participants do engage in time management activities and try to allocate their effort but they fail to deliver effective schedules and take appropriate decisions.

When students completed 'Artifact 9: Time Management (A9)', they invited to record their perceptions on a written reflective activity (Artifact 9.1). The reflective activity is linked to the objectives and context of Artifact 9: Time Management and attempts to measure specific self-regulatory processes (Microanalytic Protocols- **Table *41***). The coding of the questions is facilitated with a structured scoring rubric.

Table 41. Study#2: Microanalytic Protocols of Time Management (A9.1)

Written Reflective Activity: Time Management (A9.1)-Microanalytic Protocols		
SRL Processes	**Reflective Questions**	**Scoring**
Monitoring behaviours	○ After the completion of the activity, do you think that you are able to manage and allocate you study time? Explain	5
Time Management	○ Is it feasible to follow an organized time schedule? Explain	5

Monitoring Schedule	○ Is it necessary to monitor my time schedule so as to manage my workload?	5
Planning behaviours	○ Is it necessary to devote time in order to develop an effective time schedule?	5
Time Assessment Behaviours	○ Do you believe that an application (e.g. remember the milk™) may help you reduce procrastination, lack of discipline and minimize opportunities for interruptions?	5
Activity Judgement	○ Do you think that the activity and the information you studied help you manage time effectively?	5

Figure 54 shows that the 65% of the experimental group was able to manage and allocate their study time. Also, the 68% of the students agree that they can follow an organized time plan. This means that, students should engage in time management activities in order to strengthen their skills and monitor their actions. In addition to, the 74% of the students agree that monitoring schedule is necessary and the 76% indicate that planning is a key concept in time management. On the other hand, only the 64% of the students believed that an application can help them assess and change their behavior. Finally, the 69% of participants agreed that time management activity was very useful.

From the experimental group, 50 students selected *'Artifact 10: Familiarize with Myself as a student (A10)'* and 20 students selected *'Artifact 11: Boosting the Strategy of Note Taking (A11)' Specifically, in "Artifact 10: Familiarize with Myself as a student (A10)"* participants try to explore the benefits of learning strategies, study tactics and develop a personal learning strategy repertoire for boosting their academic performance. ***Figure 55*** indicates that students appeared to have a significant increase on the first levels of the continuum of the learning outcomes.

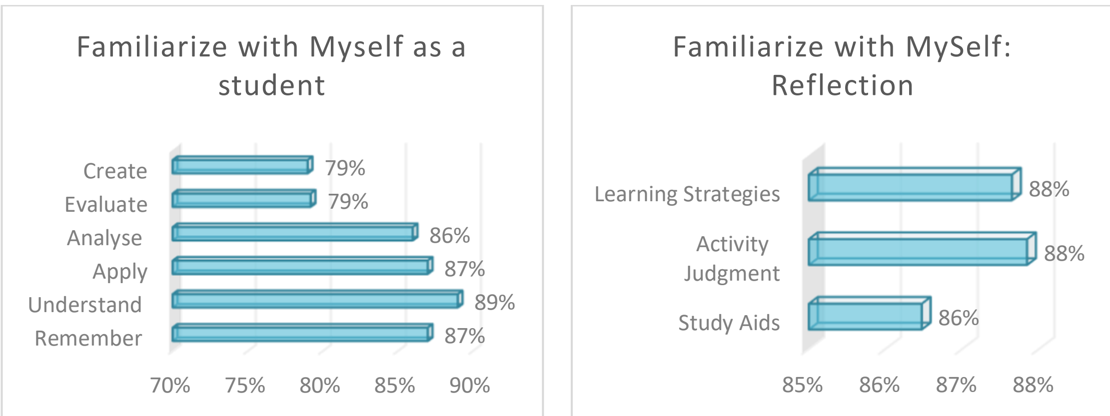


Figure 55. Study#2: Quantitative Analysis of Artifact 10: Familiarize with MySelf as a Student (Learning Strategies)

This finding is consistent with accounts from prior research where students need to master the first levels of the taxonomy before the next one can take place. Also, it is interesting that students realize the necessity of using and analyzing their learning strategies.

Specifically, from the students who completed "*Artifact 10: Familiarize with Myself as a student (A10) (Learning Strategies)":*

- 87% of the students remember concepts associated to learning strategies
- 89% of the students understand the need for using learning strategies.
- 87% of the students apply a repertoire of learning strategies in their academic study. This means that students
- 86% of the students analyse learning strategies in order to know when to use them in their academic study
- 79% of the students evaluate, select and control their learning strategies
- 79% of the students create a detailed repertoire of learning strategies which is orchestrated by web-based tools.

The findings illustrate that students' competency decrease in the higher level of learning objectives continuum (Analyze, Evaluate and Create). These results suggest that students realized the need of acquiring learning strategies but they need a long-term plan for applying them in their academic study.

When students completed *Artifact 10: Familiarize with Myself as a student (A10)* (Learning Strategies)", they invited to record their perceptions on a written reflective activity (Artifact 10.1). The reflective activity is linked to the objectives and context of Artifact 10 and attempts to measure specific self-regulatory processes (Microanalytic Protocols- ***Table 42***). The coding of the questions is facilitated with a structured scoring rubric.

Table 42. Study#2: Microanalytic Protocols of Familiarize with Myself as a student (A10.1)

Written Reflective Activity: Familiarize with Myself as a student (A10.1)-Microanalytic Protocols		
SRL Processes	**Reflective Questions**	**Scoring**
Study Aids	○ How you will use specific learning strategies in a course that you find difficult to understand? Explain	5
Activity Judgement	○ Do you think that the activity and the information you studied were helpful?	5
Use of Learning Strategies	○ Invite individuals to acquire and use a repertoire of learning strategies. Explain	5

Figure 55 shows that the 88% of the students was able to select and apply specific learning strategies for supporting their cognitive state and directing their behavior. Also, the 86% of the students admitted that they feel capable to use the appropriate strategies or study aids for learning and retrieving new content. Finally, the 88% of participants agreed that the activity was very useful.

From the experimental group, 20 students selected to implement *"Artifact 11: Boosting the Strategy of Note Taking (A11)"* participants try to discover the benefits of note taking and learn how to take effective notes for supporting their academic performance. ***Figure 56*** indicates that students appeared to have a significant increase on the first levels of the continuum of the learning outcomes. Also, it is interesting that students remember many concepts that are related to note taking and realize the necessity of applying note taking techniques.

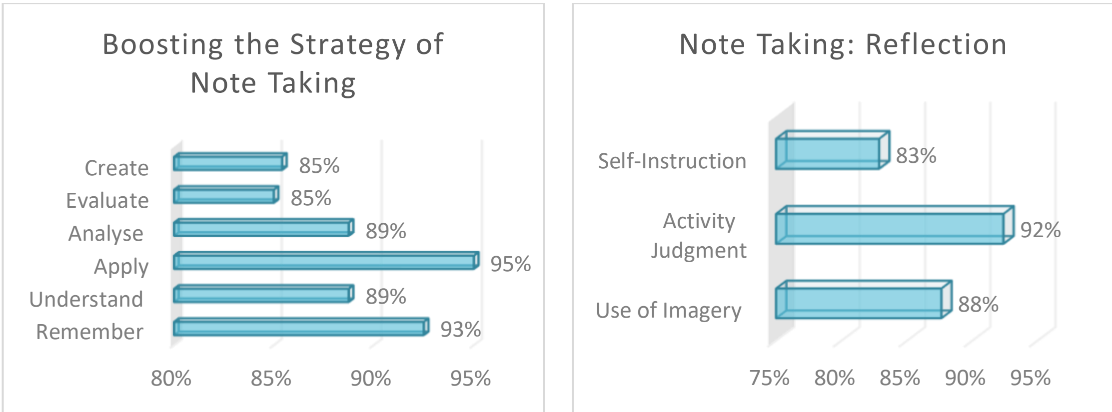


Figure 56. Study#2: Quantitative Analysis of Artifact 11: Boosting the Strategy of Note Taking (A11)

Specifically, from the students who completed *"Artifact 11: Boosting the Strategy of Note Taking (A11)":*

- 93% of the students remember concepts associated to note taking techniques
- 89% of the students understand the need for using effectively note taking.
- 95% of the students apply method or techniques of note taking in their academic life.
- 89% of the students analyse different note taking techniques in order to know when to use them in their academic study
- 85% of the students evaluate, select and control different note taking techniques
- 85% of the students create a detailed repertoire of note taking techniques

The findings illustrate that students' competency decrease in the higher level of learning objectives continuum (Analyze, Evaluate and Create). These results suggest that students already use note taking techniques but they don't understand their categories. Probably, students should use and evaluate their techniques and then create their own personal repertoire of note taking techniques.

When students completed *"Artifact 11: Boosting the Strategy of Note Taking (A11)",* they invited to record their perceptions on a written reflective activity (Artifact 11.1). The reflective activity is linked to the objectives and context of Artifact 11 and attempts to measure specific self-regulatory processes (Microanalytic Protocols- ***Table 43***). The coding of the questions is facilitated with a structured scoring rubric.

Table 43. Study#2: Microanalytic Protocols of Boosting the Strategy of Note Taking (A11.1)

Written Reflective Activity: Boosting the Strategy of Note Taking (A11.1)-Microanalytic Protocols		
SRL Processes	**Reflective Questions**	**Scoring**
Use of Imagery	○ Explain which is the most effective method / technique for taking notes. Do you think there is only one effective technique?	5
Activity Judgement	○ Do you think that the activity and the information you studied were helpful?	5
Self-Instruction	○ When you are taking notes, do you think is important to remind yourself the steps that you follow?	5

Figure 56 illustrates that the 88% of the students admits that every learner should have a set of techniques for taking notes. Students don't believe that there is only one effective method but it depends on the subject matter. Also, the 83% of the students admitted that it is important remind yourself the steps that you follow (self-instruction). Finally, the 92% of participants agreed that the activity was very useful.

4.2.6.4 Reliability Analysis for quantitative data (RQ2)

Research Question (RQ2) examined '*How does the ePortfolio intervention impact academic achievement?*'. To answer RQ2 set within the context of the present research four types of quantitative analysis were conducted and are presented in this section.

The goal is to evaluate the accuracy of the ePortfolio based self-regulated learning (ePSRL) approach as a method of authentic assessment. It was attempted the design of a comprehensive ePortfolio assessment methodology that actively engages students, peers, instructors and external evaluators into the process. Also, it was attempted to investigate whether the ePortfolio achievements (measured by students, peers, instructors and external evaluators) of the experimental and the control group show a statistically significant difference. Finally, in what extent the active participation of students in the ePortfolio process elevated their academic achievement.

At the end of the experimental procedure, students, peers, instructor and two external evaluators (four sources of raters/evaluators) attempted to evaluate the process, the content and the outcomes of the ePortfolio. All raters/evaluators completed the ePortfolio rubric in order to assess the ePortfolio achievement. The ePortfolio achievement was divided into four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics (see details in Chapter 3 – ePortfolio Rubric).

Towards this, it was selected the Intraclass Correlation Coefficient (ICC) test for measuring the inter-rater reliability (IRR). The IRR attempts to quantify the level of agreement among assessors that independently rate the constructs of a scale.

The ePortfolio rubric used a 3-point rating scale ranging from 1-(Lacking) to 3- (Exemplary) to evaluate the level of ePortfolio achievement. Accordingly, an efficient ePortfolio encompasses all the constructs and manages the parts in a meaningful manner. The ICC based on the answers of four assessment methods (students, peers, instructor and external evaluators) so as to measure consistency. It was selected a two-way random ICC for providing explanations about the differences in scores, the way raters use the constructs and estimate possible measurement error (Nunnally & Bernstein, 1994). The ICC analysis for consistency can be considered substantial ($ICC_{experimental\ group}$)=0.61 also the ICC value can be excluded from the population with a probability greater than 95% ($F(69, 207) = 2.525$, $p=0.000<0{,}005$). **Table *44*** presents the average measure intra-class correlations for each of the ePortfolio constructs and the results suggest that the average scores of the experimental group were moderately reliable. In the experimental group, there is a consistency in the usage of the scale values among the four assessment methods, also the participants had a better understanding of the rating scale. Furthermore, the ICC analysis for consistency can be considered fair ($ICC_{control\ group}$)=0.53 also the ICC value can be excluded from the population with a probability greater than 95% ($F(52, 156) = 2.131$, $p=0.000<0{,}005$). **Table *44*** presents the average measure intra-class correlations for each of the ePortfolio constructs and the results suggest that the average scores of the control group were not overly reliable. The control group seems to have a difficulty in understanding the ePortfolio constructs and dynamically apply them into practice.

Table 44. Study#2 Intraclass Correlation Coefficient test measured the inter-rater reliability of the two groups

Study#2	*Experimental Group*	*Control Group*

ePortfolio Criteria	ICC (3,4) 95%CI	ICC (3,4) 95%CI
ePortfolio Purpose	0.453 (69,207)	0.500 (52,156)
Artifacts Repository	0.637 (69,207)	0.386 (52,156)
Reflection in Action	0.334 (69,207)	0.474 (52,156)
ePortfolio Usability characteristics	0.606 (69,207)	0.581 (52,156)

Pearson's correlation analysis was selected for exploring the relationships between the ePortfolio assessment methods and the final course grade. In the experimental group, the Pearson r correlation revealed that correlation coefficient was significant for specific items (**Table *45***). As we expected, course grade was positively related to instructor's ePortfolio assessment ($r=.63$, $p<.01$) and external's evaluator assessment ($r=.31$, $p<.01$), which indicates that ePortfolio assessment can be seen as a reliable measure of learner's achievement.

Table 45. Study#2: Pearson's r correlation analysis among ePortfolio assessment measurements

Pearson r Correlations – Experimental Group					
Variables	1	2	3	4	5
(1) Self	1				
(2) Peer	.220	1			
(3) Instructor	.252*	.207	1		
(4) External Evaluators	.287*	.280	.447**	1	
(5) Teacher-Course Grade	.149	.225	.635**	.316**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

In addition to, instructor's ePortfolio assessment with external evaluator's assessment had high and positive correlation ($r=.45$, $p<.05$) This correlation is significant and highlights that the ePortfolio assessment is reliable as the raters agree. Also, self-assessment was found to correlate significantly with instructor's assessment ($r=.25$, $p<.05$) and external evaluator's assessment ($r=.28$, $p<.05$). This indicates that when students engage in the ePSRL approach through the ePortfolio system internalize the learning concepts and apply their SRL skills.

In the control group, no significant correlations were found between self-assessment and instructor's or external evaluator's assessment (**Table *46***). This means that the control group didn't follow the guidelines and found difficult to elaborate the learning concepts.

Table 46. Study#2: Pearson's r correlation analysis among ePortfolio assessment measurements

Pearson r Correlations – Control Group					
Variables	1	2	3	4	5
(1) Self	1				
(2) Peer	.253	1			
(3) Instructor	.105	-.091	1		
(4) External Evaluator	.052	.086	.447**	1	
(5) Teacher-Course Grade	.045	.083	.704**	.472**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

It was carried out a one-way repeated-measures analysis of variance (ANOVA) to test if there is any significant difference between mean values of the ePortfolio achievement. The ePortfolio achievement was divided into four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics.

For the experimental group, the results of a repeated-measures ANOVA revealed that ePortfolio achievement can be affected by the assessment measurements, ($F(2.747, 189.525) = 3.45$, $p<0.001$, $\eta^2=0.02$. Since Mauchly's test of sphericity was violated, the Huynh-Feld correction was used ($\varepsilon=0.878 > .75$). To find out which assessment measurements (students/self, peers, instructor and external evaluator) were significantly different from each other, we conducted a Bonferroni post-hoc test. The overall peer assessment (mean=2.23) is higher than external evaluator's assessment. This comparison indicates that students delivered well-designed ePortfolios and embraced SRL principles, their peers where more enthusiastic about the ePortfolio outcomes and gave higher grades. On the other hand, the external evaluator and the instructor gave a more precise evaluation and provided a stricter scoring.

In detail (**Table *47***), findings showed that self-assessment (mean = 2.51) about the purpose of the ePortfolio is higher than external evaluator's assessment. Specifically, these findings suggest that students feel confident about the purpose of their ePortfolio, on the other hand external evaluators are more skeptical about the accuracy of the ePortfolio purpose.

Table 47. Study#2: ANOVA results for the Experimental Group

Experimental Group								
ePortfolio's Criteria	Self	Peer	Instructor	Ex. Eval.	F	Sig	Effect size η^2	Comparison
ePortfolio Purpose	2.51	2.47	2.50	2.34	2.84	0.039	0.040	ExEval<Self
Artifacts Repository	2.37	2.38	2.33	2.34	0.28	0.833	0.004	Instr. <Peer
Reflection in Action	2.16	2.23	2.21	1.82	9.94	0.000	0.126	ExEval<Peer

Usability char.	2.54	2.75	2.67	2.66	3.45	0.000	0.119	Self <Peer
Overall	2.22	2.23	2.19	2.11	3.45	0.021	0.021	ExEval<Peer

The findings showed that peer assessment (mean = 2.38) about ePortfolio's artifacts is higher than instructor's assessment. Specifically, the results suggest that peers believe that the artifacts provide a detailed description of learner's academic development, but instructor's assessment suggests that there are deficiencies in the collection of artifacts. Furthermore, peer assessment (mean = 2.23) about reflection in action is higher than external evaluator's assessment. These findings, indicate that peers overrated learners' reflections and were more enthusiastic, on the other hand external evaluator described accurately the levels of reflective thinking. Also, peer assessment (mean=2.75) about usability characteristics is higher than self-assessment. This means that peers have high expectations about their co-learners and they estimated that their peers structured dynamic ePortfolios.

For the control group, the results of a repeated-measures ANOVA revealed that ePortfolio achievement can be affected by the assessment measurements, ($F(1.930, 100.366) = 11.31$, $p<0.001$, $\eta^2=0.179$. Since Mauchly's test of sphericity was violated, the Greenhouse-Geisser correction was used ($\varepsilon=0.643 < .75$). To find out which assessment measurements (students/self, peers, instructor and external evaluator) were significantly different from each other, we conducted a Bonferroni post-hoc test (**Table *48***).

Table 48. Study#2: ANOVA results for the Control Group

Control Group								
ePortfolio's Criteria	Self	Peer	Instructor	Ex Eval	F	Sig	Effect size η^2	Comparison
ePortfolio Purpose	2.45	2.42	2.38	2.23	2.47	0.084	0.045	ExEval<Self
Artifacts Repository	2.40	2.25	1.96	2.01	9.67	0.000	0.157	Instructor<Self
Reflection in Action	2.31	2.06	1.76	1.68	3.45	0.000	0.225	ExEval<Self
Usability char.	2.67	2.61	2.36	2.39	8.08	0.000	0.135	ExEval<Self
Overall	2.21	2.11	1.90	1.89	11.31	0.000	0.179	ExEval<Self

The findings indicated that there isn't a significant main effect among ePortfolio methods on their ePortfolio purpose. The overall findings showed that self-assessment (mean=2.21) is higher than external evaluator's assessment. This comparison indicates that the control group felt confident about the ePortfolio outcome and high scored their artifacts. On the other hand, the external evaluator and the instructor followed the guidelines and gave accurate grades.

4.2.6.5 Research Question 2- Quantitative Analysis

In this study, ePortfolio achievement is measured by the ePortfolio Rubric (APPENDIX B: ePortfolio Rubric). At the end of the intervention, students, peers, instructors and external evaluators completed the ePortfolio rubric in order to assess the ePortfolio.

Further, at the end of the semester students participated in the final exams for testing their knowledge of the subject matter. The written examination consisted of open-ended and multiple-choice questions, or/and exercises (failing grade<5, passing grade=5, excellent grade=10).

Firstly, descriptive statistics was employed to describe the data collected; in the tables to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted (**Table *49***).

To determine if there is any significant difference among the assessment measurements towards the use of ePortfolio with regard to their approach, means and standard deviations for the method of assessment, including self, peer, instructor and external evaluators are calculated as presented in Table 49 (experimental and control group).

In the experimental group, course grades (Mean = 9.29) indicate that students studied the course material, understood the learning content and achieved an excellent performance. On the other hand, the control group had a good performance (Mean = 8.51). Probably the ePortfolio helped them to attain better results. Also, it is observed that there are differences in the peer-assessment, Instructor's and External evaluators' assessment between the experimental and control group. The experimental group had significantly better peer-assessment (Mean = 2.23) than the control group (Mean = 2.11). This outcome showed that peers in the experimental group were more enthusiastic about the process. Further, for the experimental group, instructor's and external evaluators' assessment were significantly higher than control's group. This fact pin points that the ePortfolio intervention supported the experimental group to achieve better grades and advance their academic achievement.

Table 49. Study#2: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of academic achievement (Experimental and Control Group)

ePortfolio and Academic Achievement	Experimental Group			Control Group		
	N	M	SD	N	Mean	SD
Learner	70	2.22	.245	53	2.21	.207
Peer	70	2.23	.229	53	2.11	.274
Instructor	1	2.19	.391	1	1.91	.501
External Evaluator	2	2.11	.290	2	1.89	.477
Course Grade	70	9.29	1.15	53	8.51	1.55

As evident from **Figure *57***, in the experimental group there is an agreement among the raters (self, peers, instructor, external evaluators), all the scores were similar (70-74%). EPortfolio intervention focus on how to manage learning tasks and behaviors. This means that the experimental group who practice SRL through the intervention are more likely to achieve better academic performance (Course Grade=93%). On the other hand, the control group that tried to build an ePortfolio without using SRL had a lower academic performance (Course Grade=85%). Also, in the control group instructor's and external evaluators' assessment were stricter. Further, the control group use the ePortfolio as a tool and not as a learning experience and students didn't have the opportunity to articulate SRL processes. Thus, control group was not able to experience the benefits of ePortfolio based learning.

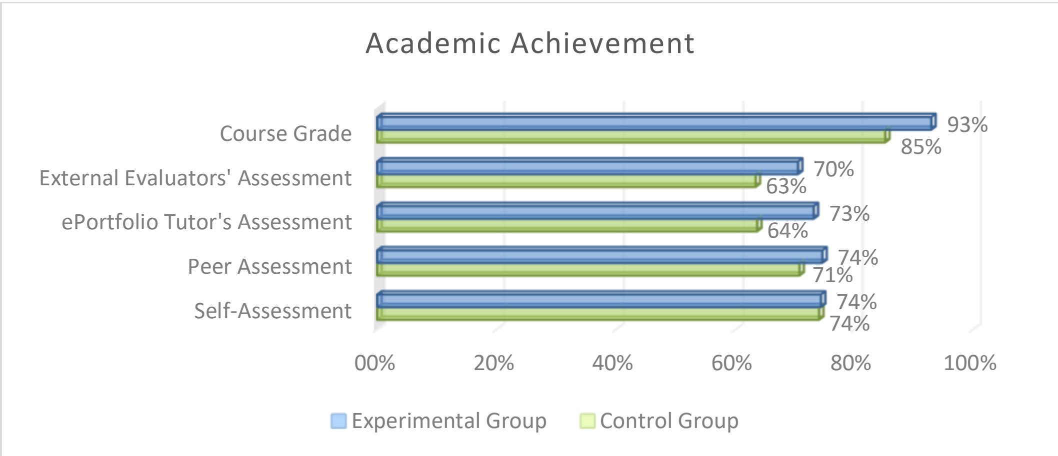


Figure 57. Study#2: Academic Achievement Measurements of Experimental and Control Group

Secondly, descriptive statistics was employed to describe the data of the ePortfolio assessment rubric. After the completion of the ePortfolio construction process, each student and the instructor evaluated the ePortfolio criteria: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics for measuring the level of ePortfolio achievement (***Table 50*** and ***Table 51***).

Table 50. Study#2: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of aspects of ePortfolio Assessment- Experimental Group

Experimental Group	**Self**			**Peer**			**Instructor**			**External Evaluator**		
ePortfolio Assessment	**M**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**	**n**
ePortfolio Purpose	2.51	.392	70	2.47	.419	70	2.50	.513	1	2.34	.363	2
Artifacts Repository	2.37	.440	70	2.38	.382	70	2.33	.580	1	2.34	.552	2
Reflection in Action	2.16	.516	70	2.23	.484	70	2.21	.597	1	1.82	.565	2

ePortfolio Usability characteristics	2.54	.235	70	2.75	.190	70	2.67	.362	1	2.66	.262	2

For the experimental group, the results (***Table 50***) indicate that peers assigned higher scores on the ePortfolio criteria compared to self, instructor's and external evaluator's grades. This finding suggests that peers were more lax on their scorings, perhaps they realized the difficulties of the process and they wanted to boost their colleagues' self-efficacy. Only the criterion 'ePortfolio purpose', had higher self-assessment scores.

For the control group, the results (***Table 51***) indicate that students (self-assessment) assigned higher scores on the ePortfolio criteria compared to peers, instructor's and external evaluator's grades. This finding indicates that the control group spent more time on developing an ePortfolio and collecting artifacts, implying that students devoted time for the final outcome and didn't value the process of learning. Probably, control group made superficial judgements because they didn't know how to identify and use SRL processes in practice.

Table 51. Study#2: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of aspects of ePortfolio Assessment- Control Group

Control Group	**Self**			**Peer**			**Instructor**			**External Evaluator**		
ePortfolio Assessment	**M**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**	**n**
ePortfolio Purpose	2.45	.387	53	2.42	.382	53	2.38	.676	1	2.23	.569	2
Artifacts Repository	2.40	.387	53	2.25	.461	53	1.96	.618	1	2.01	.590	2
Reflection in Action	2.31	.435	53	2.06	.467	53	1.76	.691	1	1.68	.719	2
ePortfolio Usability characteristics	2.67	.252	53	2.61	.302	53	2.36	.590	1	2.39	.556	2

To sum up, both groups didn't have great prior experience on ePortfolios and weren't familiar with ePortfolio construction process. Also, experimental and control group believed that the ePortfolio was a useful that may boost their academic development. This means that, both groups had the same dynamic and equal learning expectation. It can be assumed that the sample of study#2 was a set of novice participants that attained the ePortfolio intervention for gaining knowledge and updating their skills.

In terms of academic achievement, the experimental group performed better than the control group. This finding highlights that students that were engaged in the ePSRL approach learn how to set goals, monitor their actions, maintain their self-efficacy and reflect upon the process. Perhaps, the ePSRL approach helped them internalize SRL processes and this in turn affected their performance and boost their academic achievement. On the other hand, the control group experienced the merits of ePortfolio construction process and performed well. Participants' performance (control group) suggested that they learn how to structure their ePortfolio but they weren't able to evaluate the process and their actions. In other words, they were immature in using SRL in action and monitor their learning.

Thus, it is recommended that learners should engage in ePortfolio based self-regulated learning (ePSRL) approach throughout an academic semester and actively participate in the intervention.

4.2.6.6 Research Question 2- Qualitative Analysis

During the intervention, the experimental group engaged in 'Artifact 1: Implementation of a stand-alone ePortfolio'. This is an activity that evolves throughout the three SRL phases and attempts to strengthen learners' potential for developing a customized ePortfolio as stand-alone application. When students completed their holistic process of designing and implementing their own ePortfolio ("Self-reflection' phase [C]) engaged in the processes of self-monitoring and self-evaluating. Specifically, students completed self-assessment rubrics and devoted time to self-reflect and articulate their self-judgements about their actions and the process. Specifically, students self-evaluated their ePortfolio (Artifact 25: Self-Assessing the ePortfolio, Instrument: ePortfolio rubric). They reflected upon their performance and verbalized their perceptions about the purpose of their ePortfolio, the selected artifacts, the analysis of their reflections and the usability characteristics of the environment (Reflections).

On the other hand, the control group completes the ePortfolio construction process, publishes their ePortfolio projects as stand-alone applications, engages in peer assessment and reflects on the process.

It was attempted to explore student's level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009). My intention is to express the level of expertise required to deliver an effective ePortfolio. The experimental and the control group completed their ePortfolio Project and then the researcher attempted to measure the degree to which participants understand, analyze, use the concepts, demonstrate skills and create learning outcomes. **Figure *58*** shows the level that the experimental group who completed 'Artifact 1: Implementation of a stand-alone ePortfolio' and the control group who delivered an ePortfolio were able to (six competency statements about the intended cognitive process):

- Remember the basic concepts of an ePortfolio (artifacts, systems, ownership, reflections)
- Understand the necessity of delivering a dynamic and effective ePortfolio
- Apply an integrated ePortfolio project

- Analyse the aspects and the tools of an ePortfolio project
- Evaluate the levels of sustainability and usability of an ePortfolio Project
- Create a well-organized and responsive ePortfolio based on SRL principles

Findings indicated that experimental group shows high levels of expertise across the continuum of the competency statements (84%-87%). The experimental group was able to remember the basic concepts of ePortfolio as well as to create a well-organized and responsive ePortfolio.

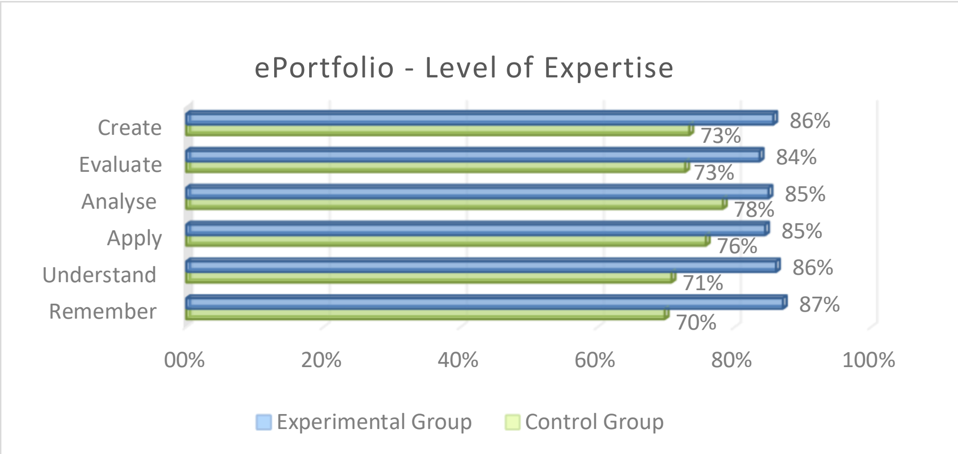


Figure 58. Study#2: Quantitative Analysis of Artifact 1: Implementation of a stand-alone ePortfolio – Experimental and Control Group

The results suggest that the experimental group is confident about the ePortfolio and aims to deliver a robust ePortfolio. On the other hand, the control group shows moderate levels of expertise across the continuum of competency statements (70%-78%). The control group was able to apply and analyze the aspects and tools of an ePortfolio project but fail to remember the basic concepts and to create a well-organized ePortfolio. The results yield that the control group didn't internalize the basic concepts and fail to evaluate and deliver their ePortfolio project.
Probably, the experiment group engaged in the ePortfolio based self-regulated learning (ePSRL) approach and devoted time to edit and deliver various artifacts. Throughout this process, students feel confident about their skills, familiarize with the new learning concepts and engage in the ePortfolio construction process. On the other hand, the control group needed more time to involve in the process and learn the concepts for creating an integrated ePortfolio.

When the experimental group completed 'Artifact 1: Implementation of a stand-alone ePortfolio' and the control group delivered the ePortfolio Project, then they they invited to record their perceptions on a written reflective activity (Artifact 1.1).
The reflective activity attempts to measure specific self-regulatory processes (Microanalytic Protocols- **Table *52***). The coding of the questions is facilitated with a structured scoring rubric.

The reflection activity explores learners' perceptions about the construction process of the ePortfolio and the final learning outcome (e.g ePortfolio Project).

Table 52. Study#2: Microanalytic Protocols of "Reflection Artifact1: Implementation of a stand-alone ePortfolio (A1.1)"

Reflection Activity 1: Implementation of a stand-alone ePortfolio (A1)- Microanalytic Protocols		
SRL Processes	**Reflective Questions**	**Scoring**
Causal Attribution	○ After the completion of the process, do you think that you will continue using and updating your ePortfolio? Explain	5
Activity Judgement	○ Do you think that the information you studied was helpful?	5
Self-evaluation	○ Do you think that your ePortfolio will support your academic and career development?	5

The experimental group is enthusiastic about the ePortfolio process and seems to feel satisfied with the outcome (>90%). On the other hand, the control group is more neutral but express a positive attitude (>84%) (**Figure *59***).

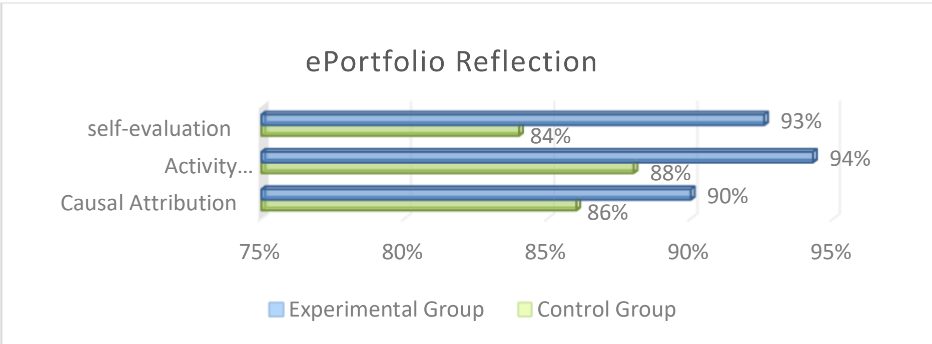


Figure 59. Study#2: Quantitative Analysis of students' reflections about ePortfolio Project (Experimental and Control Group)

Also, students invited to answer two open-ended questions "How do you feel about your performance during the ePortfolio development? Think about your final outcome and write one positive and one negative element of your ePortfolio project?

Figure *60* shows that the 22% of the experimental group and the 26% of the control group believed that their ePortfolio is 'a useful tool' and respectively, the 20% and the 21% admitted that they will 'use to in the future'. The 17% of the experimental group yielded that the ePortfolio help them to learn aspects about their self. Also, the experimental group indicated that the ePortfolio helped them to set goals (14%) and they valued the benefits of this detailed process (13%). On the other hand, the 19% of the control group agreed that this project will support their career development.

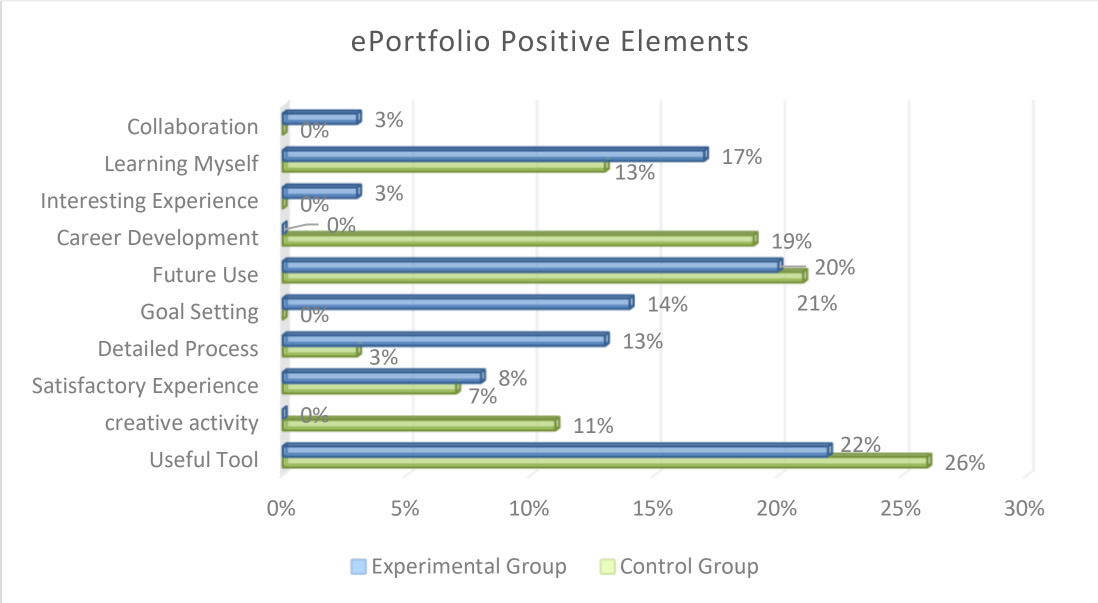


Figure 60. Study#2: Quantitative Analysis of students' reflections about the positive elements of their ePortfolios (Experimental and Control Group)

Figure *61* shows that the 34% of the experimental group and the 42% of the control group agreed that the delivery of an ePortfolio is 'a time-consuming process' and respectively, the 17% and the 14% admitted that they should 'add content and projects'. The 29% of the experimental group believed that their ePortfolio didn't have negative elements but the 17% of the students that there was complicated workload.

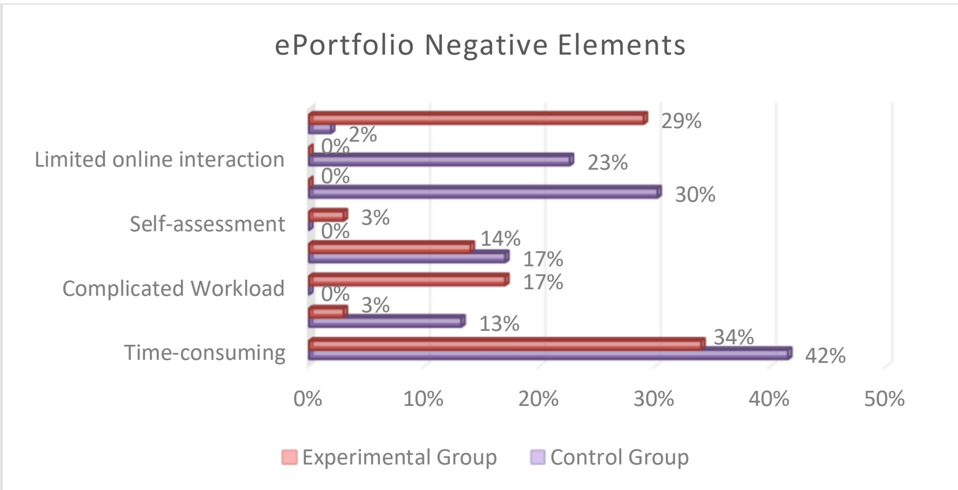


Figure 61. Study#2: Quantitative Analysis of students' reflections about the negative elements of their ePortfolios (Experimental and Control Group)

On the other hand, the 23% of the control group believed that there was limited online interaction and limited face-to-face interaction.

This means that, the majority of the students admire the use of the ePortfolio project and validate it as a useful tool but they fail to realize the benefits of ePortfolio as a tool for strengthening SRL skills (e.g. goal setting, time management, task value, self-monitoring).

4.2.6.7 Reliability Analysis for quantitative data (RQ3)

The goal is to examine the ePortfolio intervention as an effective approach that bolsters SRL processes and investigate the relationship between the ePortfolio use and SRL competency. Research Question (RQ3) addressed in this research is 'Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practise SRL processes?'

To answer RQ3 set within the context of the present research three types of quantitative analysis were conducted and are presented in this section.

First, general observations about the survey results are presented. A reliability analysis was, hence, conducted to measure the instrument's (ePortfolio based Self-Regulated Learning Rubric) internal consistency.

Cronbach's alpha reliability coefficient normally ranges between 0 and 1 (Nunnally & Bernstein, 1994). The Scale in Phase A [Forethought Phase], had a high reliability (Cronbach's Alpha=.890), Scale in Phase B [Performance Control] had a high reliability (Cronbach's Alpha=.824) and Scale in Phase C [Self-Reflection] measure also had a high reliability (Cronbach's Alpha=.837) (**Table *53***).

Table 53. Study#2: Cronbach's a coefficient of ePortfolio based Self-Regulated Learning Rubric

Constructs	Items	Study#2 Experimental Group
Phase A [Forethought Phase]	19	.890
Phase B [Performance Control]	11	.824
Phase C [Self-Reflection]	10	.837

4.2.6.8 Research Question 3- Quantitative Analysis

When students completed their holistic process of designing and implementing their own ePortfolio ("Self-reflection' phase [C]) engaged in the processes of self-monitoring and self-evaluating. Participants assessed whether the proposed ePortfolio system has the potential to support and advance SRL skills (Artifact 24: Self-Assessing My SRL Skills/Competences). They reflected upon their SRL competency and verbalized their perceptions about their SRL (Reflections).

Firstly, descriptive statistics was employed to describe the data collected; in **Table *54*** to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted.

Table 54. Study#2: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio based Self-Regulated Learning Rubric

ePortfolio based Self-Regulated Learning Rubric	**Experimental Group Study#2**		
	M	**SD**	**n**
Phase A [Forethought Phase]	4.10	0.43	70
Phase A. Cognitive Processes	4.11	0.45	70
Phase A. Motivation Processes	4.04	0.53	70
Phase A. Affective Processes	4.17	0.43	70
Phase A. Context Processes	4.18	0.74	70
Phase B [Performance Control]	4.20	0.44	70
Phase B. Cognitive Processes	4.18	0.49	70
Phase B. Motivation Processes	4.23	0.68	70
Phase B. Affective Processes	4.35	0.56	70
Phase B. Context Processes	4.11	0.57	70
Phase C [Self-Reflection]	4.11	0.47	70
Phase C. Cognitive Processes	4.18	0.45	70
Phase C. Motivation Processes	4.34	0.53	70
Phase C. Affective Processes	4.11	0.75	70
Phase C. Context Processes	3.92	0.71	70

The findings suggest that ePSRL system received mean values of above 4.0 across the three SRL phases, which means that the ePortfolio supported SRL almost excellent. Further, the findings indicate that mean values of the Phase A (Mean= 4.10) and C (Mean= 4.11) were equal. Students experiencing the ePortfolio intervention can facilitate their SRL processes. Also, it is interesting that students' mean score in Phase B (Mean=4.20) is very high. This means that students' internalized SRL processes and practice SRL skills.

Pearson's correlation was run to determine the relationship among SRL phases and ePortfolio assessment (**Table *55***). The coefficients of Pearson's correlation revealed that Phase A [Forethought] was positively related to Phase B [Performance Control] and Phase C [Self-Reflection] which indicates that ePSRL system facilitated the cyclic nature of SRL and conceptualized it as a process.

Table 55. Study#2: Pearson's r Correlations between ePortfolio based Self-Regulated Learning and ePortfolio achievement

Variables- Study#2	[1]	[2]	[3]	[4]	[5]	[6]
[1] Phase A [Forethought Phase]	1					
[2] Phase B [Performance Control]	.710**	1				
[3] Phase C [Self-Reflection]	.626**	.755**	1			
[4] ePortfolio Self-Assessment	.031	.049	.073	1		
[5] ePortfolio Tutor's Assessment	-.148	-.005	-.070	.249*	1	
[6] Course Grade	-.021	.080	-.069	.125	.629**	1

4.2.6.9 Research Question 3- Qualitative Analysis

At the end of the ePSRL intervention, the experimental group attempted to assess whether the proposed ePortfolio system has the potential to support and advance SRL skills (Artifact 24: Self-Assessing My SRL Skills/Competences, Instrument: SRL based on ePortfolio based Self-Regulated Learning rubric). They reflected upon their SRL competency and verbalized their perceptions about their SRL (Reflections).

The reflection of "Artifact 24: Self-Assessing My SRL Skills/Competences," investigates learners' perceptions about the development of their SRL skills in the context of the ePortfolio system (***Table 56***) (APPENDIX G: Coding Schemas – Students' Reflections about their SRL skills (Study#2)). Students engaged in a reflective activity where they provided they following open-ended question 'Do you think that the ePortfolio system support you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write a few recommendations to someone that could become an effective self-regulated student.'

Table 56. Study#2: Qualitative Analysis of students' reflections about their SRL Skills/Competences (A24)

Artifact 24 *Self-Assessing My SRL Skills/Competences -Reflections*	*Total* *Numbers of Concepts*
Academic & Career Development	29
Reconsider Mistakes	5
Organizing Learning Path	32
Goal Setting	42
Motivation	26
Collaboration	18
Skills Development	30
Self-Efficacy	32
Time Management	21

Self-Evaluation	23
Learning Strategies	11
Self-Monitoring	17
Help Seeking	19
TOTAL Concepts	305

Figure 62 shows that the 14% of the experimental group agreed that their ePortfolio system supported them to understand and apply the process of 'goal setting' and the 10% admitted that this intervention actively engaged them in organizing their 'learning path', realizing their characteristics, developing their skills and valuing their 'self-efficacy beliefs'.

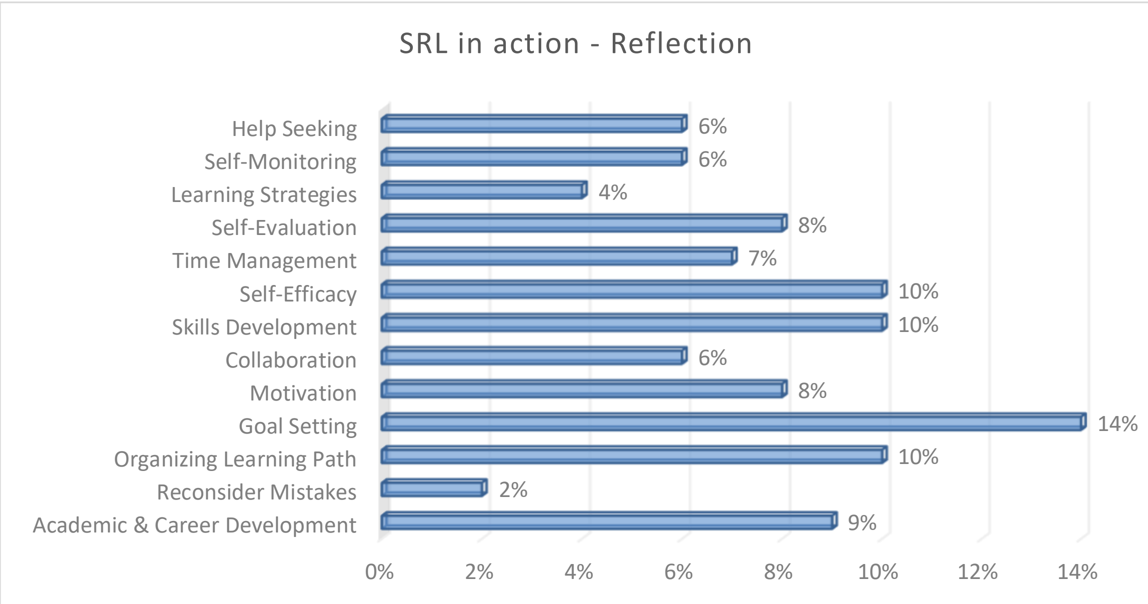


Figure 62. Study#2: Quantitative Analysis of students' reflections about 'Artifact 24: Self-Assessing My SRL Skills/Competences' – Experimental Group

Also, the 9% of the participants admitted that the ePortfolio process advance their academic and career development. The 8% of the students agreed that the process help them manage and direct their motivation, also they engaged in the process of self-evaluation.

On the other hand, only the 2% of the students believed that through the ePortfolio process they were able to 'reconsider their mistakes'. This means that, the majority of the students agreed that the use of the ePortfolio system provided a well-organized manner to engage in SRL processes (e.g. goal setting, self-efficacy, self-evaluation). Also, the ePSRL approach provided a learning opportunity and open new horizons to several important life skills and invited learners to familiarize with concepts such as self-monitoring, motivation, self-management, time management, etc.

Table 57, illustrates students written reflections about their SRL skills. At the end of the process, students attempted to answer the following question: 'Do you think that the ePortfolio system supports you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write your thoughts about this learning experience.' Many students expressed their gratitude for participating in the ePortfolio project and valued this learning experience. They felt that the ePortfolio project supported them to understand and set meaningful goals for managing their academic development

Table 57. Study#2: Students' written reflections about their SRL Skills

Students	Reflections 'Artifact 24: Self-Assessing My SRL Skills/Competences'	Concepts
Student: A. V. – Male [S2_Student_EXPR_2]	*The ePSRL system had a simple structure of learning activities. The set of activities was very pleasant and motivated me to engage in the learning process. Also, the ePortfolio helped me to realize the merits of self-reflection and self-evaluation. Because, when we completed the activities we invited to self-reflect and record our thoughts and ideas.*	*Motivation* *Self-reflection* *Self-evaluation*
	Number of concepts	***3***
Student: V. T. – Male [S2_Student_EXPR_3]	*When I initiated the ePSRL approach, I thought that the workload was high and I felt that it was difficult to follow the path. But now that I completed my ePortfolio, I believe that this process taught me how to set my goals, organize my academic and career path and realize my self-image.*	*Goal Setting* *Academic & career development* *Self-efficacy*
	Number of concepts	***3***
Student: Z. M. – Female [S2_Student_EXPR_17]	I *think the whole process worked positively because I learned to manage my time, to study following a structured plan, to self-evaluate my skills and use my assets.*	*Time management* *Organizing Learning Path* *Self-evaluation*
	Number of concepts	***3***
Student L. M. – Female [S2_Student_EXPR_35]	*The ePSRL approach helped me to discover aspects of myself, to advance my skills, to set smart goals and find ways to implement them, to match my skill to my career development.*	*Goal Setting* *Organizing Learning Path* *Academic & career development*

	Number of concepts	**3**
Student T. V. – Male [S2_Student_EXPR_63]	*I believe that the ePSRL helped me to identify what is self-regulated learning and prompted me to organize my learning path based on the proposed artifacts. I activated my interest and attempted to manage my academic and career development.*	*Organizing Learning Path* *Motivation* *Academic & career development* *Skills development*
	Number of concepts	**4**

After the completion of the experimental procedure, participants completed a 'Post ePortfolio-Intervention Review', that consisted of six open-ended questions. The goal of this instrument is to record students' perceptions about the ePortfolio process and the levels of satisfaction.

The experimental and the control group were invited to record the positive characteristics of the ePortfolio process and explain 'Why this was a positive experience?' (**Figure *63***).

The 13% of the experimental group admitted that one positive element of the ePortfolio intervention was the organized learning content. In addition, the experimental group agreed that among the positive characteristics of the ePortfolio intervention was the creation of a learning community (11%) and actions for becoming a better version of myself (10%). On the other hand, the control group indicated that among the positive characteristics of the ePortfolio was career development (26%), self-presentation (23%) and support of academic path (20%).

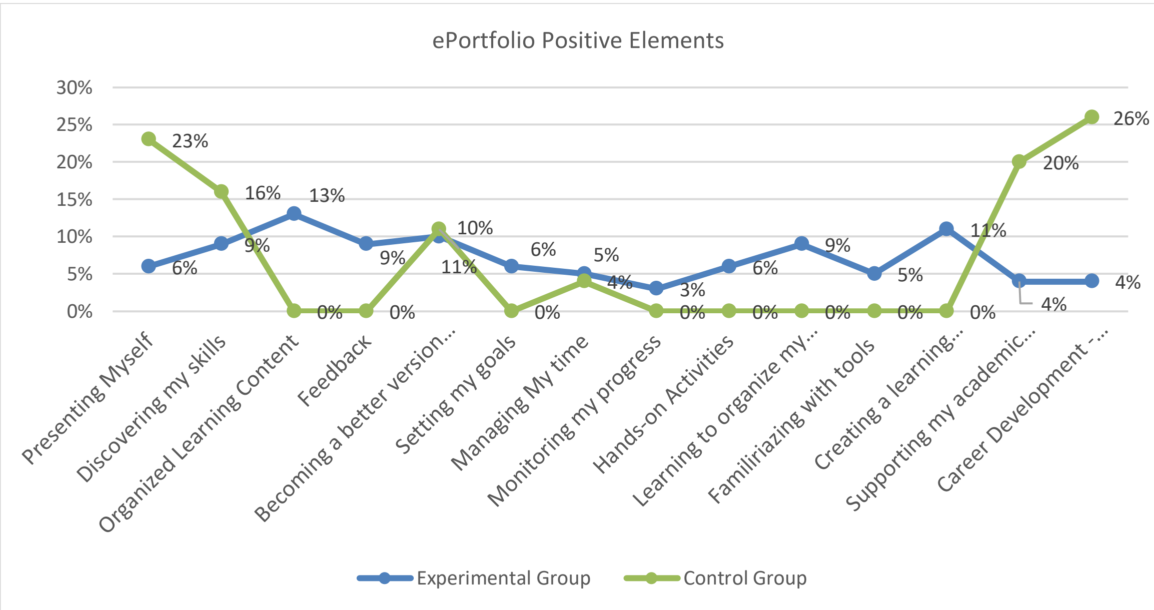


Figure 63. Study#2: Positive Characteristics of the ePortfolio intervention (Experimental and Control Group)

The majority of the participants (Experimental and control group) admitted that they hold a positive viewpoint about the ePortfolio process and had a positive attitude towards the ePortfolio experience.

Students were invited to record the negative characteristics of the ePortfolio process and explain 'Why this was a negative experience?' (**Figure *64***).

The 42% of the experimental group agreed that the workload was pressing and the time schedule had short-term deadlines. Also, the experimental group agreed that among the negative characteristics of the ePortfolio intervention was the practice of time management.

The 18% of the control group admitted that they found difficulties in managing time and structuring the ePortfolio. On the other hand, both groups agreed that the ePortfolio implementation didn't have negative characteristics.

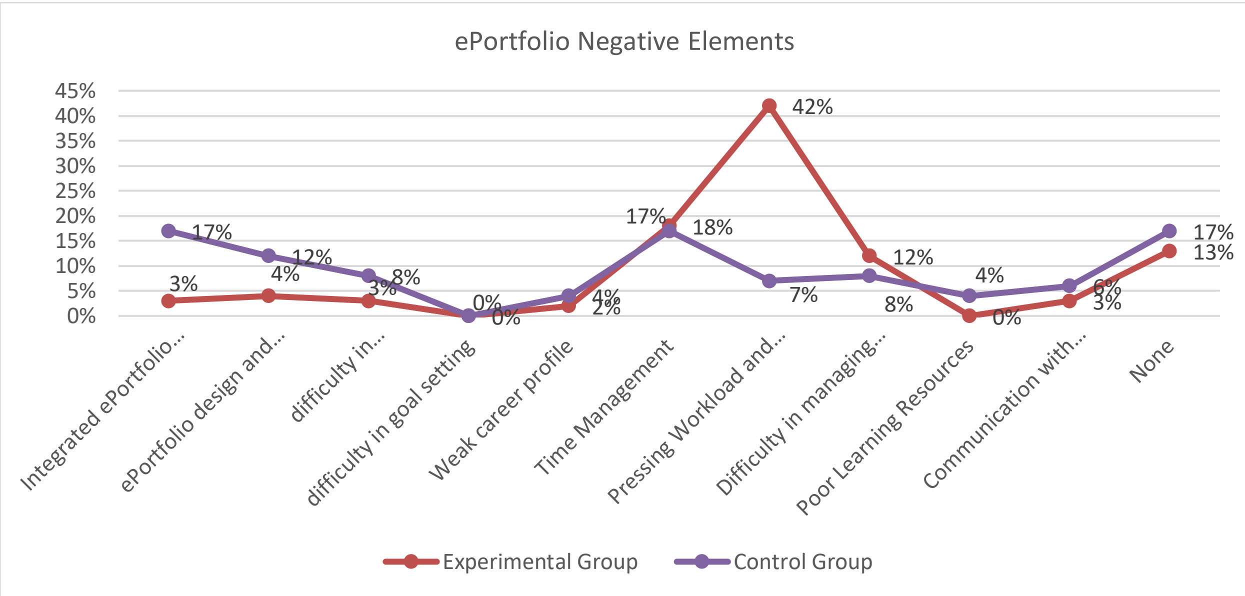


Figure 64. Study#2: Negative Characteristics of the ePortfolio intervention (Experimental and Control Group)

Participants invited to submit a comment 'What do you think should be added, changed or removed from the ePortfolio Project?' (**Figure *65***).

The experimental group yielded that among the future suggestions about the ePortfolio intervention was that the time schedule should allocated according to the workload (42%) and should be added ePortfolio examples (12%). The control group admitted that among the future suggestions about the ePortfolio was the delivery of an integrated learning management system (19%) that will support learners' interaction (16%). The 16% of the experimental group and the

18% of the control group agreed that they couldn't provide suggestions for future ePortfolio implementation.

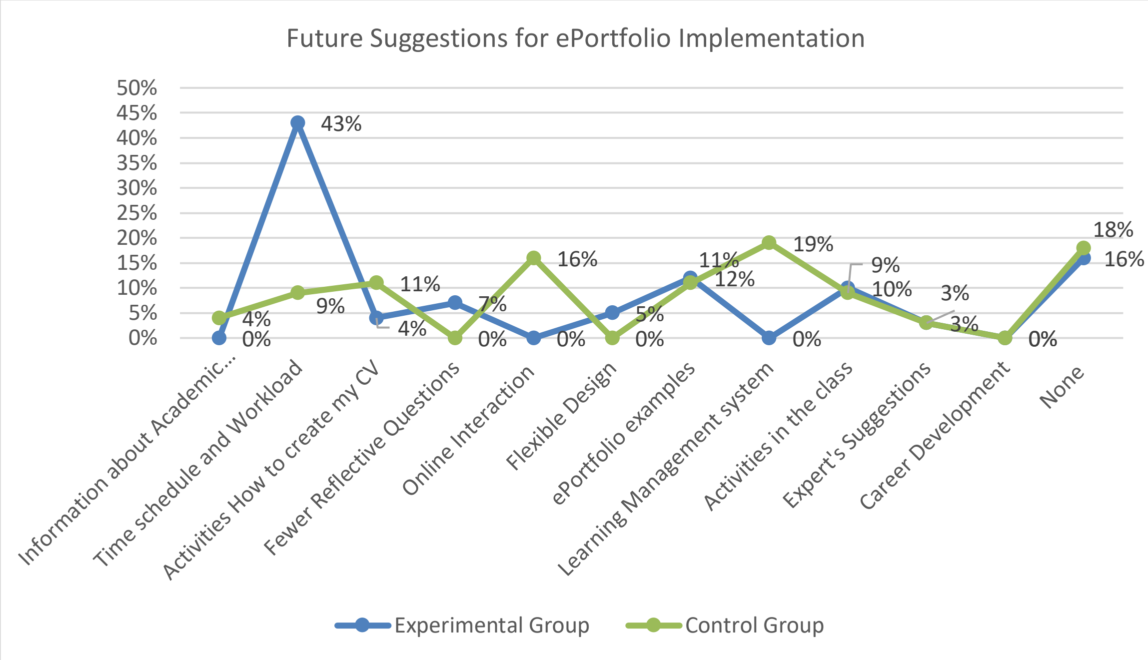


Figure 65. Study#2: Future Suggestions about ePortfolio Intervention

The 100% of the experimental group and the 91% of the control group agreed that the teachers, administrators and tutors were very helpful and positive (**Figure *66***). The ePortfolio interaction was very positive among participants. Both groups suggested that the active communication and continuous feedback supported them to complete their projects.

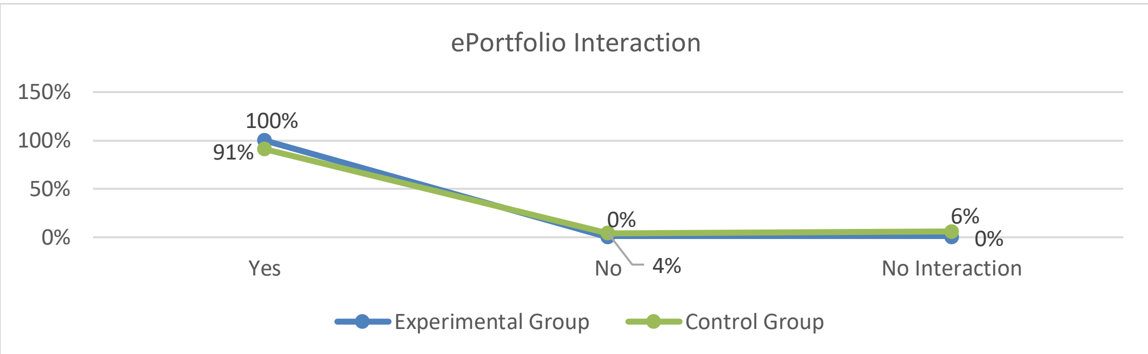


Figure 66. Study#2: ePortfolio's Interaction and feedback

Finally, the 94% of the experimental group highlighted that they would like to continue using their ePortfolio (**Figure *67***). On the other hand, the 75% of the control group noted that probably they will use their ePortfolio after the completion of the intervention. All participants indicated that this is a valuable tool that will help them to organize their studies, manage their skills and market themselves to future employers.

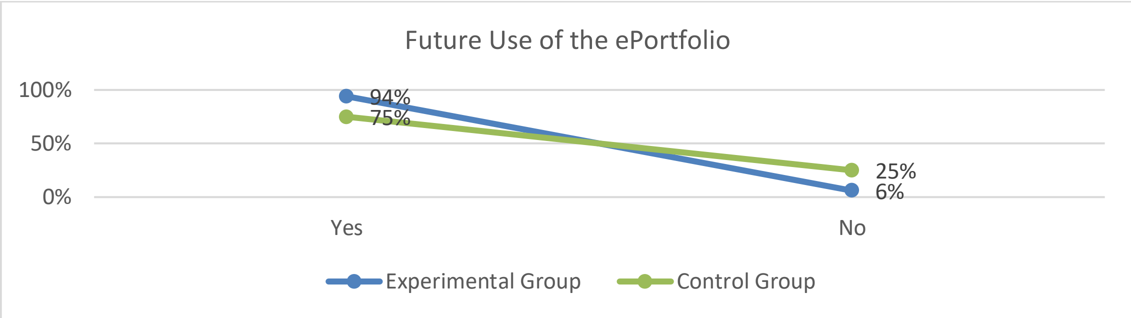


Figure 67. Study#2: Future Use of the ePortfolio

Table 58, illustrates students written reflections about their ePortfolio experience. At the end of the intervention, students attempted to analyze their thoughts and write a final remark: 'Write your final comment, idea or concluding remark about the ePortfolio construction process.'

Table 58. Study#2: Students' written reflections about their ePortfolio experience

Students	Concluding Remarks
	Experimental Group
Student M. H. - Male	*The ePortfolio activities supported me throughout the semester. All the activities helped me to organize myself and follow a specific time schedule. I think that this is very important for my future career path.*
Student K. D. - Male	*This learning experience showed me a way of elaborating different tasks. Also, helped me monitor the level of integration, to be more cooperative and more open to my peer-students and teachers, to discuss, to set questions and to interact. Also, I felt stronger as I kept evaluating my abilities and skills and now I feel confident and ready to deal with failure or success.*
Student K. A. - Male	*It is very important that the ePortfolio system encompasses various tools. I enjoyed to communicate, collaborate and interact with my peers for completing the assignments.*
Student P. P. - Male	*All the activities and the material helped me understand the importance of being a responsible and organized student in university. I believe I have been able to improve my self-regulatory skills, manage my academic development and I hope to take my degree.*
	Control Group
Student A. C. - Male	*This is a helpful tool but needs time and effort.*

Student B. D. - Male	*I think it was a beautiful experience and a challenging tool that I will remember throughout my academic studies.*
Student P. A. - Female	*The implementation of the ePortfolio helped me a lot in organizing my time and academic study.*

4.3 Study#3

This section outlines the implementation of an ePortfolio intervention (ePortfolio System-Version 2) for HE in order to support individuals (postgraduates and professionals) to enhance SRL skills, manage their knowledge, skills, attitudes and develop their academic and career path. Specifically, Study#3 describes the third cycle of testing the ePortfolio intervention.

4.3.1 Purpose of Study#3

Based on Study's#2 findings, design principles and insights, I tried to test the ePSRL approach (conceptual framework and ePortfolio system- version 2). Study#2 noted that a challenging issue, is the delivery of an ePortfolio intervention for HE in order to support students and future graduates to identify aspects of self, analyse their skills, foster SRL skills, manage academic achievement and develop their career path.

Study#3 is part of the broader design-based and describes the third cycle of testing the ePortfolio intervention (Prototype Stage). The aim is to empower post-graduate students to self-regulate their learning, develop their sense of time management, achieve their life aspirations and manage their well-being through the process of structuring an ePortfolio. Thus, this study will attempt to evaluate the ePSRL approach (third cycle of testing the ePortfolio system), reflect on the results and develop a set of educational affordances for future implementation.

4.3.2 Research Question

The **Research Questions (RQs)** addressed in this research are as follows:

***RQ1**- Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?*

***RQ2-** How does the ePortfolio intervention impact academic achievement?*

***RQ3-** Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support postgraduate students to metacognitively practise SRL processes?*

4.3.3 Research Design

Study#3 follows the principles of design-based research. In preliminary stage, I conducted a thorough review of the current literature on ePortfolios, ePortfolio construction process, ePortfolio platforms, Self-Regulated Learning, Self-regulated learning models, self-regulated learning processes. In prototype stage, I tested the conceptual framework (version 1) through a social networking ePortfolio system for HE. The findings of Study#1 highlighted the need of re-designing the conceptual framework and re-calibrating the ePortfolio system (version 2). In Study#2, I described the second iteration of the prototype stage (version 2).

In Study#3, I attempt to describe the third iteration of the prototype stage, where the ePortfolio-based self-regulated learning (ePSRL) approach was re-visited (see Chapter 3) and tested through the ePortfolio system (version 2) for postgraduate students.

A mixed methods research was employed as the methodology and the data analysis will be based on the triangulation design using parallel phases for converging both quantitative (numeric) and qualitative (text) data (**Figure *68***).

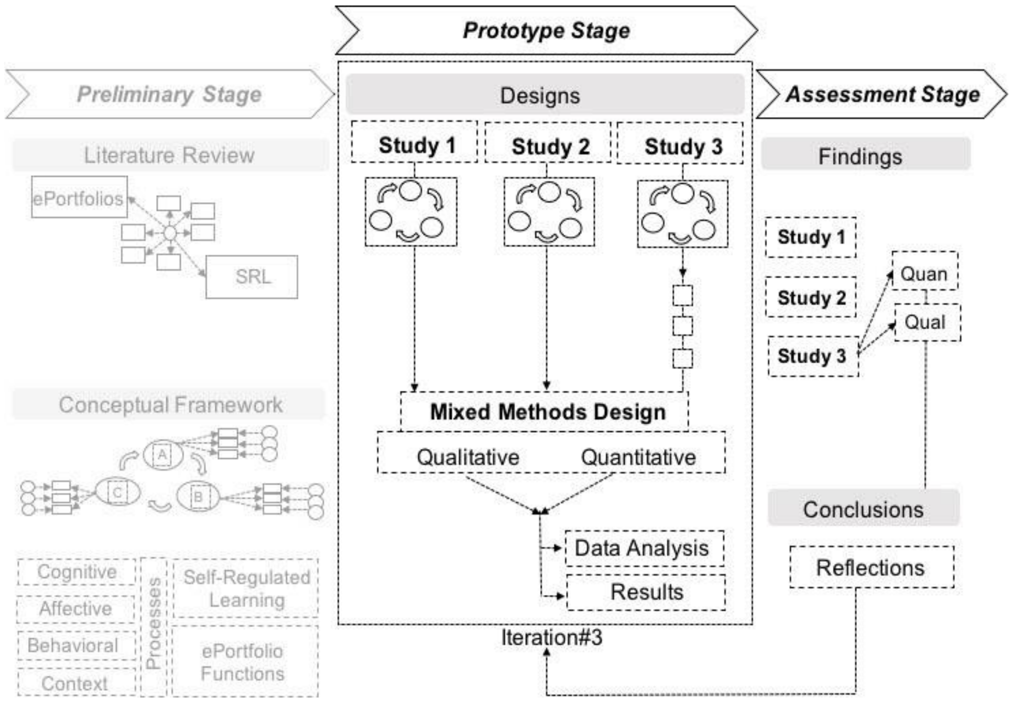


Figure 68. Study#3: Description of the Mixed Methods Research Design

In Study#3, the data gathering procedures performed with a wide range of instruments for quantitative and qualitative data (See chapter 4.2.3 Research Design).

4.3.4 Participants

The participants in **study III** were 28 higher education students (18 males and 10 females). The sample of study III comprised postgraduate students (One-Group Only Research) at a computer science department of a Greek university. Their average age was 26 years. The sample of the study voluntarily signed up for acquiring new knowledge and enriched experiences through the implementation of the ePortfolio Project. The participation wasn't a prerequisite for passing course or taking credits (ECTS). The duration of the study was a 10-week period.

4.3.5 Experimental Design and Procedure

Study#3 adopted a design with one-Group (e.g. Experimental Group), as well as pre-testing, during and post-testing, as shown in ***Table 59***. The purpose of the experimental design was to test the ePortfolio intervention (version 2- Iteration 3), provide valuable insights about the process and the ePortfolio system.

Table 59. Study#3: Description of the Experimental Design

Group	*Subject Numbers*	*Pretest*	*Intervention*	*Posttest*	*Duration*
Experimental Group	28	Questionnaire about SRL skills Prior ePortfolio experience	Engaging in the ePortfolio-based self-regulated learning approach (ePSRL) through a social networking ePortfolio system	Questionnaire about SRL skills ePortfolio Rubric ePortfolio based Self-Regulated Learning Rubric ePortfolio Reviews ePortfolio based Self-Regulated Learning Review	10 Weeks
			During		
			Student's level of cognitive development SRL Microanalytic Protocols Log Files		

Postgraduate students enter the ePortfolio system and follow the SRL phases which consisted of several learner-centred activities, reflective questions and peer discussions. One instructor guided the experimental group through the procedure and provided timely feedback. Also, participants attended two face-to-face workshops (**Figure *69***).

Week# 1

The experimental group attends a face-to-face workshop for introducing on the themes of the ePSRL Project. Before the workshop, students completed a web-based questionnaire about their prior ePortfolio experience. During the meeting, students informed about the process (familiarizing with the four learning modules and the ePortfolio construction process) and created their ePortfolio accounts in order to familiarize with system's functionalities. The ePortfolio tutor informed users that they should login in the ePortfolio system for monitoring the timetable, viewing learning activities, checking about calendar updates, using micro-blogging tools and interacting with their peers and instructors.

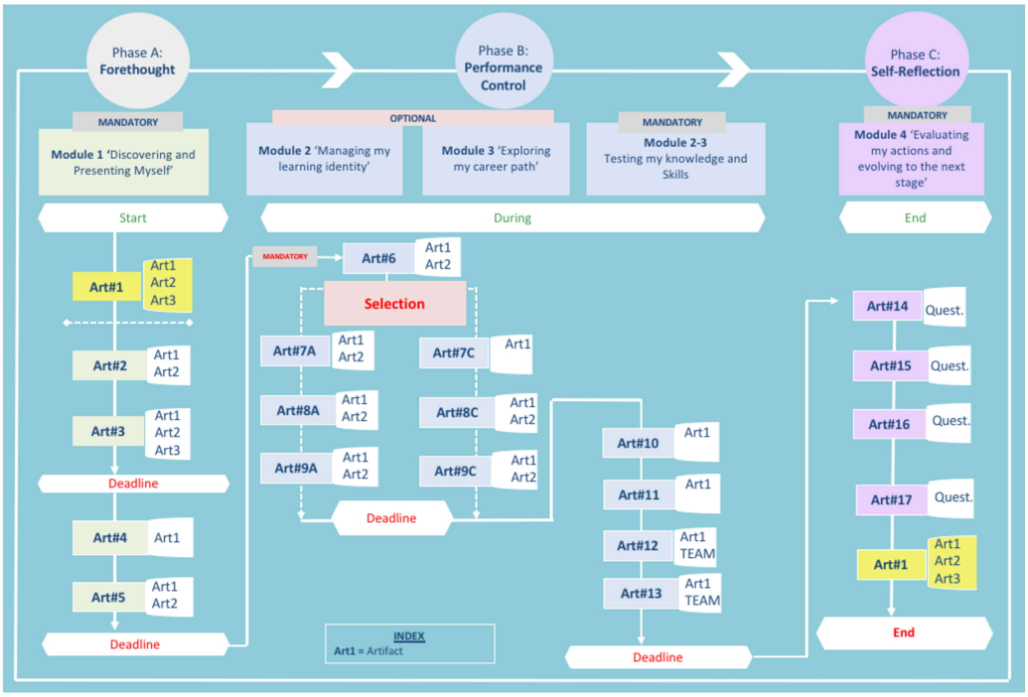


Figure 69. Study#3: The workflow of the learning activities

Weeks# 2-4

Students (experimental group) enter in the ePortfolio system and follow SRL phases in the context of the ePSRL approach. Students familiarize with the system, set up their profiles, change their profile pictures, write about their skills and interests, connect to peers and create their learning community. Students initiate the ePortfolio construction process as they enter the SRL cycle following a cyclical order of three major SRL phases and get involved in a set of activities:

Phase A - The 'Forethought' phase illustrates a learning path that guides learners to discover aspects of their self and present their skills. Students are invited to select and implement artifacts for understanding and applying SRL processes. In the context of Module 1 'Discovering and Presenting Myself', students have the opportunity to discover their skills and personal characteristics, to set their goals, to select strategies for accomplishing their goals, to explore their motivations, to learn how to be dynamic decision makers and organize their life plan (Artifacts 2-8). Students can choose among different activities and develop artifacts that correspond to their academic expectations, motivations and career aspirations.

Weeks# 5-8

The experimental group follows the SRL cycle and enters *Phase B- The 'Performance Control'* phase which consists of the processes for elaborating on and delivering specific tasks (individual and group mode) that can be embedded in the ePortfolio. Learners continue their ePortfolio construction through Module 2: 'Managing my learning identity' were they develop artifacts that advance their academic performance. Learners are able to select specific artifacts based on preferences and their learning needs. In Module 2, learners attempt to discover their learning strategies, regulate their skills and boost their performance (Artifacts 9-13). In Module 3 'Exploring my career path', learners can structure artifacts for designing their academic and career path. Through this process, learners could select specific artifacts that correspond to their academic expectations, motivations and career aspirations (Artifacts 14-18). Each user enters the ePortfolio system, reads the activities, elaborates on the learning content, analyses the tasks and uploads his/her deliverables on the 'Pages' tool. The system allows users to customize their 'Pages' and enables them to edit their deliverables in order to present an effective outcome.

Weeks#9-10

The experimental group follows the SRL cycle and enters in Phase C - *'Self-reflection' phase* which consists of processes for self-monitoring and self-evaluating. Students complete ePSRL approach through Module 4 'Evaluating my actions and evolving to the next stage' and reflect on the artifacts that created throughout the process. This module enables self-judgement through the use of self- and peer-assessment rubrics. Thus, they reflect upon the artifacts and the learning decisions. Learners elaborate and complete all the artifacts (without a fixed order) in order to assess their performance and control their goals (Artifacts 19-25).

Week#10

In parallel (Weeks#1-10), learners engage in "Activity 1: Implementation of a stand-alone ePortfolio", which is a holistic process of designing and implementing a customized ePortfolio that is a stand-alone application prompting users to collect and present appropriate artifacts for structuring their academic and professional profile

Finally, students invited to attend the final face-to-face workshop where they complete the post-test rubrics and interact with their tutor and peers for exchanging opinions about the intervention and their performance.

4.3.6 Results

For the needs of Study#3, we gathered two different sources of data: quantitative and qualitative so as to deliver a coherent and robust result and the statistical analysis of the data conducted with the 'Statistical Package for Social Sciences (SPSS) v. 20.0'.

Before the intervention, post-graduate students invited to fill in 9 close-ended questions (Yes/No) and one open-ended question (Prior ePortfolio Experience Rubric). The goal of this instrument is to identify if postgraduate students had prior ePortfolio experience and discover their expectations about the project.

Figure 70, presents students' positive answers (Yes) about their prior ePortfolio experience and their expectations of the project. All participants (100%) admitted that they participate for supporting their academic development, gaining new knowledge and exploiting a useful tool. Also, the 82% of the students suggest that they have a positive first impression and feel confident for completing the process (71%). Only the 14% of the post-graduate students had prior experience in using ePortfolios.

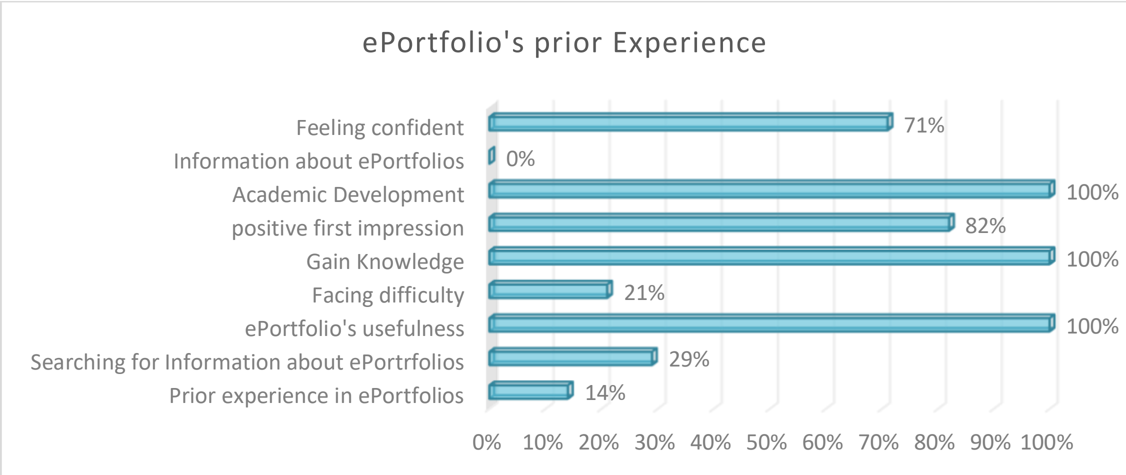


Figure 70. Study#3: ePortfolio's Prior Experience (postgraduate students)

Also, students answered the open-ended question 'Why do you participate in the ePortfolio Intervention?' (**Figure *71***). The 47% of the post-graduate students yielded that it is a challenging and interesting task to deliver and maintain an ePortfolio. Also, the 25% of the participants admitted that they want to gain knowledge and advance their skills. It is interesting that only the 4% of the participants indicated that they participate for taking better grades.

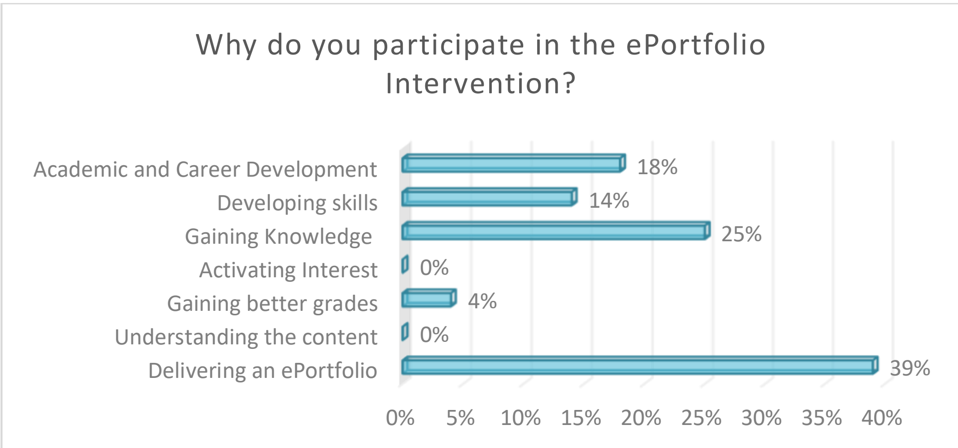


Figure 71. Study#3: 'Why do you participate in the ePortfolio Lab?'

4.3.6.1 Reliability Analysis for quantitative data (RQ1)

Research Question (RQ1) addressed in this research is '*Does the ePortfolio based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?*

To answer RQ1 set within the context of Study#3 three types of quantitative analysis were conducted and are presented in this section. The goal is to examine whether the use of the ePSRL system influences postgraduate students' SRL and explore the relationship between SRL processes and ePortfolio experience.

First, general observations about the survey results are presented. A reliability analysis was, hence, conducted to measure the instrument's (Questionnaire about SRL skills-MSLQ) internal consistency (Pintrich et al., 1991). The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale (Nunnally & Bernstein, 1994).

Along these lines, Scale A: Motivation, had an acceptable reliability (Cronbach's Alpha=.64) and Scale B: Learning Strategies measure had a high reliability (Cronbach's Alpha=.91) (**Table *60***). The Cronbach's a values for Value Components, Expectancy Components, Affective Components, Cognitive and Metacognitive Strategies and Resource Management Strategies in this study were .79, .78, .51, .84 and .74, respectively, exceeding the threshold of .5. The Cronbach's coefficient alpha values for five subscales were all larger than 0.50, presenting an acceptable reliability for each scale (Nunnally, 1978).

Table 60. Study#3-Cronbach's a Coefficient

Questionnaire about SRL skills-MSLQ		
Scales	**Items**	**α**
Scale A: Motivation	31	.641
Value Components	16	.793
Intrinsic Goal Orientation	4	.725
Extrinsic Goal Orientation	4	.606
Task Value	8	.788
Expectancy Components	12	.785
Control Beliefs	4	.365
Self-Efficacy	8	.846
Affective Components	5	.512
Test Anxiety	5	.412
Scale B: Learning Strategies	50	.910
Cognitive and Metacognitive Strategies	31	.846
Rehearsal	4	.569
Elaboration	6	.727
Organization	4	.108
Critical Thinking	4	.805
Metacognitive Self-Regulation	12	.719
Resource Management Strategies	19	.741
Time Management	8	.368
Effort Regulation	4	.187

Peer Learning	3	.684
Help Seeking	4	.642

4.3.6.2 Research Question 1- Quantitative Analysis

It was conducted a paired samples t-test to check for the possible differences in post-graduates' perceptions before and after the intervention. Descriptive statistics was employed to describe the data collected. ***Table 61*** indicates that after the completion of the ePortfolio project the experimental group appeared to have a significant increase on the means across all the variables of Scale A: Motivation.

Specifically, **Table *61*** indicates that the experimental group appeared to have a significant increase on the means across the Scale A: Motivation $t(27) = -7.80$, $p < 0.01$. This finding is consistent with accounts from prior studies that there is a positive relationship between motivation and ePortfolio (Lopez-Fernandez & Rodriguez-Illera, 2009, Huang & Yang, 2012). A detailed observation indicates that the experimental group appeared to have a significant increase on the means across Value Components: Intrinsic Goal Orientation, Extrinsic Goal Orientation, Task Value, Expectancy Components: Control Beliefs, Self-Efficacy and Affective Components: Test Anxiety.

The contrast in the 'Intrinsic Goal Orientation' between the pre-test and post-test was significant, $t(27) = -3.98$, $p < 0.01$. Results indicate that after the completion of the ePortfolio implementation, students' intrinsic motivation improved. This means that students displayed interest in the ePortfolio workload for reasons such as challenge, curiosity, enjoyment and mastery.

Table 61. Study#3: Paired Samples t-test – Scale A: Motivation

Paired Differences										
		Pre-Test		**Post-Test**						
Variables	**N**	**M**	**SD**	**M**	**SD**	**95% CI for Mean Difference**		**p-value**	**t**	**df**
Scale A: Motivation	28	3.25	.295	4.07	.450	-1.033	-.603	.000	-7.808	27
Value Components	28	3.50	.336	4.28	.406	-.994	-.575	.000	-7.690	27
Intrinsic Goal Orientation	28	3.98	.597	4.49	.438	-.771	-.247	.000	-3.988	27
Extrinsic Goal Orientation	28	3.01	.658	3.87	.741	-1.213	-.502	.000	-4.949	27
Task Value	28	3.49	.466	4.48	.367	-1.245	-.731	.000	-7.899	27
Expectancy Components	28	3.35	.392	4.22	.419	-1.090	-.656	.000	-8.244	27
Control Beliefs	28	3.32	.526	4.14	.533	-1.137	-.506	.000	-5.345	27
Self-Efficacy	28	3.37	.456	4.29	.478	-1.155	-.693	.000	-8.199	27
Affective Components	28	2.92	.642	3.77	.757	-1.271	-.425	.000	-4.112	27
Test Anxiety	28	2.92	.642	3.77	.757	-1.271	-.425	.000	-4.112	27

Furthermore, the contrast in the ‘Extrinsic Goal Orientation’ between the pre-test and post-test was significant, $t(27) = -4.94$, $p < 0.01$. Results indicate that post to the completion of the procedure, students’ extrinsic motivation also improved. A significant indicator of extrinsic motivation is the acquisition of excellent grades and achieving high performance. The results indicate that the experimental group appeared to have a significant increase on the means across ‘Task Value’ $t(27) = -7.89$, $p < 0.01$. Results indicate that after the intervention, students showed that the process of constructing their ePortfolio was a meaningful process and helped them realize their own process of learning. Participants also believed that the learning content was meaningful and well-organized, and they could apply what they had learned during their academic studies.
Table 62 indicates that the experimental group appeared to have a significant increase on the means across the Scale B: Learning Strategies namely: Cognitive & Metacognitive Strategies: Rehearsal, Elaboration, Organization, Critical Thinking, Metacognitive Self-Regulation and Resource Management Strategies: Time Management, Effort Regulation, Peer Learning, Help Seeking.

Table 62. Study#3: Paired Samples t-test – Scale B: Learning Strategies

Paired Samples t-test Differences										
		Pre-Test		Post-Test						
Variables	**N**	**M**	**SD**	**M**	**SD**	**95% CI for Mean Difference**		**p-value**	**t**	**df**
Scale B: Learning Strategies	28	3.29	.355	4.05	.401	-.945	-.578	.000	-8.518	27
Cognitive & Metacognitive Strategies	28	3.45	.425	4.22	.408	-.974	-.578	.000	-8.047	27
Rehearsal	28	3.48	.673	4.13	.583	-.962	-.324	.000	-4.131	27
Elaboration	28	3.57	.436	4.28	.484	-.947	-.469	.000	-6.081	27
Organization	28	3.68	.659	4.44	.370	-1.044	-.474	.000	-5.469	27
Critical Thinking	28	3.24	.581	4.21	.559	-1.226	-.717	.000	-7.823	27
Metacognitive Self-Regulation	28	3.27	.473	4.07	.450	-1.027	-.574	.000	-7.241	27
Resource Management Strategies	28	3.13	.341	3.88	.447	-.943	-.549	.000	-7.780	27
Time Management	28	3.12	.373	4.05	.369	-1.121	-.736	.000	-9.886	27
Effort Regulation	28	2.78	.432	3.44	.599	-.961	-.361	.000	-4.520	27
Peer Learning	28	3.31	.536	4.11	.748	-1.132	-.463	.000	-4.895	27
Help Seeking	28	3.31	.507	3.91	.691	-.870	-.326	.000	-4.511	27

The results suggest that the experimental group appeared to have a significant increase on the means across the Scale B: Learning Strategies $t(27) = -8.51$, $p < 0.01$. This finding is consistent with accounts from prior studies that students need training to learn how to use strategies and display a high level of SRL in their ePortfolios (Abrami et al., 2008; Cheng & Chau, 2012).

Pearson's correlation approach was also performed to examine the relationships between the SRL processes and ePortfolio assessment level as well as between SRL processes and the course grade. Our intention was to examine whether our variables were linearly related in order to promote learning and support students for structuring their ePortfolios. **Table *63*** and **Table *64*** revealed that correlation coefficients for all the items were significant, which meant that each item possessed adequate internal consistency.

Table 63 shows various significant intercorrelations between constructs in Scale A: Motivation. The most significant intercorrelations are between Expectancy components and Motivation (0.608). Also, Extrinsic Goal orientation and Value components (0.85), Task Value and Value components (0.78), Expectancy Components and Control Beliefs (0.84), Expectancy Components and Self-efficacy (0.80). Also, there is high correlation between course grade and ePortfolio Assessment (0.76).

Table 63. Study#3: Pearson r Correlations – Scale A: Motivation

Variables	1	2	3	4	5	6	7	8	9	10	A	B
(1) Motivation	1											
(2) Value Components	.493**	1										
(3) Intrinsic Goal Orientation	.410*	.672**	1									
(4) Extrinsic Goal Orientation	.389*	.859**	.274	1								
(5) Task Value	.360	.780**	.479**	.502**	1							
(6) Expectancy Components	.608**	.663**	.550**	.485**	.563**	1						
(7) Control Beliefs	.547**	.504**	.422*	.384*	.392*	.849**	1					
(8) Self-Efficacy	.457*	.602**	.494**	.423*	.551**	.807**	.374	1				
(9) Affective Components	.419*	.196	-.104	.297	.173	.173	.165	.119	1			
(10) Test Anxiety	.419*	.196	-.104	.297	.173	.173	.165	.119	1.00**	1		
(A) ePortfolio Assessment	-.045	.339	.007	.464*	.181	.068	-.082	.211	.411*	.411*	1	
(B) Course Grade	-.135	.407*	.111	.456*	.295	-.010	-.108	.103	.306	.306	.767**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

Table *64* shows various highly significant intercorrelations between constructs in Scale B: Learning Strategies. The most significant intercorrelations are between learning strategies and cognitive and metacognitive strategies (0.93), elaboration (0.85), resource management strategies (0.94) and peer learning (0.87). Also, there intercorrelation between cognitive strategies and rehearsal strategies (0.81), elaboration (0.91), critical thinking (0.82) and metacognitive self-regulation (0.82).

Table 64. Study#3: Pearson r Correlations – Scale B: Learning Strategies

Variables	11	12	13	14	15	16	17	18	19	20	21	22	A	B
(11) Learning Strategies	1													
(12) Cognitive S	.931**	1												
(13) Rehearsal	.694**	.819**	1											
(14) Elaboration	.855**	.914**	.669**	1										
(15) Organization	.732**	.789**	.445*	.746**	1									
(16) Critical Thinking	.774**	.821**	.571**	.740**	.539**	1								
(17) Metacognitive SR	.840**	.824**	.626**	.669**	.708**	.503**	1							
(18) RM Strategies	.942**	.754**	.496**	.698**	.591**	.637**	.752**	1						
(19) Time Management	.696**	.526**	.269	.522**	.483**	.429*	.543**	.768**	1					
(20) Effort Regulation	.380*	.259	.281	.057	.222	.106	.435*	.445*	.267	1				
(21) Peer Learning	.872**	.718**	.428*	.732**	.515**	.683**	.645**	.907**	.627**	.174	1			
(22) Help Seeking	.791**	.668**	.431*	.686**	.520**	.586**	.579**	.808**	.542**	-.047	.777**	1		
(A) ePortfolio Assessment	-.031	.034	.118	.064	.003	-.020	-.045	-.086	-.231	-.063	-.086	.048	1	
(B) Course Grade	-.101	-.048	-.069	.073	.054	-.093	-.135	-.138	-.140	-.074	-.124	-.085	.767**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

The results yielded that there are correlations between metacognitive self-regulation and resource management strategies (0.75) as well as between help seeking and resource management strategies (0.80).

4.3.6.3 Research Question 1- Qualitative Analysis

To answer the research question (RQ1) set within the context of the present research qualitative analysis was conducted and is presented in this section.

During the ePortfolio intervention, the experimental group engaged in a set of learning tasks (Conceptual Framework v.2- ePortfolio based self-regulated learning (ePSRL) approach) in order to learn how to self-regulate their actions, to construct their own ePortfolio and promote their academic development and career orientation (***Figure 49***).

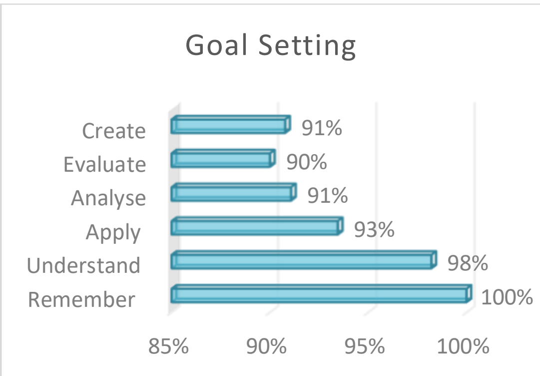
We selected artifacts A3, A7, A9, A10 and A15 of ePSRL approach for investigating the use of SRL processes and the levels of achievement in ePortfolio use.

It was attempted to explore student's level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009). My intention is to express the level of expertise required to complete ePSRL approach and deliver an effective ePortfolio. For the needs of this research, we defined six competency statements about the intended cognitive process (remember, understand, apply, analyze, evaluate and create). Each statement is a measurable learning outcome that measures the degree to which participants understand, analyze, use the concepts, demonstrate skills and create learning outcomes. Furthermore, it was attempted to investigate the written reflections that accompanied artifacts A3.1, A7.1, A9.1, A10.1 and A15.1 (***Figure 49***).

In "*Artifact 3: Goal Setting (A3)*" participants set specific, measurable, achievable, realistic and time specific goals in order to accomplish short and long-term activities in an academic, professional and personal context. ***Figure 72*** suggests that the experimental group appeared to have differences among the levels of the continuum of the learning outcomes. Specifically, from the students who completed "Artifact 3: Goal Setting (A3)":

- 100% of students remember to use the syntax of a S.M.A.R.T (Specific, Measurable, Attainable, Realistic, Timely) goal.
- 98% of the students understand the basic components of a S.M.A.R.T. This means that students couldn't recall the basic concepts of goal setting but they understood the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely).
- 93% of the students apply and set their S.M.A.R.T goals.
- 91% of the students analyse the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely). The results show that students find difficult to analyse their intended outcomes and produce elaborated plans.
- 90% of the students evaluate their capability of setting sustainable goals
- 91% of the students create Specific, Measurable, Attainable, Realistic, Timely goals.

It is observed that students of the experimental group achieved high levels of expertise across the continuum of the learning outcomes. This activity seems to support learners to understand and apply S.M.A.R.T goals. Post-graduate students were determined to complete the goal setting activity and achieve high levels of expertise. The findings indicate that the goal setting activity helped learners to remember, understand, apply, analyse and create S.M.A.R.T, but they need more time and training to be able to evaluate accurately their goals and their strategic planning.



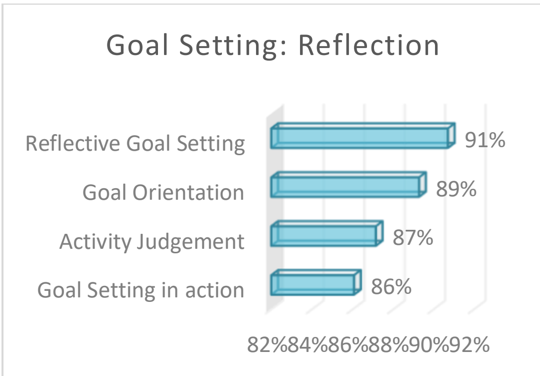


Figure 72.Study#3: Quantitative Analysis of Artifact 3: Goal Setting

When students completed “Artifact 3: Goal Setting (A3)”, they invited to record their perceptions on a written reflective activity (Artifact 3.1). The ‘Reflection Activity’ consists of open-ended questions that measure the effects of SRL processes across the ePortfolio based self-regulated learning (ePSRL) approach. The reflective activity is linked to the objectives and context of Artifact 3: Goal Setting and attempts to measure specific self-regulatory processes (Microanalytic Protocols- See Section 4.1.6.3, ***Table 39***). The coding of the questions is facilitated with a structured scoring rubric.

Figure 72 shows that students’ goal setting is high as they believe that is a valuable procedure. Specifically, the 86% were able to remember, set analyze goals in authentic learning context. This means that this activity helped students realize the merits of effective goal setting. Also, it is important to engage learners into training activities in order to realize how to set effective goals and adjust their actions for accomplishing the tasks.

In “*Artifact 7: Presenting Myself (A7)”* participants attempt to explore and visualize aspects of their academic, professional and social self in order to construct an effective presentation. ***Figure 73*** shows the degree to which participants understand, use concepts, demonstrate skills and create their learning outcome. the process developing their lower order thinking skills to higher order thinking skills.

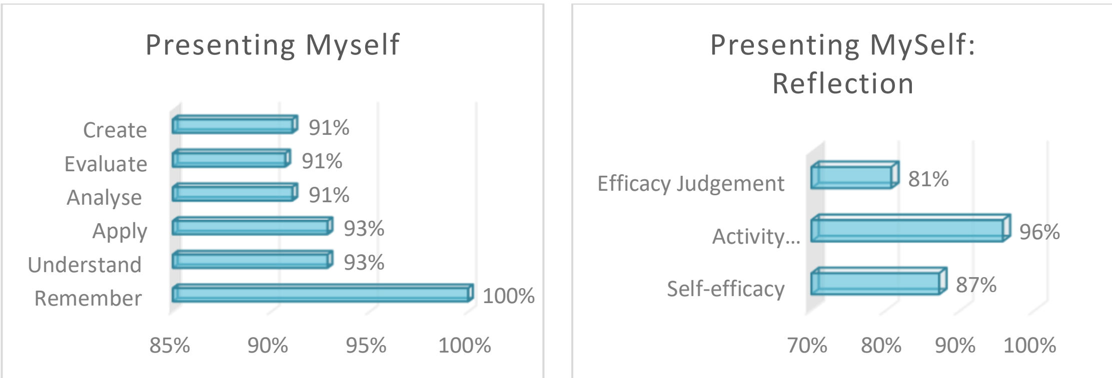


Figure 73. Study#3: Quantitative Analysis of Artifact 7: Presenting Myself

The results suggest that the experimental group appeared to have a significant increase on the first levels of the continuum of the learning outcomes. This finding is consistent with accounts from prior research where students need to master the first levels of the taxonomy before the next one can take place. Participants who completed “Artifact 7: Presenting Myself (A7)” were able to:

- 100% of the students remember a set of aspects of that describe their self (knowledge, skills, attitudes, interests, values, beliefs)
- 93% of the students understand their aspects of Self (knowledge, skills, attitudes, interests, values, beliefs)

- 93% of the students apply their aspects of self into a personal project
- 91% of the students can analyse their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self)
- 91% of the students evaluate their personal identity and their self-image
- 91% of the students can create a presentation about their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self) and set a specific career goal.

Specifically, students achieved better on the first levels of the continuum (Remember, Understand, Apply) while they faced difficulty on the higher levels of continuum (Analyze, Evaluate and Create). This means that participants were able to recognize, interpret and manage the aspects of self but they need more training in order to monitor and construct detailed self-presentations. Specifically, students were able to create a detailed presentation in order to describe their knowledge, skills, attitudes, interests, values, beliefs but they found difficult to analyse and reflect on the concepts.

When students completed 'Artifact 7: Presenting Myself (A7)', they invited to record their perceptions on a written reflective activity (Artifact 7.1). The reflective activity is linked to the objectives and context of Artifact 7: Presenting Myself and attempts to measure specific self-regulatory processes (Microanalytic Protocols- See Section 4.1.6.3, ***Table 40***). The coding of the questions is facilitated with a structured scoring rubric.

Figure 73 shows that students' self-efficacy is good (87%) as they feel that they created an accurate presentation and they described in detail academic, professional and social aspects of their self. Also, the 96% of the students reported that the activity helped them realize their 'Aspects of Self'. It is interesting that only the 81% of the participants admitted that they possess the appropriate skills, knowledge, attitudes, interests and values to achieve their career goals. The results highlight that students' judgments about their ability to complete an organized self-presentation were good. This means that students need time to realize and strengthen their efficacy judgement. Also, it is challenging to engage student on activities for identifying and boosting their skills, knowledge, attitudes, interests and values.

In "*Artifact 9: Time Management (A9)"* learners investigate the benefits of managing time, organize their tasks and plan their activities (individual, academic and professional level) to complete their ePortfolio. ***Figure 74*** suggests that the experimental group appeared to have low scores across the continuum of learning outcomes. Specifically, from the participants who completed "Artifact 9: Time Management":

- 96% of the students remember terms related to time management.
- 93% of the students understand the necessity for effective time management

- 92% of the students apply techniques for effective time management
- 87% of the students analyse various methods and techniques for time management
- 87% of the students evaluate the efficacy of time schedules
- 89% of the students create effective time management plans

The results indicate that the activity helped students to understand and apply the basic principles of effective time management. Also, the findings underline that participants do engage in time management activities and try to allocate their effort but they fail to deliver effective schedules and take appropriate decisions.

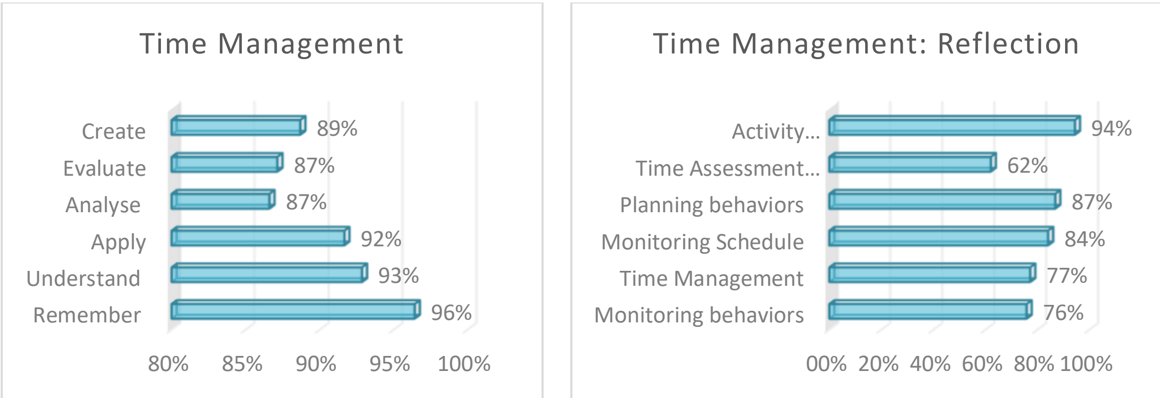


Figure 74. Study#3: Quantitative Analysis of Artifact 9: Time Management

When students completed '*Artifact 9: Time Management (A9)*', they invited to record their perceptions on a written reflective activity (Artifact 9.1). The reflective activity is linked to the objectives and context of Artifact 9: Time Management and attempts to measure specific self-regulatory processes (Microanalytic Protocols- See Section 4.1.6.3, ***Table 41***). The coding of the questions is facilitated with a structured scoring rubric.

Figure 74 shows that the 76% of the experimental group was able to manage and allocate their study time (monitoring behavior). Also, the 77% of the students agree that they can follow an organized time plan (time management). This means that, students should engage in time management activities in order to strengthen their skills and monitor their actions. In addition to, the 84% of the students agree that monitoring schedule is necessary and the 87% indicate that planning is a key concept in time management. On the other hand, only the 62% of the students believed that an application can help them assess and change their behavior (time assessment behaviors). Finally, the majority the of participants (94%) agreed that time management activity was very useful.

From the experimental group 28 students selected '*Artifact 10: Familiarize with Myself as a student (A10)*' and 0 students selected '*Artifact 11: Boosting the Strategy of Note Taking A(11)*'

Specifically, in "*Artifact 10: Familiarize with Myself as a student (A10)*" participants try to explore the benefits of learning strategies, study tactics and develop a personal learning strategy repertoire for boosting their academic performance. ***Figure 75*** indicates that students appeared to have a significant increase on the first levels of the continuum of the learning outcomes. This finding is consistent with accounts from prior research where students need to master the first levels of the taxonomy before the next one can take place. Also, it is interesting that students realize the necessity of using and analyzing their learning strategies.

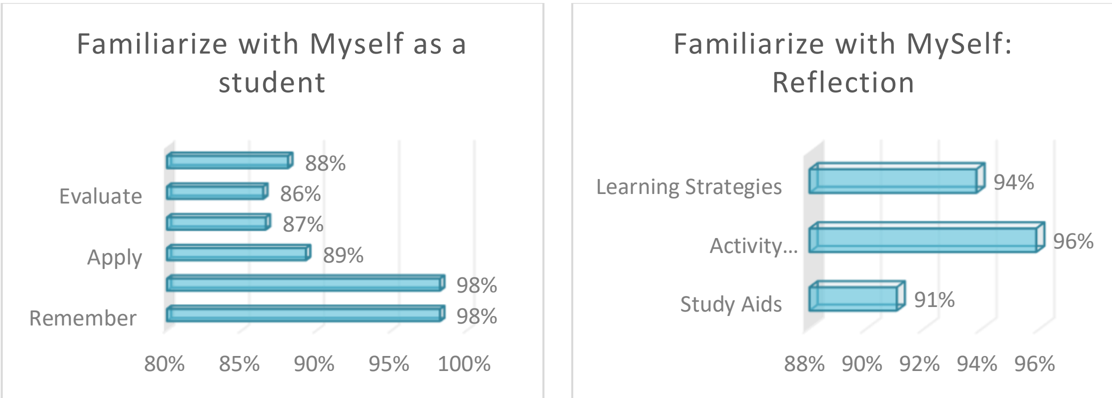


Figure 75. Study#3: Quantitative Analysis of Artifact 10: Familiarize with MySelf as a Student (Learning Strategies)

Specifically, from the students who completed "**Artifact 10: Familiarize with Myself as a student (A10)** (Learning Strategies)":

- 98% of the students remember concepts associated to learning strategies
  98% of the students understand the need for using learning strategies.
- 89% of the students apply a repertoire of learning strategies in their academic study. This means that students
- 87% of the students analyse learning strategies in order to know when to use them in their academic study
- 86% of the students evaluate, select and control their learning strategies
- 88% of the students create a detailed repertoire of learning strategies which is orchestrated by web-based tools.

The findings illustrate that students' competency decrease in the higher level of learning objectives continuum (Analyze, Evaluate and Create). These results suggest that students realized the need of acquiring learning strategies but they need a long-term plan for applying them in their academic study.

When students completed ***Artifact 10: Familiarize with Myself as a student (A10)*** (Learning Strategies)", they invited to record their perceptions on a written reflective activity (Artifact 10.1). The reflective activity is linked to the objectives and context of Artifact 10 and attempts to measure specific self-regulatory processes (Microanalytic Protocols- See Section 4.1.6.3, ***Table 42***). The coding of the questions is facilitated with a structured scoring rubric. **Figure *75*** shows that the 91% of the students was able to select and apply specific learning strategies for supporting their cognitive state and directing their behavior (study aids). Also, the 94% of the students admitted that they feel capable to use the appropriate strategies or study aids for learning and retrieving new content. Finally, the 96% of participants agreed that the activity was very useful.

4.3.6.4 Reliability Analysis for quantitative data (RQ2)

Research Question (RQ2) examined '*How does the ePortfolio intervention impact academic achievement?*'. To answer RQ2 set within the context of the present research three types of quantitative analysis were conducted and are presented in this section.

The goal is to evaluate the accuracy of the ePortfolio based self-regulated learning (ePSRL) approach as a method of authentic assessment. It was attempted the design of a comprehensive ePortfolio assessment methodology that actively engages students, peers, instructors and external evaluators into the process.

For the needs of the research, ePortfolio achievement is measured by the ePortfolio Rubric (see APPENDIX B: ePortfolio Rubric). EPortfolio achievement is divided into four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics. Each ePortfolio criterion was given a score:1-(Lacking), 2-(Satisfactory), 3-(Exemplary).

Firstly, it was attempted to examine if the proposed ePortfolio rubric is a reliable assessment method. Thus, it was selected the two-way random Intraclass Correlation Coefficient (ICC) for providing explanations about the differences in scores, the way raters use the constructs and estimate possible measurement error (Nunnally & Bernstein, 1994). So, it was conducted the (ICC) test for ensuring the inter-rater reliability (IRR). Accordingly, an efficient ePortfolio encompasses all the constructs and manages the parts in a meaningful manner.

In Study#3, the ICC based on the answers of four raters (students, peers, instructor and two external evaluators) so as to measure consistency. Students, peers, instructor and two external evaluators (four sources of raters/evaluators) attempted to evaluate the process, the content and the outcomes of the ePortfolio

The ICC analysis for consistency can be considered substantial ICC=0.67 also the ICC value can be excluded from the population with a probability greater than 95% ($F(27, 81) = 3.046$, $p=0.000<0,005$).

Also, it was performed an ICC analysis of consistency for the criteria of the ePortfolio achievement: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics (***Table 65***). Results yielded that the ICC is significant for the three criteria: ePortfolio Purpose, Artifacts Repository, Reflection in Action and there is agreement among the raters. This means that the average scores of the experimental group were reliable.

For the 'ePortfolio Usability characteristics', the ICC analysis for consistency can be considered not significant (ICC)= 0.297 also the ICC value can be excluded from the population with a probability greater than 95% ($F(27, 81) = 1.422$, $p=0.115>0.005$). In general, there is a consistency in the usage of the scale values among the four assessment methods, also the participants had a better understanding of the rating scale.

Table 65. Study#3: Intraclass Correlation Coefficient test measured the inter-rater reliability

Study#3	**Experimental Group/4 Raters**	Significance (Sig.)
ePortfolio Criteria	ICC (2,4) 95%CI	
ePortfolio Purpose	0.662 (27, 81)	.000
Artifacts Repository	0.660 (27, 81)	.000
Reflection in Action	0.739 (27, 81)	.000
ePortfolio Usability characteristics	0.297 (27, 81)	.115

Further, we attempted to explore the relationships among the ePortfolio measurements. Pearson correlation analysis was selected for exploring the relationships between the ePortfolio assessment methods and the final course grade. A Pearson's correlation was run to determine the relationship among the raters (students, peers, instructor and external evaluators).

In Study#3, Pearson r correlation revealed that correlation coefficient was significant for specific items (**Table *66***).

As we expected, course grade was positively related to instructor's ePortfolio assessment ($r=.63$, $p<.01$) and external's evaluator assessment ($r=.31$, $p<.01$), which indicates that ePortfolio assessment can be seen as a reliable measure of learner's achievement. In addition to, instructor's ePortfolio assessment with course grade had high and positive correlation ($r=.94$, $p<.05$) This correlation is significant and highlights that the ePortfolio assessment is reliable as the raters agree. Also, self-assessment was found to correlate significantly with external's evaluator assessment (r=.28, p<.05). Also, instructor's assessment is correlated to instructor's assessment (r=.40, p<.05).

Table 66. Study#3: Pearson's r correlation analysis among ePortfolio assessment measurements

Pearson r Correlations – Study#3					
Variables	1	2	3	4	5
(1) Self	1				
(2) Peer	.220	1			
(3) Instructor	.360	.404*	1		
(4) External Evaluators	.287*	.280	.372	1	
(5) Teacher-Course Grade	.299	.413*	.941**	.272	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

A One-way Analysis of Variance (ANOVA) was used to examine whether there are significant differences in the mean scores on the ePortfolio assessment criteria across the four types of assessment methods. It was selected one-way ANOVA and can be considered reliable as long as the assumption of normality, homogeneity of variance and independence of samples are met.

The independent variable represented the four different types of assessment methods: 1) students, 2) peers, 3) instructors and 4) external evaluators. The dependent variable was the ePortfolio assessment criteria (**Table *67***).

There was a statistically significant difference at the $p < .001$ level in ePortfolio assessment for four different assessment measurement $F(3, 81) = 9.706$, $p = .000$. The effect size, calculated using eta squared, was .264 ($\eta^2=.264$). Despite reaching statistical significance, the actual difference in mean scores between groups was quite small. Data has met the assumption of Mauchly's test of sphericity ($\varepsilon=0.692 > .05$). Post-hoc comparisons using the Bonferroni test indicated that the mean score of tutor assessment (M = 2.02, SD = 0.31) was significantly different from Peer assessment (M = 2.30, SD = 0.25). Also, there was statistically significant difference in mean scores between External evaluators assessment (M = 2.05, SD = 0.26) and Self (M = 2.19, SD = 0.24) as well as peer assessment (M = 2.30, SD = 0.25).

Table 67. Study#3: One-way ANOVA results of the ePortfolio assessment measurements

Study#3- Experimental Group								
ePortfolio's Constructs	Self	Peer	Instructor	Ex. Eval.	F	Sig	Effect size η^2	Comparison
ePortfolio Purpose	2.39	2.74	2.18	1.79	29.565	0.000	0.523	ExEval<Peer

Artifacts Repository	2.36	2.47	2.36	2.63	11.359	0.000	0.296	Self <ExEval.
Reflection in Action	1.96	2.08	1.79	1.69	3.871	0.000	0.126	ExEval<Peer
Usability char.	2.51	2.85	2.65	2.54	15.051	0.000	0.358	Self <Peer
Overall	2.19	2.30	2.02	2.05	9.706	0.000	0.264	Instr.l<Peer

*p < .05.

Also, the one-way ANOVA compared the means between the four different assessment measurements (groups) and investigated whether any of those means are significantly different for each of the ePortfolio assessment criteria.

For the ePortfolio purpose, the analysis revealed that there is a significant main effect of assessment measurements (factor 1) ($F(3,81) = 29.565$, $p =.000$, $\eta^2=.523$). Data has met the assumption of Mauchly's test of sphericity because Sig. was .993 > ,05. Post-hoc comparisons using the Bonferroni test indicated highly significant differences between assessment measurement. There was no statistically significant difference in mean scores between tutor (M = 2.18, SD = 0.53) and self-assessment (M = 2.39, SD = 0.52)

For the Artifacts repository, the analysis revealed that there is a significant main effect of assessment measurements (factor 1) ($F(3,81) = 11.359$, $p =.000$, $\eta^2=.296$). Data has met the assumption of Mauchly's test of sphericity because Sig. was .590 > ,05. Post-hoc comparisons using the Bonferroni test indicated highly significant differences between assessment measurement. There was no statistically significant difference in mean scores between external evaluator (M = 2.63, SD = 0.36) and self-assessment (M = 2.36, SD = 0.48) as well as external evaluator and peer-assessment (M = 2.47, SD = 0.42). Also, there are no differences between self and peer assessment.

For the Reflection in action, the analysis revealed that there is a significant main effect of assessment measurements (factor 1) ($F(3,81) = 3.871$, $p =.000$, $\eta^2=.125$). Data has met the assumption of Mauchly's test of sphericity because Sig. was .517 > ,05. Post-hoc comparisons using the Bonferroni test indicated that the only highly significant difference was between external evaluators' assessment (M = 1.69, SD = 0.59) and peer assessment (M = 2.08, SD = 0.67).

For the Usability characteristics, the analysis revealed that there is a significant main effect of assessment measurements (factor 1) ($F(3,81) = 15.051$, $p =.000$, $\eta^2=.358$). Data has met the assumption of Mauchly's test of sphericity because Sig. was .176 > ,05. Post-hoc comparisons using the Bonferroni test indicated that that mean score of Peer assessment (M = 2.85, SD = 0.17) was significantly different from self (M = 2.51, SD = 0.10), instructor (M = 2.65, SD = 0.27) and external evaluators assessment (M = 2.54, SD = 0.27).

4.3.6.5 Research Question 2- Quantitative Analysis

In this study, ePortfolio achievement is measured by the ePortfolio Rubric (see ePortfolio Rubric). Further, at the end of the semester students participated in the final exams for testing their knowledge of the subject matter. The written examination consisted of open-ended and multiple-choice questions, or/and exercises (failing grade<5, passing grade=5, excellent grade=10).

Firstly, descriptive statistics was employed to describe the data collected; in the tables to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted (***Table 68***).

Table 68. Study#3: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of academic achievement

Study#3	**Experimental Group**		
Assessment Measurements	**N**	**M**	**SD**
Learner	28	2.19	.243
Peer	28	2.30	.252
Instructor	1	2.02	.311
External Evaluator	2	2.05	.261
Course Grade	28	8.07	1.15

Students' course grades (Mean = 8.07) indicate that students studied the course material, understood the learning content and achieved very good performance. Peer assessment Mean = 2.30) is higher than self-assessment ePortfolio (Mean = 2.19). Learners set high standards and assessed strictly their ePortfolio, on the other hand their peers evaluated positively the ePortfolios. It is interesting that external evaluators assessment means agreed to tutor's assessment scores.

Figure *76* shows that students evaluated higher their own ePortfolios compared to the tutor's assessment index. In addition, students' academic achievement (Course Grade: 81%) and ePortfolio self-assessment (73%) and peer assessment (77%) were similar, which means that students had a good to very good performance. The instructor and external evaluators are more skeptical about the ePortfolio implementation and provided lower grades to students.

All in all, it is noted that students' perceptions about their performance and their course grades are equivalent. It can be assumed that students internalized SRL processes and applied them during their academic study. Thus, learners realized the learning content and were able to monitor and evaluate their academic achievement.

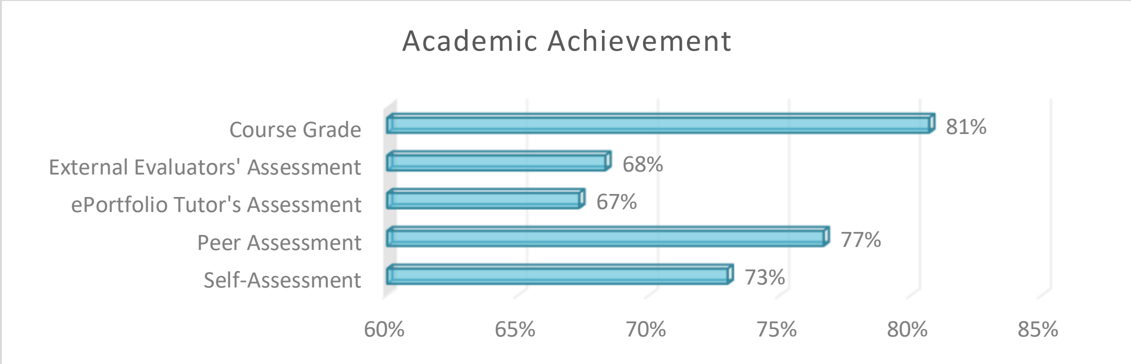


Figure 76. Study#3: Postgraduate Students' Academic Achievement Measurements

To determine if there is any significant difference among the ePortfolio criteria towards the use of ePortfolio with regard to their approach, means and standard deviations for the method of assessment, including self, peer, instructor and external evaluators are calculated as presented in ***Table 69***.

Table 69. Study#3: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of aspects of ePortfolio Assessment

Study#3	**Self**			**Peer**			**Instructor**			**External Evaluator**		
ePortfolio Assessment	**M**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**	**n**	**M**	**SD**	**n**
ePortfolio Purpose	2.39	.352	28	2.74	.332	28	2.18	.533	1	1.79	.482	2
Artifacts Repository	2.36	.484	28	2.47	.423	28	2.08	.481	1	2.63	.364	2
Reflection in Action	1.96	.589	28	2.08	.677	28	1.79	.592	1	1.69	.596	2
ePortfolio Usability characteristics	2.51	.107	28	2.85	.175	28	2.65	.277	1	2.54	.273	2

This means that students were enthusiastic about their actions and they felt positive about the final learning outcome (**Figure *77***).

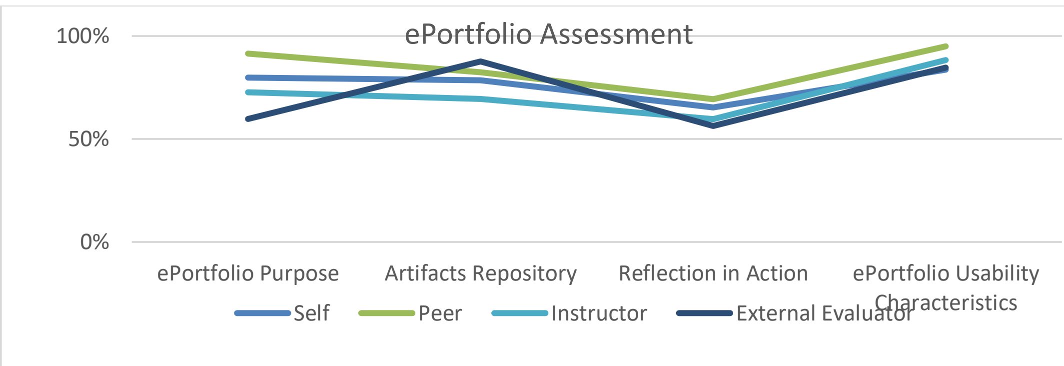


Figure 77. Study#3: Comparing's ePortfolio Assessment Measurements' among ePortfolio criteria

4.3.6.6 Research Question 2- Qualitative Analysis

During the intervention, the experimental group engaged in ‘Artifact 1: Implementation of a stand-alone ePortfolio’. When students completed their holistic process of designing and implementing their own ePortfolio (“Self-reflection’ phase [C]) engaged in the processes of self-monitoring and self-evaluating. Specifically, students self-evaluated their ePortfolio (Artifact 25: Self-Assessing the ePortfolio, Instrument: ePortfolio rubric).

It was attempted to explore student’s level of cognitive development based on the revision of Bloom's Taxonomy (Krathwohl & Anderson, 2009)

Figure *78* shows the degree to which postgraduate students who completed ‘Artifact 1: Implementation of a stand-alone ePortfolio’ were able to:

- Remember the basic concepts of an ePortfolio (artifacts, systems, ownership, reflections)
- Understand the necessity of delivering a dynamic and effective ePortfolio
- Apply an integrated ePortfolio project
- Analyse the aspects and the tools of an ePortfolio project
- Evaluate the levels of sustainability and usability of an ePortfolio Project
- Create a well-organized and responsive ePortfolio based on SRL principles

Findings indicated that post-graduate students show high levels of expertise across the continuum of the competency statements (95%-75%). The experimental group was able to remember the basic concepts of ePortfolio as well as to create a well-organized and responsive ePortfolio. The results suggest that the experimental group is confident about the ePortfolio and aims to deliver a robust ePortfolio.

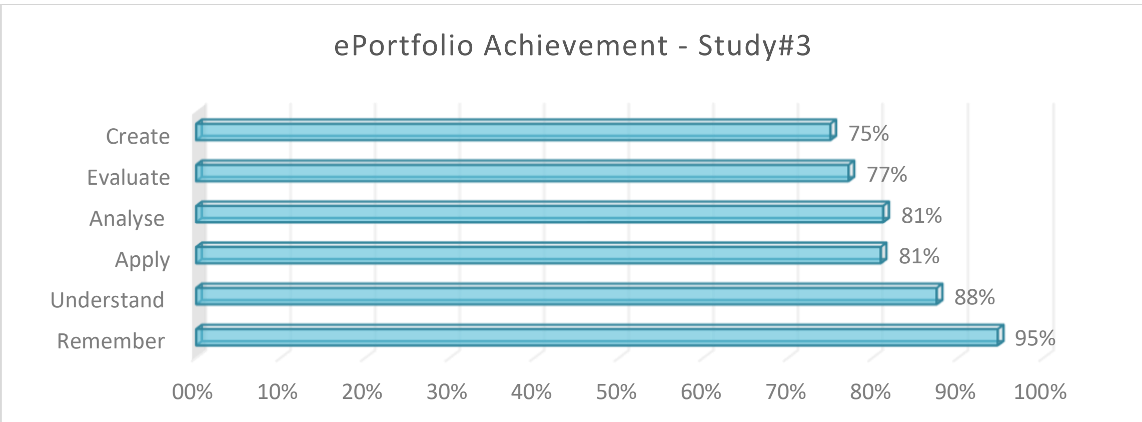


Figure 78. Study#3: Quantitative Analysis of Artifact 1: Implementation of a stand-alone ePortfolio

Probably, postgraduate students engaged in the ePSRL approach and devoted time to edit and deliver various artifacts. Throughout this process, students feel confident about their skills, familiarize with the new learning concepts and engage in the ePortfolio construction process. When participants completed ‘Artifact 1: Implementation of a stand-alone ePortfolio, then they they invited to record their perceptions on a written reflective activity (Artifact 1.1). The reflective activity attempts to measure specific self-regulatory processes (Microanalytic Protocols- See Section 4.1.6.6, **Table *52***). The coding of the questions is facilitated with a structured scoring rubric. The written Reflective Activity explores learners’ perceptions about the construction process of the ePortfolio and the final learning outcome (e.g ePortfolio Project). The experimental group is enthusiastic about the ePortfolio process and seems to feel satisfied with the outcome (>90%) (**Figure *79***).

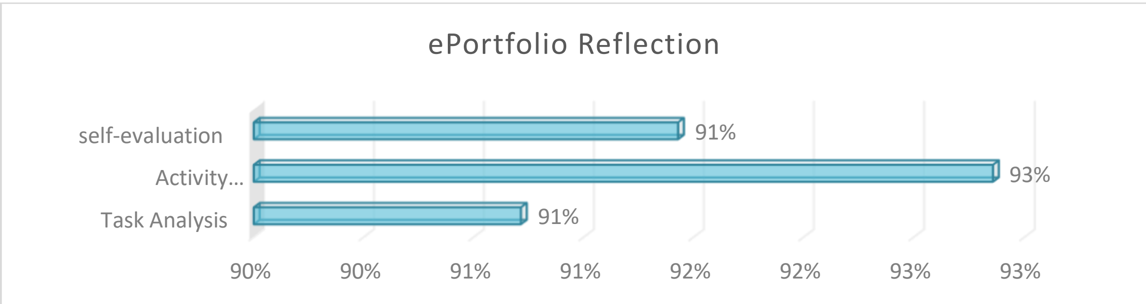


Figure 79. Study#3: Quantitative Analysis of postgraduate students’ reflections about ePortfolio Project

Also, students invited to answer two open-ended questions “How do you feel about your performance during the ePortfolio development? And Think about your final outcome and write one positive and one negative element of your ePortfolio project?

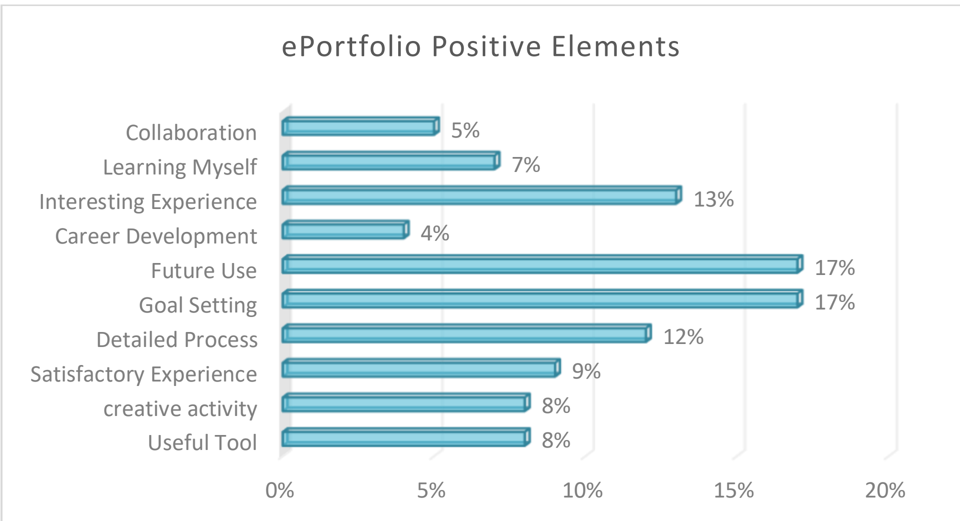


Figure 80. Study#3: Quantitative Analysis of postgraduate students’ reflections about the positive element of their ePortfolios

Figure *80* shows that the 17% of the experimental group supported them to learn how to set their goals and admitted that they will 'use the ePortfolio in the future'. The 13% of the experimental group yielded that the ePortfolio is an interesting experience and the 12% of the participants suggested that it was a detailed well-organized experience.

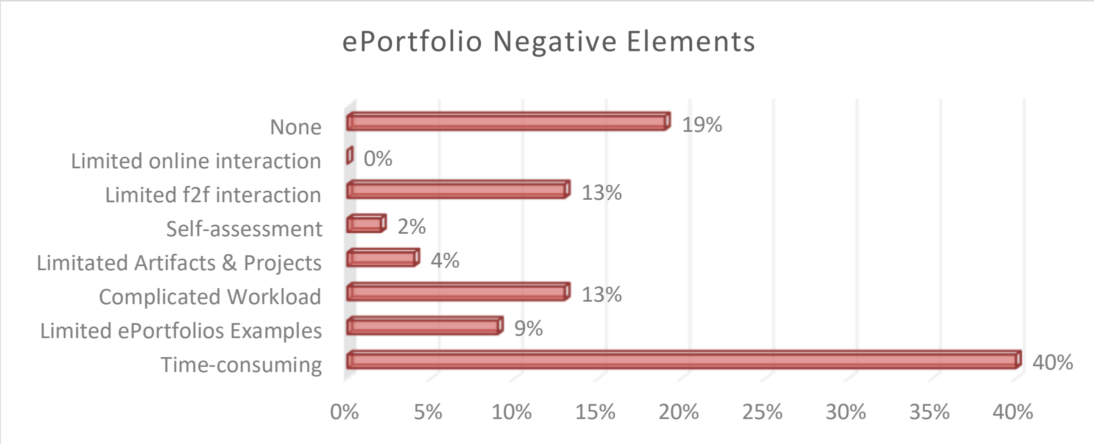


Figure 81. Study#3: Quantitative Analysis of postgraduate students' reflections about the negative elements of their ePortfolios

Figure *81* shows that the 40% of the experimental group agreed that the delivery of an ePortfolio is 'a time-consuming process' and the 13% admitted that there was complicated workload. On the other hand, the 19% of the experimental group believed that their ePortfolio didn't have negative elements.

4.3.6.7 Reliability Analysis for quantitative data (RQ3)

The goal is to examine the ePortfolio intervention as an effective approach that bolsters SRL processes and investigate the relationship between the ePortfolio use and SRL competency. Research Question (RQ3) addressed in this research is 'Whether ePortfolio based Self-Regulated Learning (ePSRL) intervention in Higher Education supported students to practice SRL processes?' To answer RQ3 set within the context of the present research three types of quantitative analysis were conducted and are presented in this section.

A reliability analysis was conducted to measure the instrument's (ePortfolio based Self-Regulated Learning Rubric) internal consistency (**Table *70***).

Table 70. Study#3: Cronbach's a coefficient of ePortfolio based Self-Regulated Learning Rubric

Constructs	Items	Study#3 Experimental Group
Phase A [Forethought Phase]	19	.858

Phase B [Performance Control]	11	.804
Phase C [Self-Reflection]	10	.829

Cronbach's alpha reliability coefficient normally ranges between 0 and 1 (Nunnally & Bernstein, 1994). The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale. Along these lines, Scale-Phase A [Forethought Phase], had a high reliability (Cronbach's Alpha=.858, Scale Phase B [Performance Control] had a high reliability (Cronbach's Alpha=.804) and Scale Phase C [Self-Reflection] measure also had a high reliability (Cronbach's Alpha=.829).

4.3.6.8 Research Question 3- Quantitative Analysis

When students completed their holistic process of designing and implementing their own ePortfolio ("Self-reflection' phase [C]) engaged in the processes of self-monitoring and self-evaluating.

Specifically, students attempted to assess whether the proposed ePortfolio system has the potential to support and advance SRL skills (Artifact 24: Self-Assessing My SRL Skills/Competences, Instrument: SRL based on ePortfolio based Self-Regulated Learning rubric). They reflected upon their SRL competency and verbalized their perceptions about their SRL (Reflections).

Firstly, descriptive statistics was employed to describe the data collected; in ***Table 71*** to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted.

Table 71. Study#3: The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio based Self-Regulated Learning Rubric

ePortfolio based Self-Regulated Learning Rubric	**Experimental Group Study#3**		
	M	**SD**	**n**
Phase A [Forethought Phase]	3.98	0.41	28
Phase A. Cognitive Processes	4.05	0.46	28
Phase A. Motivation Processes	3.80	0.48	28
Phase A. Affective Processes	4.13	0.54	28
Phase A. Context Processes	4.11	0.66	28
Phase B [Performance Control]	3.95	0.44	28
Phase B. Cognitive Processes	4.05	0.45	28
Phase B. Motivation Processes	3.69	0.83	28
Phase B. Affective Processes	4.03	0.57	28
Phase B. Context Processes	3.94	0.55	28

Phase C [Self-Reflection]	4.03	0.46	28
Phase C. Cognitive Processes	4.12	0.44	28
Phase C. Motivation Processes	4.25	0.64	28
Phase C. Affective Processes	3.78	0.83	28
Phase C. Context Processes	3.89	0.56	28

The most interesting result is that the ePSRL system received mean values of above 3.0 across the three SRL phases, which means that the ePortfolio supported SRL quite well. Also, the findings indicate that in the first phase of SRL (Forethought) students (Mean= 3.98) were not ready to practice SRL skills participants but in the last phase of SRL (Self-reflection) they internalized SRL processes and were able to practice SRL (Mean=4.03)

Pearson's correlation was run to determine the relationship among SRL phases and ePortfolio assessment (**Table *72***). The coefficients of Pearson's correlation revealed that Phase A [Forethought] was positively related to Phase B [Performance Control] and Phase C [Self-Reflection] which indicates that ePSRL system facilitated the cyclic nature of SRL and conceptualized it as a process.

Table 72. Study#3: Pearson's r Correlations between ePortfolio based Self-Regulated Learning and ePortfolio achievement

Variables- Study#3	[1]	[2]	[3]	[4]	[5]	[6]
[1] Phase A [Forethought Phase]	1					
[2] Phase B [Performance Control]	.414*	1				
[3] Phase C [Self-Reflection]	.245	.872**	1			
[4] ePortfolio Self-Assessment	.284	.659**	.608**	1		
[5] ePortfolio Tutor's Assessment	.187	.109	.158	.368	1	
[6] Course Grade	-.196	-.144	-.091	-.043	.029	1

4.3.6.9 Research Question 3- Qualitative Analysis

At the end of the intervention, post-graduate students attempted to assess whether the proposed ePortfolio system has the potential to support and advance SRL skills (Artifact 24: Self-Assessing My SRL Skills/Competences, Instrument: SRL based on ePortfolio based Self-Regulated Learning rubric). They reflected upon their SRL competency and verbalized their perceptions about their SRL (Reflections).

The reflection of "Artifact 24: Self-Assessing My SRL Skills/Competences," investigates learners' perceptions about the development of their SRL skills in the context of the ePortfolio system (***Table 73***) (APPENDIX H: Coding Schemas – Students' Reflections about their SRL skills (Study#3)).

Students engaged in a reflective activity where they provided they following open-ended question 'Do you think that the ePortfolio system support you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write a few recommendations to someone that could become an effective self-regulated student.'

Table 73. Study#3: Qualitative Analysis of students' reflections about their SRL Skills/Competences

Self-Assessing My SRL Skills/Competences -Reflections	*Total Numbers of Concepts*
Academic & Career Development	10
Reconsider Mistakes	0
Organizing Learning Path	16
Goal Setting	14
Motivation	14
Collaboration	9
Skills Development	15
Self-Efficacy	13
Time Management	12
Self-Evaluation	12
Learning Strategies	04
Self-Monitoring	07
Self-Reflection	14
Help Seeking	14
TOTAL Concepts	154

Figure 82 illustrates that the 10% of the experimental group admitted that this intervention actively engaged them in organizing their 'learning path' and advance their skills. In addition to, the 9% of the participants agreed that the ePSRL approach supported them to understand and apply the process of 'goal setting', manage and direct their motivation, value the merits of self-reflection and reconsider the necessity of seeking help and interact with peers.

On the other hand, none of the post-graduate students believed that through the ePortfolio process they were able to 'reconsider their mistakes'.

All in all, the majority of the students agreed that the use of the ePortfolio system provided a well-organized manner to engage in SRL processes (e.g. goal setting, self-efficacy, self-evaluation). Also, the ePSRL approach provided a learning opportunity and open new horizons to several important life skills and invited learners to familiarize with concepts such as self-monitoring, motivation, self-management, time management, etc.

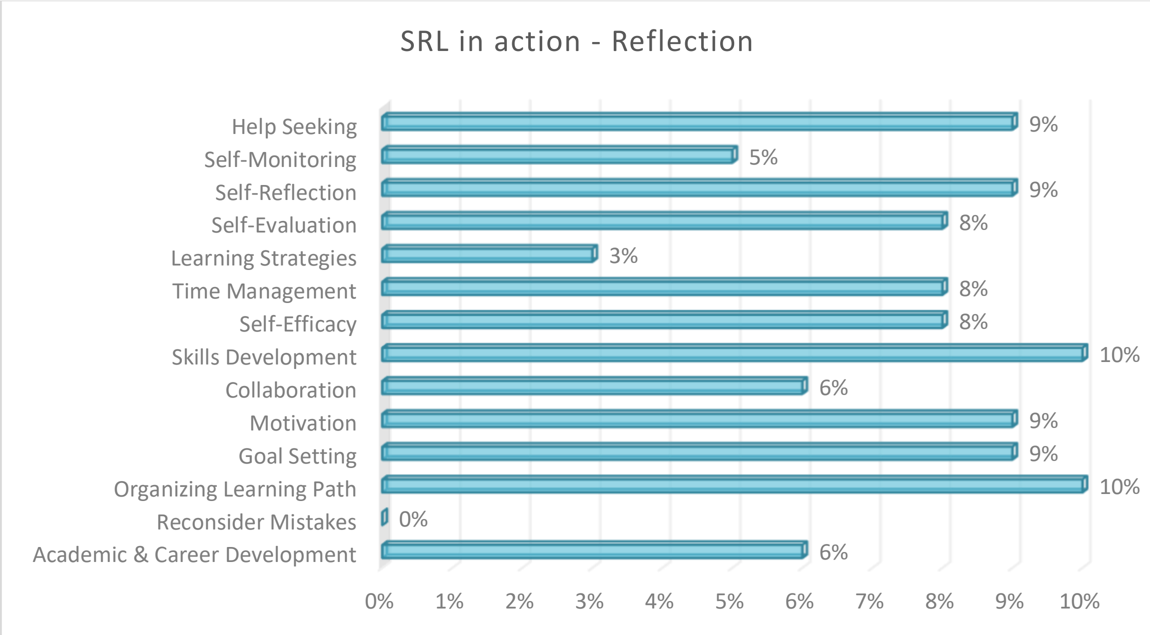


Figure 82. Study#3: Quantitative Analysis of students' reflections about 'Artifact 24: Self-Assessing My SRL Skills/Competences'

Table *74*, illustrates students written reflections about their SRL skills. At the end of the process, students attempted to answer the following question: 'Do you think that the ePortfolio system supports you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write your thoughts about this learning experience.' Many students expressed their gratitude for participating in the ePortfolio project and valued this learning experience. They felt that the ePortfolio project supported them to understand and set meaningful goals for managing their academic development.

Table 74. Study#3: Students' written reflections about their SRL Skills

Students	**Reflections 'Artifact 24: Self-Assessing My SRL Skills/Competences'**	**Concepts**
Student: V. M. – Female [S3_PostStudent_EXPR_3]	*The ePSRL system was very effective and helped me organize my academic and career path. The activities advanced my skills and engaged me in the process in a pleasant and provocative manner This process supported me to organize my time, to evaluate my strengths and weaknesses, to reflect on my actions and realize the necessity of help seeking.*	*Academic & career development* *Skills development* *Self-efficacy* *Time management* *Self-reflection*

		Self-evaluation *Help Seeking*
	Number of concepts	***7***
Student: D. I. – Male [S3_PostStudent_EXPR_7]	*The ePSRL approach was an unprecedented type of studying and learning. The learning content was well-organized and helped me to set my plans for my academic and career life. Also, the ePSRL approach helped me a lot in managing my time and set my goals. Through self-assessment I discovered elements of myself that helped me focus on my assets. At the end, we created a very useful tool for our career, that is an innovative and comprehensive way of presenting ourselves.*	*Goal Setting* *Academic & career development* *Organizing Learning Path* *Time management* *Self-evaluation*
	Number of concepts	**5**
Student: K. C. –Male [S3_PostStudent_EXPR_18]	*I believe that this process is well-organized and supported me to realize the potential of time planning and management. I engaged in various activities that arouse my interest and curiosity and encouraged my motivational beliefs. Also, I learn to organize my time and monitor my actions.*	*Organizing Learning Path* *Motivation* *Time management* *Self-monitoring*
	Number of concepts	*4*
Student T. P. – Female [S3_PostStudent_EXPR_27]	The ePSRL approach helped me to identify and focus on my skills, attitudes, values, beliefs and interests and to set realistic and measurable goals for my academic and career path. Also, I learnt how to develop feasible plans and to implement them. During the process, I engaged in self-reflection activities and tried to improve or modify my actions. I think that this experience helped me discover my positive self-image	*Goal Setting* *Skills development* *Self-monitoring* *Self-reflection*
	Number of concepts	4

After the completion of the experimental procedure, participants completed a 'Post ePortfolio-Intervention Review', that consisted of six open-ended questions. The goal of this instrument is to record students' perceptions about the ePortfolio process and the levels of satisfaction.

Postgraduate students invited to record the positive characteristics of the ePortfolio process and explain 'Why this was a positive experience?'.

The 14% of the students admitted that the ePortfolio helped them learn how to monitor their progress and keep track of their activities. The 11% of the participants agreed that this was an effective procedure for outlining their academic and career profile and improving their skills, also they yielded that the process helped them to organize their studies (***Figure 83***).

At the end of the intervention, the majority of the students has a positive attitude towards the ePortfolio experience.

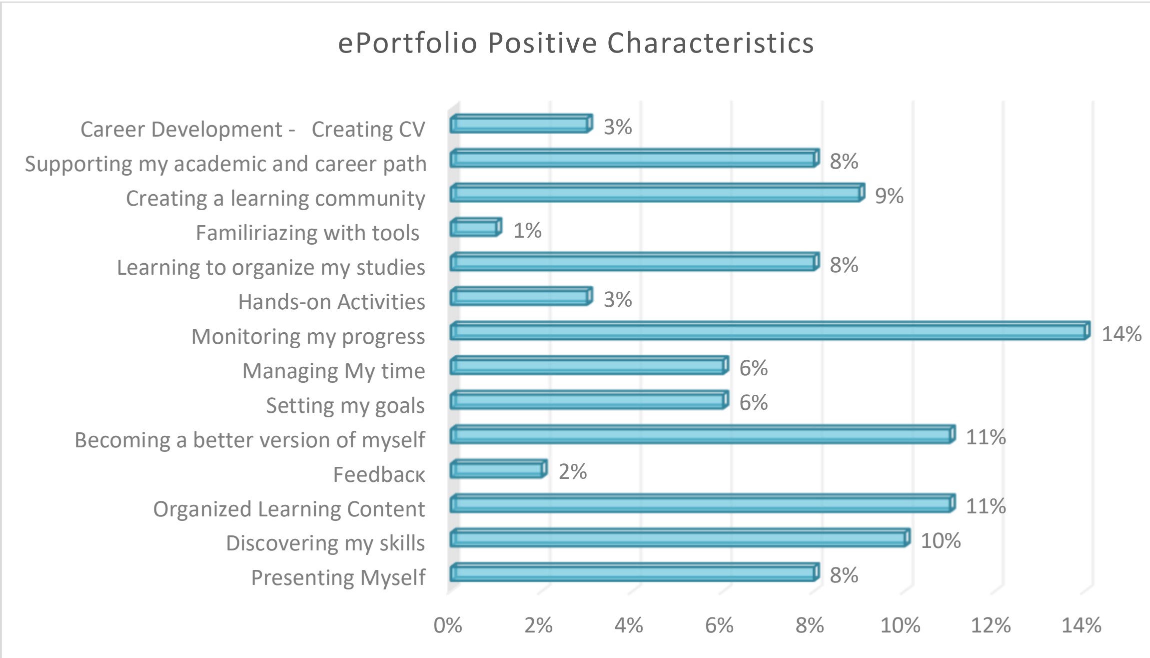


Figure 83. Study#3: Positive Characteristics of the ePortfolio intervention

Students were invited to record the negative characteristics of the ePortfolio process and explain 'Why this was a negative experience?'(**Figure *84***).

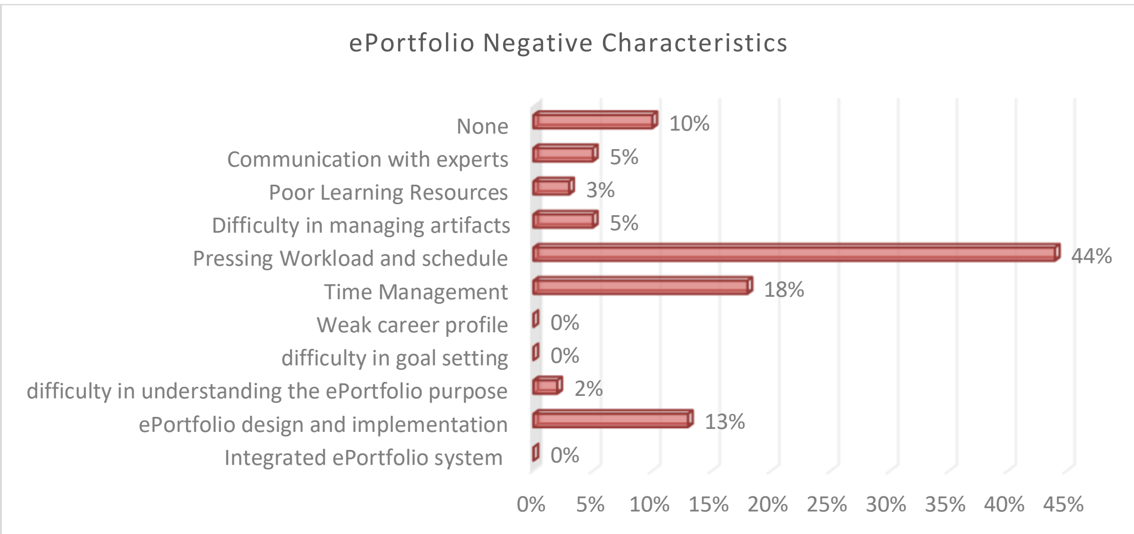


Figure 84. Study#3: Negative Characteristics of the ePortfolio intervention

The 44% of the experimental group admitted that the workload was pressing and the time schedule had short-term deadlines (time management = 18%). Also, the 13% of the participants found difficulties in the design of the ePortfolio. They stated that they activities were too detailed and didn't realize their objectives.

Participants invited to submit a comment 'What do you think should be added, changed or removed from the ePortfolio Project?' (**Figure *85***). The 29% of the students believed that the project should be re-designed so as to remove activities and follow a more flexible workload.

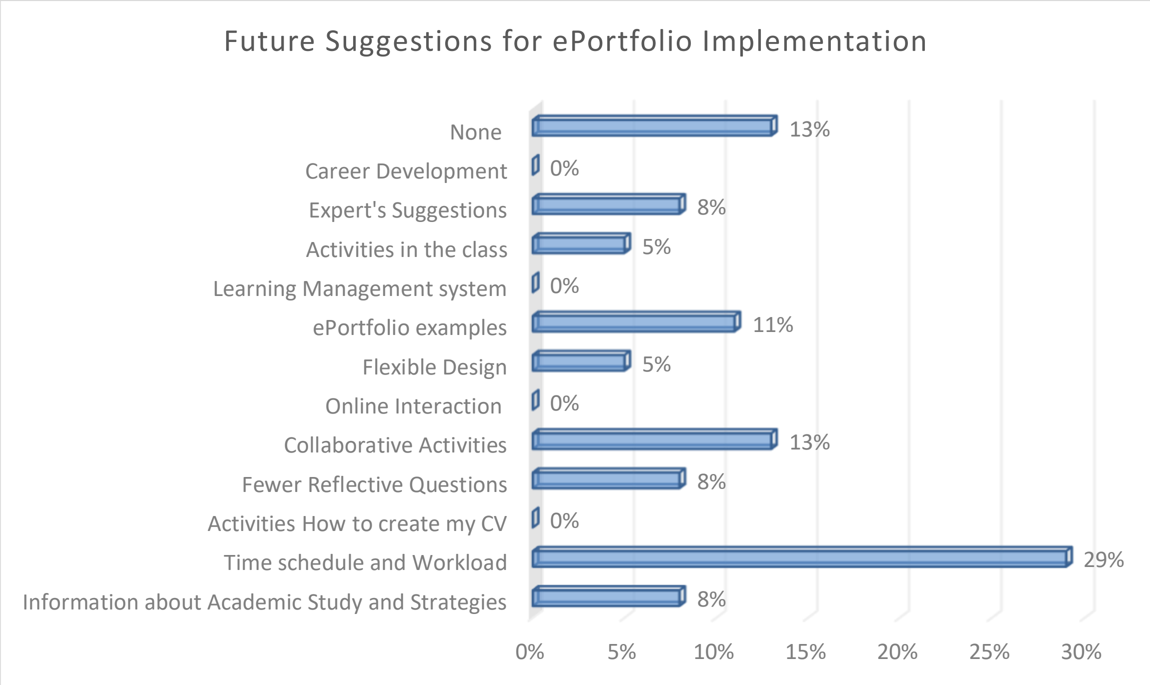


Figure 85. Study#3: Future Suggestions about ePortfolio Intervention

The 13% of the participants yielded that they wanted to participate in collaborative activities and the 11% of the students agreed that they wanted to study and review ePortfolio examples. Also, students thought (8%) that the process of answering reflective questions was often difficult and repetitive and they wanted more strategies and techniques for managing their academic studies (10%). It is interesting that, the 13% of the students indicated that the ePortfolio Project was well-organized and they didn't have the expertise to think for future suggestions.

The 94% of the experimental group agreed that the teachers, administrators and tutors were very helpful and positive (**Figure *86***). The ePortfolio interaction was very positive among stakeholders. Participants noted that the active communication and continuous feedback supported them to complete their projects.

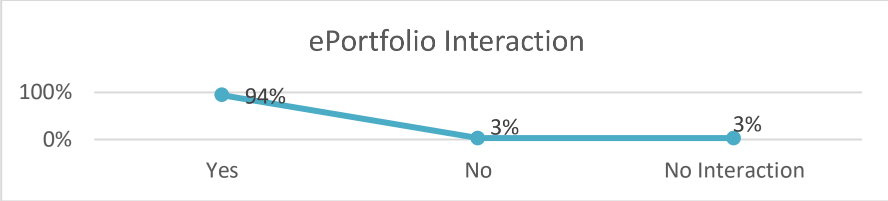


Figure 86. Study#3: ePortfolio's Interaction and feedback

Finally, the 96% of the participants highlighted that they would like to continue using their ePortfolio. Also, they indicated that this is a valuable tool that will help them to organize their studies, manage their skills and market themselves to future employers (**Figure *87***)

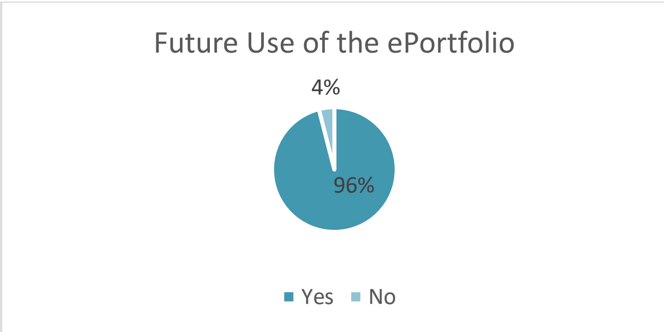


Figure 87. Study#3: Future Use of the ePortfolio

Table *75* illustrates students written reflections about their ePortfolio experience. At the end of the intervention, students attempted to analyze their thoughts and write a final remark: 'Write your final comment, idea or concluding remark about the ePortfolio construction process.'

Table 75. Study#3: Students' written reflections about their ePortfolio experience

Students	**Concluding Remarks**
Student B. D. - Male	*I think it was a beautiful experience and a challenging tool that I will remember throughout my academic studies.*
Student A. C. - Male	*This is a helpful tool but needs time and effort.*
Student H. B. - Female	I think that the activities activated me to understand many SRL constructs. Also, the reflective activities, encouraged me to evaluate and monitor my skills.
Student Z. M. - Male	*The ePortfolio process helped me a lot to realize my needs, strengths and weaknesses. The activities boosted me to see in a positive light my academic studies, university life, faculty and in general to dream about my professional future.*
Student S. I. - Male	*I feel that I become more responsible and confident, in order to set up a feasible program for accomplishing my goals.*

Chapter 5: Main Findings

In the following sections, the main findings of the research are discussed. It is attempted to highlight the combined research outcomes (quantitative and qualitative data) in reference to the Research Questions (RQs) of the study.

5.1 Analyzing Participants' Profile

It was attempted to identify and analyze participants' profile (Study 1, Study 2 Experimental Group, Study 2 Control Group and Study 3). Before the intervention, participants invited to fill in a self-report for recording their perceptions about their demographic characteristics, their knowledge about ePortfolios, their prior ePortfolio experience and their expectations about the intervention. The goal is to analyze participants' demographic characteristics, educational needs, levels of digital competency and learning preferences.

The 73% of the participants (Study 1, Study 2 Experimental Group, Study 2 Control Group and Study 3) were in the age range from 18 to 21 years old and the 23% of the participants were in the age range from 22 to 30 years old (**Table *76***). This means that the majority of the students were undergraduate students and engaged in a new learning experience.

Table 76. Participants' Profile: Age Groups

Age Groups	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
18-21	71	57	46	0	174
22-30	15	12	6	21	54
31-40	0	1	1	4	6
41-50	0	0	0	3	3
51-60	0	0	0	0	0
>60	0	0	0	0	0

Also, the participants were 237 students (undergraduates and postgraduates) from a Greek University in Athens. The 73% of the participants were males and the 27% were females (**Table *77***).

Table 77. Participants' Profile: Gender

Gender	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*

Male	71	42	43	18	174
Female	15	28	10	10	63
Not Defined	0	0	0	0	0

It is observed that all participants estimated that they are expert users in using digital devices, internet browsing, using text editing software and using social networking sites (SNSs) (**Table *78***). This means that the majority of the sample knows how to use and manipulate digital platforms, tools and environments. Also, it is noted that participants in study 2 (experimental and control group) indicated that they are advanced users in using presentation software, designing Static Websites, using video editing software and photo editing software. Both groups in Study 2 have advanced digital competences and can use easily software for different purposes. On the other hand, students in Study 1 believed that their digital competence is set in the beginner to intermediate level. It should be mentioned that students in study 1 are in their first year of their studies and need time to familiarize with software and applications. Further, participants in Study 3 estimated that that their level of digital competency is set in the novice to intermediate level. This means, that students in study 3 feel more insecure about their digital competency in using video, audio and photo editing software and need more time and support to advance their skills. To sum up, this research has a set of participants with an intermediate level of digital competency (Study 1 and 3) and a set of participants with an advanced level of digital competency.

Table 78. Participants' competency in using digital tools and applications

Indicate your level of competency in	Study 1	Study 2 Experimental	Study 2 Control	Study 3
Participants (N)	*86*	*70*	*53*	*28*
A. Using Digital Devices	**Expert (50%)**	**Expert (97%)**	**Expert (100%)**	**Expert (43%)**
B. Internet Browsing	**Expert (55%)**	**Expert (88%)**	**Expert (94%)**	**Expert (54%)**
C. Using Text Editing software	**Expert (53%)**	**Expert (79%)**	**Expert (85%)**	**Expert (53%)**
D. Using Graphic Design software	Beginner (40%)	Intermediate (32%)	Intermediate (30%)	Beginner (39%)
E. Using Presentation software	Intermediate (43%)	Advanced (68%)	Advanced (57%)	Advanced (39%)
F. Designing Static Websites	Intermediate (30%)	Advanced (43%)	Advanced (51%)	Intermediate (36%)
G. Using video editing software	Beginner (45%)	Advanced (38%)	Advanced (35%)	Novice (32%)
H. Using audio editing software	Beginner (37%)	Intermediate (35%)	Intermediate (33%)	Novice (39%)
I. Using photo editing software	Intermediate (40%)	Advanced (39%)	Advanced (40%)	Beginner (36%)
J. Using Social Networking Sites	**Expert (52%)**	**Expert (86%)**	**Expert (96%)**	**Expert (36%)**

In **Table *79***, it is observed that the majority of the participants that evaluated their level of digital competence indicated that they are independent users (75%) and proficient users (17%). The majority of the students was digital competent and had the abilities and skills to participate and complete the ePortfolio intervention.

Table 79. Participants' Level of Digital Competence

Digital Competence Levels	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
Basic User	10	3	5	2	20
Independent User	64	58	40	15	177
Proficient User	12	9	8	11	40

Before the intervention, participants invited to record their perceptions about their prior ePortfolio experience and their expectations about the project (Prior ePortfolio Experience Rubric – APPENDIX D: Pre and Post Rubrics).

Figure 88 presents students' positive answers (Yes) about the reasons that guided learners to participate in the ePortfolio. Specifically, the 98% of the participants noted that they choose to participate in the intervention so as to gain knowledge and elevate their skills. The 96% of the students agreed that the ePortfolio is a useful tool and can be seen as an important vehicle for advancing their learning. Also, they highlighted that they participate for supporting their academic development and promoting their career plans. Furthermore, the 91% of the participants suggest that they have a positive first impression and they want to learn more about ePortfolios.

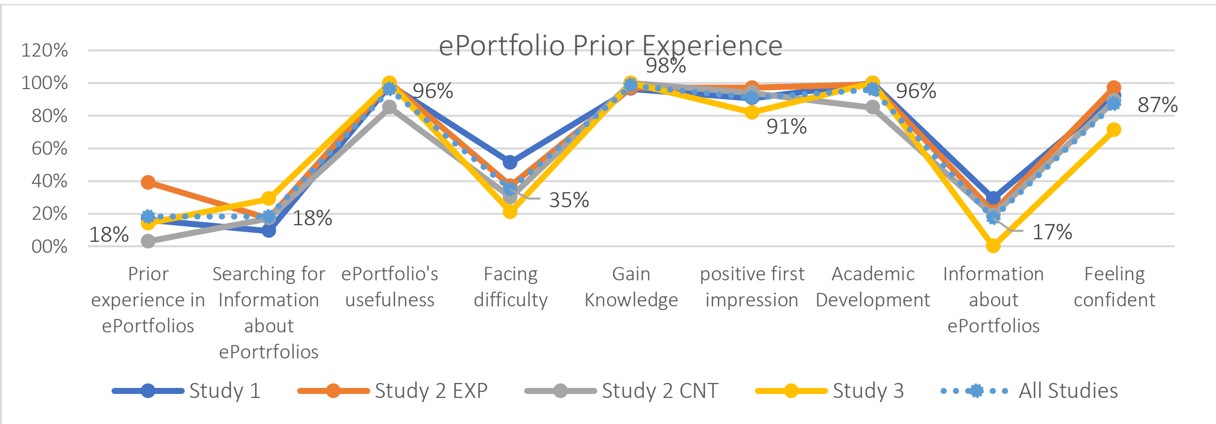


Figure 88. Quantitative Analysis of participants' perceptions about their ePortfolio prior experience

Participants answered the open-ended question 'Why do you participate in the ePortfolio Lab?' (**Figure** ***89***). Students record their perceptions and analyze their views about the reasons that motivated them to participate in the Project. Towards this, it is observed that participants indicated a wide range of reasons for choosing to implement the ePortfolio project such as:

Delivering an ePortfolio, understanding the content, gaining better grades, activating Interest, gaining Knowledge, developing Skills, academic and career development

The 30% of the students admitted that they would like to deliver and maintain an ePortfolio. The majority of the participants feel that the delivery of their own ePortfolio is an interesting and meaningful process. Also, the 29% of the participants indicated that they participated in the intervention in order to gain new knowledge and structure their learning profile. Finally, the 19% of the sample noted that they want to elevate the academic and career development.

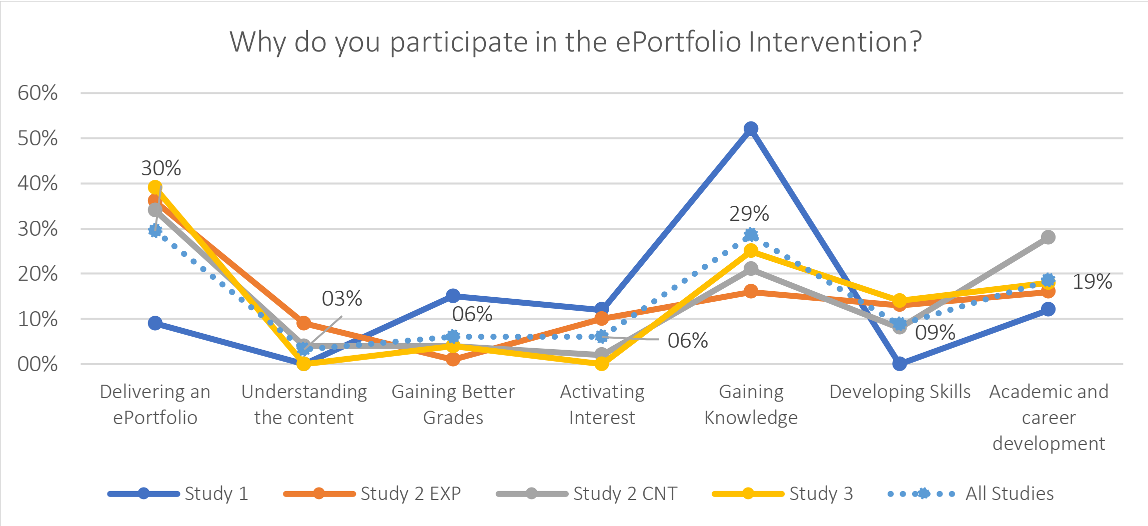


Figure 89. Quantitative Analysis of participants' perceptions about their ePortfolio participation

To sum up, the majority of the participants (Study 1, Study 2 Experimental Group, Study 2 Control Group and Study 3) was in the age range from 18 to 21 years old, undergraduate male students in a Greek Higher Education Institution. Most of the participants were expert users in using digital devices, internet browsing, using text editing software and using social networking sites (SNSs). The level of participants' digital competence is above average and indicated that they are independent users.

The sample of the study agree that the implementation of an ePortfolio is a useful activity for supporting their learning and they want to gain new knowledge and advance their skills. All in all, they participated in the intervention for delivering their own ePortfolio as this is an interesting and meaningful process. In other words, participants attempted to structure their learning profile and boost their academic development.

The following sections will synthesize the results of the research. Specifically, this section will outline the empirical evidence for answering the Research Questions (RQs).

5.2 RQ1 – Data Analysis

Research Question (RQ1): Does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?

For the instrument (Questionnaire about SRL skills- an adapted web-based version of the Motivated Strategies for Learning Questionnaire (MSLQ)) a reliability analysis was conducted. It was observed that the Cronbach's alpha reliability coefficient showed the instrument to reach acceptable reliability.

In detail, Scale A: Motivation, had a high reliability (Cronbach's Alpha=.880) and Scale B: Learning Strategies measure also had a high reliability (Cronbach's Alpha=.940) (**Table *80***). Most items appeared to be worthy of retention, resulting in a decrease in the alpha if deleted.

The Cronbach's a values for Value Components, Expectancy Components, Affective Components, Cognitive and Metacognitive Strategies and Resource Management Strategies in this study were .776, .775, .628, .920 and .859 respectively, exceeding the acceptable level (0.70) (Nunnally & Bernstein, 1994). This result indicates that all items in each subscale measured the same underlying process of SRL.

Table 80. Internal consistency reliability coefficients of Self-Regulated Learning processes

MSLQ - Scales	**Items**	**α**
Scale A: Motivation	31	.880
Value Components	16	.776
Intrinsic Goal Orientation	4	.704
Extrinsic Goal Orientation	4	.651
Task Value	8	.809
Expectancy Components	12	.775
Control Beliefs	4	.488
Self-Efficacy	8	.823
Affective Components	5	.628
Test Anxiety	5	.628
Scale B: Learning Strategies	50	.940
Cognitive and Metacognitive Strategies	31	.920
Rehearsal	4	.698
Elaboration	6	.729
Organization	4	.610
Critical Thinking	4	.771
Metacognitive Self-Regulation	12	.805
Resource Management Strategies	19	.859
Time Management	8	.562

Effort Regulation	4	.627
Peer Learning	3	.610
Help Seeking	4	.602

The *paired samples t-test (pre and post-test)* indicated that the sample of the research (N=237) appeared to have a significant increase on the means across all the variables of Scale A: Motivation.

Specifically, ***Table 81*** indicates that the experimental group appeared to have a significant increase on the means across the Scale A: Motivation $t(236) = -15.53$, $p < 0.01$.

A detailed observation indicates that the experimental group appeared to have a significant increase on the means across Value Components: Intrinsic Goal Orientation, Extrinsic Goal Orientation, Task Value, Expectancy Components: Control Beliefs, Self-Efficacy and Affective Components: Test Anxiety.

Table 81. Means, standard deviations and paired samples t-test values of SRL processes (Motivation Scale)

Paired Differences										
		Pre Test		**Post Test**						
Variables	**N**	**M**	**SD**	**M**	**SD**	**95% CI for Mean Difference**		**p-value**	**t**	**df**
Scale A: Motivation	237	3.40	.398	3.95	.418	-.622	-.482	.000	-15.532	236
Value Components	237	3.55	.456	4.11	.425	-.633	-.494	.000	-16.026	236
Intrinsic Goal Orientation	237	3.80	.617	4.18	.510	-.461	-.296	.000	-9.049	236
Extrinsic Goal Orientation	237	3.28	.747	3.96	.638	-.787	-.579	.000	-13.000	236
Task Value	237	3.58	.555	4.20	.466	-.711	-.550	.000	-15.392	236
Expectancy Components	237	3.57	.469	4.03	.416	-.529	-.384	.000	-12.404	236
Control Beliefs	237	3.68	.566	4.01	.506	-.423	-.236	.000	-6.933	236
Self-Efficacy	237	3.47	.574	4.05	.469	-.665	-.503	.000	-14.267	236
Affective Components	237	3.40	.398	3.95	.418	-.762	-.510	.000	-9.951	236
Test Anxiety	237	3.40	.398	3.95	.418	-.762	-.510	.000	-9.951	236

The contrast in the 'Intrinsic Goal Orientation' between the pre-test and post-test was significant, $t(236) = -9.04$, $p < 0.05$. Results indicate that after the completion of the ePortfolio implementation, students' intrinsic motivation improved. This means that students displayed interest in the ePortfolio workload for reasons such as challenge, curiosity, enjoyment and mastery. Furthermore, the contrast in the 'Extrinsic Goal Orientation' between the pre-test and post-test was significant, $t(236) = -13.00$, $p < 0.05$. Results indicate that post to the completion of the procedure, students' extrinsic motivation also improved. A significant indicator of extrinsic motivation is the acquisition of excellent grades and achieving high performance. The results indicate that the experimental group appeared to have a significant increase on the means across 'Task Value' t(236) = -15.39, $p < 0.05$. Results indicate that after the intervention, students showed that the process of constructing their ePortfolio was a meaningful process and helped them realize their own process of learning. Participants also believed that the learning content was meaningful and well-organized, and they could apply what they had learned during their academic studies.

The results indicate that the experimental group appeared to have a significant increase on the means across 'self-efficacy' t(236) = -14.26, $p < 0.05$. Results indicate that after the intervention, students showed that the process of intervention supported them to discover skills and recognize important aspects of their self.

Table *82* indicates that the experimental group appeared to have a significant increase on the means across the Scale B: Learning Strategies namely: Cognitive & Metacognitive Strategies: Rehearsal, Elaboration, Organization, Critical Thinking, Metacognitive Self-Regulation and Resource Management Strategies: Time Management, Effort Regulation, Peer Learning, Help Seeking. The results suggest that the experimental group appeared to have a significant increase on the means across the Scale B: Learning Strategies t (236) = -19.55, $p < 0.05$. This finding is consistent with accounts from prior studies that students need training to learn how to use strategies and display a high level of SRL in their ePortfolios (Abrami et al., 2007; Cheng & Chau, 2013). Furthermore, the contrast in the 'Time Management' between the pre-test and post-test was significant, t (236) = -16.78, $p < 0.05$. Results indicate that post to the completion of the procedure, students' time management also improved.

Table 82. Means, standard deviations and paired samples t-test values of SRL processes (Learning strategies Scale)

Paired Differences										
		Pre Test		**Post Test**						
Variables	**N**	**M**	**SD**	**M**	**SD**	**95% CI for Mean Difference**		**p-value**	**t**	**df**
Scale B: Learning Strategies	237	3.23	.368	3.96	.448	-.812	-.663	.000	-19.552	236
Cognitive & Metacognitive Strategies	237	3.31	.423	4.05	.454	-.815	-.657	.000	-18.432	236
Rehearsal	237	3.40	.655	4.13	.547	-.832	-.623	.000	-13.680	236
Elaboration	237	3.28	.626	4.02	.517	-.845	-.642	.000	-14.482	236
Organization	237	3.31	.670	4.07	.548	-.878	-.657	.000	-13.685	236
Critical Thinking	237	3.28	.570	3.97	.573	-.774	-.598	.000	-15.364	236
Metacognitive Self-Regulation	237	3.29	.398	4.04	.440	-.828	-.682	.000	-20.299	236
Resource Management Strategies	237	3.14	.387	3.88	.482	-.818	-.661	.000	-18.536	236
Time Management	237	3.20	.404	3.88	.469	-.753	-.594	.000	-16.788	236
Effort Regulation	237	3.02	.519	3.78	.694	-.860	-.656	.000	-14.659	236
Peer Learning	237	3.14	.728	3.95	.640	-.927	-.692	.000	-13.623	236
Help Seeking	237	3.19	.590	3.91	.606	-.824	-.610	.000	-13.199	236

The Pearson's correlation approach was also performed to examine the relationships between the SRL processes and ePortfolio assessment level as well as between SRL processes and the course grade.

Table 83 shows various highly significant intercorrelations between constructs in Scale A: Motivation (r>0.60. p<0.001). The most significant intercorrelations are between Value components and Motivation (0.77), Expectancy Components and Motivation (0.74) and Motivation and Affective Components (0.82). Also, Intrinsic Goal orientation and Value components (0.81), Task Value and Value components (0.82), Task Value and Intrinsic Goal Orientation (0.71), Expectancy Components and Control Beliefs (0.87) and Self-efficacy (0.84).

Table 83. Correlations among SRL processes (motivation scale), ePortfolio assessment and course grade

Variables	1	2	3	4	5	6	7	8	9	10	A	B
(1) Motivation	1											
(2) Value Components	.778**	1										
(3) Intrinsic Goal Orientation	.630**	.811**	1									
(4) Extrinsic Goal Orientation	.620**	.747**	.630**	1								
(5) Task Value	.588**	.825**	.297**	.344**	1							
(6) Expectancy Components	.743**	.674**	.716**	.403**	.619**	1						
(7) Control Beliefs	.629**	.563**	.614**	.387**	.507**	.871**	1					
(8) Self-Efficacy	.647**	.595**	.600**	.300**	.557**	.844**	.470**	1				
(9) Affective Components	.821**	.361**	.253**	.392**	.173**	.306**	.249**	.277**	1			
(10) Test Anxiety	.821**	.361**	.253**	.392**	.173**	.306**	.249**	.277**	1.000**	1		
(A) ePortfolio Assessment	-.091	-.026	-.024	-.089	.077	.011	-.092	.120	-.144*	-.144*	1	
(B) Course Grade	-.096	-.051	-.079	-.025	-.018	-.088	-.127	-.019	-.084	-.084	.655**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

Table *84* shows various highly significant intercorrelations between constructs in Scale B: Learning Strategies. The most significant intercorrelations are between learning strategies and cognitive and metacognitive strategies (0.95) and learning strategies and metacognitive self-regulation (0.92), learning strategies and resource management strategies (0.96). Also, cognitive & metacognitive strategies and elaboration (0.92), critical thinking and cognitive & metacognitive strategies (0.92), metacognitive self-regulation and cognitive & metacognitive strategies (0.92).

Table 84. Correlations among SRL processes (learning strategies scale), ePortfolio assessment and course grade

**. Correlation is significant at the 0.01 level (2-tailed).

Variables	11	12	13	14	15	16	17	18	19	20	21	22	A	B
(11) Learning Strategies	1													
(12) *Cognitive S*	.955**	1												
(13) Rehearsal	.831**	.870**	1											
(14) Elaboration	.824**	.880**	.682**	1										
(15) Organization	.785**	.838**	.637**	.686**	1									
(16) Critical Thinking	.810**	.857**	.673**	.730**	.596**	1								
(17) Metacognitive SR	.891**	.882**	.769**	.713**	.700**	.678**	1							
(18) *RM Strategies*	.960**	.835**	.727**	.703**	.670**	.701**	.827**	1						
(19) Time Management	.741**	.663**	.524**	.598**	.523**	.600**	.633**	.754**	1					
(20) Effort Regulation	.747**	.622**	.590**	.448**	.505**	.494**	.675**	.803**	.513**	1				
(21) Peer Learning	.810**	.738**	.651**	.617**	.594**	.626**	.719**	.812**	.498**	.476**	1			
(22) Help Seeking	.769**	.649**	.544**	.608**	.521**	.536**	.609**	.819**	.511**	.508**	.594**	1		
(A) ePortfolio Assessment	.094	.186**	.196**	.187**	.172**	.115	.130*	-.001	-.074	-.104	.193**	-.029	1	
(B) Course Grade	-.042	.006	.082	.033	-.043	-.050	.010	-.083	-.121	-.084	.027	-.103	.655**	1

*. Correlation is significant at the 0.05 level (2-tailed).

In general, SRL processes (e.g. motivation and learning strategies scales) were also significantly positively related to each other, except for the ePortfolio assessment and the course grade. This means that there is needed to use other types of analysis that explore ways in which the ePSRL approach affects SRL processes.

During the intervention, participants followed the ePortfolio based self-regulated learning (ePSRL) approach and engaged in a set of learning tasks in order to learn how to self-regulate their actions, to construct their own ePortfolio and promote their academic development.

(RQ1) addressed in this research, is analyzed further in (RQ1.1): Does the ePSRL intervention affect goal setting?

The qualitative analysis of the artifact about 'Goal Setting' (A3) indicates that participants in Study 3 achieved higher levels of expertise in the process of settings goals, on the other hand participants in Study 1 achieved lower levels of expertise in the continuum of the learning outcomes (**Table *85***). It is interesting that participants in all studies achieved a high level of expertise (80.6%) in the cognitive process of 'goal setting'. This means that majority of the participants was able to set specific, measurable, achievable, realistic and time specific goals in order to accomplish short and long-term activities in an academic, professional and personal context.

Table 85. Quantitative analysis of Goal Setting (cognitive SRL process) among studies

Studies		*Goal Setting: Level of Expertise*						*Total Score*	*Total%*
		Remember	*Understand*	*Apply*	*Analyze*	*Evaluate*	*Create*		
Weights x	*N*	*1*	*2*	*3*	*4*	*5*	*6*	*21*	*100%*
Study 1	86	0.69	1.43	2.05	2.47	3.37	3.71	13.71	65.3%
Study 2	70	0.84	1.81	2.73	3.49	4.10	4.85	17.81	85%
Study 3	28	1.00	1.96	2.80	3.64	4.50	5.45	19.29	92%
All Studies	**184**	**0.84**	**1.74**	**2.53**	**3.20**	**3.99**	**4.67**	**16.94**	**80.6%**

In detail, participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. It is observed that participants were able to Remember to use the syntax of a S.M.A.R.T goal, to Understand the basic components of a S.M.A.R.T (Specific, Measurable, Attainable, Realistic, Timely) and to Apply and set their S.M.A.R.T goals. But they face difficulties in the upper levels of the cognitive continuum. Participants were less prepared to analyse the basic components of a S.M.A.R.T goal (Specific, Measurable, Attainable, Realistic, Timely), to evaluate their capability of setting sustainable goals and create Specific, Measurable, Attainable, Realistic, Timely goals.

The written reflective activity about 'Goal Setting' attempted to measure specific self-regulatory processes (Goal Setting in Action, Activity Judgement, Goal Orientation and Reflective Goal Setting) based on the microanalytic protocols methodology.

The quantitative analysis noted that participants in Study 2 and Study 3 realized the process of goal setting, were able to analyze their goals and probably they apply them in their academic life (***Table 86***). Furthermore, all participants (83%) were able to set goal in authentic learning context. This means that students need effective training for learning how to set effective goals and adjust their processes for accomplishing the tasks.

Table 86. Quantitative analysis of reflections about Goal Setting (cognitive SRL process) among studies

Studies		*Goal Setting: Reflection*				*Total Score*	*Total%*
		Goal Setting in Action	*Activity Judgement*	*Goal Orientation*	*Reflective Goal Setting*		
Scale (1-5)	*N*	*5*	*5*	*5*	*5*		
Study 1	86	3.58	3.76	3.76	3.45	14.55	73%
Study 2	70	4.34	4.59	4.54	4.24	17.71	89%
Study 3	28	4.30	4.36	4.46	4.54	17.66	88%
All Studies	**184**	**4.08**	**4.23**	**4.25**	**4.08**	**16.64**	**83%**

According to the quantitative and qualitative analysis of the findings the implementation of the ePortfolio based self-regulated learning (ePSRL) approach supported the 'goal setting' process and helped learners realize the necessity of defining specific goals and develop a plan for achieving the goals.

(RQ1) addressed in this research, is analyzed further in (RQ1.2): Does the ePSRL intervention affect self-efficacy?

The qualitative analysis of the artifact about 'Self-Efficacy' (A7) indicates that participants in Study 3 achieved higher levels of expertise in the process of discovering and presenting my academic, professional and social self, on the other hand participants in Study 1 achieved lower levels of expertise in the continuum of the learning outcomes (***Table 87***). It is noted that participants in all studies achieved a high level of expertise (79.1%) in the process of 'self-efficacy'. This means that the ePSRL approach guided learners to explore and visualize aspects of their self in order to construct an effective presentation. Through this process, participants capitalized the need for strengthening their self-efficacy.

Table 87. Quantitative analysis of Self-efficacy (affective SRL process) among studies

Studies		*Presenting Myself – Self-efficacy: Level of Expertise*						*Total Mean Score*	*Total%*
		Remember	*Understand*	*Apply*	*Analyze*	*Evaluate*	*Create*		
Weights x	*N*	*1*	*2*	*3*	*4*	*5*	*6*	*21*	*100%*
Study 1	86	0.86	1.51	2.26	2.87	3.35	3.91	14.57	69.4%
Study 2	70	0.84	1.72	2.49	2.96	3.66	4.29	15.96	76.0%
Study 3	28	1.00	1.86	2.79	3.64	4.54	5.46	19.29	91.8%
All Studies	**184**	**0.90**	**1.70**	**2.51**	**3.16**	**3.85**	**4.55**	**16.61**	**79.1%**

In detail, participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. It is observed that participants were able to remember a set of aspects of that describe their self (knowledge, skills, attitudes, interests, values, beliefs), understand their aspects of Self (knowledge, skills, attitudes, interests, values, beliefs) and apply their aspects of self into a personal project. Participants were less prepared to analyse their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self), evaluate their personal identity and their self-image and create a presentation about their knowledge, skills, attitudes, interests, values, beliefs (aspects of Self) and set a specific career goal.

The written reflective activity about 'Self-efficacy' attempted to measure specific self-regulatory processes (Self-efficacy in Action, Activity Judgement, Efficacy Judgement) based on the microanalytic protocols methodology.

The quantitative analysis noted that participants in Study 2 and Study 3 were able to recognize, interpret and manage the aspects of self but they need more training in order to monitor their self-efficacy levels (***Table 88***). Furthermore, all participants (85%) were able to construct detailed self-presentations. The results highlight that students' judgments about their ability to complete an organized self-presentation were good. This means that students need time to realize and strengthen their efficacy judgement. Also, it is challenging to engage student on activities for identifying and boosting their skills, knowledge, attitudes, interests and values.

Table 88. Quantitative analysis of reflections about self-efficacy (affective SRL process) among studies

Studies		*Presenting Myself -Self-efficacy: Reflection*			*Total Mean Score*	*Total%*
		Self-efficacy in Action	*Activity Judgement*	*Efficacy Judgement*		
Scale (1-5)	*N*	*5*	*5*	*5*	*20*	*100%*
Study 1	86	3.98	4.44	3.74	12.15	81%
Study 2	70	4.14	4.51	4.06	12.75	85%
Study 3	28	4.36	4.79	4.04	13.24	88%
All Studies	**184**	**4.16**	**4.58**	**3.94**	**12.71**	**85%**

According to the quantitative and qualitative analysis of the findings the implementation of the ePortfolio based self-regulated learning (ePSRL) approach supported learners to recognize their self-efficacy levels of expertise and engaged them on a meaningful learning process for identifying and boosting their skills, knowledge, attitudes, interests and values. Participants admitted that they need time and feedback for strengthening their self-efficacy beliefs.

(RQ1) addressed in this research, is analyzed further in (RQ1.3): Does the ePSRL intervention affect time management?

The qualitative analysis of the artifact about 'Time Management' (A9) highlights that participants in Study 3 achieved higher levels of expertise in the process of organizing a feasible time schedule, on the other hand participants in Study 1 achieved lower levels of expertise in the continuum of the learning outcomes (***Table 89***). It is interesting that participants in all studies achieved a moderate level of expertise (71.4%) in the process of 'Time Management'. The findings underline that participants do engage in time management activities and try to allocate their effort but they fail to deliver effective schedules and take appropriate decisions. This means that they need time to engage and follow effective time management procedures.

Table 89. Quantitative analysis of Time Management (behavioral SRL process) among studies

Studies		*Time Management: Level of Expertise*						*Total Mean Score*	*Total%*
		Remember	*Understand*	*Apply*	*Analyze*	*Evaluate*	*Create*		
Weights x	*N*	*1*	*2*	*3*	*4*	*5*	*6*	*21*	*100%*
Study 1	86	0.80	1.55	2.08	2.45	2.67	2.99	12.55	59.7%
Study 2	70	0.79	1.45	2.11	2.67	3.06	3.61	13.70	65.2%
Study 3	28	0.96	1.86	2.75	3.46	4.36	5.32	18.71	89.1%
All Studies	**184**	**0.85**	**1.62**	**2.32**	**2.86**	**3.36**	**3.97**	**14.99**	**71.4%**

In detail, participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. It is noted that participants were able to remember terms related to time management, understand the necessity for effective time management, apply techniques for effective time management. But, participants were less prepared to analyse various methods and techniques for time management, evaluate the efficacy of time schedules and create effective time management plans.

The written reflective activity about 'Time Management' attempted to measure specific self-regulatory processes (Monitoring behaviours, Time Management, Monitoring Schedule, Planning behaviours, Time Assessment Behaviours, Activity Judgment) based on the microanalytic protocols methodology.

The quantitative analysis noted that participants in Study 3 and Study 1 investigated the benefits of managing time, organized their tasks and plan their activities (at an individual, academic and professional level) to complete their ePortfolio (**Table *90***). Furthermore, all participants (75%) were able to manage their time. The findings underline that participants do engage in time management activities and try to allocate their effort but they fail to deliver effective schedules and take appropriate decisions.

Table 90. Quantitative analysis of reflections about time management (behavioural SRL process) among studies

Studies	*Time Management: Reflection*	*Total%*

		Monitoring behaviours	Time Management	Monitoring Schedule	Planning behaviours	Time Assessment Behaviours	Activity Judgment	Total Mean Score	
Scale (1-5)	*N*	*5*	*5*	*5*	*5*	*5*	*5*	*30*	*100%*
Study 1	86	3.56	3.68	3.95	4.17	3.33	3.91	22.61	75%
Study 2	70	3.27	3.38	3.68	3.82	3.18	3.45	20.77	69%
Study 3	28	3.79	3.86	4.21	4.34	3.10	4.72	24.03	80%
All Studies	**184**	**3.54**	**3.64**	**3.95**	**4.11**	**3.21**	**4.03**	**22.47**	**75%**

According to the quantitative and qualitative analysis of the findings the implementation of the ePortfolio based self-regulated learning (ePSRL) approach supported 'time management' and helped learners to manage and allocate their study time, follow an organized time plan and realize that planning is a key concept in time management.

(RQ1) addressed in this research, is analyzed further in (RQ1.4): Does the ePSRL intervention affect learning strategies?

The qualitative analysis of the artifact about 'Learning Strategies' (A10) indicates that participants in Study 3 achieved higher levels of expertise and attempted to explore the benefits of learning strategies, study tactics and develop a personal learning strategy repertoire on the other hand participants in Study 1 achieved lower levels of expertise in the continuum of the learning outcomes (***Table 91***). It is noted that participants in all studies achieved a high level of expertise (81.6%) about 'Learning Strategies'. This means that the ePSRL approach supported learners to understand and develop a personal learning strategy repertoire for boosting their academic performance. Through this process, participants identified the benefits of learning strategies and attempted to use study techniques.

Table 91. Quantitative analysis of Learning Strategies (behavioural SRL process) among studies

Studies		*Learning Strategies: Level of Expertise*						*Total Mean Score*	*Total%*
		Remember	*Understand*	*Apply*	*Analyze*	*Evaluate*	*Create*		
Weights x	*N*	*1*	*2*	*3*	*4*	*5*	*6*	*21*	*100%*
Study 1	86	0.92	1.70	2.40	2.70	3.13	3.33	14.16	67.4%
Study 2	70	0.91	1.89	2.72	3.60	4.32	5.10	18.54	88.3%
Study 3	28	0.98	1.96	2.68	3.46	4.32	5.29	18.70	89.0%
All Studies	**184**	**0.94**	**1.85**	**2.60**	**3.25**	**3.92**	**4.57**	**17.13**	**81.6%**

In detail, participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. It is observed that participants were able to remember concepts associated to learning strategies and understand the need for using learning strategies. Participants were less prepared to apply a repertoire of learning strategies in their academic study. This means that students, analyze learning strategies in order to know when to use them in their academic study, evaluate, select and control their learning strategies and create a detailed repertoire of learning strategies which is orchestrated by web-based tools.

The written reflective activity about 'Learning Strategies' attempted to measure specific self-regulatory processes (Study Aids, Activity Judgment, Learning Strategies) based on the microanalytic protocols methodology.

The quantitative analysis noted that participants in Study 3 and Study 2 were able to select and apply specific learning strategies for supporting their cognitive state and directing their behavior (***Table 92***). Furthermore, all participants (87%) admitted that they feel capable to use the appropriate strategies or study aids for learning and retrieving new content. It is interesting that students realized the necessity of using and analyzing their learning strategies.

Table 92. Quantitative analysis of reflections about learning strategies (behavioural SRL process) among studies

Studies		*Learning Strategies: Reflection*			*Total Mean Score*	*Total%*
		Study Aids	*Activity Judgment*	*Learning Strategies*		
Scale (1-5)	*N*	*5*	*5*	*5*	*20*	*100%*
Study 1	86	3.99	4.09	3.87	11.95	80%
Study 2	70	4.32	4.39	4.38	13.10	87%
Study 3	28	4.55	4.79	4.69	14.03	94%
All Studies	184	4.29	4.43	4.32	13.03	87%

According to the quantitative and qualitative analysis of the findings the implementation of the ePortfolio based self-regulated learning (ePSRL) approach supported learners to recognize their levels of expertise about the use of learning strategies. Also, students realized the need of acquiring learning strategies. It is highlighted that students need a long-term plan for applying specific learning strategies in their academic study.

5.3 RQ2 – Data Analysis

Research Question (RQ2): "How does the ePortfolio intervention impact academic achievement?"

For the needs of this research, ePortfolio achievement is analyzed in four criteria (ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics) and measured by the ePortfolio assessment methodology (APPENDIX B: ePortfolio Rubric). Academic achievement was obtained by students' course grades.

(RQ2) *addressed in this research, is analyzed further in* ***(RQ2.1): Are ePortfolio assessment results consistent among different evaluators (self- peer- instructor- external evaluator-) (i.e. inter-rater reliability)?***

It was attempted to investigate whether the ePortfolio achievements (measured by students, peers, instructors and external evaluators) of study groups (1,2 and 3) show a statistically significant difference. The basic goal is to evaluate the accuracy of the ePortfolio based self-regulated learning (ePSRL) approach as a method of authentic assessment.

Towards this, it was selected the Intraclass Correlation Coefficient (ICC) test for measuring the inter-rater reliability (IRR). The IRR attempts to quantify the level of agreement among assessors (students, peers, instructor and external evaluators) that independently rate the constructs of a scale.

The ICC analysis for consistency can be considered substantial ICC=0.601 also the ICC value can be excluded from the population with a probability greater than 95% ($F\ (150,450) = 2.509$, $p=0.000<0,005$). This means that there is a good agreement (ICC=0.60) among the ePortfolio assessment measurements and the proposed ePortfolio instrument ensures substantial reliability (Koo, 2016)

Further, Pearson correlation analysis was selected for exploring the relationships between the ePortfolio assessment measurement and course grade. In the experimental groups, the Pearson r correlation revealed that correlation coefficient was significant for specific items (***Table 93***). As we expected, course grade was positively related to instructor's ePortfolio assessment ($r=.688$ $p<.01$) and external's evaluator assessment ($r=.413$, $p<.01$), which indicates that ePortfolio assessment can be seen as a reliable measure of learner's achievement.

Table 93. Pearson's r correlation analysis among ePortfolio assessment measurements

Pearson r Correlations (N=237)					
Variables	1	2	3	4	5

(1) Self	1				
(2) Peer	.226**	1			
(3) Instructor	.202*	.138	1		
(4) External Evaluators	.195*	.204*	.608**	1	
(5) Teacher-Course Grade	.141	.178*	.688**	.413**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation I significant at the 0.01 level (2-tailed).

In addition to, instructor's ePortfolio assessment with external evaluator's assessment had high and positive correlation (r=.608, p<.05) This correlation is significant and highlights that the ePortfolio assessment is reliable as the raters agree. Also, self-assessment was found to correlate significantly with instructor's assessment (r=.202, p<.05) and external evaluator's assessment (r=.195, p<.05). This indicates that when students engage in the ePSRL approach through the ePortfolio system internalize the learning concepts and apply their SRL skills.

To determine if there is any significant difference among the assessment measurements towards the use of ePortfolio with regard to their approach, means and standard deviations for the method of assessment, including self, peer, instructor and external evaluators are calculated as presented in **Table *94***.

Table 94. The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio and academic achievement (All studies)

ePortfolio Achievement	**Study 1**			**Study 2 - Expr**			**Study 2-Cntrl**			**Study 3**			**All Studies**		
	N	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**
Learner	86	2.07	0.22	70	2.22	0.24	53	2.21	0.20	28	2.02	0.31	237	1.93	2.16
Peer	0	0.00	0.00	70	2.23	0.22	53	2.11	0.27	28	2.30	0.25	237	1.40	1.08
Instructor	1	1.76	0.32	1	2.19	0.39	1	1.90	0.50	1	2.02	0.31	1	1.95	0.42
External Evaluator	0	0.00	0.00	2	2.11	0.29	2	1.89	0.47	2	2.05	0.26	2	1.29	1.02
Course Grade	86	6.78	1.75	70	9.29	1.16	53	8.51	1.55	28	8.07	1.15	237	8.06	1.80

In detail, descriptive statistics was employed to describe the data collected (N=237-all participants, N=151-only studies2-3); in the table to follow the number of subjects (n), the Mean (M) and the Standard Deviation (SD) are depicted (**Table *95***).

Table 95. The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio assessment

ePortfolio Achievement	**All Studies (N=237)**	**Studies 2-3 (N=151)**

	N	M	SD	N	Mean	SD
Learner	237	2.16	0.23	**151**	**2.21**	**.257**
Peer	237	1.40	1.29	**151**	**2.20**	**.257**
Instructor	1	1.95	.429	**1**	**2.06**	**.440**
External Evaluator	2	1.29	1.02	**2**	**2.02**	**.373**
Course Grade	237	8.06	1.80	**151**	**8.79**	**1.38**

Students' course grades indicate that students studied the course material, understood the learning content and achieved very good performance. Peer assessment is higher than self-assessment ePortfolio. Learners set high standards and assessed strictly their ePortfolio, on the other hand their peers evaluated positively the ePortfolios and were lax in their ratings. It is interesting that external evaluators assessment means agreed to tutor's assessment scores.

(*RQ2)* *addressed in this research, is analyzed further in* ***(RQ2.2): Are there significant differences among the four ePortfolio criteria/dimensions (i.e. ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics)***

It was performed an ICC analysis of consistency for the criteria of the ePortfolio achievement: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics (***Table 96***). Results yielded that the ICC is significant for the four criteria: ePortfolio Purpose, Artifacts Repository, Reflection in Action, ePortfolio Usability characteristics and there is agreement among the raters. This means that the average scores of the research sample were reliable. ***Table 96***, shows that the ICC can be considered significant and can be excluded from the population with a probability greater than 95%. All in all, there is a consistency in the usage of the scale values among the four assessment methods, also the participants had a better understanding of the rating scale.

Table 96. Intraclass Correlation Coefficient (ICC) test measured the inter-rater reliability of the research sample

ePortfolio Criteria (N=237)	All Raters ICC (2,4) 95%CI	Significance (Sig.)
ePortfolio Purpose	0.741 (236, 708)	.000
Artifacts Repository	0.777 (236, 708)	.000
Reflection in Action	0.740 (236, 708)	.000
ePortfolio Usability characteristics	0.716 (236, 708)	.000

Descriptive statistics was employed to describe the data (ePortfolio criteria) of the ePortfolio assessment rubric. After the completion of the ePortfolio construction process, each student and the instructor evaluated the ePortfolio criteria: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics for measuring the level of ePortfolio achievement. The results (**Table *97***) indicate that students assigned higher scores on the ePortfolio criteria compared to tutor's grades.

Table 97 indicates that the overall ePortfolio assessment (Mean=2.46) was high. Specifically, among the ePortfolio criteria, 'usability characteristics' achieved the higher mean score (Mean=2.75) and 'Reflection in action' the lowest mean score (Mean=2.23). This means that, participants (intermediate digital competency level) applied their digital competencies and delivered efficient ePortfolios following the design principles. On the other hand, as the majority of the participants were undergraduate students they couldn't provide an in-depth analysis of their projects and reflect upon their academic and career path.

Table 97. The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio criteria (All studies)

ePortfolio Assessment	**All Studies (N=237)**			**Studies 2-3 (N=151)**		
Criteria	**M**	**SD**	**n**	**M**	**SD**	**n**
ePortfolio Purpose	1.91	.849	237	2.47	.419	151
Artifacts Repository	1.82	.857	237	2.38	.382	151
Reflection in Action	1.59	.812	237	2.23	.484	151
ePortfolio Usability characteristics	2.09	.815	237	2.75	.190	151
ePortfolio Assessment - Overall	**1.86**	**.834**	**237**	**2.46**	**.374**	**151**

(RQ2) *addressed in this research, is analyzed further in* ***(RQ2.3): Are ePortfolio assessment scores appropriate for examining academic achievement? (i.e. the consistency between ePortfolio achievement scores and course grade)?***

A One-way Analysis of Variance (ANOVA) was used to examine whether there are significant differences in the mean scores on the ePortfolio assessment criteria across the four types of assessment methods for studies 2 and 3 (N=151). It was selected one-way ANOVA and can be considered reliable as long as the assumption of normality, homogeneity of variance and independence of samples are met.

The independent variable represented the four different types of assessment methods: 1) students, 2) peers, 3) instructors and 4) external evaluators. The dependent variable was the ePortfolio assessment criteria (**Table *98***).

There was a statistically significant difference at the $p < .001$ level in ePortfolio assessment for four different assessment, $F(2.449, 367.335) = 17.775$, $p = .000$. The effect size, calculated using eta squared, was .106 ($\eta^2 = .106$). Despite reaching statistical significance, the actual difference in mean scores between groups was quite small. Since Mauchly's test ($\varepsilon = 0.000 < .05$) of sphericity was violated (also Greenhouse-Geisser Epsilon was 0.802 >.75), the Huynh-Feld correction was used ($\varepsilon = 0.878 > .75$). Post-hoc comparisons using the Bonferroni test indicated that the mean score of tutor assessment ($M = 2.06$, $SD = 0.44$) was significantly different from Self-assessment ($M = 2.21$, $SD = 0.23$) and Peer assessment ($M = 2.20$, $SD = 0.25$). Also, there was statistically significant difference in mean scores between External evaluators assessment ($M = 2.02$, $SD = 0.37$) and Self ($M = 2.21$, $SD = 0.23$) as well as peer assessment ($M = 2.20$, $SD = 0.25$).

Also, the one-way ANOVA compared the means between the four different assessment measurements (groups) and investigated whether any of those means are significantly different for each of the ePortfolio assessment criteria.

The overall peer assessment (mean=2.23) is higher than external evaluator's assessment. This comparison indicates that students delivered well-designed ePortfolios and embraced SRL principles, their peers where more enthusiastic about the ePortfolio outcomes and gave higher grades. On the other hand, the external evaluator and the instructor gave a more precise evaluation and provided a stricter scoring.

In detail (**Table *98***), findings showed that self-assessment (mean = 2.51) about the purpose of the ePortfolio is higher than external evaluator's assessment. Specifically, these findings suggest that students feel confident about the purpose of their ePortfolio, on the other hand external evaluators are more skeptical about the accuracy of the ePortfolio purpose.

Table 98. The mean scores of each ePortfolio assessment measurement and the analysis of variance for studies 2 and 3 (N=151)

			Studies 2 and 3 (N=151)					
ePortfolio's Criteria	Self	Peer	Instructor	Ex. Eval.	F	Sig	Effect size η^2	Comparison
ePortfolio Purpose	2.47	2.50	2.40	2.20	14.869	0.000	0.090	ExEval<Peer
Artifacts Repository	2.15	2.35	2.10	2.28	17.897	0.000	0.050	Instr. <Peer
Reflection in Action	2.18	2.14	1.98	1.75	21.263	0.000	0.124	ExEval<Self
Usability char.	2.58	2.72	2.56	2.54	10.778	0.000	0.064	ExEval <Peer
Overall	2.21	2.20	2.06	2.02	17.775	0.000	0.106	ExEval<Peer

All in all, it is noted that students' perceptions about their performance and their course grades are equivalent. It can be assumed that students internalized SRL processes and applied them during their academic study. Thus, learners realized the learning content and were able to monitor and evaluate their academic achievement.

Additionally, the quantitative analysis of 'Artifact 1: Implementation of a stand-alone ePortfolio' indicates that participants in Study3 achieved higher levels of expertise in the process of designing and delivering a responsive ePortfolio based on SRL principles, on the other hand participants in Study 1 achieved lower levels of expertise (**Table *99***).

In detail, participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. It is observed that participants were able to remember the basic concepts of an ePortfolio (artifacts, systems, ownership, reflections) and understand the necessity of delivering a dynamic and effective ePortfolio. Participants were less prepared to apply an integrated ePortfolio project. This means that, students faced difficulties in analyzing the aspects and the tools of an ePortfolio, evaluating usability guidelines and creating an effective ePortfolio.

Table 99. Quantitative analysis of ePortfolio achievement among studies

Studies		*ePortfolio Achievement: Level of Expertise*						*Total Score*	*Total%*
		Remember	*Understand*	*Apply*	*Analyze*	*Evaluate*	*Create*		
Weights x	*N*	*1*	*2*	*3*	*4*	*5*	*6*	*21*	*100%*
Study 1	86	0.88	1.72	2.47	3.10	3.47	3.66	15.30	72.9%
Study 2 Expr	70	0.87	1.72	2.54	3.40	4.19	5.14	17.86	85%
Study 2 Cntr	53	0.70	1.42	2.27	3.13	3.64	4.41	15.57	74.10%
Study 3	28	0.95	1.75	2.43	3.25	3.86	4.50	16.73	79.7%
All Studies	**237**	**0.85**	**1.65**	**2.43**	**3.22**	**3.79**	**4.43**	**16.37**	**78%**

The written reflective activity about 'ePortfolio achievement' attempted to measure specific self-regulatory processes (Task Analysis, Activity Judgment, self-evaluation) based on the microanalytic protocols methodology (**Table *100***).

The majority of the participants (89.3%) admitted that the ePortfolio intervention supported them to realize the need of delivering an ePortfolio and admire ePortfolio as a useful tool for their academic achievement. Also, quantitative analysis noted that participants in Study 3 and Study 2 developed higher levels of reflective thinking compared to participants in Study 1. Considering that students in Studies 2 and 3 were older, were able to analyze the ePortfolio construction process, reflect upon their artifacts and deliver a well-organized outcome.

Table 100. Quantitative analysis of reflections about ePortfolio achievement among studies

Studies		*ePortfolio Achievement: Reflection*			*Total Mean Score*	*Total%*
		Task Analysis	*Activity Judgment*	*self-evaluation*		
Scale (1-5)	*N*	*5*	*5*	*5*	*20*	*100%*
Study 1	86	4.26	4.52	4.33	13.11	87.4%
Study 2 Expr	70	4.50	4.71	4.63	13.84	92.3%
Study 2 Cntr	53	4.30	4.38	4.21	12.89	86.0%
Study 3	28	4.54	4.64	4.57	13.75	91.7%
All Studies	**237**	**4.40**	**4.56**	**4.43**	**13.40**	**89.3%**

Table 101, presents the quantitative analysis of students' reflections about ePortfolio's positive characteristics. Specifically, findings yielded that the 17.3% of the participants agreed that the ePortfolio is a useful tool and the 17.1% of the participants admitted that they will 'use the ePortfolio in the future'. From 11.5% to 10% of the students agreed that the construction process of an ePortfolio was an interesting experience, supported them to manage their learning, set goals and feel satisfaction.

Table 101. Quantitative analysis of reflections about ePortfolio achievement (Analysis of Positive characteristics) among studies

Causal Attribution: ePortfolio Positive Characteristics	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
Easy to Use	18	0	0	0	18
Gain Knowledge	13	0	0	0	13
Useful Tool	32	32	19	9	92
Creative Activity	0	0	8	9	17
Satisfactory Experience	27	11	5	10	53
Detailed learning process	27	19	2	13	61
Goal setting	18	20	0	18	56
Future use	28	29	15	19	91
Career development	0	0	14	4	18
Interesting Experience	15	5	0	14	34
Learning Myself	11	25	9	8	53

Collaboration	16	5	0	5	26
Total Concepts	**205**	**146**	**72**	**109**	**532**

Participants reflected upon the positive characteristics of the ePortfolio process and articulated 532 concepts, in comparison to the negative characteristics of the ePortfolio that delivered 196 concepts. This comparison between positive and negative ePortfolio characteristics, highlights the merits of the ePortfolio project.

Table 102, presents the quantitative analysis of students' reflections about ePortfolio's negative characteristics. Specifically, the 39% of the participants noted that the ePortfolio construction process was a time-consuming activity. On the other hand, the 15% of the students suggested that they couldn't mention negative characteristics and they were very satisfied with the ePortfolio process.

Table 102. Quantitative analysis of reflections about ePortfolio achievement (Analysis of Positive characteristics) among studies

Causal Attribution: ePortfolio Negative Characteristics	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
Time Consuming	12	24	22	19	77
Limited ePortfolios examples	0	2	7	4	13
Complicated workload	0	12	0	6	18
Limited Artifacts and Projects	0	10	9	2	21
Self-assessment	0	2	0	1	3
Limited F2F interaction	0	0	16	6	22
Limited online interaction	0	0	12	0	12
None	0	20	1	9	30
Total Concepts	**12**	**70**	**67**	**47**	**196**

For answering "***Research question 2.4: How did students use the ePortfolio system?"***, log files of the ePortfolio system were used. Log files of the system is an automatic way to gather learning data. This means that, when students login on their profiles, the ePSRL system keeps track of users' actions and interactions.

The ePSRL system was designed as a learning management system and as a social networking service/site (SNS), where participants interact, communicate, share their goals, follow the schedule, exchange ideas, articulate artifacts and reflections. The system combined individual profile pages with communication and interaction tools. For the needs of this research, the ePSRL system supported logs that gather a range of users' data such as personal information, artifacts, grades, posts, messages etc.

(RQ2.4) addressed in this research, is analyzed further in sub-question (i.) Which features did they use and why? (ii.) Which plugins did they use?

Considering the aim of this research, the ePortfolio system's log files were categorized in six groups that are aligned to ePortfolio's purpose: storing, organizing, presenting, interaction, progressing, and communication-feedback (**Figure *90***).

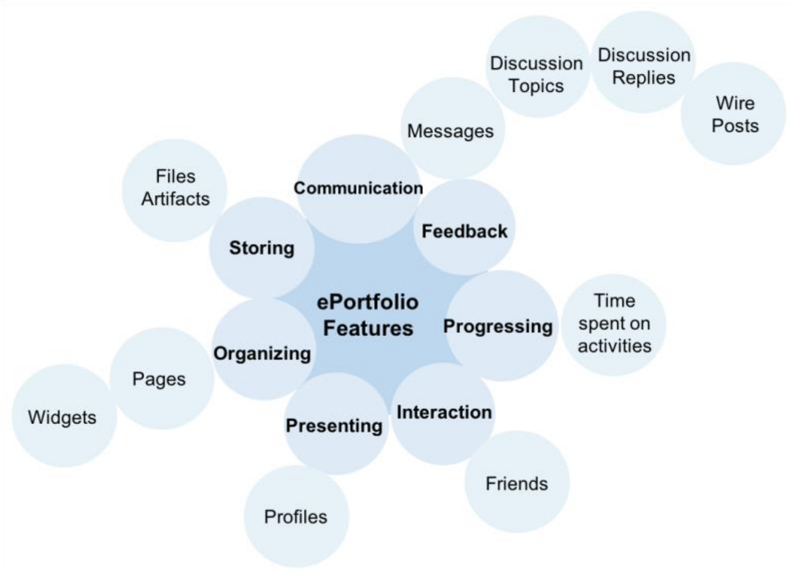


Figure 90. ePortfolio Features

The ePortfolio system was based on the open social network platform, ELGG which embraces various functionalities through the plugins. For the proposed ePortfolio system were selected 41 plugins that provided extended system functionality, languages, themes etc. For the implementation of the ePortfolio system, in study 1 and 3 were used 27 plugins and in study 2 used 26 plugins (APPENDIX I: ePortfolio Plugins). The common plugins that used in all studies and extended ePortfolio's functionality were: Embed, Site pages, File, Messages, Pages, Profile Manager, Profile, Reported Content, Search, Site notification, Likes, Log browser, Log rotate, Members and Message board (**Table *126***).

(RQ2.4) addressed in this research, is analyzed further in sub-questions **(iii.) How many artifacts did they upload? and (iv.) How much time did they devote in the ePortfolio system?**

The quantitative analysis of the ePortfolio system's log files suggests that the ePSRL system is an effective means of storing content (**Figure *91***). Participants in study 2 and 3 were organized (30%), uploaded their artifacts and integrated images, presentations, documents and digital tools. The average number of uploaded artifacts suggests that participants in Study 1 fail to organize their learning activities and complete their tasks. Overall, participants (N=184) uploaded 4412 artifacts and stored their content. This finding is consistent to studies that highlight the potential of ePortfolios as learning repositories (Lopez-Fernandez & Rodriguez-Illera, 2009) (***Table 103***).

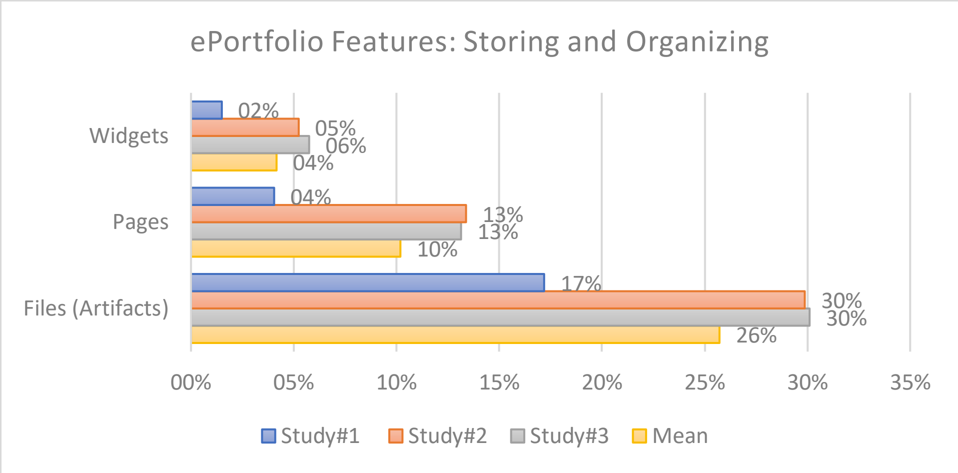


Figure 91. ePortfolio Features: Storing and Organizing

Also, the ePortfolio system's log files indicate that the ePSRL system is an effective means of organizing content (***Table 103***). Specifically, participants used the ePortfolio feature 'Pages' and created 1653 pages for describing and presenting their artifacts. Further, users exploited 657 'Widgets' for calibrating their profiles and exploring services. Consistent with previous findings, this research admits that ePortfolios enable students to integrate digital tools and better demonstrate their artifacts and learning (Meyer et al., 2010).

Further, system's log files yield that the ePSRL system is an accurate means of presenting content and promotes interaction. Participants in study 1 had the opportunity to personalize their profile and complete 5 custom profiles fields such as display name, upload image, status, education, location. In addition, participants in study 2 and 3 added more elements on their profiles such as: position, expertise, interests and email. This finding is consistent with accounts from prior studies that an ePortfolio is a way for presenting aspects of self and reflecting upon learning (Wade, Abrami, & Sclater, 2005).

Also, from the log files of the ePSRL System, it was measured the progress of the users over the time. Towards this, all participants devoted 3.4 hours on reading, editing and uploading artifacts on the system (Average time Spent on activities) and 4.4 hours on reading content, participating in discussions, creating friends' connections, informing about the schedule and viewing the system.

All participants used the 'Friends' feature of the system for interacting and exchanging ideas. Specifically, in study1 participants friended almost 43 users, participants in study2 created groups with 65 friends and participants in study 3 became all friends (28 members). Also, all participants became 'friends' with their instructors and teachers. Thus, the use of a social networking engine as an ePortfolio was successful, as participants articulated a learning community and created groups of friends. This finding is consistent with accounts from prior studies as the system served as a means to establish a learning community where users learn to manage their self-identity, share media and which in turn can motivate users (Arnold and Paulus, 2010).

Table 103. Overall ePortfolio system features

System Features	*Study#1 (N=86)*	*Study#2 (N=70)*	*Study#3 (N=28)*	***Overall (N=184)***
Storing				
o Files (Artifacts)	1478	2091	843	**4412**
Organizing				
o Pages	348	937	368	**1653**
o Widgets	129	367	161	**657**
Progressing				
o Average time Spent on activities	2,5hrs	3,2hrs	4,5hrs	**3,4hrs**
o Average time Spent on the system	3,5hrs	4,5hrs	5,2hrs	**4,4hrs**
Presenting				
o Custom profile fields	5	9	9	**23**
Interaction				
o Friends connections	43	65	28	**-**
Communication/feedback				
o Messages	1387	1839	830	**4056**
o Discussion Replies	298	479	216	**993**
o Discussion Topics	98	128	57	**283**
o Wire posts	34	108	43	**185**

(RQ2.4) addressed in this research, is analyzed further in sub-questions **(v.) How many messages did they send? And (vi.) How many questions did they set?**

The ePortfolio system's log files indicate that the ePSRL system is an interactive environment that enables communication and feedback (***Table 103***). Specifically, participants used the ePortfolio features 'Messages', 'The Wire' and 'Groups' for exchanging ideas and collaborating. In detail, participants in study2 and 3 exchange messages over the average. This means that they ePortfolio system helped them interact, seek for help and exchange ideas. On the other hand, students in study1 were less talkative. Overall, students, instructor and teachers sent 4056 messages. Further, students use 'Groups' for discussing various topics. In 'Groups' participants created 283 topics for discussion and set 993 discussion replies. Consistent with previous findings, this research admits that when ePortfolios embed features of social network tools can help users to collaborate (e.g. forum, chat, comment), see their deficiencies, identify areas where they should advance (Beresford & Cobham, 2010; Zhang et al., 2011).

(RQ2.4) addressed in this research, is analyzed further in sub-questions **(vii.) Which tools did they use for structuring a stand-alone ePortfolio?**

All participants engaged in the process of delivering ‘Artifact 1: Implementation of a stand-alone ePortfolio’. They attempted to choose a web-based environment or a web 2.0 tool for developing a customized ePortfolio as stand-alone application. Observing the final students’ deliverables, the 43% of the participants selected ‘Wix’ a user-friendly website builder and the 26% of the participants selected another well-known website builder ‘Weebly’. Students selected tools that enabled them to design their own pages, structuring their artifacts and personalize the content (**Table *104***).

Table 104. Selection of stand-alone ePortfolio implementations

ePortfolio Systems	*Study#1 (N=86)*	*Study#2 (N_E=70)*	*Study#2 (N_C=53)*	*Study#3 (N=28)*	***Overall (N=237)***
○ **Wix**	47	17	21	18	103 (43%)
○ **Weebly**	22	15	16	8	61 (26%)
○ **Google Sites**	17	11	9	2	39 (16%)
○ **Mahara**	0	14	7	0	21 (9%)
○ **Yola**	0	7	0	0	7 (3%)
○ **LinkedIN**	0	6	0	0	6 (3%)

(RQ2) addressed in this research, is analyzed further in **(RQ 2.5): To what extent does the ePortfolio based Self-Regulated Learning (ePSRL) intervention contribute to learners’ satisfaction?**

After the completion of the experimental procedure, participants completed a ‘Post ePortfolio-Intervention Review’, that consisted of six open-ended questions APPENDIX D: Pre and Post Rubrics). The goal of this instrument is to record students’ perceptions about the ePortfolio process and the levels of satisfaction.

The sample of this research was invited to record the positive characteristics of the ePortfolio process and explain ‘Why this was a positive experience?’ (**Table *105***).

Participants admitted that the ePortfolio experience had a positive effect on their learning. According to students’ written reflections, they used 614 concepts for describing the positive effects of the ePortfolio intervention. In detail, participants in Study2 used 301 concepts and in Study1 analysed 164 concepts, in comparison to students in study 3 that used only 79 concepts. This means that participants in Study 1 and 2 were more enthusiastic and value the process.

Table 105. Qualitative Analysis of students’ reflections about ePortfolio experience (Positive ePortfolio Elements)

Intervention Experience: Positive Elements	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*

Presenting Myself	21	17	16	6	60
Discovering my skills	14	28	11	8	61
Organized learning content	0	40	0	9	49
Timely feedback	0	27	0	2	29
Becoming a better version of myself	16	31	8	9	64
Setting my goals	18	18	0	5	41
Managing my time	18	15	3	5	41
Monitoring my progress	16	7	0	11	34
Hands on activities	8	18	0	2	28
Learning to organize my study	21	28	0	6	55
Familiarize with tools	7	15	0	1	23
Creating a learning community	2	34	0	7	43
Supporting my academic & career path	23	11	14	6	54
Career development – Creating my CV	0	12	18	2	32
Total Concepts	**164**	**301**	**70**	**79**	**614**
Concepts %	**26.7%**	**49.0%**	**11.4%**	**12.9%**	

In general, the 10.4% of participants admitted that the ePortfolio helped them learn how to organize their learning tasks and keep track of their activities. The 9% of the students suggested the ePortfolio experience supported them to engage in the process of monitoring the learning progress. Further, the 8.8% of the sample agreed that the ePortfolio experience it was an opportunity to learn, use and familiarize with various tools. The 8.0% of participants yielded that through the process they recognized and presented their skills. To sum up, the majority of the students holds a positive attitude towards the ePortfolio experience and they feel satisfaction for participating in the ePortfolio intervention.

Students were invited to record the negative characteristics of the ePortfolio process and explain 'Why this was a negative experience?' (**Table *106***).

Participants felt that the ePortfolio experience had a few negative elements. According to students' written reflections, they used only 318 concepts for describing the negative elements of the ePortfolio intervention. In detail, participants in Study2 used 110 concepts and in Study1 analysed 86 concepts, in comparison to students in study 3 that used only 39 concepts. In general, participants in Study 1 and 2 were more enthusiastic and they wanted to reflect upon the process, on the other hand participants in Study3 were more skeptical.

and value the process.

Table 106. Qualitative Analysis of students' reflections about ePortfolio experience (Negative ePortfolio Elements)

Intervention Experience: Negative Elements	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
Integrated ePortfolio system	1	3	14	0	18
ePortfolio design and implementation	8	5	10	5	28
Difficulty in understanding the ePortfolio purpose	6	3	7	1	17
Difficulty in goal setting	3	0	0	0	3
Weak career profile	3	2	3	0	8
Time Management	0	20	14	7	41
Pressing Workload and schedule	24	46	6	17	93
Difficulty in managing artifacts	10	13	7	2	32
Poor Learning Resources	8	0	3	1	12
Communication with experts	4	3	5	2	14
None	19	15	14	4	52
Total Concepts	**86**	**110**	**83**	**39**	**318**
Concepts %	**27%**	**34.6%**	**26.1%**	**12.5%**	

The 29.2% of participants admitted that the workload was pressing and the time schedule had short-term deadlines (time management = 12.9%). An interesting finding suggests that the 16.4% of participants didn't mention negative elements and they believed that the ePortfolio intervention was effective and meaningful.

Participants invited to submit a comment 'What do you think should be added, changed or removed from the ePortfolio Project?' (**Table *107***).

Table 107. Qualitative Analysis of students' reflections about future ePortfolio implementation (suggestions)

Intervention Experience: **Future Suggestions**	**Study 1**	**Study 2 Experimental**	**Study 2 Control**	**Study 3**	**All Studies**
Participants (N)	*86*	*70*	*53*	*28*	*237*
Information about academic study & strategies	9	0	3	3	15
Time schedule and Workload	4	41	7	11	63
Activities 'how to create my CV'	15	4	8	0	27
Fewer Reflective Questions	8	7	0	3	19
Collaborative Activities	0	0	0	5	5
Online Interaction	0	0	12	0	12
Flexible Design	6	5	0	2	13
ePortfolio examples	8	11	8	4	31
Learning Management system	0	0	14	0	14
Activities in the class	3	9	7	2	21

Expert's Suggestions	4	3	2	3	12
Career Development	5	0	0	0	5
None	23	15	13	5	56
Total Concepts	**86**	**95**	**74**	**38**	**293**
Concepts %	**29.4%**	**32.4%**	**25.3%**	**29.4%**	

The 21.5% of students proposed the design of a flexible time schedule for the ePortfolio intervention. Many students yielded that ePortfolio activities should have a different allocation for reducing the workload. Further, the 11% of participants agreed that they wanted to study and review a wide range of ePortfolio examples. An interesting fact is that the 19.1% of the sample didn't mention changes nor suggestions for future ePortfolio implementation. Participants believed that the ePortfolio intervention was well-distributed and the content was organized.
In addition, the 94.5 % of the sample agreed that the teachers, administrators and instructors were very helpful and positive. Participants noted that the active communication and continuous feedback supported them to complete their projects (***Table 108***).

Table 108. Qualitative Analysis of students' reflections about their interaction with instructor/teacher

Intervention Experience: Interaction	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
Yes – positive interaction	80	70	48	26	224
No – negative interaction	2	0	2	1	5
Neutral Interaction	2	0	3	1	8

Finally, the 78,5% of participants highlighted that they would like to continue using their ePortfolio (***Table 109***). Also, they indicated that this is a valuable tool that will help them to organize their studies, manage their skills and market themselves to future employers. It is interesting that the 96,4% of postgraduate students (Study 3) and the 94,3% of third-year students (Study 2) agreed that they will use the ePortfolio in the near future. Postgraduates yielded that this is an effective tool for their career development.

Table 109. Qualitative Analysis of students' reflections about their Future Use of their ePortfolio

Intervention Experience: Future Use	Study 1	Study 2 Experimental	Study 2 Control	Study 3	All Studies
Participants (N)	*86*	*70*	*53*	*28*	*237*
Yes	53	66	40	27	186

No	33	4	13	1	51

On the other hand, first-year students (Study 1= 61.6%) valued the ePortfolio but they weren't ready to manage their career path. Probably, undergraduates didn't develop the meaningful connections between the ePortfolio process and their personal, academic and career development.

5.4 RQ3 – Data Analysis

Research Question 3- (RQ3) Did ePortfolio based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practice SRL processes?

The goal is to examine the ePortfolio system as an effective platform that bolsters SRL processes and investigate the relationship between the ePortfolio use and SRL competency.

A reliability analysis was, hence, conducted to measure the instrument's (ePortfolio based Self-Regulated Learning Rubric) internal consistency. Findings indicate that Scale-Phase A [Forethought Phase], had a high reliability (Cronbach's Alpha=.913, Scale Phase B [Performance Control] had a high reliability (Cronbach's Alpha=.872) and Scale Phase C [Self-Reflection] measure also had a high reliability (Cronbach's Alpha=.844) (**Table *110***) (Nunnally & Bernstein, 1994).

Table 110. Internal consistency reliability coefficients of the ePortfolio based Self-Regulated Learning Rubric

Constructs	Items	All Studies
Phase A [Forethought Phase]	19	.913
Phase B [Performance Control]	11	.872
Phase C [Self-Reflection]	10	.844

Descriptive statistics was employed to describe the data (SRL phases) of the ePortfolio based Self-Regulated Learning Rubric (***Table 111***).

Table 111. The number of subjects (n), the Mean (M) and the Standard Deviation (SD) of ePortfolio based Self-Regulated Learning Rubric

ePortfolio based Self-Regulated Learning Rubric	**Experimental Group ALL Studies**		
	M	**SD**	**n**
Phase A [Forethought Phase]	3.82	0.54	184
Phase A. Cognitive Processes	3.84	0.56	184
Phase A. Motivation Processes	3.75	0.61	184

Phase A. Affective Processes	3.93	0.60	184
Phase A. Context Processes	3.81	0.84	184
Phase B [Performance Control]	3.86	0.59	184
Phase B. Cognitive Processes	3.86	0.63	184
Phase B. Motivation Processes	3.76	0.83	184
Phase B. Affective Processes	3.88	0.81	184
Phase B. Context Processes	3.91	0.69	184
Phase C [Self-Reflection]	3.88	0.54	184
Phase C. Cognitive Processes	3.91	0.60	184
Phase C. Motivation Processes	4.11	0.69	184
Phase C. Affective Processes	3.84	0.81	184
Phase C. Context Processes	3.76	0.68	184

The findings suggest that ePSRL system received mean values close to 4.0 across the three SRL phases, which means that the ePortfolio supported SRL in a good level. Further, the findings indicate that mean values of the three SRL phases were almost equal. Students engaged in the ePortfolio intervention and experienced SRL processes. During the phases, participants acquired knowledge and SRL skills and completed their ePortfolio. This means that students' internalized SRL processes and practice SRL skills.

Pearson correlation analysis was selected for exploring the relationships between SRL phases and ePortfolio achievement. ***Table 112*** revealed that correlation coefficient was significant for specific items.

Table 112. Correlations among SRL phases, ePortfolio achievement and course grade

Variables- All Studies	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
[1] Phase A [Forethought Phase]	1					
[2] Phase B [Performance Control]	.414*	1				
[3] Phase C [Self-Reflection]	.245	.872**	1			
[4] ePortfolio Self-Assessment	.284	.659**	.608**	1		
[5] ePortfolio Tutor's Assessment	.187	.109	.158	.368	1	
[6] Course Grade	-.196	-.144	-.091	-.043	.029	1

The coefficients of Pearson's correlation revealed that Phase A [Forethought] was positively related to Phase B [Performance Control] and Phase C [Self-Reflection] which indicates that ePSRL system facilitated the cyclic nature of SRL and conceptualized it as a process.

In order to analyze the differences among the Study 1, 2 and 3 including differences within SRL phases, it was conducted one way-ANOVAs (Analysis of Variance between groups) (**Table *113***). The findings yield that in Phase B [Performance Control] the three studies differ. This means that in Study2 learners performed better and probably they applied SRL processes for implementing their ePortfolios.

Table 113. One-way ANOVA results for ePortfolio based Self-Regulated Learning Constructs among studies

		All Studies (N=184)					
ePortfolio based Self-Regulated Learning Constructs	*Study#1*	*Study#2*	*Study#3*	*F*	*Sig*	*Effect size η^2*	Comparison
Phase A [Forethought Phase]	3.56	4.09	3.96	24.880	.000	.216	**Study1<Study3<Study2**
Phase A. Cognitive Processes	3.59	4.11	4.00	14.389	.000	.190	**Study1<Study3<Study2**
Phase A. Motivation Processes	3.52	4.02	3.78	14.438	.000	.137	**Study1<Study3<Study2**
Phase A. Affective Processes	3.70	4.16	4.11	19.004	.000	.138	Study1<Study3.Study2
Phase A. Context Processes	3.44	4.15	4.12	20.138	.000	.174	Study1<Study3.Study2
Phase B [Performance Control]	3.58	4.18	3.94	25.243	.000	.218	**Study1<Study3<Study2**
Phase B. Cognitive Processes	3.58	4.16	4.03	21.454	.000	.192	Study1<Study3.Study2
Phase B. Motivation Processes	3.44	4.20	3.69	19.579	.000	.178	**Study1<Study3<Study2**
Phase B. Affective Processes	3.47	4.32	4.05	28.856	.000	.242	Study1<Study3.Study2
Phase B. Context Processes	3.77	4.09	3.92	4.300	.015	.045	**Study1<Study3<Study2**
Phase C [Self-Reflection]	3.67	4.10	4.01	14.378	.000	.137	Study1<Study3.Study2
Phase C. Cognitive Processes	3.66	4.16	4.10	18.037	.000	.166	Study1<Study3.Study2
Phase C. Motivation Processes	3.92	4.32	4.23	7.721	.001	.079	Study1<Study3.Study2
Phase C. Affective Processes	3.68	4.08	3.76	5.144	.007	.054	Study1. Study3<Study2
Phase C. Context Processes	3.61	3.91	3.87	4.278	.015	.045	Study1<Study3.Study2
ePortfolio Self-Assessment	3.59	4.11	4.00	6.863	.001	.700	Study1<Study3.Study2
ePortfolio Tutor's Assessment	3.52	4.02	3.78	25.900	.000	.223	Study1<Study3.Study2
Course Grade	3.70	4.16	4.11	40.593	.000	.309	Study1.Study3<Study2

Df=(2 , 181), N=184

(RQ3) addressed in this research, is analyzed further in ***(RQ3.1): What are the students' perceptions of the ePortfolio based Self-Regulated Learning (ePSRL) intervention about SRL processes?***

The qualitative analysis of the artifact about 'Self-Assessing My SRL skills' (A24) indicates that participants in Study 2 developed a great set of concepts (total Number=305), in the second place is Study 1 (total number of concepts=227) and in the last place is Study 3 (**Table *114***). The total number of concepts that articulated is 686, this pinpoints that students engaged in ePortfolio intervention and learn how to use and apply SRL in action. Among the concepts that students recorded were important SRL processes such as goal setting, motivation, self-efficacy, self-monitoring, help seeking, learning strategies and self-reflection.

Table 114. Qualitative Analysis of students' written reflections about their SRL competency

Reflections: SRL in action competency	*Study 1*	*Study 2*	*Study 3*	*All Studies*
Participants (N)	*86*	*70*	*28*	*184*
Academic and Career development	21	29	10	60
Reconsidering mistakes	11	5	0	16
Organizing learning path	28	32	16	76
Goal setting	32	42	14	88
Motivation	13	26	14	53
Collaboration	17	18	9	44
Skills Development	0	30	15	45
Self-efficacy	25	32	13	70
Self-evaluation	24	23	12	59
Learning Strategies	20	11	4	35
Self-Monitoring	15	17	7	39
Help Seeking	0	19	14	33
Self-reflection	0	0	14	14
Total Concepts	**227**	**305**	**154**	**686**

*The findings suggest that the 12.8% of the participants admitted that this intervention actively engaged them in learning how to set and attain their goals (***Table** ***115****). This means that the ePSRL intervention helped students to practice SRL skills. Also, the 10,2% and the 11,1% of the sample admitted that they managed their self-efficacy beliefs and realized the necessity of using learning strategies. These reflections highlight the fact that ePSRL intervention was a meaningful process that helped users internalize SRL and use the processes appropriately.*

Table 115. Quantitative Analysis of students' reflections about SRL in action

Reflections: SRL in action competency													
Studies	**Academic and Career development**	**Reconsidering mistakes**	**Organizing learning path**	**Goal setting**	**Motivation**	**Collaboration**	**Skills Development**	**Self-efficacy**	**Self-evaluation**	**Learning Strategies**	**Self-Monitoring**	**Help Seeking**	**Self-reflection**

Study 1	9,3%	4,8%	12,3%	14,1%	5,7%	7,5%	0,0%	11,0%	9,3%	10,6%	8,8%	6,6%	0,0%
Study 2	9,5%	1,6%	10,5%	13,8%	8,5%	6%	9,8%	10,5%	6,9%	7,5%	3,6%	5,6%	6,2%
Study 3	6,5%	0,0%	10,4%	9,1%	9,1%	5,8%	9,7%	8,4%	7,8%	7,8%	2,6%	4,5%	9,1%
All Studies	8,7%	2,3%	11,1%	12,8%	7,7%	6,4%	6,6%	10,2%	7,9%	8,6%	5,1%	5,7%	4,8%

(RQ3) addressed in this research, is analyzed further *in* ***(RQ3.2): Are there significant differences between low- and high-achievers in terms of SRL processes?***

It was conducted an independent samples t-test between high and low achievers' groups (***Table 116***). The results yielded that there was no statistically significant difference in the Phase A [Forethought] and Phase C [Self-Reflection] between the two groups. In contrast, there was a significant difference in Phase B [Performance Control].

Table 116. Independent Samples t-test between low and high-achievers

Independent Samples											
	Low Achievers			High Achievers							
Variables ALL Studies	**N**	**M**	**SD**	**N**	**M**	**SD**	**95% CI for Mean Difference Lower**	**95% CI for Mean Difference Upper**	**p-value**	**t**	**df**
Phase A [Forethought Phase]	108	3.74	.534	76	3.93	.532	.034	.350	.017	2.408	182
Phase A. Cognitive Processes	108	3.77	.569	76	3.95	.556	.016	.349	.032	2.167	182
Phase A. Motivation Processes	108	3.68	.617	76	3.85	.597	-.007	.352	.061	1.888	182
Phase A. Affective Processes	108	3.84	.630	76	4.05	.553	.031	.385	.022	2.318	182
Phase A. Context Processes	108	3.71	.823	76	3.95	.859	-.004	.490	.054	1.937	182
Phase B [Performance Control]	108	3.74	.584	76	4.03	.565	.114	.454	.001	3.294	182
Phase B. Cognitive Processes	108	3.75	.614	76	4.03	.636	.094	.462	.003	2.980	182
Phase B. Motivation Processes	108	3.60	.811	76	4.00	.826	.163	.646	.001	3.307	182
Phase B. Affective Processes	108	3.72	.824	76	4.10	.758	.147	.618	.002	3.207	182
Phase B. Context Processes	108	3.85	.713	76	4.00	.652	-.057	.349	.158	1.419	182
Phase C [Self-Reflection]	108	3.81	.529	76	3.98	.558	.015	.335	.032	2.159	182
Phase C. Cognitive Processes	108	3.81	.626	76	4.06	.536	.071	.421	.006	2.784	182
Phase C. Motivation Processes	108	4.02	.689	76	4.25	.675	.020	.424	.031	2.170	182
Phase C. Affective Processes	108	3.78	.749	76	3.93	.899	-.093	.387	.229	1.207	182
Phase C. Context Processes	108	3.74	.625	76	3.79	.763	-.152	.252	.627	.487	182

Chapter 6: Discussion and Conclusions

6.1 Main Findings

This research put emphasis on the fact that the ubiquitous presence of technology, the penetration of social media in academic life and the new landscape of skills seem to challenge HE environments, academic achievement and individuals' well-being (Abbott-Chapman, 2011; Bartolomé and Steffens, 2011; Lau, 2017).

Empirical evidence notes that there are several examples of students who cannot find a balance between their academic and social life, thus they fail to follow a smooth transition into HE (Postareff et al., 2017). Consequently, as students attempt to find the perfect fit between choices and their expectations they often find it difficult to manage their learning path (Azevedo et al., 2012). Research unveils that learners fail to set measurable goals, organize their academic activities, use a set of learning strategies and follow a non-structured class time (Hawkins et al. 2005; Huie, Winsler & Kitsantas, 2014). When individuals experience difficulties in using their knowledge and skills proactively, then they cannot advance their academic performance (Zimmerman, 1986). Thus, low achievement may uncover limitations on cognitive, affective, behavioral and social processes of learning (Zimmerman, 1986; Zimmerman & Schunk, 2011).

The above facts imply that there is a need of thorough investigation of the predictors that contribute to high academic achievement. Thus, this research explored the predictors that ensure that learners can be motivated, use strategies effectively and manage their learning. Also, I examined how these predictors can positively affect students' academic achievement. Towards this, I attempted to design and test an educational intervention that encompasses a dynamic learning model, i.e. Self-Regulated Learning and a student-centered TELE, i.e. ePortfolio.

Acknowledging the fact that ePortfolios can enhance an individual's ability to learn in a self-regulated way and promote the development of both hard and soft skills (Wade, Abrami & Sclater, 2005; Alexiou and Paraskeva, 2010; 2019), the design of an ePortfolio intervention (as a dynamic TELE) to establish SRL skills and measure the interconnections among SRL process, academic achievement and the system is recommended. There have been numerous studies on examining the potential of ePortfolios as a vehicle for supporting reflection, assessment and learning (Barbera, 2009; Wang and Wang, 2009; Joyes et al., 2010; Chang & Tseng, 2011; Snider & McCarthy, 2012; Tzeng & Chen, 2012; Abrami et. al., 2013; Cheng & Chau, 2013; Chang et al., 2013; Nguyen & Ikeda, 2015; Beckers, 2016; Rezgui, Mhiri, Ghedira, 2017; Chang, Chou & Liang, 2018).

This is the first known study to deliver an ePortfolio as an intervention program that supports self-regulated learning (SRL). This PhD seeks to contribute to the field of Personal Development Planning (PDP) and well-being by investigating the effect of the ePortfolio intervention on SRL and academic achievement.

Considering these facts, a general question that is posed to: 'In what ways may an educational intervention contribute to high academic achievement and students' well-being?'. Towards this, three Research Questions were formulated and tested (***Figure 92***).

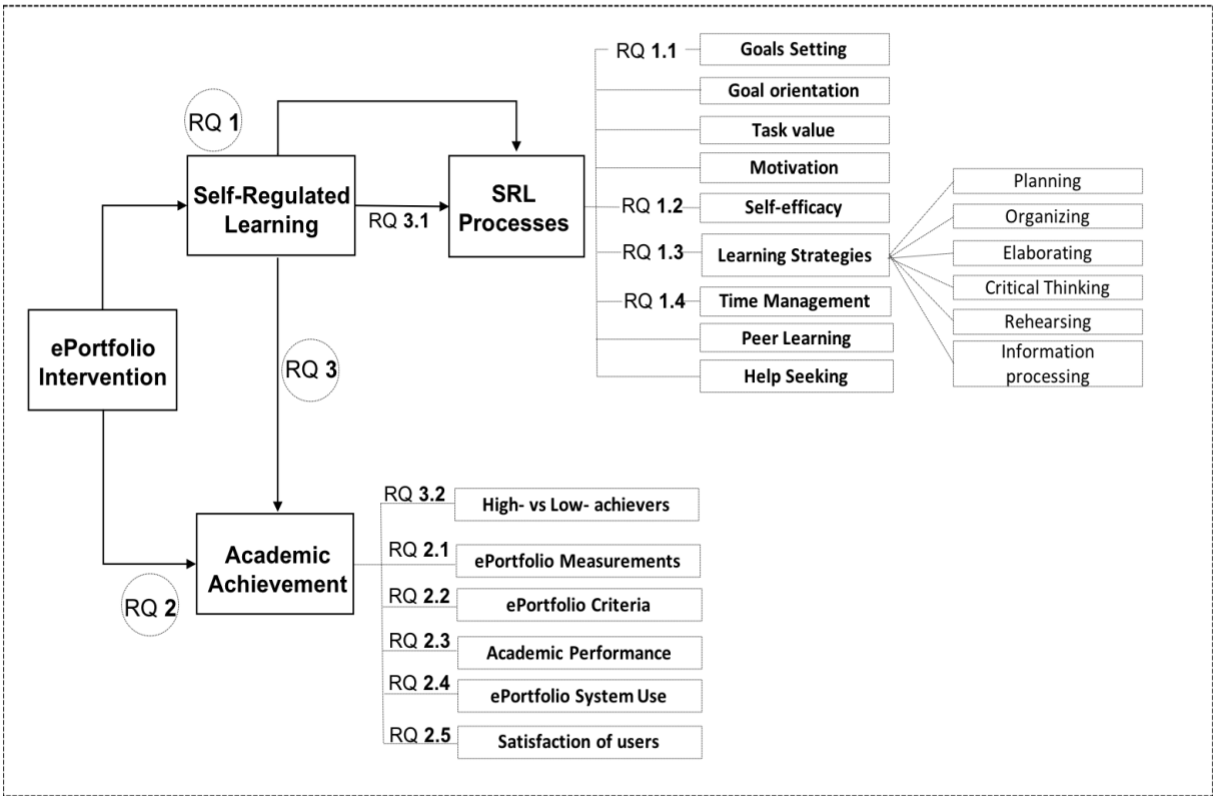


Figure 92. Representation of Research Questions and Research Variables

RQ1*- Does the ePortfolio based Self-Regulated Learning (ePSRL) intervention affect Self-Regulated Learning processes?*

- ***RQ1.1-*** *Does the ePSRL intervention affect goal setting?*
- ***RQ1.2-*** *Does the ePSRL intervention affect self-efficacy?*
- ***RQ1.3-*** *Does the ePSRL intervention affect time management?*
- ***RQ1.4-*** *Does the ePSRL intervention affect learning strategies?*

Quantitative Data

In order to evaluate the effects of the ePSRL system on SRL skills, a paired two-tailed t-test was used to examine the differences between pre and post-test (self-report data- Questionnaire about

SRL skills). The ePSRL approach and the ePortfolio system had positive effects on students' self-regulated learning skills. Specifically, the results show that students implemented self-regulated processes and their goal setting, motivation, intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy, learning strategies, time management, peer learning, help seeking improved after applying ePSRL approach to their academic study.

Overall, results indicated the ePSRL approach affected students' learning in a positive manner. Therefore, the ePSRL intervention promoted participants' motivation and learning strategies. In detail:

Results indicate that after the intervention, **students' intrinsic goal orientation improved**. This means that students displayed interest in the ePSRL approach for reasons such as challenge, curiosity, enjoyment and mastery. When students activate their intrinsic goal orientation toward activity, they can direct their actions and value their participation in the task.

Results indicate that after the intervention, **students' extrinsic goal orientation improved**.

Probably, students completed their ePortfolio because they believed that the outcome was valuable for their academic development and the process had an instrumental value for their performance. A significant indicator of extrinsic motivation is the acquisition of excellent grades and achieving high performance.

Results reveal that after the intervention, **students' task value improved**.

Participants agreed that the process of constructing their ePortfolio was a meaningful process and helped them realize their own process of learning. Participants also believed that the learning content was meaningful, well-organized and they could apply what they had learned during their academic studies. Also, after finishing the intervention, students were more interested in the process of constructing an ePortfolio and applying effective SRL strategies.

Results show that after finishing the intervention, **students' self-efficacy improved**.

This means that the ePSRL approach supported students to strengthen their confidence about their skills to perform the tasks and deliver their ePortfolio. Results indicate that students felt confident about their performance and they were positive that they could master the delivery of their ePortfolio.

Results indicate that after the intervention, **students' learning strategies improved**.

Students agreed that cognitive strategies like rehearsal (which is linked to surface learning) can support them to initiate the design of their ePortfolio. Furthermore, the application of elaboration (note-taking, summarizing, paraphrasing), organization (outlining, grouping, creating tables), critical thinking, metacognitive control, resource management and collaborative strategies in the ePortfolio construction process may assist learners and support them bolster their performance.

The ePSRL approach helped students to get involved in the learning process, gain a deeper understanding of the content and structure their own cognitive schemas.

Results indicate that after the intervention, **students' time management improved**.

The findings suggest that after the completion of the ePortfolio intervention, students understood how to manage time well and stressed the need of selecting an ideal study environment. The ePSRL approach supported learners to become fully aware of their time management habits and beliefs and follow specific strategies so as to be effective time managers in academic and professional settings.

Results indicate that after the intervention, **students' peer learning improved.**

The ePSRL approach invited learners to engage in a social network community, to develop skills of collaboration and to act as parts of a learning community. Students got involved in the process of delivering an ePortfolio and practised their communication and collaboration skills. Also, they collaborated with others to achieve mutual goals, to construct ideas and enhance performance.

Results indicate that after the intervention, **students' help seeking improved.**

Throughout the intervention, learners engaged in individual and group activities and got familiarized with the process of requesting assistance from peers, instructors or knowledgeable others. Students realized that help-seeking is social in nature and it isn't considered as a weakness but as an ability to activate effective communication for learning.

The Pearson's correlation approach was also performed to examine the relationships between the SRL processes and the ePortfolio assessment level as well as between SRL processes and the course grade. Findings indicate various highly significant intercorrelations between constructs in Scale A: Motivation and Scale B: Learning Strategies. Also, the scales (A & B) were also significantly positively related to each other, except for the ePortfolio assessment and the course grade. This finding is consistent with recent findings that indicate that SRL can lead to deep learning and high ePortfolio achievement (Cheng and Chau, 2013). The data suggest that further investigation of other types of analysis that explore ways in which the ePSRL approach affects SRL processes is needed.

Qualitative Data

Learners get involved in ePSRL approach which consists of a set of artifacts that engage learners in the process of structuring the ePortfolio. The ePSRL approach follows a linear pre-fixed order of tasks, where learners have the opportunity to adapt to the proposed path or to select their own sequence of learning tasks. The evaluation of the artifacts followed three dimensions: Knowledge, Cognitive and Reflective (**Table *117***). Overall, the data shows that all the dimensions were above 50%: Knowledge Dimension 70,7%, Cognitive Dimension 81,6%, Reflective Dimension 75% (See sections 4.1-4.3). This means that students were engaged in the learning activities of the ePSRL approach and used SRL strategies to complete their ePortfolios.

Table 117. Evaluation of the ePortfolio-based self-regulated learning (ePSRL) approach – All studies

Evaluation of ePortfolio-based self-regulated learning (ePSRL) approach (All Studies)										
ePortfolio-based self-regulated learning (ePSRL) approach	**SRL Processes** C: Cognitive, A: Affective, B: Behavior, Cx: Context	**Knowledge dimension**			**Cognitive Dimension**			**Reflective Dimension**		
		Total	**Mean**	**Avg%**	**Total**	**Mean**	**Avg%**	**Total**	**Mean**	**Avg%**
A1: Implementation of a stand-alone ePortfolio	C: Task Analysis C: Self-Observation C: Self-satisfaction C: Self-evaluation	-	-	-	21	16,37	78%	20	13,40	89,3%
A2: Personality Characteristics and Skills	A: Self-Efficacy A: Efficacy Judgement	35	17,78	50,8%	30	25,34	84,5%	20	15	75,0%
A3: Goal Setting	C: Goal Setting A: Goal Orientation	30	18,05	60,2%	30	19,12	63,7%	20	11,48	57,4%
A4: Exploring my Motivations	A: Self-motivation beliefs	50	31,34	62,7%	30	20,65	68,9%	20	13,09	65,5%
A5: Strategic Planning	C: Strategic Planning A: Task Value & Activation B: Planning of Self-Observation	20	14,80	74,0%	30	23,65	78,9%	20	16,65	83,3%
A6: Becoming a specialist in decision making	A: Intrinsic Interest A: Interest Activation Cx: Perception of Task Context	65	43,26	66,6%	30	21,43	71,5%	20	12,43	62,2%
A7: Presenting Myself	A: Self-Efficacy A: Efficacy Judgement	80	44,63	55,8%	30	13,29	44,3%	15	10,60	70,7%
A8: Visualizing my life plan	A: Outcome Expectation B: Time and effort planning	55	39,75	72,3%	30	26,26	87,6%	15	10,31	68,8%
A9: Time Management	B: Time management	45	31,45	69,8%	30	23,65	78,8%	30	23,87	79,5%
A10: Familiarize with MySelf as a Student	B: Study Aids B: Self-testing B: Test Strategies	45	30,36	67,5%	30	24,56	81,9%	15	12,04	80,3%
A11: Boosting the Strategy of Note Taking	C: Use of Imagery C: Self-Instruction	25	22,25	89,0%	30	26,13	87,1%	15	12,21	81,4%
A12: Regulating my study environment	B: Structure Environment Cx: Attention Focusing Cx:Shape-Control Environment Change Context	25	21,91	62,6%	30	22,89	76,3%	10	8,03	80,3%
A13: Effective Conflict Management	Cx: Work well with peers	45	44,14	98,1%	30	34,91	99,7%	15	14,85	99,0%
A14: Articulating my career path	C: Self-observation	50	37,28	74,5%	30	26,09	86,9%	10	7,05	70,5%
A15: Self-Regulating the process of career search	C: Self-feedback B: Help Seeking B: Effort Regulation	75	68,25	91,0%	30	28,55	95,0%	x*	x*	x*
A16: Creating My CV	C: Self-monitoring C: Self-recording	75	44,58	59,4%	30	24,64	82,1%	20	14,0	70,0%
A17: Networking	A: Self-control	35	24,43	69,8%	30	24,53	81,7%	10	8,09	80,9%
A18: Career and stereotypes	A: Awareness monitoring motivation and affect A: Selection and Adaptation strategies for managing motivation & affect	20	18,04	60,1%	30	28,63	95,4%	x*	x*	x*
A19: Managing my Artifacts	C: Self-feedback B: Help Seeking B: Effort Regulation	30	23,70	79,0%	30	26,4	88,2%	x*	x*	x*
A20: Preparing for life changes	A: Perception of Difficulty	30	24,27	80,9%	30	29,4	98,2%	x*	x*	x*
A21: Trying to enhance my positive Self-image	A: Self-judgment A: Self-reaction	x*	x*	x*	x*	x*	x*	x*	x*	x*

A22: Self-Assessing My Time Management	C: Self-reaction C: Causal attributions A: Affective Reaction A: Attributions	x*	x*	x*	x*	x*	x*	x*	x*	x*
A23: Becoming an Advisor	A: Intrinsic Interest C: Self-satisfaction	x*	x*	x*	x*	x*	x*	x*	x*	x*
A24: Self-Assessing My SRL Skills/Competences	C: Self-evaluation B: Choice Behavior	x*	x*	x*	x*	x*	x*	x*	x*	x*
A25: Self-Assessing ePortfolio	Cx: Evaluation Task Cx: Evaluation Context	x*	x*	x*	x*	x*	x*	x*	x*	x*
Mean Scores		43,94	31,59	**70,7%**	30	24,74	**81,6%**	17	12,64	**75,0%**

x Not assessed (Questionnaire, rubric, form)*

To investigate student's level of cognitive development, we defined six competency statements (remember, understand, apply, analyze, evaluate and create) about the intended cognitive process (Cognitive dimension). Each statement is a measurable learning outcome that measures the degree to which participants understand, analyze, use the concepts, demonstrate skills and create an ePortfolio and artifacts.

The overall findings indicate that students understood about the SRL processes and the ePortfolio content and they managed their artifacts for practising SRL skills better over time (**Figure *93***). In addition, the cognitive dimension of the evaluation shows that students' performance was above average (Phase A=71,4%) and increased in the following phases. Hence, It is reasonable to infer the positive effects of the ePSRL approach on learners' SRL Skills.

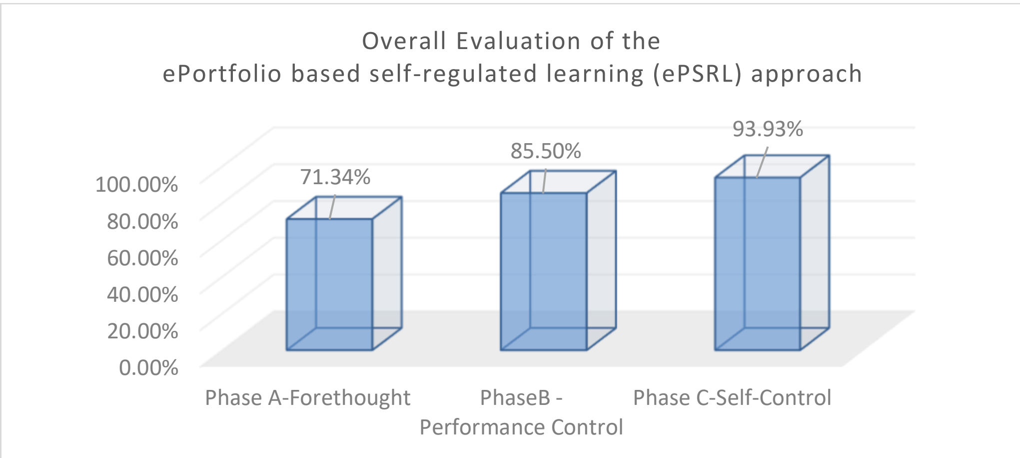


Figure 93. Overall evaluation of the ePSRL approach

According to the findings, the implementation of the ePortfolio supported the learning process and helped learners realize and develop their SRL processes. The qualitative analysis of the findings explains that the implementation of the ePortfolio-based self-regulated learning (ePSRL) approach (**Table *118***):

- supported the 'goal setting' process and helped learners realize the necessity of defining specific goals and develop a plan to achieve their goals.

- supported learners to recognize their self-efficacy levels of expertise and engaged them in a meaningful learning process to identify and boost their skills, knowledge, attitudes, interests and values. Participants admitted that they needed time and feedback to strengthen their self-efficacy beliefs.
- supported 'time management' and helped learners to manage and allocate their study time, follow an organized time plan and realize that planning is a key concept in time management.
- supported learners to recognize their levels of expertise in the use of learning strategies. Also, students realized the need of acquiring learning strategies. It is highlighted that students need a long-term plan to apply specific learning strategies in their academic study.

Table 118. Artifacts and Reflections (Overall)

Artifacts and Reflections	*N*	*Level of Expertise Total Mean Score*	*Total%*
Goal Setting	184	16.94	80,6%
Goal Setting in Action	184	4.08	81,5%
Goal Orientation	184	4.25	85,1%
Reflective Goal Setting	184	4.08	81,5%
Self-efficacy	184	16.61	79.1%
Efficacy Judgement	184	4.16	83.2%
Self-efficacy in action	184	3.94	78.9%
Time Management	184	14.99	71.4%
Monitoring Behaviours	184	3.54	70.8%
Monitoring Schedule	184	3.95	78.9%
Planning Behaviours	184	4.11	82.2%
Time Assessment behaviours	184	3.21	64.1%
Learning Strategies	184	17.13	81.6%
Study Aids	184	4.29	85.8%
Learning Strategies in action	184	4.32	86.3%

Therefore, the conclusion to be drawn is that having completed the ePortfolio implementation, students have probably developed an understanding of identifying and managing the processes that influence their motivation and value components. In addition, the findings agree with prior studies (Wang, Shannon & Ross, 2013) as far as students' development and application of learning strategies is concerned when their levels of self-efficacy are high. Conclusively, the results agree that there is a strong correlation among motivation, value, expectancy components and learning strategies (Pintrich & De Groot, 1990; Korkmaz & Kaya, 2012).

Also, the findings are consistent with accounts from prior studies that investigated learners' motivation (Huang, 2008). Furthermore, another finding in accordance with previous studies in the field (Shroff, Trent & Ng, 2013) suggests that individuals may engage in a course or a task when they acknowledge its significance and feel that they have the ability to complete it (Alexiou and Paraskeva, 2019).

RQ2- *How does the ePortfolio intervention impact academic achievement?*

- ***RQ2.1 -****Are ePortfolio assessment results consistent among different evaluators (self- peer- instructor- external evaluator-) (i.e. inter-rater reliability)?*
- ***RQ2.2-*** *Are there significant differences among the four ePortfolio criteria/dimensions (i.e. ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics)*
- ***RQ2.3-*** *Are ePortfolio assessment scores appropriate to examine academic achievement? (i.e. the consistency between ePortfolio achievement scores and course grade)?*
- ***RQ 2.4-*** *How did students use the ePortfolio system:*
    - *i. Which features did they use and why?*
    - *ii. Which plugins did they use?*
    - *iii. How many artifacts did they upload?*
    - *iv. How much time did they devote to the ePortfolio system?*
    - *v. How many messages did they send?*
    - *vi. How many questions did they set?*
    - *vii. Which tools did they use to structure a stand-alone ePortfolio?*
- ***RQ 2.5-*** *To what extent does the ePortfolio-based Self-Regulated Learning (ePSRL) intervention contribute to learners' satisfaction?*

Quantitative Data

In order to evaluate the impact of the ePSRL system and ePortfolio experience on academic achievement, an ePortfolio assessment methodology (i.e. four assessment methods- student/self-assessment, peer-assessment, teacher assessment and external evaluator- assessment) was used to examine the levels of consistency and difference of the methods. All raters/evaluators completed the ePortfolio rubric in order to assess ePortfolio achievement. To ensure content validity, the ePortfolio rubric was created with reference to relevant literature (see Chapter 3 – ePortfolio Rubric), also content modifications were made according to the comments from ePortfolio experts. The ePortfolio rubric aims to measure ePortfolio achievement and consists of four criteria/dimensions: ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics

It was attempted to investigate the degree of consistency between the assessment methods and the course grade. In addition, it is implied that the results of the assessment methods can reflect academic achievement.

The Intraclass Correlation Coefficient (ICC) test measured the inter-rater reliability (IRR). The level of agreement among assessors (students, peers, instructor and external evaluators) that independently rated the constructs of the scale can be considered substantial. Furthermore, the ICC analysis of consistency for the criteria of the ePortfolio achievement, i.e. ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics are significant.

All in all, there is consistency in the usage of the scale values among the four assessment methods, which means that there is an agreement among the raters. Also, the consistency among ePortfolio criteria was acceptably high and each construct should be reserved.

Furthermore, to examine the validity of the ePortfolio assessment methodology, the course grade was selected as exterior criterion to test correlations among the ePortfolio assessment methods. Taking into consideration the hypothesis that if the course grade or the scores of an achievement test are consistent with ePortfolios results, then they may probably reflect the level of academic performance (Gadbury-Amyot et al., 2003).

The coefficients of Pearson's correlation revealed that course grade was positively related to instructor's ePortfolio assessment and external evaluator's assessment which indicates that ePortfolio assessment can be seen as a reliable measure of learner's achievement. Also, the instructor's ePortfolio assessment and the external evaluator's assessment was not only highly correlated but also significant. These findings suggest that there is consistency among the methods; therefore, the instructor's assessment as well as the external evaluator's assessment can measure academic achievement and provide trustworthy results.

Overall, self-, instructor's- and external evaluator's assessment methods were estimated as significantly correlated, which suggests a high degree of consistency. This finding is consistent with a number of studies confirming that there is consistency between self- and teacher-assessment (Bouzidi & Jaillet, 2009; Sadler & Good, 2006; Sung et al., 2005; Tsai & Liang, 2009; Chang, Liang & Chen, 2013). This finding implies that the ePSRL approach supported learners to realize and apply the principles of SRL in their activities. Also, learners internalized SRL processes such as goal setting, self-efficacy, learning self-evaluation, self-monitoring and self-reflection and were able to provide an accurate self-assessment.

A One-way Analysis of Variance (ANOVA) was used to examine whether there are significant differences in the mean scores on the ePortfolio assessment criteria across the four types of assessment methods for studies 2 and 3 (N=151). The findings yielded that there was a statistically significant difference at the $p < .001$ level in ePortfolio assessment for four assessment methods. Self-assessment as well as Peer-assessment had the highest mean scores, followed by instructor-assessment and external evaluators' assessment that tended to assign the lowest scores. Similar findings were reported by researchers who noted that teachers and experts tend to be stricter and to assign lower grades than students and peers (Sadler and Good, 2006; Liu et al., 2001; Chang et al., 2012). According to our findings, external evaluators-raters are the strictest, followed by instructors. Self-raters are the third strictest and peers are the least.

As for ePortfolio's rubric dimensions, significant differences were noted among the four assessment methods in four criteria: Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics. From the calculation of the effect size that is based on eta squared, it is observed that reflection in action had the largest differences among the four assessment methods; the second largest differences were observed in usability characteristics; the third largest differences were observed in artifacts repository and the ePortfolio purpose had the least scoring difference. This finding indicates that the four assessment methods tended to produce similar scoring results in ePortfolio purpose, but were unlikely to reach consistency in 'Reflection in action'.

In detail, it is observed that the difference of the four assessment methods was estimated as significant in dimensions -Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics- which means that the four assessment methods were highly different in these dimensions. The mean scores of each rubric criterion revealed that peer-assessment was higher in Purpose, Artifacts and usability. Perhaps, peers were subjective and their rating was lax. In the analysis of self- peer- and instructor- assessment, Chang et.al (2012) made a similar conclusion to our results by indicating the inconsistency among assessment measurements.

The factors that resulted in the differences among assessment measurements need to be further explored.

Also, descriptive statistics was employed to describe the data collected. Students' course grades were excellent (>8) this reveals that participants studied the course material, understood the learning content and outperformed in their exams. Also, peer assessment is almost equal to self-assessment. When learners were engaged in the activities of the ePSRL approach, they acquired skills and sharpened their rating competences. Further, they set high standards and assessed their ePortfolio strictly.

Qualitative Data

When learners initiated the ePSRL approach, they were engaged in one activity ('Artifact 1: Implementation of a stand-alone ePortfolio') that evolved throughout the three SRL phases and supported learners to design and develop an ePortfolio as stand-alone application. The results of students' level of cognitive development (Cognitive dimension), revealed that:

- 85% of the participants remember the basic concepts of an ePortfolio (artifacts, systems, ownership, reflections)
- 83% of the participants understand the necessity of delivering a dynamic and effective ePortfolio
- 81% of the participants apply an integrated ePortfolio project
- 85% of the participants analyse the aspects and the tools of an ePortfolio project
- 76% of the participants evaluate the levels of sustainability and usability of an ePortfolio Project
- 74% of the participants create a well-organized and responsive ePortfolio based on SRL principles

Findings indicate that participants (studies 1-3) show high levels of expertise across the continuum of the competency statements (85%-75%). Specifically, participants perform better in the first three levels of the cognitive continuum (See sections 4.1-4.3). Probably, the ePSRL approach helped them to remember, understand and apply their knowledge about ePortfolios. Also, it is observed that participants' performance declined in the higher levels of the cognitive continuum. This means, that learners need time and more practice to perform better and be able to evaluate and create their ePortfolio.

Further, participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. The qualitative analysis of the artifact 1 (A1) highlights that participants in both Study 2 and 3 achieved higher levels of expertise in the process of creating a stand-alone ePortfolio. On the other hand, participants in Study 1 achieved lower levels of expertise in the continuum of the learning outcomes.

Further, the reflective activity that measured specific self-regulatory processes (Microanalytic Protocols) revealed that:

- 88% of the learners think that they will continue to use and update their ePortfolio
- 91% of the learners indicated that the learning content was helpful

- 89% of the learners believed that the ePortfolio will support their academic and career development.

These findings indicate that the sample is confident about the ePortfolio process and maintenance and seems to feel satisfied with the outcome.

Also, participants agreed that among the most positive characteristics of the ePortfolio implementation are:

- Future use (17% of participants)
- Useful tool (17% of participants)
- Detailed Process (11% of participants)
- Goal setting (11% of participants)

Participants yielded that among the negative characteristics of the ePortfolio implementation are:

- Time-consuming process (39% of participants)
- None (15% of participants)
- Limited Artifacts and Projects (11% of participants)

Consistent with previous studies, students involved in self-assessment, realized their strengths and weaknesses and regulated their learning efforts (Chang, 2008). Also, peer-assessment supported learners to notice their fellow students' learning tasks as well as teacher- and external evaluator- assessment allowed improvements based on feedback (Tsai & Liang, 2009). It is highlighted that the implementation of an ePortfolio system that encompasses assessment methods strengthens students' self- and peer-assessment abilities (Chang, & Tseng, 2009).

To analyze 'How did students use the ePortfolio system?', I used the log files of the system that represent an automatic way to gather learning data. The ePortfolio system log files were categorized in six groups aligned to the ePortfolio's purpose: storing, organizing, presenting, interaction, progressing, and communication-feedback (**Table *117***).

Common plugins that were used in all studies and extended the ePortfolio's functionality were: Embed, Site pages, File, Messages, Pages, Profile Manager, Profile, Reported Content, Search, Site notification, Likes, Log browser, Log rotate, Members and Message board.

Overall, participants (N=184) uploaded 4412 artifacts and stored their content. This finding is consistent to studies that highlight the potential of ePortfolios as learning repositories (Lopez-Fernandez & Rodriguez-Illera, 2009). The quantitative analysis of the ePortfolio system log files suggests that the ePSRL system is an effective means of storing content. Also, participants used the ePortfolio feature 'Pages' and created 1653 pages to describe and present their artifacts. Further, users exploited 657 'Widgets' to calibrate their profiles and explore services. Consistent with previous findings, this research admits that ePortfolios enable students to integrate digital tools and better demonstrate their artifacts and learning (Meyer et al., 2010).

The system log files yield that the ePSRL system is an accurate means of presenting content and promotes interaction. Specifically, participants in study 2 and 3 added more elements on their profiles such as: position, expertise, interests and email. This finding is consistent with accounts from prior studies that an ePortfolio is a way to present aspects of self and reflect upon learning (Wade, Abrami, & Sclater, 2005).

Also, the progress of the users over time was measured. Towards this, all participants devoted 3.4 hours to reading, editing and uploading artifacts on the system (Average time Spent on activities) and 4.4 hours to reading content, participating in discussions, creating friends' connections, informing about the schedule and viewing the system. All participants used the 'Friends' feature of the system to interact and exchange ideas. The majority of the users became 'friends' with their instructors and teachers. Thus, the use of a social networking engine as an ePortfolio was successful, as participants articulated a learning community and created groups of friends. This finding is consistent with accounts from prior studies as the system served as a means to establish a learning community where users learn to manage their self-identity, share media and which, in turn, can motivate users (Arnold and Paulus, 2010).

Students used the ePortfolio features 'Messages', 'The Wire' and 'Groups' to exchange ideas and collaborate. Overall, students, instructor and teachers sent 4056 messages. Also, students use 'Groups' for the discussion of various topics. In 'Groups' participants created 283 topics for discussion and set 993 discussion replies. Consistent with previous findings, this research admits that when ePortfolios embed features of social network tools, they can help users to collaborate (e.g. forum, chat, comment), see their deficiencies, identify areas where they should advance (Beresford & Cobham, 2011; Zhang et al., 2011).

To sum up, the majority of students holds a positive attitude towards the ePortfolio and they feel satisfaction for participating in the intervention. The quantitative analysis of students' perceptions about the ePortfolio intervention revealed that among the most positive elements of the ePSRL approach are:

- The organized learning content (10.4% of participants)
- The process of monitoring progress (9.0% of participants)
- The use of different learning tools (8.8% of participants)
- The process of structuring a presentation about aspects of self (8.0% of participants)
- The articulation of individual's academic and career path (8.0% of participants)
- The process of earning to organize my study (7.0% of participants)

Participants yielded that among the negative elements of the ePSRL approach are:

- Pressing Workload and schedule (29.2% of participants)
- None (16.4% of participants)
- Time Management (12.9% of participants)
- Difficulty in managing artifacts (10.1% of participants)
- ePortfolio design and implementation (8.8% of participants)

Therefore, the conclusion to be drawn is that having implemented their own ePortfolio, learners have probably developed an understanding of using the components of an ePortfolio. Also, participants actively use SRL processes to deliver a well-organized and responsive ePortfolio.
We concluded that the ePortfolio-based self-regulated learning (ePSRL) system advanced academic achievement. The results confirmed that self- peer- teacher- and external evaluator-assessment had a vital role on the effectiveness of the ePSRL approach. To sum up, the ePSRL system followed the principles of a social networking service (SNS) and helped users to structure a learning community. Accordingly, the ePortfolio system enabled students to interact, communicate, share their goals, follow the schedule, exchange ideas, articulate artifacts and reflections. Overall, participants felt satisfaction for participating in the intervention, even though it was a time-consuming activity with heavy workload. All in all, students agreed that ePortfolio is a useful tool that helps them discover aspects of their self, organize their academic path and set their career profile.

RQ3- *Did ePortfolio-based Self-Regulated Learning (ePSRL) intervention in Higher Education support students to metacognitively practise SRL processes?*

- ***RQ3.1-*** *What are the students' perceptions of the ePortfolio based Self-Regulated Learning (ePSRL) intervention about SRL processes?*
- ***RQ3.2-*** *Are there significant differences between low-achievers and high-achievers in terms of SRL processes?*

Quantitative Data

In order to consider the role of SRL in the ePortfolio construction process in HE, the three SRL phases, namely forethought, performance-control, and self-reflection, were investigated in relation to ePortfolio implementation. The goal was to evaluate ePSRL system's potential for supporting SRL and to discover the affordances (design requirements) that might stimulate SRL skills.

Towards this, we evaluated the ePSRL system and descriptive statistics was employed to describe the data collected (**Figure *94***).

The average results for the three SRL phases were:

- Phase A [Forethought Phase] = 3.82
- Phase B [Performance Control] = 3.86
- Phase C [Self-Reflection] = 3.88

The most interesting result is that the ePSRL system received mean values of above 3.0 across the three SRL phases, which means that the ePortfolio supported SRL quite well. This finding is consistent with research that evaluates TELEs and their potential to facilitate SRL (Dettori & Giannetti, 2005; Dettori et al., 2006, Steffens, 2006)

The average results for the four SRL processes were:

- Cognitive Processes = 3.870
- Motivation Processes = 3.873
- Affective Processes = 3.879
- Context Processes = 3.850

These findings seem to indicate that the ePSRL system has a cognitive orientation as well as a strong affective and motivation orientation. But, the social orientation isn't sufficiently supported. It is an interesting fact that the ePSRL system received high ratings for its potential to support self-regulated learning could be due to the fact that the conceptual design required students to engage in various activities that helped them to train their SRL skills. Also, the structure of the artifacts activated aspects of SRL as learners were prompted to discover and present their self, manage their learning identity, explore the career path and evaluate their actions.

The ePSRL system required learners to be very active as they designed their artifacts, got timely feedback from the ePSRL system and their instructor and interacted with their peers. The fact that the ePSRL system did not offer many collaborative artifacts could be a reason for low ratings on social processes.

The coefficients of Pearson's correlation revealed that Phase A [Forethought] was positively related to Phase B [Performance Control] and Phase C [Self-Reflection] which indicates that ePSRL system facilitated the cyclic nature of SRL and conceptualized it as a process.

Also, there was a very strong, positive correlation between Phase A [Forethought], Phase B [Performance Control] and Phase C [Self-Reflection] and self-assessment which yields that ePSRL system supported learners to internalize SRL processes and to be able to articulate SRL processes and apply them. On the other hand, the correlation coefficient between SRL phases and ePortfolio Tutor's Assessment was small and failed to reach statistical significance.

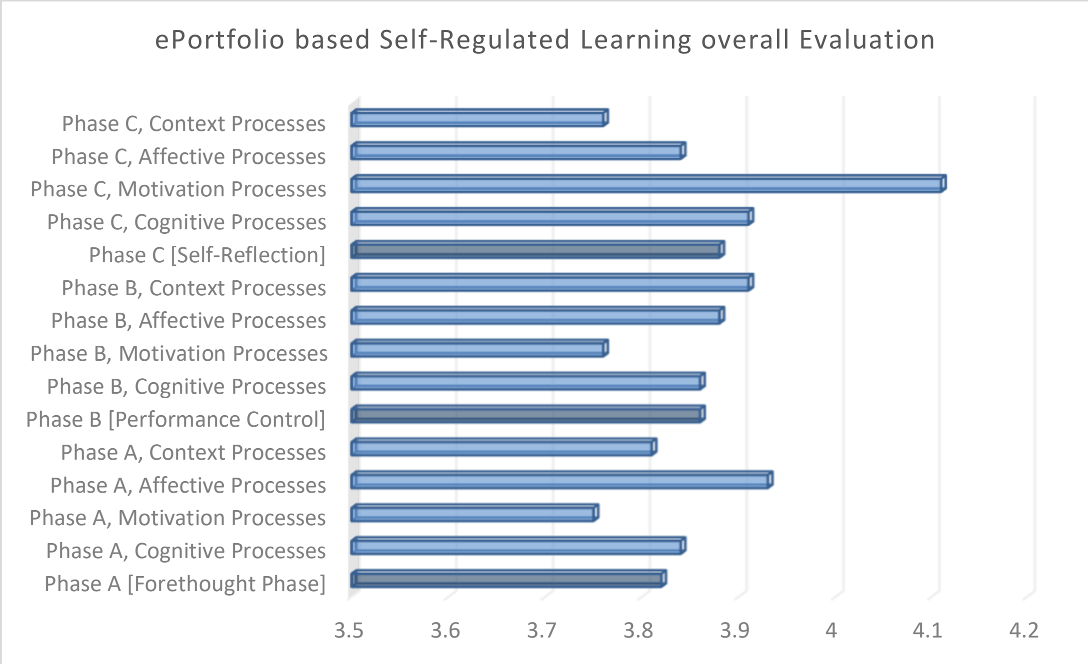


Figure 94. ePortfolio-based Self-Regulated Learning (ePSRL) overall evaluation

Further, the median-split classification was used based on the course grade to create two different groups of participants. Students that achieved a score higher than the median assigned to High Achievers Group (HAG, N= 76) and students that were below the median were the Low Achievers Group (LAG, N= 108) (Cheng and Chau, 2013).

An independent samples t-test was conducted between high and low achievers' groups. The results yielded that there was no statistically significant difference in Phase A [Forethought] and Phase C [Self-Reflection] between the two groups. In contrast, there was a significant difference in Phase B [Performance Control] (**Table *119***).

Table 119. Independent Samples t-test of SRL phases attained by high and low achievers.

Independent Samples t-test											
	Low Achievers [LAG]			High Achievers [HAG]			95% CI for Mean Difference				
SRL Phases ALL Studies	N	M	SD	N	M	SD	Lower	Upper	p-value	t	df
Phase A [Forethought Phase]	108	3.74	.534	76	3.93	.532	.034	.350	.017	2.408	182
Phase B [Performance Control]	108	3.74	.584	76	4.03	.565	.114	.454	.001	3.294	182
Phase C [Self-Reflection]	108	3.81	.529	76	3.98	.558	.015	.335	.032	2.159	182

In order to analyze the differences among the Study 1, 2 and 3 including differences within SRL phases, one Way-ANOVAs were conducted (Analysis of Variance between groups) (**Table *120***). The findings showed that in Phase B [Performance Control] the three studies differ. This means that in Study 2 learners performed better and probably they applied SRL processes to implement their ePortfolios.

Table 120. ANOVA results for the Experimental Group (N=184)

All Studies (N=184)							
ePortfolio based Self-Regulated Learning Constructs	***Study#1***	***Study#2***	***Study#3***	***F***	***Sig***	***Effect size η^2***	**Comparison**
Phase A [Forethought Phase]	3.56	4.09	3.96	24.880	.000	.216	Study1<Study3<Study2
Phase B [Performance Control]	3.58	4.18	3.94	25.243	.000	.218	Study1<Study3<Study2
Phase C [Self-Reflection]	3.67	4.10	4.01	14.378	.000	.137	Study1<Study3.Study2

Df=(2 , 181), N=184

Qualitative Data

In the last phase of the ePSRL approach, participants were engaged in the reflection of "Artifact 24: Self-Assessing My SRL Skills/Competences,". We measured learners' perceptions about the development of their SRL skills in the context of the ePortfolio system. Students were engaged in a reflective activity where they were provided with the following question 'Do you think that the ePortfolio system supports you appropriately so as to elevate your SRL competency? Reflect on your behaviour and write a few recommendations to someone that could become an effective self-regulated student.'

A coding scheme was designed based on the SRL processes. All these processes were conceptualised broadly including cognitive, affective, behaviour, context processes related to the ePortfolio implementation. The findings revealed a set of *affordances/design requirements of the ePSRL system that might stimulate self-regulated learning:*

- Goal setting (12.8% of participants)
- Organizing learning path (11.1% of participants)
- Self-efficacy (10.2% of participants)
- Academic and Career development (8.7% of participants)
- Learning Strategies (8.6% of participants)
- Self-evaluation (7.9% of participants)
- Motivation (7.7% of participants)
- Skills Development (6.6% of participants)
- Collaboration (6.4% of participants)

- Help Seeking (5.7% of participants)
- Self-Monitoring (5.1% of participants)
- Self-reflection (4.8% of participants)
- Reconsidering mistakes (2.3% of participants)

6.2 Limitations and Future Research Directions

There are a few limitations of this research that need to be considered.

Firstly, in this study we used self-report instruments that measured participants' self-perceptions and experiences rather than their behavior. This means that students had their own cognitive schemas, beliefs and values and may have been subject to biases. Since, research variables were dedicated to psychological factors, self-reports were necessary. Also, we followed a mixed method research approach and used qualitative research techniques to ensure validity and reliability of the research. To counteract this limitation, future research should address the application of a multi-dimensional instrument that evaluates quantitatively and qualitatively research variables. In the ePortfolio system, a learning analytics module could be embedded where instructors, administrators and researchers can track learner's behavior and actions. There are various useful tools such as social network visualizations, analysis of learner's interactions, overall/individual progress that may provide data for analyzing and interpreting learners' processes.

Secondly, another limitation of the study worth mentioning is the time frame of the study (10-12 weeks) that didn't let students internalize and apply the concepts to different learning contexts. Since, the latest trend in HE is Massive open online courses (MOOCs) that provide flexible courses to any interested participants and structure learning activities from 2-16 weeks or most frequently between 6-10 weeks (Hollands and Tirthali, 2014), the proposed time duration was sufficient.

Perhaps, this research may not have fully captured the internalization of SRL and the implicit practice of SRL processes. Therefore, these findings should be used as preliminary evidence. A longitudinal study is proposed that could investigate SRL effects on learning in the context of the ePortfolio system using a set of assessment tools, recommender systems, intelligent tutors and smart ePortfolios.

Thirdly, it should be noted that this research provides valuable insights into SRL processes, relationships between SRL and performance as well as SRL focusing on ePortfolio experience, but it has not investigated factors such as gender, cultural background and discipline orientation. It is recommended that future research emphasize these features and run multiple experiments.

To sum up, the studies of this PhD were conducted only with students in one Greek university. Additionally, the majority of the participants were students in computer science. Since, the type of data (quantitative and qualitative) was sufficient for the individual level of analysis we could deliver meaningful results but the findings cannot be generalized. For future research, it is suggested that the design of an intervention with students from different disciplines and learning institutions be implemented. Perhaps, it would be an interesting idea the delivery of a MOOC-course type that would make it possible to explore and generalize the success factors of the ePSRL approach at an individual and organizational level.

6.3 Conclusions

In this section, I will summarize the results of the analysis to address the purpose of this research and interpret the research findings.

EPortfolios have been studied by many researchers, revealing various advantages for learning. Thus, ePortfolios were used as tools to support and facilitate independent learning, self-regulated learning, authentic assessment, accreditation of prior learning, reflection, communication and IT skills (Barbera, 2009; Wang and Wang, 2009; Joyes et al., 2010; Chang & Tseng, 2011; Snider & McCarthy, 2012; Tzeng & Chen, 2012; Abrami et. al., 2013; Cheng & Chau, 2013; Chang et al., 2013; Nguyen & Ikeda, 2015; Beckers, 2016; Rezgui, Mhiri, Ghedira, 2017; Chang, Chou & Liang, 2018).

This PhD highlighted the need of integrating quality ePortfolio implementation into teaching practice, exploring effective ways of improving the ePortfolio construction process (Morales, Soler-Domínguez & Tarkovska, 2015) and cultivating the attitudes for practising self-regulated and lifelong learning (Welsh, 2012). This research attempted to support learners to use and practise SRL strategies on ePortfolio development, to guide them to self-monitor, to promote technological literacy and to elevate their academic performance (Abrami et al., 2007; Cheng & Chau, 2013; Bowman, Waite, and Levine, 2015).

This PhD adds to the literature by developing a conceptual framework for the ePortfolio construction process based on a Self-Regulated Learning Model (ePortfolio-based Self-Regulated Learning (ePSRL) approach), implementing an ePortfolio intervention and revealing the interrelationships of cognitive, affective, behavioral and contextual processes (fundamental SRL constructs), academic achievement and ePortfolio system. Also, I attempted to discover the dimensions of a meaningful and fruitful ePortfolio implementation in HE to activate SRL skills.

In order to answer RQ1, RQ2, RQ3 an ePortfolio-based Self-Regulated Learning (ePSRL) system was designed and tested in three studies.

The majority of the participants (Study 1, Study 2 Experimental Group, Study 2 Control Group and Study 3) was in the age range from 18 to 22 years old, undergraduate male students in a Greek Higher Education Institution. Most of the participants were expert users in using digital devices, internet browsing, using text editing software and using social networking sites (SNSs). The sample of the research was digitally mature, as they were independent technology users and were able to use the ePortfolio tools and participate in the intervention. Also, the majority of the participants were positive about the ePortfolio implementation as they wanted to gain new knowledge and advance their skills.

The results of the quantitative and qualitative analysis revealed that:

⇒ *The implementation of the ePortfolio based Self-Regulated Learning (ePSRL) approach and the system affected students' SRL*

The sample of the studies indicates to a great extent that the use of the ePSRL approach advances SRL. Specifically, students used a wide range of self-regulated processes and their goal setting, motivation, intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy, learning strategies, time management, peer learning, help seeking improved after applying the ePSRL approach to their academic study. Also, the results of the analysis revealed that the learners engaged in the learning activities of the ePSRL approach, used SRL strategies to complete their ePortfolios and attain a medium to high performance, suggesting that the implementation of the ePortfolio supported the learning process and helped learners realize and develop their SRL processes.

⇒ *The ePortfolio intervention had a positive impact on academic achievement*

The level of agreement among four assessors (students, peers, instructor and external evaluators) that independently rated the constructs of the scale (ePortfolio Purpose, Artifacts Repository, Reflection in Action and ePortfolio Usability characteristics) can be considered substantial. Also, the consistency among the ePortfolio criteria was acceptably high and each construct should be reserved. This means that there is an agreement among the raters, suggesting that the ePortfolio experience can be measured through the proposed ePortfolio assessment methodology.

Further self-, instructor's- and external evaluator's assessment methods were estimated as significantly correlated, which suggested a high degree of consistency. This finding suggests that the ePSRL approach supported learners to realize and apply the principles of SRL to their activities. Also, it is implied that the results of the assessment methods can reflect academic achievement. Students' course grades were excellent (>7) this reveals that students studied the course material, understood the learning content and intervention's participants outperformed, the general population of students in their exams.

Moreover, the findings indicate that external evaluators-raters are the strictest, followed by instructors, self-raters are the third strictest and peers are the least. In addition, the mean scores of each rubric criterion revealed that peer-assessment was higher in Purpose, Artifacts and usability. Perhaps, peers were subjective and their rating was lax, suggesting that when learners engaged in the activities of the ePSRL approach, they acquired skills and sharpened their rating competences. They set high standards and assessed their ePortfolio strictly.

Further, the ePSRL approach prompted interesting findings from qualitative data about the impact on academic achievement. Participants in all studies appeared to have differences among the levels of the continuum of the learning outcomes. The approach helped them to remember, understand and apply their knowledge about ePortfolios. However, it was observed that the participants' performance declined in the higher levels of the cognitive continuum, suggesting that learners need time and more practice to perform better and be able to evaluate and create their ePortfolio. Overall, the sample is confident about the ePortfolio process and maintenance and seems to feel satisfied with the outcome. Also, the majority of the participants agreed that among the most positive characteristics of the ePortfolio experience were: future use, useful tool, detailed Process and goal setting. On the other hand, they agreed that among the three most negative characteristics of the ePortfolio experience were: a time-consuming process, none, limited artifacts and projects.

Also, research findings confirmed that an ePortfolio intervention should be supported by an environment that encompasses the merits of a learning management system and a social networking site (SNS). The articulation of a learning community helped users to interact, communicate, share their goals and exchange ideas. Participants felt satisfaction for being members of a community with common goals and expectations. Thus, the system helped them follow the schedule, articulate artifacts and organize their reflections. However, users as members of a learning community, developed social relations and collective knowledge that helped them complete their ePortfolio project. Also, as parts of the ePortfolio community were engaged in SRL practice and learn how to self- and co- regulate their actions for accomplishing tasks. Therefore, the conclusion to be drawn is that having implemented their own ePortfolio, learners have probably developed an understanding of using the components of an ePortfolio and advanced their academic achievement.

- ⇒ *The ePSRL intervention in HE supported students to metacognitively practise SRL processes.*

Participants evaluated the ePSRL approach and agreed that the design of the ePortfolio supported SRL well and tended to increase during the SRL phases (namely forethought, performance-control, and self-reflection). Also, Phase A [Forethought] was positively related to Phase B [Performance Control] and Phase C [Self-Reflection] which indicates that the ePSRL system facilitated the cyclic nature of SRL and conceptualized it as a process. Further, there was a very strong, positive correlation among the three SRL phases and self-assessment suggesting that the ePSRL system supported learners to internalize SRL processes and to be able to articulate SRL processes and apply them.

Further, findings yielded that the ePSRL system had a cognitive orientation as well as a strong affective and motivation orientation. Yet, the social orientation wasn't sufficiently supported. Probably, the structure of the artifacts helped learners to activate aspects of SRL, as they were prompted to discover and present aspects of their self, manage their learning identity, explore the career path and evaluate their actions. The ePSRL system required learners to be very active as they designed their artifacts, got timely feedback from the ePSRL system and their instructor and interacted with their peers. The fact that the ePSRL system did not offer many collaborative artifacts could be a reason for low ratings on social processes.

All in all, the ePSRL system received high ratings for its potential to support self-regulated learning, suggesting that the ePSRL approach (conceptual design) guided students to engage in various activities that helped them to train and practise their SRL skills. In detail, the findings revealed a set of affordances/design requirements of the ePSRL system that might stimulate self-regulated learning:

- Cognitive Processes = *goal setting, academic and career development, self-evaluation, self-monitoring, self-reflection, reconsidering mistakes*
- Affective Processes = *self-efficacy, motivation*
- Behavior Processes= *organizing learning path, learning strategies, skills development*
- Context Processes = *collaboration, help seeking*

6.4 Implications of the Study

6.4.1 Theoretical Implications

The key findings of this PhD contribute to the literature, by showing how to design a conceptual framework based on SRL (cognitive, affective, behavioral and contextual processes) for ePortfolios in HE (ePortfolio-based Self-Regulated Learning (ePSRL) approach) and tailor a workflow process that supports individuals to initiate SRL processes and manage their learning path (**Figure *95***)

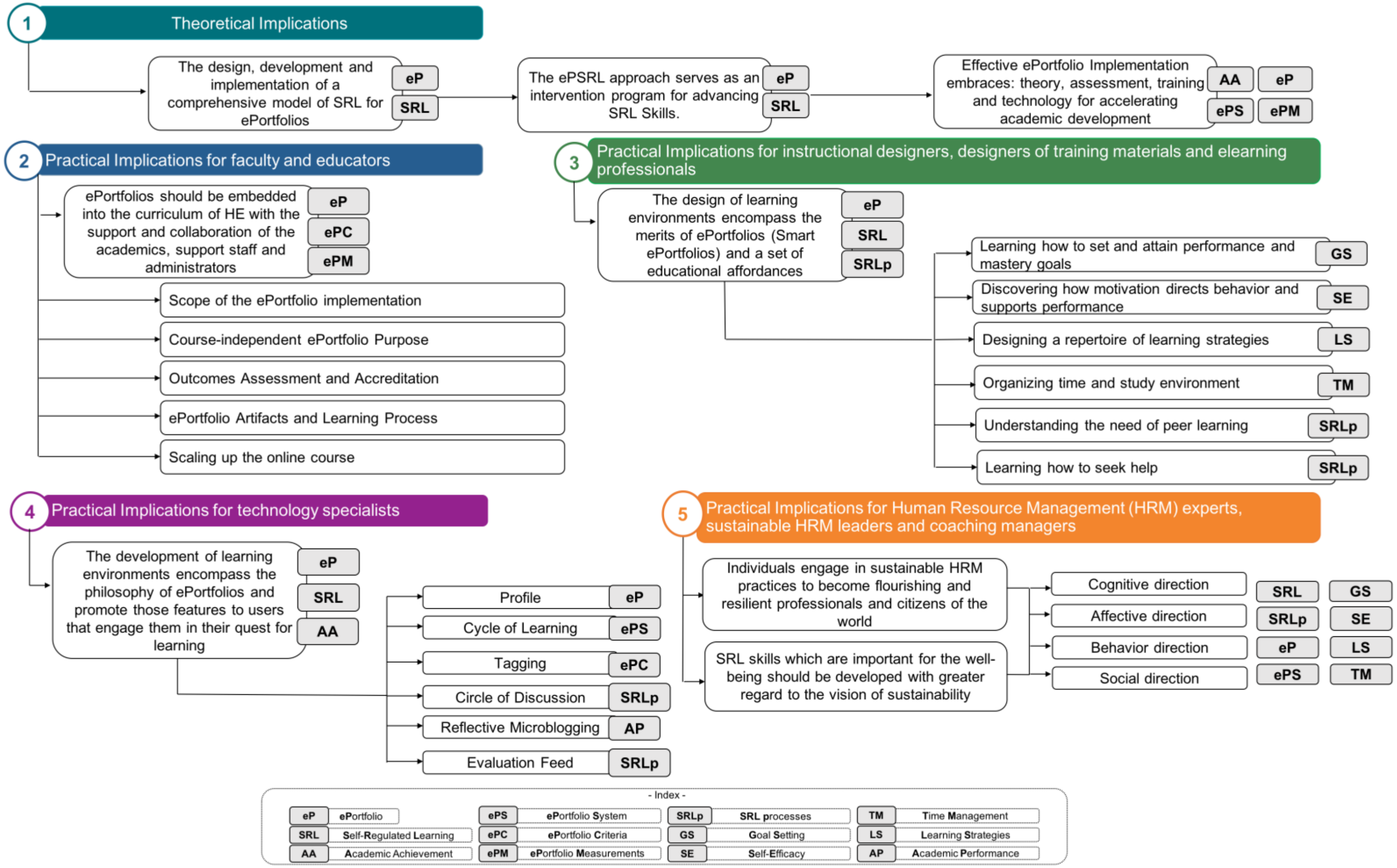


Figure 95. Implications of the Study

The findings of the research highlight the need of delivering an ePortfolio as an intervention program that supports self-regulated learning (SRL). This provides theoretical implications for a strong connection between ePortfolio experience and SRL processes in HE.

The design, development and implementation of a comprehensive model of SRL for ePortfolio (ePSRL approach), provides an empirical infrastructure so that wider ePortfolio implementations can be delivered in HE to boost SRL skills. Moreover, the ePSRL approach serves as an intervention program were learners can articulate accurate goals, advance their skills, cultivate learning strategies and manage academic performance.

The hypothesis that a well-designed ePortfolio solution has a positive effect on SRL processes and academic achievement, on which the general research question was based on, was confirmed as:

- ✓ participants yielded that the use of the ePSRL approach advances SRL skills
- ✓ self-, instructor's- and external evaluator's assessment methods had a high degree of consistency and it is implied that the results of the assessment methods can reflect academic achievement
- ✓ the ePSRL system received high ratings for its potential to support self-regulated learning

Theoretically, these findings agree that an effective ePortfolio implementation embraces four dimensions: theory, assessment, training and technology for accelerating academic and career development.

6.4.2 Practical Implications for faculty and educators

This research provides a basis for understanding the need for realizing and articulating the construction process of an ePortfolio in HE. Towards this, an ePortfolio system (eP) as a learning platform was developed and tested, articulated to support and promote the cyclical phases of Self-Regulated Learning (SRL). The ePortfolio system (ePSRL) guided learners through the construction process of their ePortfolio, where they practised SRL processes and interacted with their peers.

Based on students' perceptions (questionnaires, rubrics, microanalytic protocols), learning performance (artifacts) and input through the system, the ePortfolio helped them use specific SRL processes (goal setting, self-efficacy, time management, learning strategies), advance SRL skills, collaborate with peers and have a positive attitude toward the construction process of an ePortfolio for academic development. Moreover, the findings indicate that the ePSRL approach helped learners to take control, manage, reflect upon their ePortfolio content. Also, the process set the basis for cultivating positive attitudes towards learning and academic development.

Participants felt more confident as the ePSRL approach gave them the opportunity to discover their self, take decisions, assess their artifacts and their peers as well as use feedback and refine the output. The importance of training students how to structure their ePortfolio also shown in previous studies revealed that students and instructors require time and training in order to understand the tool and to structure an effective environment (Morales, Soler-Domínguez & Tarkovska, 2016; Shroff, Trent, and Ng, 2013; Shroff, Ng, & Deneen, 2011; Deneen, 2013).

These findings suggest that ePortfolios should be embedded into the curriculum of each higher education institution with the support and collaboration of the academics, support staff and administrators.

- *Scope of ePortfolio Implementation*: Important elements that affect the scope of ePortfolio implementation are finances (investments, funding, costs and risks), human resources (technical staff and experts) and number of participants. HE (universities, colleges, vocational education and training institutions) should provide and support electronic services. Several applications have disadvantages such as proprietary format, licensing costs and less user's control. It is important to provide a cost-effective solution where users can participate in an online course (e.g. MOOC) where they will earn a certification and learn how to structure their own ePortfolio and promote their academic and career development. The delivery of an online course is proposed (self-paced mode and training mode) where learners will select the type of training that corresponds to their needs, select among various authoring tools and follow the SRL learning path to complete their ePortfolio.
- *Course-independent ePortfolio Purpose*: Participants should be familiarized with the basic concepts of an ePortfolio and be able to set their own purpose for their ePortfolio. It is imperative that learners should be able to distinguish the common types of conventional portfolio usage in different learning contexts: assessment, showcase, development, reflective. In the proposed online course, learners should select the goal of their ePortfolio according to their needs and expectations. Moreover, the goal of the online training course will be universal and context-free as it will emphasize personal development planning (PDP) and articulate life skills such as Self-regulation.
- *Outcomes Assessment and Accreditation:* The proposed online course should immerse users to the ePortfolio-based assessment that entails a detailed examination of individual's achievements, reflections and learning progress. The assessment procedure will encompass a set of actions, such as self and peer-assessment, instructor and external evaluators assessment, reviews and feedback. Learners should learn about the factors that alter authenticity of the ePortfolio assessment, such as reliability, validity, time management, rubrics criteria and

student's abilities. Another interesting issue is the accreditation of learning that can be aligned to learning badges (a visual representation that is linked to evidence as proof of accomplishment), certification or ECTS points. The online course can be used by educational institutions, organizations and service providers to assure if a student has fulfilled the requirements for graduation or for earning a certificate.

- *ePortfolio Artifacts and Learning process:* The online course will encourage individuals to develop skills, to cultivate reflection, manage personal growth and to self-regulate their actions. This means that participants will engage in a structured learning path where they can engage in learning activities, complete artifacts and earn specific badges. The proposed learning path will assist individuals (students and professionals) to develop their personal learning path and promote their professional profile. The course will provide various services and features to users to engage them in their quest for learning
- *Scaling up the online course:* Implementing ePortfolio into a curriculum is dependent upon staff and students having the necessary technical skills, knowledge and appreciation of the purpose and the scope of the ePortfolio. To provide an online course, we should emphasize specific issues, such as: the target group, the readiness for ePortfolio-based learning, the IT literacy skills, usage of the ePortfolio by students, a standardized format for the ePortfolio, a public or a private document, supporting students, reviewing and formative feedback. It is noted that, the proposed online course should be able to provide two levels of training for novice (low IT skills) and expert users (high IT skills). In both cases, participants will be able to participate and advance a range of skills so as to develop an ePortfolio, to earn certifications and/or badges and to become successful and blissful in the workplace.

6.4.3 Practical Implications for instructional designers, designers of training materials and elearning professionals[12]

This research is founded upon the fact that SRL can be seen as an inherent trait or an event that follows a dynamic process that encompasses various cognitive, affective, behavior and context processes and can be adapted to different learning experiences (Moos and Stewart, 2013; Zimmerman, 2013). Towards this, a multidimensional SRL model was designed in which self-

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[12] Part of this section has been published in the following journal paper:

Alexiou, A., & Paraskeva, F. (accepted for publication). Being a student in the social media era: Exploring educational affordances of an ePortfolio for managing academic performance. International Journal of Information and Learning Technology.

regulation is seen as a cyclical learning process. The proposed model was consistent with most SRL theories where learning performance follows a cyclical structure of phases. In these phases, learners activate and apply learning processes, receive feedback and make adjustments in order to initiate new learning efforts (Zimmerman, 2000; Pintrich, 2004). This means that SRL processes are interrelated and affect learners' performance and achievement. Consistent to various studies, we highlighted that the use of ePortfolio systems as effective environments may support students to foster their self-regulation (Cheng & Chau, 2013; Abrami et. al., 2013).

Toward this, an ePSRL approach was designed and tested that guides learners through a regulatory path to engage in SRL activities, construct their ePortfolio and manage their academic development. The ePSRL approach consists of functional layers empowering different aspects of human learning. The functional layers include multiple cognitive processes, affective factors, aptitudes, beliefs and 21st century skills (flexibility, collaboration, creativity) that can help participants to be successful and effective learners, professionals and citizens of a sustainable world. Based on students' learning actions (microanalytic protocols) and performance indicators (artifacts), the ePSRL approach supported them to apply specific SRL processes and the use of the ePortfolios system influenced SRL processes (cognition, motivation/affect, behavior, and context) positively. These findings are consistent with studies which highlight that when ePortfolios are based on SRL theories, they have a statistically positive effect on SRL skills (Nguyen & Ikeda, 2015; Huang, Yang, Chiang & Tzeng, 2012).

The importance of creating a comprehensive model of SRL through the implementation of an ePortfolio that encompasses a set of educational affordances and supports learners to develop a skillset for 21st century is widely acknowledged (**Figure *96***).

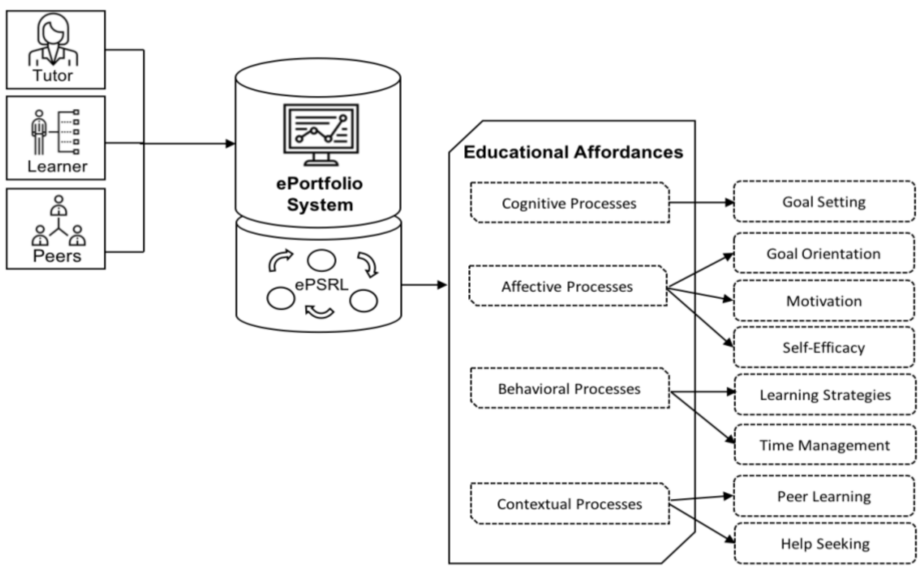

Figure 96. The SRL affordances for the ePortfolio-based self-regulated learning (ePSRL) approach

Therefore, the proposed ePSRL approach for ePortfolio development aims to support instructional designers (ID) and designers of training materials (DTM) in creating effective environments, courses or learning scenarios (Alexiou and Paraskeva, 2019). It is recommended the design of learning environments encompass the merits of ePortfolios (Smart ePortfolios) and a set of educational affordances.

- *Learning how to set and attain performance and mastery goals (Goal Setting).* ID and DTM should aim at designing environments to support goal setting and goal orientation offering plugins that guide learners to verbalize their goals. Learners should be encouraged to learn about goals syntax, action verbs of setting goals and categorization of mastery and performance goals.
- *Discovering how motivation directs behaviour and supports performance (Goal orientation and Motivation*). ID and DTM should create environments that help users to recognize their motivations and boost their performance. A set of features is proposed such as certifications, badges, ECTS points and interview with experts. Learners should be invited to realize their intrinsic and extrinsic goal orientations to fulfil their needs.
- *Identifying and evaluating aspects of self (Self-Efficacy).* ID and DTM should focus on providing plugins that help users to present aspects of self and interact with peers (synchronous and asynchronous communication tools, video-conference tools and feedback tools). Learners should realize their aspects of self and attempt to identify their skills to empower their self-perception.
- *Designing a repertoire of learning strategies (Strategic Planning).* ID and DTM should deliver a training module to help participants to select and test their learning strategies. Learners should be encouraged to practise various learning strategies and select the most appropriate study tactics.
- *Organizing time and study environment (Time Management).* ID and DTM should aim at designing environments to manage time offering plugins that help learners to prioritize their tasks and set feasible plans (calendar, notifications). Learners should learn about the merits of time management and explore beneficial planning strategies.
- *Understanding the need of peer learning (Peer Learning).* ID and DTM should provide plugins that promote active participation and interaction (group activities, discussion, open questions and argumentation). Learners should be engaged in collaborative tasks in order to identify the merits of a dynamic community.
- *Learning how to seek help (Help Seeking).* ID and DTM should create environments that help users recognize their learning status and seek for advice or/and help (scaffolding tools,

intelligent tutors, learning agents, feedback from peers). Learners should be encouraged to realize their own discrepancies and misunderstandings and request support from knowledgeable others.

6.4.4 Practical Implications for technology specialists

A fruitful ePortfolio implementation process is highly dependent on the available software tools and systems (Schaffert & Hilzensauer, 2008; Barrett, 2007; Himps & Baumgartner,2009; Kim et al., 2010; JISC, 2013). Such being the case, stakeholders can use among various environments, such as: Commercial ePortfolio systems, Individual authoring tools, University-designed software, Open source ePortfolio software, Web 2.0 tools, Learning Management Systems (LMS), Open Source Learning Management System, Content Management Systems (CMS) or Learning Content Management Systems (LCMS), Open Source Content Management System, Personal Development Planning, Career oriented systems, Assessment Platforms. Although the ePortfolio experience is an efficient learning approach for students, stakeholders (faculty, students, instructional designers, trainers) generally did not have high willingness to use the ePortfolio system. Instead, they often lacked interest and motivation (Morales, Soler-Domínguez & Tarkovska, 2016). Therefore, an appropriate ePortfolio system should assist individuals to develop their personal learning path, set goals, promote their academic and professional profile, feel confident about their self, interact with peers and communicate their ideas to experts. Also, showing consideration for the affordances of social media in HE including the unlimited access to course content, alternative e-learning platforms with new possibilities and upgrading of students' skills, it is recommended to deliver a cost-effective and flexible solution for institutions and individuals (Legaree, 2015; Lau, 2017). It is noted that there exists a wide range of platforms for interaction and exchange of ideas, such as: Twitter, Facebook and LinkedIn Google+, Wordpress and Research Gate Instagram, Pinterest, Mendeley, Tumblr, Blogger, Reddit, Academia.edu, LiveJournal, YouTube, Flickr, Xing, UnTapped and Google Groups.

In this research, we developed an ePortfolio system (ePSRL system) that embraces the merits of a social networking platform and the functionalities of a learning management system. The use of a social networking engine as an ePortfolio was successful, as participants articulated a learning community and valued the simple interface. The primary aim is to provide a simple system based on the open social network platform, ELGG, that supports users to create profiles, connect to peers and interact with the learning community. The secondary aim is to support students to assist individuals to identify and present their knowledge and skills, explore their learning identity and their future career aspirations and build their career profile. It is recommended the development of learning environments encompass the philosophy of ePortfolios and promote those features to users that engage them in their quest for learning:

- *Profile*

Users should design their profiles by collecting information about their self, characteristics, knowledge, studies, interests, values. This tool can help the learner to manage his/her self-identity and explore the levels of self-efficacy. Also, individuals have the opportunity to advance their motivation and engagement in the learning situation.

- *Cycles of Learning*

Users engage in learning tasks through the SRL cycle for academic and career development. This tool may support learners to set goals, organize their learning path, manage their learning strategies and develop a wide range of skills. Further, individuals have the opportunity to select specific artifacts and earn badges to update their profiles and elevate their SRL competency.

- *Tagging*

Learners use tags to describe concepts and topics. The learning community has the opportunity to find about skills or topics dynamically. Also, tagging helps participants to collaborate, interact, make lists of users and seek help.

- *Circle of Discussion*

Users may start a discussion about a topic and invite peers to join and interact. Each user has the opportunity to create discussion boards. Also, when learners set questions and attempt to increase group interaction, they can earn badges and increase their motivation.

- *Reflective Microblogging*

Learners may use the reflective microblogging tool as a personal diary/journal for writing notes about their aspirations. Further, users can self-reflect about their artifacts and monitor their learning path.

- *Evaluation feed*

Users have the opportunity to assess their tasks and reconsider their mistakes. Peers and tutors may use rubrics in order to evaluate artifacts and provide feedback. Learners may reflect upon their learning tasks and set new goals.

6.4.5 Practical Implications for Human Resource Management (HRM) experts, sustainable HRM leaders and coaching managers

The findings of this research revealed that learners should actively engage in the construction process of the ePortfolio for boosting SRL skills, managing their academic path and enhancing employability. Furthermore, the establishment of ePortfolios may help individuals to market themselves to employers and successfully join the workforce. This finding is consistent with prior research results that they should consistently use and update their ePortfolios so as to reflect on and enrich their learning outcomes (Cheng, Chen & Yen, 2015). Therefore, when an individual maintains an ePortfolio targets to shape their learning identity so as to enable career decisions (Dalton, 2007). This research attempted to design and implement a multifaceted ePortfolio that supports and allows learners to discover their learning identity, manage their skills and enable career planning and development. The findings of the research offer insights into students' perceptions about their SRL skills and ePortfolio experience. Participants agreed that there were specific features that gained significance within the ePortfolio intervention such as:

- Organized learning content (training content)
- Monitoring learner's progress (trainees)
- Familiarizing with various tools
- Presenting Myself
- Supporting academic & career path
- Learning to organize my training (professional and career development)

Also, the ePSRL system received high ratings for its potential to support self-regulated learning presumably due to the fact that the conceptual design required students to engage in various activities and train their SRL skills. Also, the ePSRL system has a cognitive orientation as well as a strong affective and motivation orientation. However, the social orientation of the system needs further support. Perhaps, the structure of the artifacts activates aspects of SRL as learners are prompted to discover and present themselves, manage their learning identity, explore the career path and evaluate their actions.

Therefore, this research provides practical implications for Human Resource Management (HRM) experts, sustainable HRM leaders and coaching managers. In the context of an organization, a corporate environment or an academic department, human resource management and training aim at cultivating skills and knowledge in order to boost productivity, advance academic achievement and promote sustainability. In recent years, sustainable development is considered to be an important indicator that will shape the ecological, economic and social future of the global environment (United Nations, 2015). In addition, it is noted that human resource managers should focus on issues related not only to the ecological and social environment but also to embrace the well-being of individuals (Di Fabio, 2017). Research points that well-being is a fundamental sustainable development goal and is defined as "a state of complete physical, mental, spiritual, and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 2007; Macik-Frey et al., 2007). Towards, this, sustainable HRM should provide training procedures that leverage knowledge about responsible workplaces, emotional intelligence, empathy, compassion, acceptance of change, decent leadership, authenticity, human rights, performance development, diversity etc. (Di Fabio, 2017; Cohen, Taylor, & Muller-Camen, 2010).

Organizations should focus on empowering healthy graduates and professionals by delivering counseling, mentoring, coaching and training programs that target individuals' well-being. It is proposed the delivery of a ubiquitous learning solution like an ePortfolio platform. In this platform learners will have the opportunity to read the objectives, review the learning procedure, find valuable resources and be familiarized with the learning content. Also, the platform will provide a personal workspace where individuals could upload, manage and edit their files and articulate their reflections. Additionally, this platform will incorporate a learner-centered approach by enabling social media functions in order to support a learning community. It is recommended that individuals engage in sustainable HRM practices to become flourishing and resilient professionals and citizens of the world. Therefore, SRL skills which are important for the well-being should be developed with a greater regard to the vision of sustainability. In detail:

- ***Cognitive direction:*** Encouraging individuals to participate in coaching and training modules that support intervention in the cognitive processes such as goal setting, goal orientation and strategic planning. In these modules, students will learn how to define tangible and proximal goals, to design a challenging goal plan, to select strategies, to monitor and evaluate their actions.
- ***Affective direction:*** Supporting individuals to engage in training and mentoring modules that target affective processes such as motivation and self-efficacy. In these modules, individuals may manage their thoughts and actions by modifying their self-efficacy beliefs and control their perceptions. When learners organize their workload and manage their skills, then, they advance their motivation which, in turn, influences performance.
- ***Behavior direction:*** Assisting individuals to participate in training and mentoring modules that attempt to affect behavior processes such as time management. In these modules, individuals may engage in tasks to construct personal organizers for studying, scheduling short or long-term studies, allocating their efforts and workload as well as organizing their time.
- ***Social direction:*** Inviting individuals to engage in coaching and training modules that target social processes such as peer learning and help seeking. In these modules, learners may develop learning communities where they can interact with their peers, exchange opinions, seek assistance and share knowledge in order to elevate their performance.

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Appendices

APPENDIX A: Questionnaire about SRL skills

An adapted web-based version of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991)

1. In an educational intervention, I prefer learning content l that really challenges me so I can learn new things.
2. If I study in appropriate ways, then I will be able to learn the learning content
3. When I take a test, I think about how poorly I am doing compared to peers
4. I think I will be able to use what I learn in the educational intervention in other courses.
5. I believe I will receive excellent grades this semester
6. I'm certain I can understand the most difficult content presented in this intervention
7. Getting good grades is the most satisfying thing for me right now.
8. When I take a test, I think about items on other parts of the test I can't answer
9. It is my own fault if I don't learn the learning content
10. It is important for me to learn the learning content and resources
11. The most important thing for me right now is improving my overall grade point average, so my main concern is getting a good grade.
12. I'm confident I can learn the basic concepts taught in this educational intervention
13. If I can, I want to get better grades in this intervention than most of the other students
14. When I take tests, I think of the consequences of failing
15. I'm confident I can understand the most complex material presented by the instructor in the intervention.
16. In the intervention, I prefer content that arouses my curiosity, even if it is difficult to learn.
17. I am very interested in the content area of the intervention
18. If I try hard enough, then I will understand the learning content.
19. I have an uneasy, upset feeling when I take an exam.
20. I'm confident I can do an excellent job on the projects in this intervention.
21. I expect to do well in the intervention.
22. The most satisfying thing for me in this intervention is trying to understand the content as thoroughly as possible.
23. I think the content in the educational intervention is useful for me to learn.
24. When I have the opportunity in the intervention, I choose activities that I can learn from even if they don't guarantee a good grade.
25. If I don't understand the content, it is because I didn't try hard enough
26. I like the subject matter of this intervention.
27. Understanding the subject matter of the intervention is very important to me.
28. I feel my heart beating fast when I take an exam.
29. I'm certain I can master the skills being taught in the educational intervention.
30. I want to do well in the educational intervention because it is important to show my ability to my family, friends, employer, or others.
31. Considering the difficulty of this intervention, the instructor, and my skills, I think I will do well in this project.
32. When I study the learning content, I outline the material to help me organize my thoughts.
33. During class time I often miss important points because I'm thinking of other things.
34. When studying for the project, I often try to explain the material to a peer or friend.
35. I usually study in a place where I can concentrate on my course work.
36. When reading for this project, I make up questions to help focus my reading.
37. I often feel so lazy or bored when I study for this project that I quit before I finish what I planned to do.
38. I often find myself questioning things I hear or read in this course to decide if I find them convincing.
39. When I study for this project, I practice saying the material to myself over and over.

40. Even if I have trouble learning the learning content, I try to do the work on my own, without help from anyone.
41. When I become confused about something I'm reading for this project, I go back and try to figure it out.
42. When I study for this project, I go through the learning content and my notes and try to find the most important ideas.
43. I make good use of my study time for this project
44. If learning content is difficult to understand, I change the way I read the material.
45. I try to work with other students from this intervention to complete the activities.
46. When studying for this project, I read my notes and resources over and over again.
47. When a theory, interpretation, or conclusion is presented, I try to decide if there is good supporting evidence.
48. I work hard to do well in intervention even if I don't like what we are doing.
49. I make simple charts, diagrams, or tables to help me organize learning content.
50. When studying for the project, I often set aside time to discuss course material with a group of peers.
51. I treat the learning content as a starting point and try to develop my own ideas about it.
52. I find it hard to stick to a study schedule.
53. When I study for the project, I pull together information from different sources, such as notes, resources and discussions.
54. Before I study new content thoroughly, I often skim it to see how it is organized
55. I ask myself questions to make sure I understand the material I have been studying in this project
56. I try to change the way I study in order to fit the intervention requirements and the instructor's teaching style.
57. I often find that I have been reading for this project but don't know what it was all about.
58. I ask the instructor to clarify concepts I don't understand well
59. I memorize key words to remind me of important concepts in this project.
60. When course work is difficult, I either give up or only study the easy parts.
61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying for the project.
62. I try to relate ideas in the intervention to those in other courses whenever possible.
63. When I study for the intervention, I go over my class notes and make an outline of important concepts.
64. When reading for this project, I try to relate the material to what I already know.
65. I have a regular place set aside for studying.
66. I try to play around with ideas of my own related to what I am learning in the intervention.
67. When I study for this intervention, I write brief summaries of the main ideas from the content and my notes.
68. When I can't understand the material in the intervention, I ask another student for help.
69. I try to understand the learning content by making connections between the readings and the concepts from the intervention.
70. I make sure that I keep up with the weekly readings and assignments for this project.
71. Whenever I read or hear an assertion or conclusion in this intervention, I think about possible alternatives.
72. I make lists of important items for this project and memorize the lists.
73. I attend the intervention regularly.
74. Even when the content is dull and uninteresting, I manage to keep working until I finish.
75. I try to identify students in this intervention whom I can ask for help if necessary
76. When studying for this intervention I try to determine which concepts I don't understand well.
77. I often find that I don't spend very much time on this project because of other activities.
78. When I study for this project, I set goals for myself in order to direct my activities in each study period.
79. If I get confused taking notes, I make sure I sort it out afterwards.
80. I rarely find time to review my notes or readings before an exam
81. I try to apply ideas from the learning content in other activities such as discussion.

APPENDIX B: ePortfolio Rubric

Table 121. *Description of the ePortfolio Rubric*

ePortfolio Rubric			
ePortfolio Criteria	**SRL Processes**	**Intended Purpose**	**Question**
ePortfolio Purpose	Goal Setting	[1] Intended Target- Audience	*[1] The outline of the ePortfolio provides clear implications about the target-audience*
		[3] Purpose	*[3] The purpose of the ePortfolio is specific and measurable.*
		[8] Artifacts – Short-term Goals	*[8] The structure of the ePortfolio consists of short-term goals*
		[9] Artifacts – Long-term Goals	*[9] The structure of the ePortfolio consists of long-term goals*
Artifacts Repository	Self-Efficacy	[7] Artifacts - Self	*[7] The EPortfolio depicts personal characteristics such as skills, interests, attitudes and values.*
	Organizing	[10] Artifacts - Academic	*[10] The ePortfolio consists of artifacts that present individual's academic development.*
	Self-Monitoring	[11] Artifacts - Progress	*[11] The ePortfolio supports learner to monitor their progress*
	Learning Strategies	[13] Artifacts – Learning Strategies	*[13] The structure of the ePortfolio encourages the use of learning strategies.*
	Work well with Peers	[14] Artifacts - Career	*[14] The ePortfolio demonstrates my active participation in collaborative activities for academic and career purposes.*
Reflection in Action	Self-Judgement	[12] Analysis of Project	*[12] The structure of the ePortfolio provides an in-depth analysis of the projects.*
		[16] Academic Feedback	*[16] The ePortfolio provides reflective feedback on academic activities*
		[17] Career Feedback	*[17] The ePortfolio provides reflective feedback on career activities*
	Self-Evaluation	[18] Self-assessment	*[18] The structure of the EPortfolio highlights the process of self-assessment*
ePortfolio Usability characteristics	Critical Thinking Information Processing	[6] ePortfolio system satisfaction	*[6] I feel satisfied with the selection of the ePortfolio platform*
		[19] Navigation	*[19] ePortfolio's appearance and navigation are clear and consistent*
		[20] Multimedia	*[20] ePortfolio's links and multimedia work as expected*
		[21] Images	*[21] ePortfolio's images are optimized according to web requirements*

[22] Interface	*[22] ePortfolio's interface is appropriate (not very restrictive or too intensive)*
[23] Readability	*[23] ePortfolio's text is readable (font, size, contrasts)*
[24] Mechanics	*[24] Grammar and syntax are correct*
[25] Ethical Literacy	[25] ePortfolio's published material respects copyright.
[26] Usability Design	[26] The ePortfolio is consistent to the design criteria.

APPENDIX C: ePortfolio-based Self-Regulated Learning Rubric

The ePortfolio based Self-Regulated Learning Rubric was developed based on an instrument that is designed for the needs of European Project TELEPEERS, entitled 'Self-regulated Learning in Technology Enhanced Learning Environments at University Level: A Peer Review', (Grant agreement 2003-4710-/001-001 EDU-ELEARN).

Phase A: Planning

Cognitive Processes
1.The ePSRL system helps the learner to structure the learning content.
2.The ePSRL system has an easy and intuitive interface.
3.The ePSRL system records a history of learner activities.
4.The ePSRL system allows the student to plan her/his learning with the help of activity plans, personal development plans, progress reports etc.
5.The ePSRL system provides the student with the opportunity to choose between different modules.
6.The ePSRL system provides the student with the opportunity to choose between different learning paths.
7.The ePSRL system provides the student with the opportunity to choose between different modes of delivery.

Motivational Processes
8. The ePSRL system is likely to arouse the learner's interest.
9. The ePSRL system allows each student to partially personalize the interface used in the environment.
10. The ePSRL system eases the student's becoming aware of personal learning goals.
11. The ePSRL system helps the learner plan her/his activities by pointing out to her/him external resources
12. The ePSRL system reminds the learner of her/his own knowledge and skills relevant to the task at hand.
13. The ePSRL system sensitizes the learner with respect to how problems might be solved.
14. There are explicit mechanisms in the ePSRL system to encourage the learner to tackle tasks.
15. There are implicit mechanisms in the ePSRL system to encourage the learner to tackle tasks.

Affective Processes
16. The ePSRL system helps the learner to cope with the challenges of the task.
17. The ePSRL system may be adapted to reach a congruence between the learner's level of competence and the level of difficulty of the task.
18. The ePSRL system is organized in such a way that the learner is likely to enjoy working in it.

Social Processes
19. The ePSRL system offers the possibility to set up both public and private communication.
20. The ePSRL system provides the learner with the opportunity to negotiate with her/his tutor/instructor how to organize her/his work.
21. The ePSRL system allows the learner to work together / communicate with her/his peers.

Phase B: Performance-Control

Cognitive Processes
22. The ePSRL system allows the user to make decisions on how to proceed.
23. The ePSRL system leads the learner to reflect on her/his own problem-solving activities.
24. The ePSRL system provides the user with the possibility to find out to what extent she/he is achieving her/his learning goals.
25. The ePSRL system allows the learner to switch to another learning strategy if necessary.

Motivational Processes
26. The ePSRL system helps the learner to maintain her/his motivation.

27.The ePSRL system provides help facilities that aim at strengthening the learner' perseverance in case of failure.

Affective Processes
28. The ePSRL system provides the user with formative feedback that facilitates the maintenance of a positive working attitude.
29. The ePSRL system provides the user with formative feedback that intervenes at critical points in the learning cycle in order to restore a positive working attitude.

Social Processes
30.The ePSRL system allows the user to contact and receive help from her/his tutor/instructor.
31 The ePSRL system provides the user with the opportunity to communicate with her/his peers in order to exchange ideas or to ask for help.
32. The ePSRL system provides the user with possibilities to collaborate with her/his peers.

Phase C: Self-Reflection

Cognitive Processes
33. The ePSRL system helps the user to reflect on her/his learning progress.
34. The ePSRL system encourages the learner to compare her/his present state with the state she/he wanted to be in.
35. The ePSRL system provides the learner with the means to assess her/his own achievements.
36. The ePSRL system allows the student to select the achievements to be assessed.
37. The ePSRL system allows the student to select the competencies to be assessed.

Motivational Processes
38. The ePSRL system provides the learner with feed-back that leads to appropriate self-efficacy beliefs.

Affective Processes
39. The ePSRL system provides the learner with appropriate feedback on her/his achievements and on the amount of work done.

Social Processes
40. The ePSRL system provides the learner with the opportunity to compare her/his results with that of a tutor/instructor
41. The ePSRL system allows the learner to discuss her/his results with her/his tutor/instructor
42. The ePSRL system provides the learner with the opportunity to compare her/his results with those of her/his peers.
43. The ePSRL system allows the learner to discuss his/her results with her/his peers.

APPENDIX D: Pre and Post Rubrics

Prior ePortfolio Experience Rubric (Pre-Test)

Part A: Demographics

A1. Level of Education

a. Primary education
b. Secondary education
c. Higher Education – undergraduate students
d. Higher Education – postgraduate students
e. Higher Education – PhD students

A2. Gender

a. Male
b. Female
c. Not defined

A3. Age groups

a. 18-21
b. 22-30
c. 31-40
d. 41-50
e. 51-60
f. >60

Part B: Participant Digital Competency

B1. Please rate your level of digital competency using the following scale: 1 = Totally disagree, 2 = Somewhat disagree, 3 = Neutral, 4 = Somewhat agree, 5 = Totally agree.

a. Using Digital Devices
b. Internet Browsing
c. Using Text Editing software
d. Using Graphic Design software
e. Using Presentation software
f. Designing Static Websites
g. Using video editing software
h. Using audio editing software
i. Using photo editing software
j. Using Social Networking Sites

B2. Which best describes your level of digital competence?

a. Basic User
b. Independent User
c. Proficient User

Part C: Perceptions about ePortfolio prior experience

Please rate the following statements about ePortfolio prior experience (scale: 1 = Yes, 2 = No)

1. Did you have previous experience using ePortfolio?
2. Before your participation, did you search about ePortfolios?
3. Do you think that the ePortfolio implementation will be beneficial?
4. Do you estimate to face difficulties during the ePortfolio implementation?
5. Do you participate in the ePortfolio intervention for gaining knowledge?
6. Do you think that ePortfolios are useful tools?
7. Do you believe that the implementation of ePortfolios may promote career development?
8. Do you have sufficient knowledge and information about ePortfolios?
9. Do you feel that you will be able to complete the ePortfolio intervention?
10. Which best describe 'Why do you participate in the ePortfolio Intervention?'
    - 10.1 Delivering an ePortfolio
    - 10.2 Understanding the content
    - 10.3 Gaining better grades
    - 10.4 Activating Interest
    - 10.5 Gaining Knowledge
    - 10.6 Developing Skills
    - 10.7 Academic and career development

Post ePortfolio-Intervention Review (Open-ended questions)

1. After the completion of the ePortfolio intervention, please describe the positive elements of the ePortfolio.
2. After the completion of the ePortfolio intervention, please describe the negative elements of the ePortfolio.
3. What do you think should be added, changed or removed from the ePortfolio Intervention? (future suggestions)
4. Do you feel that feedback and interaction with instructors and administrators were helpful?
5. In the future, do you think that you will be able to use your ePortfolio?
6. Please write a short comment about your ePortfolio experience. Justify your answer.

APPENDIX E: ePSRL Conceptual Framework (Version 1.)

Table 122. EPortfolio System is based on the proposed SRL conceptual framework (Version 1.) which consists of a specific SRL processes (C: Cognitive, A: Affective, B: Behavior, Cx: Context)

SRL Model - Phases ePortfolio Activities	**Forethought** [A]	**Performance Control** [B]	**Self-Reflection** [C]	***ePortfolio Artifacts***
A0: Implementation of ePortfolio	C: Task Analysis	C: Self-Observation	C: Self-satisfaction	*Website deliverable*
A1: Identifying Personality Characteristics and Skills **A2:** Presenting MySelf	A: Self-Efficacy A: Efficacy Judgement			*Presentation*
A3: Goal Setting	C: Goal Setting A: Goal Orientation			*Document*
A4: Strategic Planning for Goals accomplishment	C: Strategic Planning A: Task Value & Activation B: Planning of Self-Observation			*Document*
A5: Familiarize with MySelf as a Student		B: Study Aids B: Self-testing B: Test Strategies		*Presentation*
A6: Boosting the Strategy of Note Taking		C: Use of Imagery C: Self-Instruction		*Web-based application*
A7: Time Management		B: Time management		*Web-based application*
A8: Creating My CV		C: Self-monitoring C: Self-recording	B: Choice Behavior	*Document*
A9: Self-Assessing My Time Management			C: Self-reaction C: Causal attributions A: Affective Reaction A: Attributions	*Online Assessment Tool*
A10: Self-Assessing My SRL Skills/Competences			C: Self-evaluation	*Online Assessment tool*
A11: Self-Assessing ePortfolio			Cx: Evaluation Task Cx: Evaluation Context	*Online Assessment Tool*

APPENDIX F: ePSRL Conceptual Framework (Version 2.)

Table 123. EPortfolio System is based on the proposed conceptual framework (Version 2), titled ePortfolio-based self-regulated learning (ePSRL) approach

ePortfolio based self-regulated learning (ePSRL) approach (Conceptual Framework-Version 2)				
SRL Model-Activities		**Career Management Competencies**		
Module 1: Discovering and Presenting Myself	**Reflection**	**Area A:** Personal Management	**Area B:** Learning & Work Exploration	**Area C:** Career Building
Artifact 1 'Implementation of a stand-alone ePortfolio	**Artifact 1.1**			Understand and engage in and manage the career building-process
SRL Model: Forethought Phase [A]				
Artifact 2 'Personality Characteristics and Skills'	Artifact **2.1**	Build and Maintain a positive self-concept		
Artifact 3 'Goal Setting'	Artifact **3.1**		Participate in a lifelong learning supportive of career goals	
Artifact 4 'Exploring my Motivations'	Artifact **4.1**	Change and Grow throughout life		
Artifact 5 'Strategic Planning'	Artifact **5.1**		Participate in a lifelong learning supportive of career goals	
Artifact 6 'Becoming a specialist in decision making'	Artifact **6.1**			Maintain Balanced Life and Work Roles
Artifact 7 'Presenting Myself'	Artifact **7.1**	Build and Maintain a positive self-concept		
Artifact 8 'Visualizing my life plan'	Artifact **8.1**			Maintain Balanced Life and Work Roles
SRL Model: Performance Control Phase [B]				
Module 2: Managing my learning identity				
Artifact 9 'Time Management'	Artifact **9.1**		Understand the relationship between work-society-economy	
Artifact 10 'Familiarize with Myself as a Student'	Artifact **10.1**			Understand Engage in and manage the career building-process
Artifact 11'Boosting the Strategy of Note Taking'	Artifact **11.1**		Locate & Effectively use career information	
Artifact 12 'Regulating my study environment'	Artifact **12.1**	Change and Grow throughout life		

Artifact 13 'Effective Conflict Management'	Artifact **13.1**			Understand Engage in and manage the career building-process
Module 3: Exploring my career path				
Artifact 14 'Articulating my career path'	Artifact **14.1**		Understand the relationship between work-society-economy	
Artifact 15 'Self-Regulating the process of career search'	Artifact **15.1**			Understand Engage in and manage the career building-process
Artifact 16 'Creating My Curriculum Vitae'	Artifact **16.1**			Secure /Create and Maintain Work
Artifact 17 'Networking'	Artifact **17.1**			Secure /Create and Maintain Work
Artifact 18 'Career and stereotypes'	Artifact **18.1**			Understand the changing nature of life and work roles
SRL Model: Self-Reflection Phase [C]				
Module 4: Evaluating my actions and evolving to the next stage				
Artifact 19 'Managing my Artifacts'	Artifact **19.1**			Understand Engage in and manage the career building-process
Artifact 20 'Preparing for life changes'	Artifact **20.1**	Change and Grow throughout life		
Artifact 21 'Trying to enhance my positive Self-image'	Artifact **21.1**	Build and Maintain a positive self-concept		
Artifact 22 'Self-Assessing My Time Management'	Artifact **22.1**		Participate in a lifelong learning supportive of career goals	
Artifact 23 'Becoming an Advisor'	Artifact **23.1**			Make career enhancing decisions
Artifact 24 'Self-Assessing My SRL Skills/Competences'	Artifact **24.1**		Build and Maintain a positive self-concept	
Activity 25 'Self-Assessing the ePortfolio'	Artifact **25.1**			Understand Engage in and manage the career building-process

APPENDIX G: Coding Schemas – Students' Reflections about their SRL skills (Study#2)

Table 124. Qualitative Analysis of students' reflections about their SRL Skills/Competences (A24)

Students Experimental Group	*Numbers of Concepts*	*Self-Assessing My SRL Skills/Competences -Reflections*	*Total Numbers of Concepts*
S2_Student_EXPR_1	3	Academic & Career Development	29
S2_Student_EXPR_2	3	Reconsider Mistakes	5
S2_Student_EXPR_3	3	Organizing Learning Path	32
S2_Student_EXPR_4	3	Goal Setting	42
S2_Student_EXPR_5	5	Motivation	26
S2_Student_EXPR_6	3	Collaboration	18
S2_Student_EXPR_7	4	Skills Development	30
S2_Student_EXPR_8	4	Self-Efficacy	32
S2_Student_EXPR_9	3	Time Management	21
S2_Student_EXPR_10	2	Self-Evaluation	23
S2_Student_EXPR_11	3	Learning Strategies	11
S2_Student_EXPR_12	3	Self-Monitoring	17
S2_Student_EXPR_13	3	Help Seeking	19
S2_Student_EXPR_14	6	TOTAL Concepts	305
S2_Student_EXPR_15	5		
S2_Student_EXPR_16	5		
S2_Student_EXPR_17	3		
S2_Student_EXPR_18	4		
S2_Student_EXPR_19	3		
S2_Student_EXPR_20	5		
S2_Student_EXPR_21	2		
S2_Student_EXPR_22	4		
S2_Student_EXPR_23	2		
S2_Student_EXPR_24	4		
S2_Student_EXPR_25	3		
S2_Student_EXPR_26	0		
S2_Student_EXPR_27	5		
S2_Student_EXPR_28	4		
S2_Student_EXPR_29	4		
S2_Student_EXPR_30	2		
S2_Student_EXPR_31	11		
S2_Student_EXPR_32	2		
S2_Student_EXPR_33	4		
S2_Student_EXPR_34	3		
S2_Student_EXPR_35	5		

S2_Student_EXPR_36	6
S2_Student_EXPR_37	3
S2_Student_EXPR_38	5
S2_Student_EXPR_39	8
S2_Student_EXPR_40	4
S2_Student_EXPR_41	8
S2_Student_EXPR_42	13
S2_Student_EXPR_43	4
S2_Student_EXPR_44	6
S2_Student_EXPR_45	7
S2_Student_EXPR_46	6
S2_Student_EXPR_47	4
S2_Student_EXPR_48	3
S2_Student_EXPR_49	5
S2_Student_EXPR_50	3
S2_Student_EXPR_51	3
S2_Student_EXPR_52	6
S2_Student_EXPR_53	4
S2_Student_EXPR_54	3
S2_Student_EXPR_55	13
S2_Student_EXPR_56	6
S2_Student_EXPR_57	6
S2_Student_EXPR_58	4
S2_Student_EXPR_59	4
S2_Student_EXPR_60	4
S2_Student_EXPR_61	3
S2_Student_EXPR_62	6
S2_Student_EXPR_63	4
S2_Student_EXPR_64	6
S2_Student_EXPR_65	2
S2_Student_EXPR_66	5
S2_Student_EXPR_67	4
S2_Student_EXPR_68	5
S2_Student_EXPR_69	2
S2_Student_EXPR_70	2
TOTAL Concepts	305

APPENDIX H: Coding Schemas – Students' Reflections about their SRL skills (Study#3)

Table 125. Study#3: Qualitative Analysis of students' reflections about their SRL Skills/Competences

Students Experimental Group	*Numbers of Concepts*	*Self-Assessing My SRL Skills/Competences -Reflections*	*Total Numbers of Concepts*
S3_PostStudent_EXPR_1	6	Academic & Career Development	10
S3_PostStudent_EXPR_2	8	Reconsider Mistakes	0
S3_PostStudent_EXPR_3	7	Organizing Learning Path	16
S3_PostStudent_EXPR_4	5	Goal Setting	14
S3_PostStudent_EXPR_5	4	Motivation	14
S3_PostStudent_EXPR_6	4	Collaboration	9
S3_PostStudent_EXPR_7	5	Skills Development	15
S3_PostStudent_EXPR_8	6	Self-Efficacy	13
S3_PostStudent_EXPR_9	6	Time Management	12
S3_PostStudent_EXPR_10	8	Self-Evaluation	12
S3_PostStudent_EXPR_11	4	Learning Strategies	04
S3_PostStudent_EXPR_12	6	Self-Monitoring	07
S3_PostStudent_EXPR_13	4	Self-Reflection	14
S3_PostStudent_EXPR_14	4	Help Seeking	14
S3_PostStudent_EXPR_15	4	TOTAL Concepts	154
S3_PostStudent_EXPR_16	4		
S3_PostStudent_EXPR_17	4		
S3_PostStudent_EXPR_18	4		
S3_PostStudent_EXPR_19	7		
S3_PostStudent_EXPR_20	6		
S3_PostStudent_EXPR_21	7		
S3_PostStudent_EXPR_22	5		
S3_PostStudent_EXPR_23	9		
S3_PostStudent_EXPR_24	7		
S3_PostStudent_EXPR_25	6		
S3_PostStudent_EXPR_26	5		
S3_PostStudent_EXPR_27	4		
S3_PostStudent_EXPR_28	5		
TOTAL Concepts	154		

APPENDIX I: ePortfolio Plugins

Table 126. ePortfolio Plugins

Plugins	*Study#1*	*Study#2*	*Study#3*
[41]	[27/**41**]	[26/**41**]	[27/**41**]
○ Blog	✓		
○ Bookmarks	✓		
○ Site-wide categories	✓		
○ CKEditor		✓	✓
○ Front Page Demo	✓		
○ Captcha	✓		
○ Easy Theme 1.3.6	✓		
○ Aalborg Theme		✓	✓
○ User dashboard			
○ Elgg developer tools		✓	
○ diagnostics		✓	✓
○ **embed**	✓	✓	✓
○ **Site pages**	✓	✓	✓
○ **File**	✓	✓	✓
○ Elggx Badges	✓		
○ Elggx Userpoints			
○ Last login			✓
○ Login Required	✓	✓	✓
○ Notifier		✓	
○ **Messages**	✓	✓	✓
○ Notifications		✓	✓
○ **Pages**	✓	✓	✓
○ The Wire		✓	✓
○ Twitter API	✓		
○ User validation email		✓	✓
○ **Profile Manager**	✓	✓	✓
○ **Profile**	✓	✓	✓
○ **Reported Content**	✓	✓	✓
○ **Search**	✓	✓	✓
○ **Site notification**	✓	✓	✓
○ Tag cloud			✓
○ Invite friends	✓		✓
○ Legacy url support	✓		
○ **Likes**	✓	✓	✓
○ **Log browser**	✓	✓	✓
○ **Log rotate**	✓	✓	✓
○ **Members**	✓	✓	✓
○ **Message board**	✓	✓	✓
○ Spam login filter		✓	✓
○ Tidypics photo gallery	✓		
○ Groups		✓	✓