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“Evaluation framework for the integration of gamification elements in Massive Open Online Courses for Professional Development (MOOCs4PD)”

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Στους γονείς μου,
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Abstract

Gamification has been used as a successful strategy for users' motivation and engagement in various fields, including education and training. In the context of digital teaching and learning, gamification is considered as an effective educational design intervention to enhance learner's motivation, engagement, and eventually performance. When it comes to MOOCs (Massive Open Online Courses), gamification is recognized as one of the most common strategies to improve MOOC participants' learning experience and reduce the high drop-out rates that characterized them. Yet, the appropriate gamified elements need to be carefully selected to enhance effectiveness of MOOC's design, especially in professional development MOOCs.

In this thesis, an evaluation framework is proposed for evaluating the gamification's integration in MOOCs for professional development (MOOCs4PD), based on the psychological, behavioral, and learning outcomes along with their potential factors regarding the learners' profile and overall success of MOOCs4PD. A pre-course survey is used to collect data about the general characteristics of participants, their gamification profile, their intention towards the MOOC and their initial competence level. Data about the psychological outcomes that participants experienced regarding to the overall gamification experience, the gamification experience per element and the attitude towards gamification after the course completion are collected by a post-course survey. This gamification experience is based on how the gamification elements made the participants feel during the course (the sense of satisfaction, enjoyment, motivation, competence, autonomy, accomplishment, challenge, competition, guided, social experience, usefulness). In the same post-course survey, participants also self-reflect on their behavioral outcomes, namely, the perceived use, the continued use intention, the platform experience, and the achieved competence level. In addition, the behavioral outcomes' data about the engagement of participants with the course and the personal completion rate are retrieved and analysed from the MOOC's platform.

This evaluation framework was implemented and validated through a real-life case scenario, that is, the Learn2Analyzed MOOC (L2A MOOC 2021). The L2A MOOC 2021 is a competence based MOOC4PD that integrates specific gamification elements, aiming to support the development and accreditation of both core and advanced competences for Educational Data Analytics of Online and Blended teaching and learning.

The L2A MOOC 2021 started on March 1st, 2021, and closed on June 6th, 2021, with 2188 enrolled participants from 83 countries. From the enrolled participants, 1235 unique participants started the L2A MOOC (56,44% of the enrolled), namely, the participants that answered the pre-course survey, with 282 to have completed the post-course survey and the assessment requirements for the L2A MOOC certification (Completion Rate=22,83% from those who started the course and 12,88% from those initially enrolled). In regard to the self-reported intention of course completion and the personal completion rate of the 1235 participants, they achieved, on average, almost the half of their initial goal (Overall Goal Achievement Ratio = 0,438). The 282 participants, that successfully completed the MOOC, presented a perceived Educational Data Literacy (EDL) competence advancement of one level, from Advanced Beginner (initial level=2) to Competent (achieved level=3).

With regard to gamification, the post-course survey indicated that participants who completed the L2A MOOC showed positive psychological and behavioral outcomes. The overall gamification experience, the gamification experience per element, the platform experience and the continued use intention presented strong and positive relationships among them. The attitude towards gamification was strongly affected by the psychological outcomes, but moderately by the behavioral outcomes, while the perceived use showed only a low positive relationship with overall gamification experience. The positive relationship between the sense of competence that participants got from the integration of gamification and the achieved competence level indicated that elements being directly connected with EDL competences helped users to self-assess their achieved level. Among the different gamification profiles, the participants that had already used themselves gamification in their educational design in the past showed significantly better psychological and behavioral outcomes, while participants who were familiar with the gamification were indicated with significantly greater continued intention and more earned Points. The analysis of the participants' gamification profile based on the player types showed that a participant was more likely to complete the course if he/she had been characterized as Player and/or Disruptor compared with the other player types. In respect of earned Points, engagement did not seem to have been affected or have affected any of the outcomes. Personal Goal Achievement and EDL competence level advancement did not show any effect, even though the achieved EDL competence level was slightly affected by the psychological and behavioral outcomes.

Keywords: Gamification Elements, Evaluation of Gamification, MOOCs for Professional Development, Psychological and Behavioral Outcomes, Personal Goal Achievement, Competence Advancement

Περίληψη

Η Παιχνιδοποίηση έχει χρησιμοποιηθεί ως μία επιτυχημένη στρατηγική για την κινητοποίηση και την εμπλοκή των χρηστών σε διάφορους τομείς, συμπεριλαμβανομένης της εκπαίδευσης. Στο πλαίσιο της ψηφιακής διδασκαλίας και μάθησης, η παιχνιδοποίηση θεωρείται ως μια αποτελεσματική εκπαιδευτική παρέμβαση για την ενίσχυση των κινήτρων του μαθητή, την εμπλοκή και, τελικά, την απόδοση. Όσον αφορά τα ΜΑΔΜ (Μαζικά Ανοιχτά Διαδικτυακά Μαθήματα), η παιχνιδοποίηση αναγνωρίζεται ως μία από τις πιο κοινές στρατηγικές για τη βελτίωση της μαθησιακής εμπειρίας των συμμετεχόντων στο MOOC και τη μείωση των υψηλών ποσοστών εγκατάλειψης που τα χαρακτηρίζουν. Ωστόσο, τα κατάλληλα παιχνιδοποιημένα στοιχεία πρέπει να επιλέγονται προσεκτικά για να βελτιωθεί η αποτελεσματικότητα του σχεδιασμού του ΜΑΔΜ, ιδίως σε εκείνα που αφορούν την επαγγελματική ανάπτυξη.

Σε αυτή τη Μεταπτυχιακή Διπλωματική Εργασία, προτείνεται ένα πλαίσιο αξιολόγησης για την αξιολόγηση της ενσωμάτωσης της παιχνιδοποίησης στα ΜΑΔΜ για επαγγελματική ανάπτυξη, με βάση τα ψυχολογικά, συμπεριφορικά και μαθησιακά αποτελέσματα, μαζί με τους πιθανούς παράγοντες τους σχετικά με το προφίλ των μαθητών και τη συνολική επιτυχία των ΜΑΔΜ. Μια έρευνα προ-μαθήματος χρησιμοποιείται για τη συλλογή δεδομένων σχετικά με τα γενικά χαρακτηριστικά των συμμετεχόντων, το παιχνιδοποιημένο προφίλ τους, την πρόθεσή τους προς το ΜΑΔΜ και το αρχικό επίπεδο ικανοτήτων τους. Τα δεδομένα σχετικά με τα ψυχολογικά αποτελέσματα των συμμετεχόντων σχετικά με τη συνολική εμπειρία παιχνιδοποίησης, την εμπειρία παιχνιδοποίησης ανά στοιχείο και τη στάση απέναντι στην παιχνιδοποίηση μετά την ολοκλήρωση του μαθήματος συλλέγονται από μια μετα-μαθήματος έρευνα. Η εμπειρία παιχνιδοποίησης βασίζεται στο πώς τα στοιχεία της έκαναν τους συμμετέχοντες να αισθάνονται κατά τη διάρκεια του μαθήματος (την αίσθηση ικανοποίησης, απόλαυσης, κινήτρου, ικανότητας, αυτονομίας, επιτεύγματος, πρόκλησης, ανταγωνισμού, καθοδηγούμενης, κοινωνικής εμπειρίας, χρησιμότητας). Στην ίδια μετα-μαθήματος έρευνα, οι συμμετέχοντες ερωτώνται επίσης για τα συμπεριφορικά αποτελέσματα τους, δηλαδή, την αντιληπτή χρήση, την πρόθεση συνέχειας χρήσης, την εμπειρία της πλατφόρμας και το επιτευχθέν επίπεδο ικανοτήτων. Επιπλέον, τα δεδομένα των συμπεριφορικών αποτελεσμάτων σχετικά με τη εμπλοκή στο μάθημα και το προσωπικό ποσοστό ολοκλήρωσης ανακτώνται από την πλατφόρμα του ΜΑΔΜ.

Αυτό το πλαίσιο αξιολόγησης εφαρμόστηκε και επικυρώθηκε μέσω μίας μελέτης περίπτωσης, του Learn2Analyzed MOOC (L2A MOOC 2021). Το L2A MOOC 2021 είναι ένα ΜΑΔΜ για επαγγελματική ανάπτυξη βασισμένο σε ικανότητες που ενσωματώνει συγκεκριμένα στοιχεία παιχνιδοποίησης, για την ανάπτυξη βασικών και προηγμένων ικανοτήτων για την ανάλυση εκπαιδευτικών δεδομένων της ψηφιακής εκπαίδευσης.

Το L2A MOOC 2021 ξεκίνησε την 1η Μαρτίου 2021 και έκλεισε στις 6 Ιουνίου 2021 με 2188 εγγεγραμμένους από 83 χώρες. Από τους εγγεγραμμένους, το 1249 ξεκίνησε το L2A MOOC, δηλαδή απάντησαν στην προ-μαθήματος έρευνα. Από τους συμμετέχοντες που ξεκίνησαν το μάθημα, 1235 εντοπίστηκαν στα δεδομένα της πλατφόρμας IMC MOOC, με 282 να έχουν ολοκληρώσει την μετα-μαθήματος έρευνα και τα απαιτούμενα της αξιολόγησης για την πιστοποίηση του L2A MOOC (Ποσοστό ολοκλήρωσης = 22,83%). Όσον αφορά την αυτό-αναφερόμενη πρόθεση ολοκλήρωσης του μαθήματος και το ποσοστό προσωπικής ολοκλήρωσης των 1235 συμμετεχόντων, πέτυχαν, κατά μέσο όρο, σχεδόν το μισό του αρχικού τους στόχου (Συνολική αναλογία επίτευξης στόχου = 0,438). Οι 282 συμμετέχοντες, που ολοκλήρωσαν επιτυχώς το L2A MOOC, παρουσίασαν αντιλαμβανόμενη ανάπτυξη των ικανοτήτων αξιοποίησης εκπαιδευτικών δεδομένων ενός επιπέδου, από το τους προηγμένους αρχάριους (αρχικό επίπεδο 2) έως τους ικανούς (επιτευχθέν επίπεδο 3).

Η μετα-μαθήματος έρευνα έδειξε ότι οι συμμετέχοντες που ολοκλήρωσαν το μάθημα είχαν θετικά ψυχολογικά και συμπεριφορικά αποτελέσματα. Η συνολική εμπειρία παιχνιδοποίησης, η εμπειρία παιχνιδοποίησης ανά στοιχείο, η εμπειρία πλατφόρμας και η πρόθεση συνέχειας χρήσης παρουσίασαν ισχυρές και θετικές σχέσεις μεταξύ τους. Η στάση απέναντι στην παιχνιδοποίηση επηρεάστηκε έντονα από τα ψυχολογικά αποτελέσματα, αλλά μετρίως από τα συμπεριφορικά, ενώ η αντιληπτή χρήση έδειξε μόνο μια χαμηλή θετική σχέση με τη συνολική εμπειρία παιχνιδοποίησης. Η θετική σχέση μεταξύ της αίσθησης ικανότητας των συμμετεχόντων από την ενσωμάτωση της παιχνιδοποίησης και του επιτευχθέντος επιπέδου ικανότητας έδειξε ότι τα παιχνιδοποημένα στοιχεία συνδεδεμένα άμεσα με τις ικανότητες βοήθησαν τους χρήστες να αυτοαξιολογήσουν το επιτευχθέν επίπεδό τους. Μεταξύ των διαφορετικών προφίλ παιχνιδοποίησης, όσοι την είχαν ενσωματώσει σε εκπαιδευτικό σχεδιασμό έδειξαν σημαντικά καλύτερα ψυχολογικά και συμπεριφορικά αποτελέσματα, ενώ όσοι ήταν εξοικειωμένοι με την παιχνιδοποίηση υποδείχθηκαν με σημαντικά μεγαλύτερη πρόθεση συνέχειας χρήσης και περισσότερους πόντους. Η ανάλυση του προφίλ παιχνιδοποίησης των συμμετεχόντων με βάση τους τύπους παικτών έδειξε ότι ένας συμμετέχων ήταν πιο πιθανό να ολοκληρώσει το μάθημα εάν είχε χαρακτηριστεί ως

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Keywords: Στοιχεία Παιχνιδοποίησης, Αξιολόγηση της Παιχνιδοποίησης, ΜΑΔΜ για την επαγγελματική ανάπτυξη, Ψυχολογικά και Συμπεριφορικά Αποτελέσματα, Επίτευξη Προσωπικού Στόχου, Ανάπτυξη Δεξιοτήτων

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Chapter 1 – Introduction

1.1 Thesis Introduction

The term “Gamification” was first seen in bibliography more than a decade ago with many different definitions being written and proposed during this time to establish it. Among the numerous definitions, the one being used the most is of Deterding, Dixon, Khaled, & Nacke (2011) who present gamification as “the use of game design elements in non-game contexts”. The attention of researchers has been rapidly increased and gamification has been applied in various fields, with education and learning dominating the literature (Koivisto & Hamari, 2019; Seaborn & Fels, 2015). Gamification is considered as an educational intervention to enhance motivation and engagement of learners (Dicheva, Dichev, Agre, & Angelova, 2015) by rewarding the effort instead of winning (Folmar, 2015); while this has been successfully implemented in face-to-face contexts (Hanus & Fox, 2015; Nicholson, 2012), it thrives in blending and online learning (Romero-Rodriguez, Ramirez-Montoya, & Gonzalez, 2019).

In the context of digital teaching and learning, Massive Online Open Courses (MOOCs) use the integration of gamification as an effective strategy to deal with weaknesses that characterize them. Taking advantage of cutting-edge technologies and the Internet (Antonaci, Klemke, Stracke, & Specht, 2019), MOOCs attract massive audience as they are open, free or low cost, and flexible courses, mostly addressing to adults for further professional development. Despite the high participation, MOOCs are suffering from high drop-out rates due to their special characteristics. Investigating the integration of gamification, researchers report positive findings about learning outcomes, participation, motivation and engagement of participants along with higher course completion rates, especially in academic or higher education (Alraimi, Zo, & Ciganek, 2015; Antonaci, Klemke, Stracke, & Specht, 2017; Borrás-Gené, Martínez-Núñez, & Martín-Fernández, 2019; García-Peñalvo, Fidalgo-Blanco, & Sein-Echaluce, 2018; Jarnac de Freitas & Mira da Silva, 2020; Kaplan & Haenlein, 2016; Rincón-Flores, Montoya, & Mena, 2019; Romero-Rodriguez et al., 2019; Vaibhav & Gupta, 2014). However, it is important for gamified MOOCs to be thoughtfully designed so as participants’ motivation be increased (Dicheva et al., 2015; Domínguez, Saenz-De-Navarrete, De-Marcos, Fernández-Sanz, Pagés, & Martínez-Herráiz, 2013) and, therefore, instructional designers of MOOCs should choose properly the gamification elements, mechanics, and design principles to enhance the effectiveness of gamification.

The evaluation of gamification in MOOCs is the key to investigate the success and added value of the proper integration of gamified elements on content and educational design of MOOCs. Psychological, behavioral, and learning outcomes should be examined along with their potential factors. While MOOCs don't necessarily need to be completed in order to be considered successful (Antonaci et al., 2017), the overall success of the course, especially of MOOCs for professional development (MOOCs4PD), should be evaluated through the personal goal achievement (Antonaci et al., 2017) and competence level advancement (Mougiakou, 2020), combined with MOOC's completion rate.

1.2 Thesis Contribution

The purpose of this study is the proposition of a framework to evaluate the gamification's integration in MOOCs4PD, not only in its entirety but also separately per every gamified element. The evaluation of the gamification is based on the psychological, behavioral, and learning outcomes of learners along with their potential factors regarding their profile (general characteristics, gamification profile, intention towards MOOC) and the overall success of MOOCs4PD (competence advancement, personal goal achievement, completion rate).

The core question of the evaluation framework to be investigated is:

Does the integration of gamification elements on the content and educational design of MOOCs for Professional Development improve psychological and behavioral outcomes leading to participants' competence advancement and goal achievement?

The answers of users, who started and/or complete the course, collected with pre- and post-course survey combined with data retrieved from MOOC's platform are analyzed to investigate the core question. Learning and gamification experience along with potential factors, regarding the profile of the learners, are examined to disclose strengths and weaknesses of the MOOC to enhance the quality of the experience, the competence advancement and the personal goal achievement of users.

The evaluation framework is implemented and validated through a real-life case scenario, that is, the Learn2Analyzed MOOC (L2A MOOC 2021). The L2A MOOC 2021 is a competence based MOOC4PD that integrates specific gamification elements, aiming to support the development and accreditation of both core and advanced competences for

Educational Data Analytics of Online and Blended teaching and learning. The proposed framework for the evaluation of the gamification is incorporated in the framework, proposed and validated by Sofia Mougiakou (2020) that was used to evaluate the first edition of the L2A MOOC.

1.3 Thesis Structure

The structure of this thesis consists of six chapters:

- Chapter 1 introduces the thesis and refers its contribution and structure.
- Chapter 2 presents information and definitions of gamification, the implementation of gamification in education, MOOCs and especially for professional development, and a literature review about the gamification elements, mechanics, and design principles.
- Chapter 3 analyzes the literature review of gamification's evaluation regarding the gamification's outcomes and their factors, along with MOOCs' overall success. In addition, this chapter presents the gamification's evaluation framework for gamified MOOCs4PD divided in five dimensions (learners' profile, psychological and behavioral outcomes, competence level advancement and personal goal achievement) and the implementation of the framework. Finally, research questions and hypotheses are analyzed.
- Chapter 4 introduce the Learn2Analyze Project and presents the proposed evaluation framework as it was implemented to the Learn2Analyzed MOOC 2021, the sampling method, the instruments of data collection along with privacy and ethical issues. Additionally, the Chapter 4 presents the methods that were used to analyze the data, leading to the validation of the proposed evaluation framework.
- Chapter 5 analyzes the pre- and post-course survey answers along with the data provided by IMC's MOOC Platform, presenting the results of the evaluation of Learn2Analyze MOOC based on the core question and the hypotheses development. Closing, it presents a comparison of descriptive statistics between the two editions of Learn2Analyze MOOC.
- Chapter 6 concludes the findings, points the potential limitations, and suggests areas for further research with regards to the proposed evaluation framework.

Chapter 2 – Literature Review

2.1 Introduction

Gamification may have acquired numerous definitions yet, all of them express the ability of services or systems to have elements, mechanics, principles, or design that characterize games but not being one of them. It has been presented as a successful strategy to enhance users' motivation and engagement, being a popular choice among designers from different domains. Researchers present positive findings about the integration of gamification in educational contexts, especially in online learning and MOOCs, where the lack of participants' motivation seems to lead to high dropout rates. In a time that MOOCs are chosen by a huge number of adults as a flexible and free way for their professional development, the instructional designers need to be careful when selecting which elements, mechanics, principles, or design will be implemented to have the best outcomes from gamification.

2.2 Gamification

The origin of the term "Gamification" is found in the digital media industry with first recorded appearance taking place in 2008 (Paharia, 2010) as a tool to enhance participation and motivation of users to carry out tasks or activities that generally could not be too attractive (Aparicio, Vela, Sánchez, & Montes, 2012). However, in 2002, a British game developer named Nick Pelling named his idea of adding "game-like accelerated user interface design" in "electronic transactions" to make them more enjoyable and fast as gamification (Antonaci et al., 2017; Nepal, Paris, & Bista, 2015). For the establishment of the term, many different definitions have been written.

2.2.1 Defining Gamification

According to Deterding et al. (2011), gamification is referred as "the use of game design elements in non-game contexts". With the same approach in "For the Win: How Game Thinking Can Revolutionize Your Business", Werbach and Hunter (2012) present gamification as "the use of game elements and game-design techniques in non-game contexts", while Zichermann and Cunningham (2011) in "Gamification by Design" characterize it as "the process of game-thinking and game mechanics to engage users and

solve problems". Kapp (2012) defines gamification as the use of "game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems". After studying and discussing the literature, Huotari and Hamari (2017) propose gamification's definition as "a process of enhancing a service with affordances for gameful experiences to support users' overall value creation", highlighting the gamification's goal rather than the methods.

To conceptualize gamification, Alsawaier (2017) presents a few more known approaches such as the utilization of game mechanics and dynamics in non-game applications focusing on the social aspect of gamification, like collaboration, (Simões, Redondo, & Vilas, 2013), an experience out of gaming context (Leaning, 2015) or from an educational aspect as a combination of "content area instruction, literacy, and 21st century learning skills in a highly-engaging learning environment" (Kingsley & Grabner-Hagen, 2015).

The most viral and now well-established definition of gamification, on which most researchers have relied, is the one of Deterding et al. (2011). It is based on the contrasts via the two intersecting dimensions of "playing – gaming" and "parts – whole". With regard to the fist dimension "playing – gaming", *play* refers to game mainly as the broader and looser category with a childish sense, containing but differ from it while *game* is structured by rules and competitive goals (Deterding et al., 2011). The second dimension "parts – whole" is referred to *gamification* and *serious games* and based on the size of the part that the game and its elements cover the application, i.e. whether it is an entirely game for non-entertainment purposes or an environment that contains a number of game elements.

Figure 1 shows the schematic conceptual place of this definition.

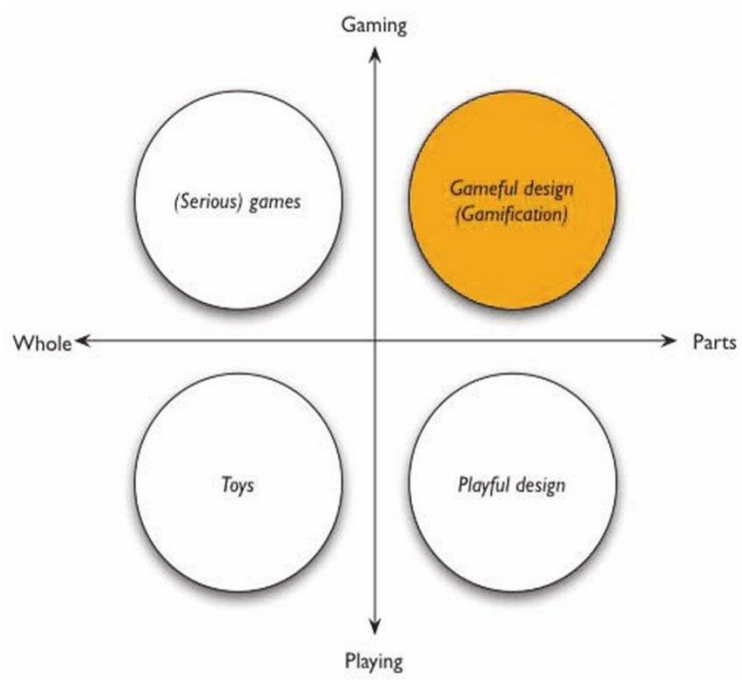

Figure 1: "Gamification" between game and play, whole and parts (Deterding et al, 2011)

The formulation of the Deterding definition of gamification is centered on five terms "use", "game", "element", "design" and "non-game context". While presenting gamification, they point the choice of the five terms: use rather than the extension, design instead of game-based technologies and practices, game in contrast with play or playfulness, elements rather than full games, and non-game contexts to show the non – specific intentions or areas of gamification's integration (Deterding et al., 2011).

2.2.2 Gamification in Education

Over the recent decades, gamification has increasingly piqued the attention of researchers and has been implemented in more and more domains such as science, government services and public engagement, marketing and advertising, health and exercise, environmental behavior and sustainability, education and learning, with the last field dominating the literature and studies (Koivisto & Hamari, 2019; Seaborn & Fels, 2015).

The traditional learning environment often leads to undesirable outcomes such as disengagement, cheating, learning helplessness, and dropping out (Lee & Hammer, 2011). Gamification has been adopted to address relevant attitudes, activities and behaviors,

supports participation, collaboration, self-directed learning, homework assignments completion, facilitates assessment procedures, enhances creativity and learners' retention (Caponetto, Earp, & Ott, 2014). Teachers create gamified learning environments to enhance engagement of learners and improve learning outcomes (Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner, 2014) as they have the necessary tools to motivate and direct learners, turning their simple learning experience into a joyful one (Lee & Hammer, 2011). In traditional instructional methods, learners earn grades based on the performance of a task and the demonstration of achievement, while gamified environments reward their effort even without achieving and completing the goal, leading the integration of gamification to act as a "cure" to those who feel alienated from traditional methods (Alsawaier, 2017). As Folmar (2015) states, gamification "rewards the effort, not the winning".

Gamification stands out as an educational intervention to enhance motivation and engagement of learners (Dicheva et al., 2015) along with their learning outcomes, which, although tested in face-to-face contexts (Hanus & Fox, 2015; Nicholson, 2012), thrives in blending and online learning, due to its close relationship with information and distance learning systems (Romero-Rodriguez et al., 2019).

2.2.3 Gamification in MOOCs

The implementation of gamification elements tends to be a popular choice for instructional designers of Massive Online Open Courses (MOOCs). The basic reason behind this strategy is dealing with high dropout rates, MOOCs' major problem as studies have reported. This assumption has motivated many researchers to investigate gamification contribution to the reduction of dropout rates and the learning outcomes of participants.

To explore the impact of gamified MOOCs, Jarnac de Freitas and Mira da Silva (2020) conducted a literature review with twenty two (22) papers and reported positive findings in terms of learning outcomes, participation and retention. Antonaci et al. (2017) propose the integration of gamified elements or strategies in MOOCs to improve the learning experience and enhance learners' goal achievement as they point lack of addressing personal goals to be a main weakness of MOOCs.

Romero-Rodriguez et al. (2019) confirm the achievement of higher level of participants' engagement and motivation in gamified energy sustainability – related MOOCs with global completion rate being 14.43%, while in non-gamified MOOCs only 6.162% was obtained. Rizzardini, Chan, & Guetl (2016) compared the behavior of participants in a traditional MOOC with its gamified version according to AMOES (Attrition Model for Open Environment Setting) and report reduction of learners' attrition and improved motivation, but almost same dropout rate. Along with the already mentioned researchers, Vaibhav and Gupta (2014), Alraimi et al. (2015), Hew (2016), Kaplan & Haenlein (2016), García-Peñalvo et al. (2018) and Borrás-Gené et al. (2019) support the increase of motivation, course completion rate and better academic or learning level from the integration of gamification elements or strategies in MOOCs (Rincón-Flores et al., 2019).

It is of great importance the gamified MOOCs to be designed and implemented thoughtfully so as participants' motivation be increased (Dicheva et al., 2015; Domínguez et al., 2013). Domínguez et al. (2013) concluded that gamification in e-learning platforms has the potential to increase student motivation, when designed and implemented with thought, with Dicheva et al. (2015) coming to the same conclusion. Even though gamification could be characterized as an effective technique when embodied in MOOCs (Antonaci et al., 2017), the lack of empirical experiments and evidence, due to the relatively recent development of the MOOCs (Antonaci et al., 2017, 2019) raise questions about the actual impact on learners' performance and impose great attention to be given during the design of the gamification elements of a MOOC, which target to solve variety of MOOCs' problems and a massive audience of learners (Antonaci et al., 2017, 2019).

2.2.3 Elements of Gamification

In attempt to find a way for the identification of gamification or game elements, Deterding et al. (2011) define these elements as characteristic of games, elements that appear in most of them but not necessarily at all, elements with directly connection to games or significant role in gameplay.

After the review of fifteen (15) papers, Nah et al. (2014) identified points, levels, badges, leaderboards, rewards, progress bars, storyline and feedback being extensively used in educational and learning contexts with impact mostly on learners' motivation, engagement and sense of achievement. Similar results are found in Dicheva & Dichev

(2015) systematic mapping study about gamification in education with badges, points, leaderboard and levels being most popular game mechanism, while visible status, social engagement, rapid feedback being the most implementing gamification design principles followed by freedom of choice, freedom to fail, storyline and challenges.

To explore and identify engaging gamification mechanics in MOOCs, Chang and Wei (2016) conclude to forty (40) mechanics and grouped them according to interactivity: learner – content interaction, learner – instructor interaction and learner – learner interaction. The ten (10) of most engaging gamification mechanics accounted for more than 50% of engagingness, with top three being virtual goods, (redeemable) points and leaderboard (Chang & Wei, 2016). The same criterions were used to group the satisfying gamification elements for MOOC by Ling, Chen, & Teh (2018). Leaderboard, badges, and opponent are pointed as the most satisfying gamification elements, while learner – learner interaction seem to be a significant to participants' sense of satisfaction in MOOCs. In the research question "What are the game elements most used in Online Learning environments?" of a systematic literature review about the effects of gamification in online learning environments and mostly in MOOCs, Antonaci et al. (2019) tracked badges, leaderboard and points being the most used ones.

2.2.3.i Points

Points are a numerical form of reward that the user usually receives with the completion of an activity or task. Chang and Wei (2016) list six (6) types of points: redeemable points, skill points, experience points, check points, karma points, reputation points, with redeemable and skill points being among the ten (10) gamification elements with the most impact to engagement. Dicheva et al. (2015) and Koivisto & Hamari (2019) present points on of the three (3) most popular choices for gamification implementation. Ling et al. (2018) categorize points in the learner-trainer interaction, as a form of cognitive feedback. Points have mainly personal impact and are associated with the enhancement of user engagement, motivation, participation, and performance.

2.2.3.ii Badges (Trophies – Virtual Reward System – Achievements – Medals)

Badges are awarded to users for completing an activity, challenge, or goal achievement, being one of the three (3) dominant elements of gamification. Ling et al. (2018) report them as a learner-trainer interaction element and as the second most satisfactory of all. Badges are seen as proof and recognition of achievement for users, enhancing their intrinsic motivation and sense of satisfaction since earning badges makes them feel that they have been treated fairly (Keller, 2000). The contribution with the integration of this element in educational environment is mainly emotional and enhances external/social recognition of learners, improving dropout rates (Borras-Gene, Martiñez-nunez, & Fidalgo-Blanco, 2016), while Chang and Wei (2016) rank badges and trophies in fifth place in terms of engagement. They are often integrated in challenges to gradually enhance the level of difficulty (Domínguez et al., 2013). Badges have a positive effect on both cognitive and behavioral – towards gamification and system/service – engagement, as well as on users' motivation, sense of fun, satisfaction, but also enhance the competition between them. In addition, participation and performance seems to be increased with regards to quality and quantity of learning outcomes.

2.2.3.iii Leaderboard

Leaderboard refers to the board that users are ranked depending on the score, mainly points, they have earned and it's based on social comparison giving them the opportunity to understand their performance (Antonaci et al., 2019). Ling et al. (2018) highlighted it as the element that causes most the sense of satisfaction and classify it in the category of interaction between learners. Along with points and badges, they form the triptych PBL (Werbach Kevin & Hunter Dan, 2012), which is considered to be the simplest and most popular implementation of gamification in services or systems. Koivisto and Hamari (2019) refer to this element as goal metrics for users that provide them feedback about their performance, leading to positive effects on performance and perception of gamification use. Leaderboards intensify the sense of competition, satisfaction, behavioral and cognitive engagements, while reducing user attrition.

2.2.3.iv Levels

Levels are strictly related to goals, they present different degrees of difficulty and, in order to level up, users must complete all the goals corresponding to the current level (Antonaci et al., 2019). Most of times, reaching goals and completing various activities offer points that users collect to move up, categorizing this element in learner-content interaction group of elements (Ling et al., 2018). In a study conducted by of Hew, Huang, Chu, & Chiu (2016), except from points badges and leaderboard that have already being integrated, learners indicated levels as the most wanted element to be added. Levels as gamification element has positive effect on trainees' performance, enhances motivation, engagement but also the sense of satisfaction by every level conquest.

2.2.3.v Progress Bar (Monitoring Progress)

Progress bars allow each user to monitor their own improvement (Antonaci et al., 2019). In their literature review, Koivisto and Hamari (2019) report that, although progress bars are not among the most popular elements, indicators related to progress is clearly the most common choice. Both designers and users seem to prefer other progress elements which offer more information and motivation. However, progress bar enhances the sense of fun, perception of gamification uses, and it can increase user retention, engagement and performance.

2.2.3.vi Feedback

Feedback is defined as the information that users receive about their performance, achievements, activities (Antonaci et al., 2019) and it should be provided directly or at short intervals (Dicheva et al., 2015). Domínguez et al. (2013) note that the lack of automatic feedback worked negatively for some users, as they lost interest and did not complete their activities. As Koivisto and Hamari (2019) resulted, it acts as an essential mediator between gamification interaction and psychological outcomes. Immediate feedback works encouragingly for users' motivation and engagement, increasing their retention and completion rate.

2.2.3.vii Auto-grading

Auto-grading refers to the automatic correction of activities, quizzes, tasks etc., therefore it leads to automatic and immediate feedback along with the corresponding effects that was previously analyzed.

2.2.3.viii Challenges (Tasks – Missions)

Challenges refer to activities, quizzes, problems that users are required to complete, either individually or in groups (Antonaci et al., 2019) and are clearly presented, specifically in order by the increasing level of complexity. Completing a challenge is usually followed by earning badges, points, or another virtual reward. The existence of challenges has a positive effect on user engagement, motivation, fun, performance, and participation. It appears that challenges help the retention of users to be extended while course attrition to be reduced. Additionally, the sense of competition and satisfaction are activated by the completion of challenges. However, it is important to pay attention at the level of difficulty for every challenge, as either too low or too high would negatively affect user motivation.

2.2.3.ix Social Features (Reactions – Comments – Shares)

Social features are characteristics of social networks, such as reactions (Like, Love, Sad, etc.), comments or shares, and presented as game design elements (Antonaci et al., 2019; Aparicio, Oliveira, Bacao, & Painho, 2019; Borras-Gene et al., 2016; Borrás-Gené et al., 2019; Rizzardini et al., 2016). Using social features activates the sense of fun and enhances user engagement and motivation while reacting to shares seems to increase satisfaction. Users develop the power of habit and so they continue to use social community after the end of the course (Borrás-Gené et al., 2019) improving the perception of gamification use.

2.2.3.x Communication Channels (Forums – Chats – Virtual Learning Communities VLCs – Social Networks)

Communication channels consider to be elements, platforms or methods with which users can communicate and send messages to each other. Forums allow the exchange asynchronous messages while chat messages can be exchanged simultaneously. VLCs refer to spaces or groups of users who have interests with a common theme and they allow interaction, synchronous and asynchronous communication or dialogue (Borrás-Gené et al., 2019; Goldie, 2016; Núñez, Gené, & Blanco, 2014) and allow the development of collaboration among users. Social networks are spaces that criteria. As reported by Borrás-Gené et al (2019), their implementation in education is widespread, as MOOCs limit these features, especially xMOOCs. Rizzardini et al. (Rizzardini et al., 2016) note several cases where users found it difficult to manage forums, due to the volume of messages, and showed their preference for social networks as a communication tool. Communication channels as forums affect positively engagement, motivation, participation, and retention of trainees. However, VLCs appear to develop more the sense of fun and the habit of use after the end of the course. As social networks integrate social features, they present similar effects.

2.2.3.xi Storytelling (Narratives)

Storytelling or narratives refer to the use of stories to convey information or clues to users, most of times with a starring character (Antonaci et al., 2019). It is usually about a challenge or activity that users must face and complete. Armstrong and Landers (2017) report positive effect of narrative on users. Despite the rare use of this element (Koivisto & Hamari, 2019), it enhances the sense of immersion.

2.2.3.xii Cooperation (Teams – Guild)

Cooperation includes any kind of collaboration that takes place, either within a group or as allies, with a common goal to be fulfilled. As Koivisto and Hamari (2019) point out, as social beings, humans always seek senses of relatedness (Deci, Connell, & Ryan, 1989; Deci & Ryan, 2000; Ryan & Deci, 2000) and collectivity, so the need of collaboration and cooperation is natural. The existence of cooperative activities as a game design element

is common, wanting alongside to emphasize on communication and socialization of users. In the same report, Koivisto and Hamari (Koivisto & Hamari, 2019) concluded that, while gamification social elements are quite often integrated, studies have not examined sufficiently social interactions as behavioral result and suggest the further research of cooperative gamification along with its possible negative effects. Implementing collaboration can enhance intrinsic motivation, increase retention, and reduce dropout rates.

2.2.3.xiii Competition (Opponent)

Competition refers to any method that creates the sense of competition within the course, either individually or in groups. The research conducted by Ling et al. (2018) rated the opponent as the third gamification element that enhancing most users' sense of satisfaction. Although its existence as a gamification element is rare, the phenomenon of competition appears through several other elements, such as leaderboard, badges, virtual rewards when their status is public. Competitive gamification elements seems to have positive effect on motivation (Domínguez et al., 2013), but their integration requires attention.

2.2.3.xiv Time Limit (Time restriction – Time constraints)

Time limit refers to the time that is available to users for completing activities. Ling et al. (Ling et al., 2018) classify it as learner-content interaction gamification element. Time limit enhances the sense of challenge and is a positive factor in user performance (M. Aparicio et al., 2019; Tsay, Kofinas, & Luo, 2018).

2.2.3.xv Virtual Currency (Virtual Goods)

Virtual currency refers to virtual money that users earn as a reward for completing an achievement, while virtual goods refer to virtual objects in which user can invest or spend their virtual money (Dicheva et al., 2015). In educational and e-learning, virtual goods are clues in a challenge, hints in quizzes, assignment extensions without penalty or extra

changes (Goehle, 2013; O'Donovan, Gain, & Marais, 2013). According to Chang and Wei (2016), virtual goods emerged as the first gamification element choice to enhance engagement, as users seek to achieve more goals to earn more virtual goods. Their integration affects positively engagement and motivation of learners.

2.2.3.xvi Avatar

Avatar consider as the digital image or version of user and it is classified in learner-content interaction gamification element (Ling et al., 2018). It mainly enhances user's immersion in the digital world of platform.

2.2.3.xvii Personalization (Personalizing Features)

Personalization is the ability of users to change appearance, features, role on their avatar according to their own preferences (Antonaci et al., 2019). Studies on personalization are rare, as it does not seem to be much preferred as other gamification elements.

2.2.3.xviii Freedom of Fail (Replayability)

Freedom of fail gives users the opportunity to try more than one-time activities or quizzes in course without any penalty. Learners do not take any risk by performing an activity as a result a potential wrong answer to act as feedback to them. According to Dicheva et al. (2015), it is one of the most commonly used gamification element. Integrating freedom of fail appears to work positively (Stott & Neustaedter, 2013) and more specifically regarding to user engagement and retention (Romero-Rodriguez et al., 2019).

2.2.3.xix Freedom of Choice (Customization)

Freedom of choice allows users to choose which activities to complete, which goals to follow, to have their personal pace of attending or delivering tasks, whether they want to answer a quiz or questionnaire etc. and belongs to the most preferable gamification

design principles (Dicheva et al., 2015). Although not many studies have examined freedom of choice effects, it appears to be positive (Stott & Neustaedter, 2013). Hew et al. (2016) reported that combining gamification and freedom of fail led to learners' motivation about choosing activities with higher degree of difficulty.

2.2.3.xx Goals (Goal Indicators)

Goals represent the objectives of each course and should be clear and specific. Indicators can usual be other elements, such as levels, badges, missions or leaderboards (Antonaci et al., 2019) making the goals clearly defined. Therefore, their effects are determined by the respective gamification element that have been used.

2.2.3.xxi Visible Status

Visible status refers to the public status of user's profile and his/her achievements, awards, badges that he/she has collected. It offers reputation, recognition but also social credibility (Dicheva et al., 2015).

2.2.3.xxii Memory-game Interactions

According to Chang and Wei (2016), memory-game interactions are defined as "game interactions in which a set of cards are laid face down on a surface and two objects are flipped face up after each turn", while the goal of the game is to turn over the matching pairs. Even though memory-game interactions are rated in top elements with the greatest impact on users' engagement, they are rarely studied in surveys.

2.2.3.xxiii Where's Wally Game

Where's Wally is game with great influence on learner engagement in MOOCs, where students' task is to find on website a hidden learning object (Chang & Wei, 2016).

Chapter 3 – Proposed Evaluation Framework for Gamified MOOCs4PD

3.1 Introduction

In the educational literature, especially when it comes to e-learning, many studies deal with gamification and its outcomes. Even though researchers have examined and proposed different frameworks for the correct implementation in courses, gamification lacks of evaluation frameworks. Psychological and behavioral outcomes along with their potential factors should be examined, not only for the gamification in total, but also in combination with each element separately. When it comes to MOOCs, the effectiveness of gamification integration should be added in the evaluation of their overall success. Since MOOCs mainly address to adults for their professional development, the need for evaluation of gamification combined with learning outcomes is even more important.

3.2 Evaluation of Gamification

3.2.1 Evaluating gamification outcomes

During the last decade, gamification has gained significant attention and been presented as a successful strategy to engage users, with potential for online education (Antonaci et al., 2019). The gamification literature review shows that education and learning are the most common contexts for empirical research (Koivisto & Hamari, 2014, 2019; Majuri, Koivisto, & Hamari, 2018). To examine the effects and benefits that the implementation of the gamification offers, Hamari, Koivisto and Sarsa (2014) created a framework to conceptualize gamification, which consists of three main parts: the implemented motivational affordances, the resulting psychological outcomes, and the further behavioral outcomes (**Figure 2**).

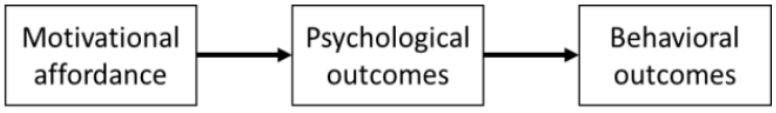

Figure 2: Conceptualization of the gamification (Hamari et al., 2014)

The affordances refer to the various elements and mechanics that structure games, aid in inducing gameful experiences within a system or service leading to the psychological outcomes, which refer to game psychological experiences as competence, autonomy, relatedness or enjoyment, while they lead further to behavioral outcomes, i.e. behaviors and activities that are supported through use of gamification system such as better learning results in the context of education (Koivisto & Hamari, 2019). Affordances are considered as independent variables/items, psychological outcomes both dependent and independent variables/items and behavioral outcomes only as dependent variables/items.

To research gamification in depth, Koivisto and Hamari (2019) conducted a comprehensive review of 819 studies and presented a list of outcomes studied in the 273 empirical studies that had been found. Psychological outcomes were studied in 138 studies with most common of which being perception of use (use experience, perceptions of system and features), enjoyment, motivation, perceived usefulness and ease of use, followed by challenge, interest, perceived competence and satisfaction (Koivisto & Hamari, 2019). Behavioral outcomes seem to be more frequently studied (studied in 166 of the 273 empirical studies), but lack of variety with participation (in the system/system use) and performance (in aspects of time, amount of contributions, grades/academic performance, amount of points/badges and learning/skill progression) being most common (Koivisto & Hamari, 2019). While the general gamification literature review of Koivisto and Hamari (2019) had not been still published, Majuri, Koivisto and Hamari (2018) reviewed gamification on education literature with similar findings and emphasis on grades and speed of conducting tasks and assignment, which is referred as logical as such outcomes are often the quantifiable goals of education. Additionally, Antonaci et al. (2019) identify six areas of gamification empirical effects in online learning environments: performance, motivation, engagement, attitude towards gamification, collaboration, and social awareness.

Research studied present positive or mostly positive effects from the implementation of the gamification. However, a gap still remains to the effects control of the individual affordances used in a given gamification implementation (Dichev & Dicheva, 2017; Hamari, Koivisto, & Sarsa, 2014; Koivisto & Hamari, 2019; Majuri et al., 2018). Without understanding the effect of each element separately, it is difficult to identify their contribution in studies with a group of gamified elements (Dichev & Dicheva, 2017).

Regarding the data type and the gathering methods, the review of the literature shows almost equally survey and use/log data to be most common. As for data gathering methods, the most commonly used seems to be survey/questionnaire, either qualitive or quantitative, along with the gamified system implementation/prototype (Hamari et al., 2014; Koivisto & Hamari, 2019). A popular structure for data gathering seems to be the combination of the two categories (Koivisto & Hamari, 2019).

For the evaluation of gamification value to course content, Youssef (2015) recognize six (6) critical issues to be considered: course goals, culture of learning community, type of content, level of learning trying to be achieved based on Bloom's Taxonomy, technical/structural environment and capacity of the Institution, budget. Tondello, Kappen, Mekler, Ganaba, & Nacke (2016) reviewed several gameful design frameworks and presented a set of guidelines for heuristic evaluation of gameful design with three (3) categories and twelve (12) dimension (**Table 1**).

Table 1: Heuristic Evaluation for Gameful Design (Tondello et al., 2016).

Intrinsic Motivation Heuristics	**Extrinsic Motivation Heuristics**	**Context Dependent Heuristics**
Purpose and Meaning	Ownership and Rewards	Feedback
Challenge and Competence	Scarcity	Unpredictability
Completeness and Mastery	Loss Avoidance	Change and Disruption
Autonomy and Creativity		
Relatedness		

To provide a more concise view of gamification factors, Baptista and Oliveira (2019) conducted a meta-analysis of 54 studies and 59 datasets about gamification and serious games and developed a theoretical model for the most significant relationships between the recorded effects (**Figure 3**).

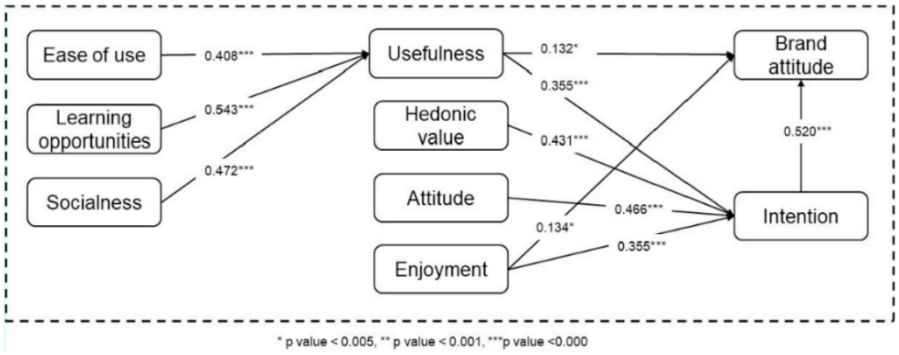

Figure 3: Theoritical model based on the results of the weight and meta-analysis (Baptista & Oliveira, 2019)

Dimension	Indicators
Typology of actors *(TA)*	- *CSB:* Characteristics of the student body (target). - *SR*: Student roles. - *TR*: Teacher roles. - *OA:* Other actors in the process.
Motivation for learning *(ML)*	- *ACM:* Access to concepts and materials. - *LS:* Learning schedule. - *CTE:* Completing tasks and exercises. - *GID:* Gradual increase in the degree of difficulty of the lessons. - *TA:* Measuring time to complete the activity. - *IS:* Interaction systems. - *LBE:* Learning based on pragmatic experiences and exemplifications.
Creating and maintaining expectations *(CE)*	- *SDC:* Type of stimulation of didactic components. - *GE:* Gameplay elements: levels, challenges, goals, etc. - *PBL:* Reward systems: points, badges, and leaderboards. - *FI:* Feedback on interactions. - *NS:* Narrative and storytelling. - *PC:* Promoting competition and cooperation.
User Control *(UC)*	- *AMA:* Ability of the main actor (user) to determine the course of the story. - *P:* Personalization.

Figure 4: Taxonomy of E-MIGA (Romero-Rodriguez et al., 2019)

Romero-Rodriguez et al. (2019) evaluated gamification strategies used in MOOCs that had been analyzed by applying the Integrated Theoretical Gamification Model in E-Learning Environments (E-MIGA) (Torres-Toukoumidis, Romero-Rodríguez, Pérez-Rodríguez, & Björk, 2018) which taxonomy consists of four (4) dimensions and nineteen (19) indicators (**Figure 4**).

To give a clearer and more measurable frame to gamefulness, Högberg, Hamari, & Wästlund (2019) developed and validated the GAMEFULQUEST (Gameful Experience Questionnaire), which measures the gameful experience users have while using a gamified system or service. Based on questionnaires that have been used in literature to measure the game experience or its dimension, Högberg et al. (2019) derived seven (7) main dimensions: accomplishment, challenge, competition, guided, immersion, playfulness, and social experience.

Karra, Karampa, & Paraskeva (2019) propose a gamification design framework for adult trainees motivation based on the combination of gamified elements and strategies with the three components of Self-Determination Theory SDT (autonomy, competence, relatedness), as literature reports a direct link between gamification and SDT leading to intrinsic motivation.

3.2.2 Gamification outcomes' factors

Reviewing past literature on the evaluation of the gamification, few studies are observed to analyze users' profile and how their individual differences can be factors that influence psychological, behavioral, and learning outcomes.

In the early researches in online learning, Lim and Kim (2003)examined sociodemographic and motivational factors to reveal that gender, profession and motives affect their learning outcomes. More recently, Koivisto and Hamari (2014) studied the demographic differences in perceived benefits from gamification and examined the effects of users' gender, age and time using the gamified system on their behavior and attitude towards it. The findings show that "women report greater social benefits from the use of gamification and ease of use of gamification is shown to decline with age". Gender being a factor to the participants' outcomes with regards to gamification is also confirmed by Tsay et al. (2018). The empirical study of the evaluation of the use of gamification to the course and the gamified supported material indicated that female participation was

significantly higher than male. Job seems also to affect the outcomes as it was reported that students with jobs engaged significantly more than unemployed ones.

Previous experience with gamification and gamified systems appears to be a factor to the participants' outcomes. Some authors discuss the novelty effects that might occur with gamification (Farzan, DiMicco, Millen, Brownholtz, Geyer, & Dugan, 2008; Hamari, 2013, 2017; Hamari et al., 2014; Koivisto & Hamari, 2014). In some cases, studies have shown a diminution of perceived enjoyment, usefulness, and playfulness of users as they spent more time using gamified services. In the begging, users seem to feel more excited using the gamification elements, but it fades as their curiosity is being satisfied. Koivisto and Hamari (2014) note that "the interaction effects between age and time using the service show that the novelty effects are stronger the younger the user is", leading to the general belief that younger people are more open to gamified courses but get bored quickly, while the older ones might experience the opposite situation.

While most of the literature review shows that the integration of the gamification elements on the information systems, especially on education and online learning, has mainly positive effects and benefits, a few studies have shown that some of the gamification elements, such as leaderboard and other competition mechanics, affect negatively learners' psychological outcomes and do not improve their educational performance (Hanus & Fox, 2015). This kind of findings confirms the common thought that every user experiences the same motivational affordance with different effect.

In the discussion for the psychological aspects that might affect the outcomes of the gamification, Hamari (2017) suggests the study of the personality and player types as moderators. One of the most common model for the identification of user's personality type is the Big 5 model (McCrae & John, 1992). The five (5) dimensions of personality traits operate more like spectrums rather than binary categories: extraversion (how much outgoing or solitary a person is), agreeableness (how much compassionate or detached a person is), conscientiousness (how much organized or not a person is), neuroticism (how much confident or nervous a person feels), and openness to experience (how much open or closed to experiences a person is).

Based on the difficulty to design framework for appropriate outcome's behavior, Butler (2014) presents a framework to evaluate the effectiveness of the gamification affordances by users' personality type, categorizing them with the Myers-Briggs Type Indicator (MBTI) (Myers & McCaulley, 1985; Myers, 1962) (**Figure 5**).

(E)	Extroversion	**Energy**	Introversion	(I)
(S)	Sensing	**Perception**	Intuitive	(N)
(T)	Thinking	**Judgment**	Feeling	(F)
(J)	Judging	**Orientation**	Perceiving	(P)

Figure 5: The four dimension of MBTI and their poles (Butler, 2014)

Tondello, Wehbe, Diamond, Busch, Marczewski, & Nacke (2016) created and validated the Gamification User Types Hexad Scale, a 24-items survey response scale based on Marczewski's (2015) Gamification User Types Hexad framework, to fill the gap of assessment protocol for users' preferences and map their personality onto design elements of gamified systems. Hexad framework was developed based on human motivation, player types, and practical design experience (Tondello et al., 2016) and consists of six (6) types (Marczewski, 2015):

- Philanthropists (motivated by purpose)
- Socializers (motivated by relatedness)
- Free Spirits (motivated by autonomy)
- Achievers (motivated by competence)
- Players (motivated by extrinsic rewards)
- Disruptors (motivated by the triggering of change)

Hexad scale combines personality characteristics with player types creating an interesting factor for psychological and behavioral outcomes that occur from the motivational affordances.

On the other hand, to understand the factors for a successful MOOC, Aparacio et al. (2019) propose a theoretical framework based on gamification and information system (IS) theory. Although gamification was reported to play a crucial role to the success of MOOC (M. Aparicio et al., 2019), it is suggested to also take into account the contextual characteristics as they are likely to affect the results (Dichev & Dicheva, 2017; Hamari et al., 2014; Koivisto & Hamari, 2019; Majuri et al., 2018).

3.2.3 Evaluating gamified MOOCs' overall success

Even though the popularity of MOOCs has been increased during the last decade, high dropout rates continue to be the most common negative characteristic. Although the integration of gamification elements and strategies on MOOCs manages to reduce the participants dropout, the completion rates remain low. Among the reasons for students' dropout (e.g., lack of time, skills or support, course difficulty or poor quality, technical issues) is that they might never intended to complete the course. In the Attrition Model for Open Learning Environment Setting (AMOES) (Rizzardini et al., 2016), one of the three learners' groups that are defined is the healthy attrition group, in which none of the learners intends to complete the course, and includes exploring users (only previewing the course to gain a quick understanding of the topic), content learners (choosing only what they wish to learn from the course) and restricted learners (checking out the entire course but not intending to complete assignments or earning badges and certificates) (Rizzardini et al., 2016). With MOOCs not necessarily need to be completed to considered successful, Antonaci et al. (2017) introduce the Personal Goal Achievement Ratio (PGAR) and the Overall Goal Achievement Ratio (OGAR). PGAR is calculated as the personal completion ratio (PCR) divided by the self-reported user intention ratio (UIR) (Antonaci et al., 2017):

$$Personal\ Goal\ Achievement\ Ratio\ (PGAR) = \frac{PCR}{UIR}$$

As a result, the OGAR is calculated through the following formula (Antonaci et al., 2017):

$$Overall\ Goal\ Achievement\ Ratio\ (OGAR) = \frac{1}{n} * \sum PGAR$$

Undoubtedly, learning outcomes achieved by users represent a significant indicator for MOOC's success. In the evaluation framework for MOOCs4PD, Sofia Mougiakou (2020) suggests perceived advancement of competence level to measure the learning outcomes. The competence level advancement results by the difference between the achieved and initial competence level, which are self-reported respectively in a post- and pre-course survey (Mougiakou, 2020):

$$Competence\ Level\ Advancement$$
$$= Initial\ Competence\ Level - Achieved\ Competence\ Level$$

3.3 Addressing questions

The current evaluation framework aims to explore the psychological and behavioral outcomes from the integration of gamification elements on the educational design of MOOCs for Professional Development as well as the factors which affect MOOC's success in aspect of participants' perceived competence advancement and their personal goal achievement. Pre- and post-course survey answers combined with the exporting data from the system are expected to bring to light the strengths and weaknesses of the MOOC leading to the improvement of the quality of the learning experience and the competences advancement of the participations.

3.4 Dimensions of the evaluation framework

The proposed evaluation framework for gamified competence-based Professional Development MOOCs is based on the collection of data, which takes place on two separate phases using different methodologies. Following the commencement of the MOOC, a pre-course survey aims to shape the profiles of the participants based on four aspects: their characteristics, any past relationship with gamification, their initial competence level and the user intention rate. At the end of the MOOC, a post-course survey examines participants' psychological outcomes by reporting their overall gamification experience and gamification experience per element, as well as participants' behavioral outcomes concerning perceived use, intention of use, general platform experience and their achieved competence level. In addition to participants' behavioral outcomes, the system provides data about learners' engagement and personal completion rate.

The correlation among learners' profile, learners' psychological outcomes and learners' behavioral outcomes will highlight factors that help gamified MOOCs4PD succeed regarding the aspects of competence advancement and personal goal achievement.

3.4.1 Learners' profile (pre-course survey)

The pre-course survey helps to distinguish the groups of learners' profiles by questioning about their general characteristics and background, as well as their previous relationship

with the gamification in order to investigate whether or not any of these can be a factor for the success of gamified MOOCs4PD.

General Characteristics

- Social and demographic: characteristics: gender, age, location
- Educational background: educational level, English language competency, technological skills
- Professional profile: current job sector, professional role

Gamification Profile

- Previous gamification experience: previous gamified learning or MOOC experience as a learner, previous use of gamification as educators, instructional designers, etc.
- Attitude towards gamification: rated in a 5-point Likert scale plus an extra "not applicable" option.
- Gamification user types: twenty-four (24) 5-point Likert scale Gamification User Types Hexad Scale questionnaire (G. F. Tondello et al., 2016)

Intention towards MOOC

- Motives for MOOC enrollment: reasons for enrollment
- Intention of devoting time: hours planning to spend per week
- User intention ratio: percentage of the course user intends to complete

Initial competence level

As it is suggested by Sofia Mougiakou (2020) at the evaluation framework for MOOCs4PD, based on the Dreyfus model of skill acquisition (Dreyfus, 2004), initial level per competence is self-reported using a 5-point scale with the corresponding options: Novice, Advanced Beginner, Competent, Proficient and Expert.

3.4.2 Psychological Outcomes (post-course survey)

For the majority of the post-course survey, participants are asked to answer questions about how their psychological outcomes are affected by the integration of the gamification elements in the MOOCs4PD. The two main dimensions are the overall gamification experience and the gamification experience per element that they perceived during the course.

Overall Gamification Experience

Table 2 shows overall gamification experience's items.

Table 2: Overall gamification experience's items in Evaluation Framework

Psychological outcomes	**Post-course survey questions**	**Based on**
Satisfaction	Two (2) questions about participants' satisfaction of the gamified course.	Validation of the Instructional Materials Motivation Survey (IMMS) in a self-directed instructional setting aimed at working with technology (Loorbach, Peters, Karreman, & Steehouder, 2015)
Enjoyment	Two (2) questions about how much participants enjoyed the course.	Why do people use gamification services? (Hamari & Koivisto, 2015) *(Adapted from: User Acceptance of Hedonic Information Systems (Van Der Heijden, 2004))*
Motivation	Three (3) questions about how motivated participants felt during the course.	New Challenges for the Motivation and Learning in Engineering Education Using Gamification in MOOC (Borras-Gene et al., 2016)

Competence	Three (3) questions about how competent participants felt during the course, as well as at the completion of it, based on Player Experience of Need Satisfaction (PENS).	Validation of two game experience scales: The Player Experience of Need Satisfaction (PENS) and Game Experience Questionnaire (GEQ) (Johnson, Gardner, & Perry, 2018) The Motivational Pull of Video Games: A Self-Determination Theory Approach (Ryan, Rigby, & Przybylski, 2006)
Autonomy	Three (3) questions about the freedom of choice participants felt during the course, based on PENS.	Validation of two game experience scales: The Player Experience of Need Satisfaction (PENS) and Game Experience Questionnaire (GEQ) (Johnson et al., 2018) The Motivational Pull of Video Games: A Self-Determination Theory Approach (Ryan et al., 2006)
Accomplishment	Two (2) questions about the feeling of accomplishment participants had by using the gamification elements, based on Gameful Experience Questionnaire (GAMEFULQUEST).	Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use (Högberg et al., 2019)
Challenge	Three (3) questions about the feeling of challenge participants had by using the gamification elements, based on GAMEFULQUEST.	Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use (Högberg et al., 2019)
Competition	Three (3) questions about the feeling of competition among participants by using the gamification elements, based on GAMEFULQUEST.	Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use (Högberg et al., 2019)

Guided	Three (3) questions about how much guided the gamification elements helped participants feel, based on GAMEFULQUEST.	Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use (Högberg et al., 2019)
Social Experience	Three (3) questions about how socialized the participants felt by using the gamification elements in the course, based on GAMEFULQUEST.	Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use (Högberg et al., 2019)
Usefulness	Four (4) questions about the sense of usefulness the gamification elements in the course gave to participants.	Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology (Davis, 1989)
Attitude towards Gamification	One (1) question about the attitude towards gamification the participants have after completing the course.	Teachers' Attitude towards and Actual Use of Gamification (Martí-Parreño, Seguí-Mas, & Seguí-Mas, 2016) *(Adapted from: User Acceptance of Computer Technology: A Comparison of Two Theoretical Models (Davis, Bagozzi, & Warshaw, 1989))*

Gamification Experience per Element

To measure the psychological outcomes of participants' experience for each gamification element and calculate the dimension of gamification experience per element, five (5) sets of items are selected:

- Enjoyment: one (1) question
- Motivation: two (2) questions
- Competence: three (3) questions
- Guided: one (1) question
- Usefulness: three (3) questions

The questions of the sets correspond to those from overall gamification experience.

3.4.3 Behavioral Outcomes (post-course survey / system's data)

The answers of the post-course survey and the data retrieved from MOOC's platform are used to measure the behavioral outcomes. In post-course survey, participants are asked to self-report the perceived use and continued use intention of the gamified course, their experience with the platform regarding the information, the system and the service quality, as well as their achieved competence level. The data retrieved from MOOC's platform presents the actual participants' engagement in the course and the personal completion rate.

Post-Course Survey

Perceived Use

Questions about participants' perceived use such as number of comments, completed activities, performance, participation, depending on the content of the course and the gamification elements that have been incorporated.

Continued Use Intention

Participants are asked to answer questions about their intention to visit and use again in the future the course or even recommend it.

Platform Experience

Table 3 presents the sets of questions to investigate whether a contextual factor affects the success of the gamified course.

Table 3: Contextual factors' items

Contextual Factor	Post-course survey questions
Information Quality	Four (4) questions about the quality of educational content and information that has been provided to the participants.
System Quality	Four (4) questions about quality of structure and ease of use of the course.
Service Quality	Four (4) questions about quality of service the course provides.
Based on: Gamification: A key determinant of massive open online course (MOOC) success (M. Aparicio et al., 2019) *(Theoretical support: An empirical investigation of employee portal success (Urbach, Smolnik, & Riempp, 2010))*	

Achieved Competence Level

Given the fact that participants' initial competence level is self-assessed, the achieved level per competence is also self-reported. A different assessment could possibly cause a disproportion among the participants' competence level advancement.

System's Data

Engagement

- Participation: user's participation and actual use in aspects of time (how much they spent), quality (chosen level of difficulty in activities), quantity (number of activities, comments, views, etc.)
- Performance: user's performance in aspects of grades, completion rate, number of points/badges/levels etc. (if any of these is being used)

Personal Completion Rate

The percentage of the course that has been completed by the user.

3.4.4 Competence Level Advancement

The competence level advancement is measured by the difference between achieved and initial competence level that have been self-reported by participants. Sofia Mougiakou (2020) presents the generation of a personal Unique ID Code to match participants' answers of pre- and post-course survey by answering a set of five questions:

The first letter of participant's first name (e.g., B)
The last 2 digits of participant's cell phone (if none use 00) (e.g., 45)
Participant's month of birth (e.g., 09)
The first letter of participant's middle name (if none, use X) (e.g., X)
The first letter of city/town participant was born in (e.g., A)

Unique ID Code: B4509XA

The Unique ID Code makes it easier for users to generate correctly and, at the same time, decoding it very difficult.

3.4.5 Personal Goal Achievement

Personal goal achievement poses as an indicator for MOOCs success, as not every participant has intention to actively participate in the course, complete it or earn a certificate. To calculate personal goal achievement, user intention rate from the pre-course survey and personal completion rate from system's data are needed. Since the MOOC's platform stores users' e-mail and username during the enrollment, the matching can be performed without any extra code.

Personal goal achievement ratio gives the opportunity to invest the factors that affect the completion of the course by participants who did not intent to complete the course. In addition, the overall goal achievement ratio of MOOC can be calculated to compare it with others as an indicator of MOOC's success.

Figure 6 shows the schematic representation of evaluation framework's components.

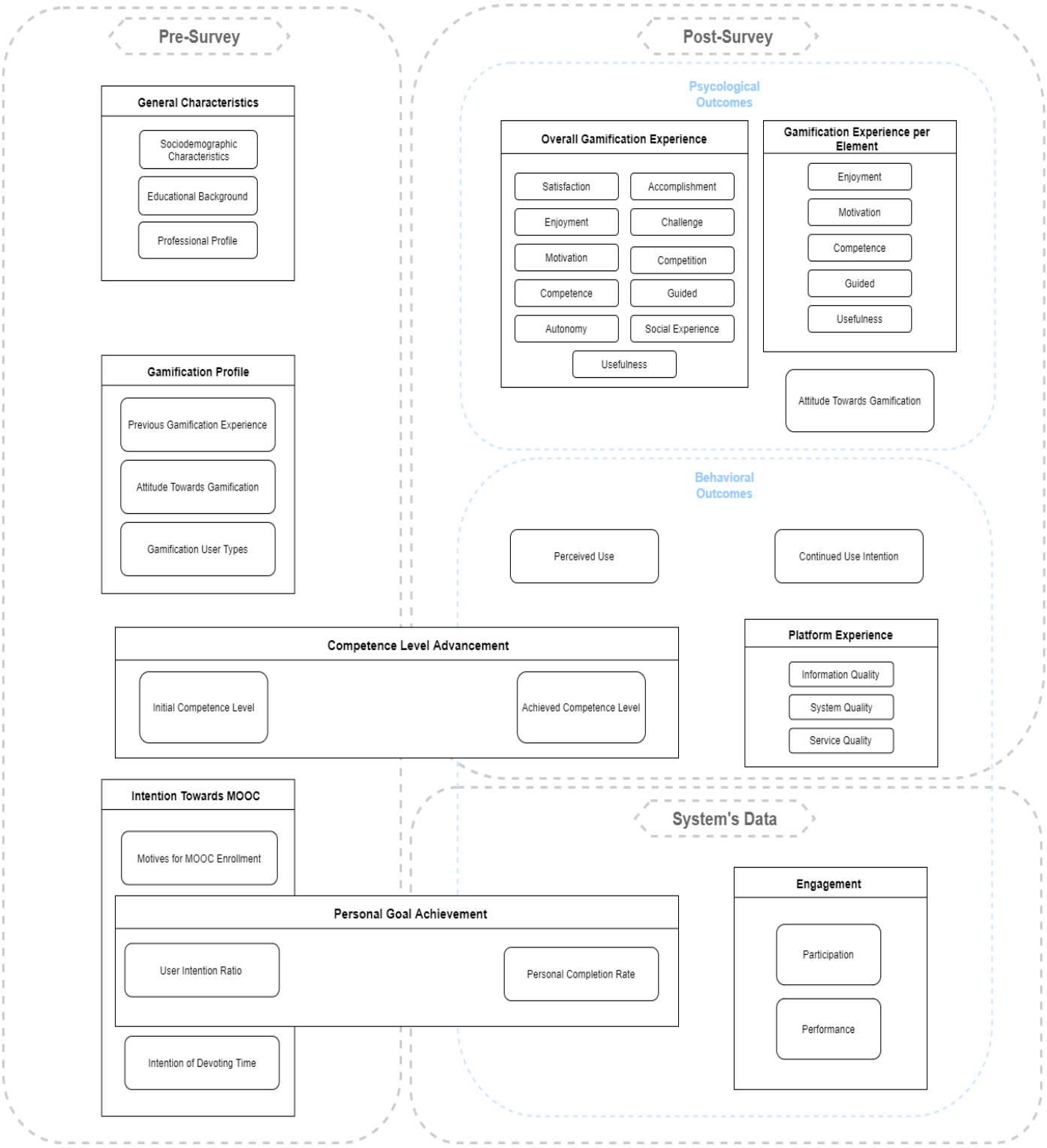

Figure 6: Schematic representation of components of the evaluation framework

3.5 Implementation

The proposed evaluation framework is based on two phases. In the first phase, pre-course survey takes place at the beginning of MOOC and users answer questions about their profile. The completion of pre-course survey is obligatory for users to participate in the course. The second phase consist of the post-course survey and the data collection of the system or platform where MOOC was developed. Only users who have finished the course can participate in post-course survey at the end of MOOC, answering questions about psychological, behavioral, and learning outcomes and their experience. Regardless the completion of the course, data about the behavioral outcomes of all users are retrieved at the end of the MOOC.

Both pre- and post-course survey follow the same structure and they are conducted online via Google Forms. Users are informed about the purpose of the survey and they are guided how to answer and successfully complete it. Next, users are informed in details with respect to privacy and ethical issues about participating in this survey, along with their right of consent. Finally, the questionnaire is provided to users to collect their responses, with all the questions being set as required.

The structure of pre- and post-course survey's instruments as they were implementing in the case study of Learn2Analyze MOOC 2021 is analyzed in the next chapter (**4.4.1 Instruments**) and presented in **Appendix 1 – L2A MOOC 2021 Evaluation Instruments**.

3.6 Research Questions

The core research question of the present evaluation framework to be investigated is:

Does the integration of gamification elements on the content and educational design of MOOCs for Professional Development improve psychological and behavioral outcomes leading to participants' competence advancement and goal achievement?

The main dimensions of the core question are:

1. What is the profile of MOOC's participants? Do personal goal achievement, course completion and competence advancement differ between player types?
2. What is the difference in psychological and behavioral outcomes per gamification profile?

3. What is the overall gamification experience of participants in the MOOC and how is it related to personal goal achievement and competence advancement?
4. What is the gamification experience per element and how does it affect the overall gamification experience?
5. How are behavioral outcomes related to psychological outcomes?
6. Does platform experience affect competence advancement?
7. What is the overall goal achievement rate for the gamified MOOC?

3.7 Hypotheses Development

The main dimensions are analyzed to the following hypothesis:

1a. What is the profile of the learners in the MOOC based on the general characteristics and the gamification profile?

Descriptive statistics.

Variables: General Characteristics [Sociodemographic Characteristics, Educational Background, Professional Role], Gamification Profile [Previous Gamification Experience, Attitude towards Gamification, Gamification User Types], Intention towards MOOC [Motives for MOOC Enrollment, UIR, Intention of Devoting Time], Initial Competence Level

1b. What is the difference in personal goal achievement and competence level advancement between player types?

$H1.1_0$: Personal goal achievement does not differ significantly between player types.
$H1.1_1$: Personal goal achievement differs significantly between player types.

$H1.2_0$: Competence level advancement does not differ significantly between player types.
$H1.2_1$: Competence level advancement differs significantly between player types.

Variables: PGA [PCR/UIR], Competence Level Advancement [Achieved Competence Level – Initial Competence Level]
Groups: Player Types

1c. Does course completion and player types relate to each other?

$H1.3_0$: Course completion and player types are not related.
$H1.3_1$: Course completion and player types are related.

Variables: Player Types - Course Completion

2a. Do psychological and behavioral outcomes differ between previous gamification experience?

$H2.1_0$: Overall gamification experience does not differ between previous gamification experience.
$H2.1_1$: Overall gamification experience differs between previous gamification experience.

$H2.2_0$: Gamification experience per element does not differ between previous gamification experience.
$H2.2_1$: Gamification experience per element differs between previous gamification experience.

$H2.3_0$: Engagement does not differ between previous gamification experience.
$H2.3_1$: Engagement differs between previous gamification experience.

Variables: Overall Gamification Experience [Satisfaction, Enjoyment, Motivation, Competence, Autonomy, Accomplishment, Challenge, Competition, Guided, Social Experience, Usefulness], Gamification experience per element [Elements], Engagement
Groups: Previous Gamification Experience

2b. What is the relationship of the attitude towards gamification on psychological and behavioral outcomes?

$H2.4_0$: Overall gamification experience is not related to attitude towards gamification.
$H2.4_1$: Overall gamification experience is related to attitude towards gamification.

$H2.5_0$: Gamification experience per element is not related to attitude towards gamification.
$H2.5_1$: Gamification experience per element is related to attitude towards gamification.

$H2.6_0$: Platform experience is not related to attitude towards gamification.
$H2.6_1$: Platform experience is related to attitude towards gamification.

$H2.7_0$: Engagement is not related to attitude towards gamification.
$H2.7_1$: Engagement is related to attitude towards gamification.

Independent Variable: Attitude towards Gamification before
Dependent Variables: Overall Gamification Experience, Gamification experience per element [Elements], Engagement

Independent Variables: Overall Gamification Experience, Gamification experience per element [Elements], Engagement
Dependent Variable: Attitude towards Gamification after

2c. What is the difference in psychological and behavioral outcomes between player types?

$H2.8_0$: Overall gamification experience does not differ significantly between player types.
$H2.8_1$: Overall gamification experience differ significantly between player types.

$H2.9_0$: Gamification experience per element does not differ significantly between player types.
$H2.9_1$: Gamification experience per element differ significantly between player types.

$H2.10_0$: Platform experience does not differ significantly between player types.
$H2.10_1$: Platform experience differ significantly between player types.

$H2.11_0$: Engagement does not differ significantly between player types.
$H2.11_1$: Engagement differ significantly between different player types.

Variables: Overall Gamification Experience, Gamification experience per element [Elements], Engagement
Groups: Player Types

3a. What is the overall gamification experience of participants in the MOOC?

Descriptive statistics.

Variables: Overall Gamification Experience [Satisfaction, Enjoyment, Motivation, Competence, Autonomy, Accomplishment, Challenge, Competition, Guided, Social Experience, Usefulness]

3b. What is the relationship of overall gamification experience on personal goal achievement and competence level advancement?

$H3.1_0$: Personal goal achievement is not related to overall gamification experience.
$H3.1_1$: Personal goal achievement is related to overall gamification experience.

$H3.2_0$: Competence level advancement is not related to overall gamification experience.
$H3.2_1$: Competence level advancement is related to overall gamification experience.

Independent Variable: Overall Gamification Experience
Dependent: PGA, Competence Level Advancement

4a. What is the relationship between every gamification experience per element?

$H4.1_0$: Gamification experience per element does not affect the gamification experience of the other elements.
$H4.1_1$: Gamification experience per element affects the gamification experience of the other elements.

Variables: Gamification experience per Element [Elements]

4b. How does the gamification experience per element affect overall gamification experience?

$H4.2_0$: Overall gamification experience is not related to gamification experience per element.
$H4.2_1$: Overall gamification experience is related to gamification experience per element.

Independent Variables: Gamification Experience per Element [Elements]
Dependent Variable: Overall Gamification Experience

5a. What is the relationship of overall gamification experience on behavioral outcomes?

$H5.1_0$: Overall gamification experience is not related to platform experience.
$H5.1_1$: Overall gamification experience is related to platform experience.

$H5.2_0$: Overall gamification experience is not related to perceived use.
$H5.2_1$: Overall gamification experience is related to perceived use.

$H5.3_0$: Overall gamification experience is not related to continued use intention.
$H5.3_1$: Overall gamification experience is related to continued use intention.

$H5.4_0$: Overall gamification experience is not related to engagement.
$H5.4_1$: Overall gamification experience is related to engagement.

Independent Variable: Overall Gamification Experience
Dependent Variables: Platform Experience, Perceived Use, Continued Use Intention, Engagement

5b. What is the relationship of gamification experience with behavioral outcomes?

$H5.5_0$: Gamification experience per element is not related to platform experience.
$H5.5_1$: Gamification experience per element is related to platform experience.

$H5.6_0$: Gamification experience per element is not related to perceived use.
$H5.6_1$: Gamification experience per element is related to perceived use.

$H5.7_0$: Gamification experience per element is not related to continued use intention.
$H5.7_1$: Gamification experience per element is related to continued use intention.

$H5.8_0$: Gamification experience per element is not related to engagement.
$H5.8_1$: Gamification experience per element is related to engagement.

Independent Variables: Gamification experience per Element [Elements]
Dependent Variables: Platform Experience, Perceived Use, Continued Use Intention, Engagement

6. How does the platform experience affect competence level advancement?

$H6.1_0$: Competence level advancement is not related to platform experience.
$H6.1_1$: Competence level advancement is related to platform experience.

Independent Variable: Platform Experience
Dependent Variable: Competence level advancement

Chapter 4 – Validation of the proposed Evaluation Framework

4.1 Introduction

The validation of the evaluation framework for the gamification of gamified MOOCs4PD, that was proposed in the previous chapter, requires to be extensively examined. With this purpose, a case study research is used to investigate and evaluate the proposed framework in a real-life situation.

The evaluation framework will be implemented to the second version of the Learn2Analyzed MOOC (L2A MOOC 2021). The L2A MOOC 2021 is a competence based MOOC4PD that integrates specific gamification elements, aiming to support the development and accreditation of both core and advanced competences for Educational Data Analytics of Online and Blended teaching and learning. This edition is the improved version of Learn2Analyze MOOC. Given this fact, the L2A MOOC 2021 adheres to the same evaluation plan, with the proposed framework for the evaluation of the gamification being incorporated to fill in the gap that occurs.

The scope of this chapter is the presentation of the Learn2Analyze Project, the proposed evaluation framework as it was implemented to the second version of Learn2Analyze MOOC and the validation of it through MOOC's evaluation.

All the information about Learn2Analyze is retrieved from the official website www.learn2analyse.eu, which can be visited to find more.

4.2 Learn2Analyze

4.2.1 Learn2Analyze Project

Learn2Analyze (L2A)[1] is an Academia-Industry Knowledge Alliance for enhancing Online Training Professionals' (Instructional Designers and e-Trainers) Competences in Educational Data Analytics, co-funded by the European Commission through the Erasmus+ Program of the European Union (Cooperation for innovation and the exchange

[1] https://learn2analyse.eu/

of good practices – Knowledge Alliances, Agreement n. 2017-2733 / 001-001, Project No 588067-EPP-1-2017-1-EL-EPPKA2-KA) for the period 2018-2020.

The scope of the Learn2Analyze project is to[2]:

- Enhance existing competence frameworks for instructional designers and e-trainers of online courses with new Educational Data Literacy competences for using emerging Educational Data Analytics methods and tools.
- Develop and evaluate a series of professional development Massive Open Online Courses (MOOCs) for cultivating these competences with emphasis to combining theory and practice in the form of authentic work-oriented tasks.

This is important since, existing professional competence frameworks and professional development programs for instructional designers and e-trainers of online courses, almost ignore the dimension of Educational Data Literacy, missing out the potential of using emerging Educational Data Analytics methods and tools in effective online professional training.

To this end, the Learn2Analyze project aims to produce and evaluate[3]:

- a comprehensive proposal for an Educational Data Literacy Competence Framework for instructional designers and e-trainers of online courses.
- A series of professional development Massive Open Online Courses to cultivate these competences combining Educational Data Analytics theory and practice (through the use of existing educational data analytics tools from world market leaders)

4.2.1 Learn2Analyze Educational Data Literacy Competence Profile (L2A-EDL-CP)

The Learn2Analyze project has developed a comprehensive proposal for an Educational Data Literacy Competence Framework to enhance existing competence frameworks for

[2] https://learn2analyse.eu/proj/objectives/
[3] https://learn2analyse.eu/proj/objectives/

instructional designers and e-trainers of online courses with new Educational Data Literacy competences.

The Learn2Analyze Educational Data Literacy Competence Framework comprises of 6 competence dimensions and 17 competence statements. **Figure 7** presents the Competence Dimensions of Learn2Analyze Educational Data Literacy Competence Profile[4].

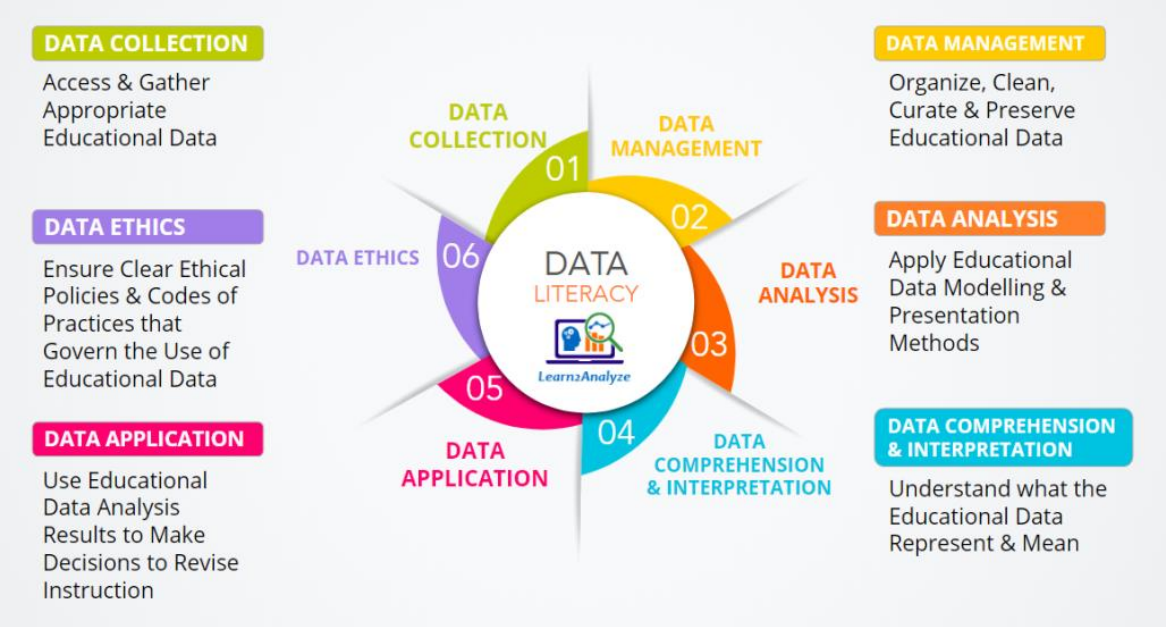

Figure 7: Competence Dimensions of Learn2Analyze Educational Data Literacy Competence Profile (https://learn2analyse.eu/proj/l2a-edl-cp/)

4.2.2 Learn2Analyze MOOC

About the course

Learn2Analyze MOOC[5] aims to support the development of both core and advanced competences for Educational Data Analytics of Online and Blended teaching and learning.

It is appropriate for the following target **groups**[6]:

[4] https://learn2analyse.eu/proj/l2a-edl-cp/
[5] https://learn2analyze.imc-learning.de/
[6] https://learn2analyse.eu/proj/l2a-mooc/

- e-learning professionals (such as instructional designers and e-tutors) of online and blended courses,
- school leaders and teachers engaged in blended (using the flipped classroom model) and online (during the COVID19 crisis and beyond) teaching and learning
- higher education students (undergraduates & postgraduates).

It combines[7]:

- **theoretical knowledge** on core issues related to collecting, analyzing, interpreting and using educational data, including ethics and privacy, with
- **practical experience** of applying educational data analytics in three different e-learning platforms, namely, Moodle, the eXact Suite, and the IMC Learning Suite.

No previous knowledge related to Educational Data Analytics is needed.

Learning Objectives

According to the syllabus of the L2A MOOC, by completing the course, participants will[8]:

- **know** where to locate useful educational data in different data sources and understand their limitations,
- **know** the basics for managing educational data to make them useful, understand relevant methods and be able to use relevant tools,
- **know** the basics for organizing, analyzing, interpreting, and presenting learner-generated data within their learning context, understand relevant learning analytics methods and be able to use relevant learning analytics tools,
- **know** the basics for analyzing and interpreting educational data to facilitate educational decision making, including course and curricula design, understand relevant teaching analytics methods and be able to use relevant teaching analytics tools,
- **understand** issues related with educational data ethics and privacy.

[7] https://learn2analyse.eu/proj/l2a-mooc/
[8] https://learn2analyse.eu/proj/l2a-mooc/

L2A MOOC Version 2021

The first edition of Learn2Analyze MOOC run between the 21th of October 2019 and the 14th of January 2020, with 1920 enrollments! A new and enhanced version of the Learn2Analyze University-Industry Massive Online Open Course (MOOC) on Educational Data Literacy is now offered by the Learn2Analyze Consortium, incorporating[9]:

- **gamification elements** to offer enhanced engagement in several authentic learning activities,
- **self-assessed assignments** based on real-life scenarios to offer deeper understanding of the educational data field, and
- an **upgraded assessment mechanism** leading to two levels of Certification of Achievement on Educational Data Literacy (EDL). Level A requires the learner to have acquired a basic set of competences for EDL and Level B requires demonstration of a higher expertise assessed through hands-on assignments based on simulated practice scenarios.

The L2A MOOC 2021 run between the 1st of March 2021 and the 6th of June 2021.

The course consists of eight (8) modules including six (6) core modules (Educational Data, Learning Analytics, Teaching Analytics, Educational Data Analytics with Moodle, Educational Data Analytics with eXact Suite, Educational Data Analytics with IMC Learning Suite) one orientation and one concluding module.

The course was initially estimated to be open for nine (9) weeks with the expected effort from participants' side to complete the basic requirements for the Certificate of Achievement to be approximately one hundred (100) hours in total. Due to the massive participation, the duration was extended to fourteen (14) weeks.

The educational design considerations and the syllabus of the L2A MOOC 2021 are described in **Appendix 2 – Educational Design Considerations and Syllabus of Learn2Analyze MOOC 2021**.

[9] https://learn2analyse.eu/proj/l2a-mooc/

4.2.3 Implementation of Proposed Evaluation Framework in Learn2Analyze MOOC 2021

The evaluation of the L2A MOOC 2021 adheres the framework that was used to evaluate the first edition, which was based on the validated "Evaluation framework for Massive Open Online Courses for Professional Development (MOOCs4PD)" designed, proposed and implemented by Sofia Mougiakou (2020).

Figure 8 shows the elements of pre- and post-course survey that constitute the evaluation framework applied to Learn2Analzyzed MOOC.

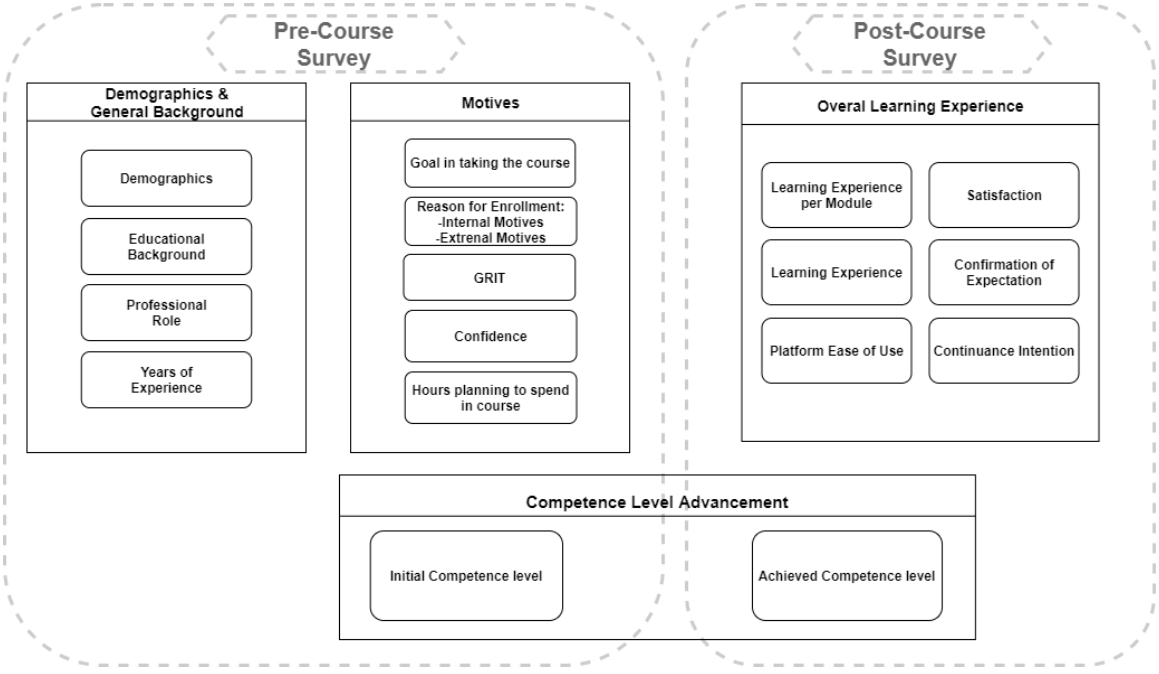

Figure 8: Pre- and post-course survey elements of L2A MOOC by Sofia Mougiakou (2020)

Due to the integration of gamification elements in the new version, a gap arises in the evaluation of the course. In order to evaluate this new feature and its outcomes, the proposed evaluation framework for the gamification of gamified MOOCs4PD is incorporated in the prior one. To avoid duplicates in pre- and post-course survey, few elements of the proposed evaluation framework were rejected in case of similarities with the evaluation framework of L2A MOOC.

Figure 9 shows the elements of pre- and post-course survey after the combination of the two frameworks in addition with elements about Level A/B Certificate.

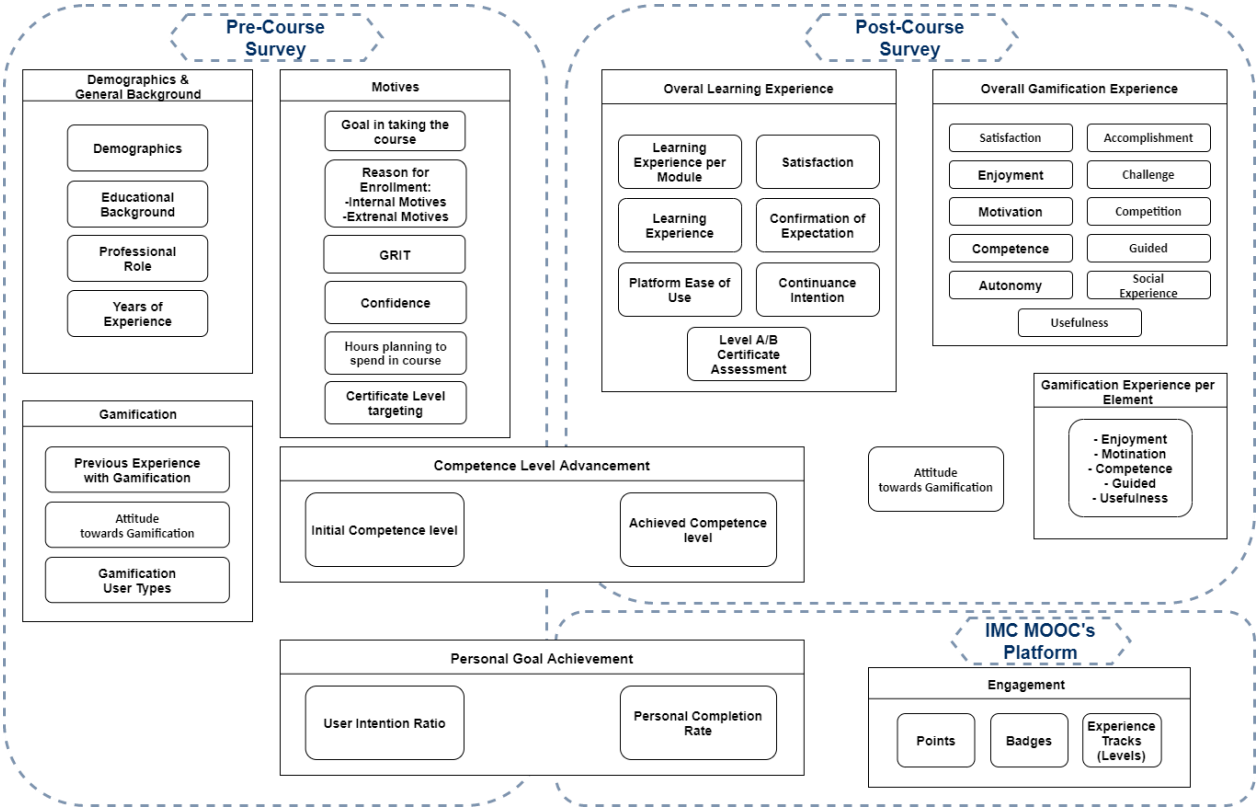

Figure 9: Pre- and Post-course survey elements of L2A MOOC 2021

The implementation of the proposed evaluation framework in the L2A MOOC, that has been previous evaluated without the integration of the specific gamification elements, gives the opportunity to compare the two editions of L2A MOOC and to add three more research dimensions to the previous six (6):

7. Is the learners' profile of the L2A MOOC 2021 similar to the L2A MOOC learners' profile?
8. Does the gamified version of the L2A MOOC have better course completion rate?
9. Does the gamified version of the L2A MOOC have better EDL Level advancement?

As the samples of the two editions of L2A MOOC are not the same, only descriptive statistics will be used to compare them to some extent.

4.3 Sampling

The present research belongs to the quantitative research group. According to Creswell (2012), two types of sampling are used to quantitative research: probability and non-probability sampling. In this case, non-probability sampling is used, since the individuals are selected for being available, convenient, and represent characteristics that are preferable for being studied.

The sampling follows the same procedure that was used during the evaluation of the first edition of L2A MOOC. **Figure 10** shows the sampling procedure.

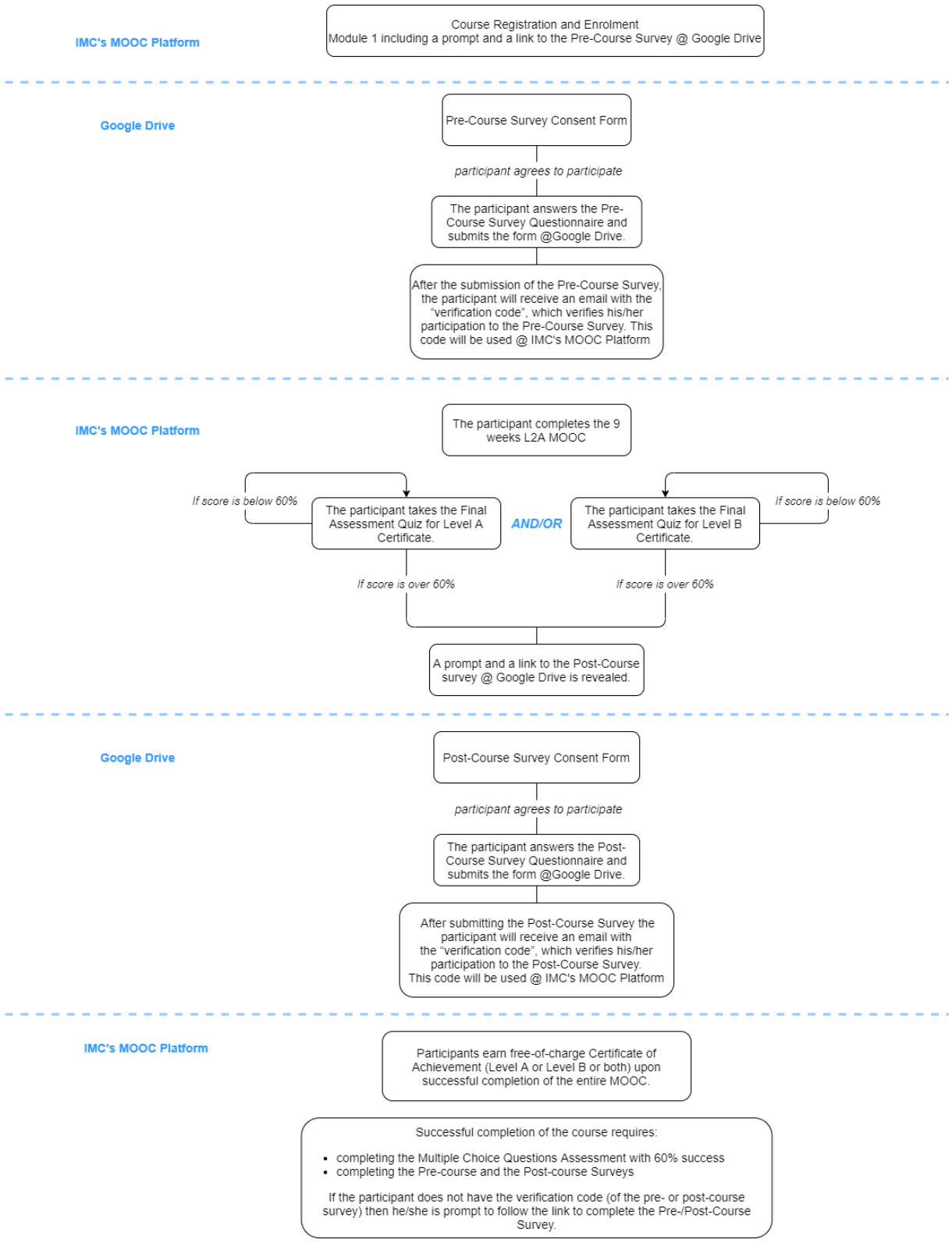

Figure 10: Sampling Procedure of L2A MOOC 2021

4.4 Data Collection

The survey was incorporated in the general evaluation of L2A MOOC 2021 and conducted through pre- and post- course survey combined with the data provided by IMC's MOOC Platform, always with respect to privacy and ethical issues. Following the evaluation plan of L2A MOOC's first edition (Mougiakou, 2020), the survey consists of the invitation letter, pre- and post- course questionnaire (the instruments of the survey) in addition with the consent form (privacy and ethical issues).

4.4.1 Instruments

Table 4 presents the **pre-course** survey used in L2A MOOC 2021. This is the same pre-course survey used by Sofia Mougiakou (2020) for the evaluation of L2A MOOC with the addition of the Gamification Profile section, that consists of twenty-nine (29) questions, along with one (1) question about User Intention Ratio.

Table 4: Pre-course survey

Invitation Letter	• Inviting to participate • Informing about the objectives • Guiding survey's completion • Guiding receipt and usage of code to unlock L2A MOOC content
Consent form	Following the guidelines of the General Data Protection Regulation (EU) 679/2016 (GDPR), informing about: • Purpose and procedure • Potential benefits, risk, or discomforts • Data storage and transfer outside the EU • Right to withdraw • Rights of research participants • Participant concerns and reporting • Conflict of interest, compensation, anonymity, confidentiality • Usage, debriefing and dissemination of results Participants either agree or not to the consent form and the survey.

Questionnaire	To collect responses of participants, the questionnaire is created in an online form (using Google Forms) and structured into eight (8) sections. **1. Invitation letter** **2. Consent form** **3. Unique Code ID –** guidelines to create and provide this code to match participants' pre- and post- course survey answers **4. Demographics & General Background** • Year of birth • Gender • Country of residence • Highest level of education completed • Current job sector • Definition of professional role – selecting from a given list • Years involved in this role • Years involved in the field of Digital Teaching and Learning • English proficiency • Comfort with technology • Number of MOOCs enrolled in the past • Number of MOOCs completed **5. Gamification** • Familiarization with gamification in teaching and learning • Experience with gamified learning in the past • Number of gamified MOOCs taken part • Use of gamification in educational design of participants • Attitude towards Gamification - rating one statement from "Not at all true" to "Very True" plus a "Not applicable" choice • Gamification User Types based on Hexad Scale (24-item scale) – rating the agreement to 24 statements in a 7-point likert scale, from "Strongly Disagree" to "Strongly Agree" **6. Motives for enrolling in the L2A MOOC** • Goal in taking the course - selecting from 7 statements or providing alternative answer

	• Reason for enrolment - rating 8 statements from “Not at all true” to “Very True” plus a “Not applicable” choice • Self-confidence about learning the course material – rating a 5-point likert scale • Possibility of course completion according to defined by the syllabus time commitment – rating a 5-point likert scale • Hours per week planning to spend on the course • User Intention Ratio – the percentage of the course intending to be completed • Certificate Level targeting • 8-item GRIT scale – passion and perseverance for long-term and meaningful goals rating from “Very much like me” to “Not at all like me” **7. Existing Competence Level per L2A EDL-CP Statement –** rating the initial competence level of total 17 statements from the 6 EDL Competence Dimensions with possible options: Novice, Advanced Beginner, Competent, Proficient, Expert **8. Unlocking L2A MOOC content instructions** Participants need approximately 25 minutes to response in the sets of closed type questions that were mentioned above using the Likert scale.

Appendix 1.1 - L2A MOOC 2021 Pre-Course Survey presents pre-course survey in detail as it was used in L2A MOOC 2021.

Table 5 presents the **post-course** survey used in L2A MOOC 2021. This is the same post-course survey used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC with the addition of the Overall Gamification Experience section with thirty-two (32) questions and the Gamification Experience per Element section with ten (10) question for each integrated gamification element.

Table 5: Post-course Survey

Invitation Letter	• Inviting to participate • Informing about the objectives • Guiding survey's completion • Guiding receipt and usage of code to unlock L2A MOOC Certificate of Achievement (Level A and/or Level B)
Consent form	Following the guidelines of the General Data Protection Regulation (EU) 679/2016 (GDPR), informing about: • Purpose and procedure • Potential benefits, risk, or discomforts • Data storage and transfer outside the EU • Right to withdraw • Rights of research participants • Participant concerns and reporting • Conflict of interest, compensation, anonymity, confidentiality • Usage, debriefing and dissemination of results Participants either agree or not to the consent form and the survey.
Questionnaire	To collect responses of participants, the questionnaire is created in an online form (using Google Forms) and structured into nine (9) sections. 1. **Invitation letter** 2. **Consent form** 3. **Unique Code ID –** guidelines to create and provide this code to match participants' pre- and post- course survey answers 4. **Learning experience per module –** rating 13 statements about the learning experience for every module separately from "Strongly Disagree" to "Strongly Agree" (5-point likert scale) 5. **Overall learning experience** • Learning Experience – rating the agreement to 7 statements from "Strongly Disagree" to "Strongly Agree" (5-point likert scale)

	• Platform Ease of Use - rating the agreement to 5 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Level A Certificate assessment – rating the agreement to 2 statements about the difficulty level from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Level B Certificate assessment – rating the agreement to 3 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Satisfaction – rating the agreement to 2 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Confirmation – rating the agreement to 2 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Continuance Intention – rating the agreement to 2 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Positive & Negative comments – answering 2 open-ended questions about what participants liked & disliked to the course **6. Overall Gamification Experience** • Satisfaction, Enjoyment, Motivation, Autonomy, Competence (of Gamification Experience) – rating the agreement to 13 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) • Accomplishment, Guided, Social Experience, Competition, Challenge (of Gamification Experience) – rating the agreement to 14 statements from “Strongly Disagree” to “Strongly Agree” “Strongly Disagree” to “Strongly Agree” (5-point likert scale), based on Gameful Experience Questionnaire (GAMEFULQUEST). • Usefulness – rating the agreement to 4 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale)

	• Attitude towards Gamification - rating one statement from “Not at all true” to “Very True” plus a “Not applicable” choice 7. **Gamification Experience per Element –** rating the agreement to 10 statements from “Strongly Disagree” to “Strongly Agree” (5-point likert scale) for each gamification element separately (Points, Badges, Levels, Progress Bar, Leaderboard) 8. **Achieved Competence Level per L2A EDL-CP Statement -** rating the achieved competence level of total 17 statements from the 6 EDL Competence Dimensions with possible options: Novice, Advanced Beginner, Competent, Proficient, Expert 9. **Unlocking L2A MOOC Certificate of Achievement instructions** Participants need approximately 30 minutes to response in two (2) open-ended questions and in the sets of closed-ended questions and that were mentioned above using the Likert scale.

Appendix 1.2 - L2A MOOC 2021 Post-Course Survey presents post-course survey in detail as it was used in L2A MOOC 2021.

4.4.2 IMC's MOOC Platform Data

IMC’s MOOC Platform provides a set of limited data about users and their activities in Learn2Analyze MOOC. The data that are utilized for the survey are:

- Number of Badges per user
- Level of Experience Track per user
- Course completion rate per user (Personal Completion Rate)

and refer to all the enrolled users having or not completed the course.

4.5 Privacy and ethical issues

In both pre- and post-course surveys, consent form was written following the guidelines of the General Data Protection Regulation (EU) 679/2016 (GDPR) to inform in detail participants about:

- the **purpose of the project** and a link to official website for more information
- the **procedure and structure** of the survey
- the categories of **personal and sensitive data** concerned
- the **non**-existence of potential **benefits, risk, or discomforts** of the survey
- the duration of **data storage** and the potential **data transfer** outside the EU
- the right to **withdraw** from the survey prior to submitting it at any time
- the right to request access to, a copy of, rectification, restriction in the use of, or erasure of data (**basic data protection rights**)
- the right to lodge a complaint with **Data Protection Authority (DPA)**
- the right to contact and inform about potential **concerns or report**
- the **non**-existence of **conflict of interest or compensation** for them
- the **anonymity and confidentiality**
- the **usage, debriefing and dissemination** of survey's data

After reading the consent form, participants can agree to consent only if they check the "I Agree" option and submit the survey.

4.6 Data Analysis

4.6.1 Pre- & Post-Course Survey Data

4.6.1.1 Completeness

Both questionnaires of pre- and post-course survey are created using Google Forms with all questions being set as required to complete the survey, so no value is missing.

4.6.1.2 Matching

Following the practice adopted by Sofia Mougiakou (2020) in the evaluation of L2A MOOC, participants were asked to produce and provide a Unique ID Code by answering a

set of five (5) questions to match their personal responses from pre- and post-course survey:

1. The first letter of your first name (e.g. B)
2. The last 2 digits of your cell phone (if none use 00) (e.g. 45)
3. Your month of birth (e.g. 09)
4. The first letter of your middle name (if none, use X) (e.g. X)
5. The first letter of city/town you were born in (e.g. A)

(e.g., Unique ID Code: B4509XA)

The Unique ID Code makes it easier for participants to (re-)generate it correctly and, at the same time, decoding it very difficult.

4.6.1.3 Deduplication

To avoid duplications in case of more than one submission per participant in pre- or post-course survey, the first submission was deleted and only the last one was saved using the Unique ID Code for the identification.

4.6.2 IMC's MOOC Platform Data

4.6.2.1 Matching IMC's MOOC Platform Data with Pre- & Post-Course Survey Data

To match data per user about badges, level of experience track, and personal completion rate regarding course's content with pre- and post-course survey data provided by IMC's MOOC Platform, e-mails are used. More specifically, the e-mail that a user used to sign in and enroll in L2A MOOC 2021 is matched to the e-mail that he/she used to submit pre- and post-course survey's responses. Only data from users who have successfully completed pre- and post-course were utilized.

4.6.2.2 Missing Data

In a few cases, users from pre- and/or post-course survey could not be identified in IMC's MOOC Platform data by the provided e-mails. To avoid missing data, these users were deleted only from pre- course survey, as none of them had completed the post-course survey.

4.6.3 Coding of Questions

All the questions of pre- and post-course survey have been coded before the data analysis. **Appendix 3 – L2A MOOC 2021 Coding of Questions** presents the coding in detail. This is the coding of questions used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC in addition with the coding of the questions about the Gamification Profile, the User Intention Ratio, the Overall Gamification Experience, and the Gamification Experience per Element.

4.6.4 Data's Distribution

Due to the large samples' sizes of pre- and post-course survey (1235 and 282 respectively), the examined variables consider following the normal distribution and there were used parametric tests.

4.6.5 Reliability Analysis

Reliability analysis for every set of questions is examined with the calculation of the Cronbach's Alpha (a) coefficient. For each calculation, two tables are produced.

In the first table "Cronbach's Alpha for…", the score in the first column shows how reliable is the set of questions. The Cronbach's a coefficient takes value from zero (0) to one (1), where zero (0) indicates no reliability and one (1) a very strong one. Cronbach's a coefficient values that are considered satisfactory are greater than 0,7. For example, in **Table 6** "Cronbach's Alpha for Philanthropist", Cronbach's a is 0,871, a value greater than 0,7. Therefore, the set of questions considers to be reliable.

Following up, the second table “Cronbach's Alpha for … if item deleted” shows if there is a need for an item to be deleted from the set of questions to have a better reliability. More specifically, the second column (Corrected Item-Total Correlation) shows how well each item of the set correlates with the overall score of the questionnaire. If correlation’s value is less than 0,3, the item probably needs to be removed. Furthermore, the third column (Cronbach's Alpha if Item Deleted) shows the score of overall reliability if each item is deleted. If a score is significantly greater than Cronbach’s Alpha score from the first table, the item will be removed from the questionnaire set to have a greater reliability. For example, in **Table 7** “Cronbach's Alpha for Philanthropist if item deleted” none of the items need to be deleted as their removal will not offer substantially greater reliability.

4.6.5.1 Reliability of Pre-Course Survey

Gamification User Types

Users are asked to rate their agreement to 24 statements, 4 statements for Philanthropist, Socialiser, Free Spirit, Achiever, Disruptor and Player (each user type of Hexad Scale), in a 7-point likert scale, from “Strongly Disagree” to “Strongly Agree” to identify in which type they can be categorized.

- ***Philanthropist***

Table 6: Cronbach's Alpha for Philanthropist

Cronbach’s Alpha	N of items
0,871	4

As it is shown in **Table 6**, Philanthropist presents a great reliability.

Table 7: Cronbach's Alpha for Philanthropist if item deleted

Cronbach’s Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PHIL1	0,722	0,837

PHIL2	0,757	0,823
PHIL3	0,726	0,836
PHIL4	0,697	0,847

The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability.

- ***Socializer***

Table 8: Cronbach's Alpha for Socializer

Cronbach's Alpha	N of items
0,887	4

As it is shown in **Table 8**, Socializer presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Free Spirit***

Table 9: Cronbach's Alpha for Free Spirit

Cronbach's Alpha	N of items
0,740	4

As it is shown in **Table 9** Free Spirit presents a satisfactory reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Achiever***

Table 10: Cronbach's Alpha for Achiever

Cronbach's Alpha	N of items
0,824	4

As it is shown in **Table 10**, Achiever presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Disruptor***

Table 11: Cronbach's Alpha for Disruptor

Cronbach's Alpha	N of items
0,727	4

As it is shown in **Table 11**, Disruptor presents a satisfactory reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Player***

Table 12: Cronbach's Alpha for Player

Cronbach's Alpha	N of items
0,799	4

As it is shown in **Table 12**, Player presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted

as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

Initial Competence Level

Users are asked to rate the initial competence level of total 17 statements from the 6 EDL Competence Dimensions (2 for Data Collection, 4 for Data Management, 2 for Data Analysis, 4 for Data Comprehension and Interpretation, 2 for Data Application, 3 for Data Ethics) with possible options: Novice, Advanced Beginner, Competent, Proficient, Expert.

- ***Data Collection (Initial)***

Table 13: Cronbach's Alpha for Data Collection (Initial)

Cronbach's Alpha	N of items
0,903	2

As it is shown in **Table 13**, Data Collection (Initial) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Management (Initial)***

Table 14: Cronbach's Alpha for Data Management (Initial)

Cronbach's Alpha	N of items
0,938	4

As it is shown in **Table 13**, Data Management (Initial) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Analysis (Initial)***

Table 15: Cronbach's Alpha for Data Analysis (Initial)

Cronbach's Alpha	N of items
0,859	2

As it is shown in **Table 15**, Data Analysis (Initial) presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Comprehension and Interpretation (Initial)***

Table 16: Cronbach's Alpha for Data Comprehension and Interpretation (Initial)

Cronbach's Alpha	N of items
0,948	4

As it is shown in **Table 16**, Data Comprehension and Interpretation (Initial) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Application (Initial)***

Table 17: Cronbach's Alpha for Data Application (Initial)

Cronbach's Alpha	N of items
0,938	2

As it is shown in **Table 17**, Data Application (Initial) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Ethics (Initial)***

Table 18: Cronbach's Alpha for Data Ethics (Initial)

Cronbach's Alpha	N of items
0,931	3

As it is shown in **Table 18**, Data Ethics (Initial) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***EDL Initial Competence Level***

Table 19: Cronbach's Alpha for EDL Initial Competence Level

Cronbach's Alpha	N of items
0,949	6

As it is shown in **Table 19**, EDL Initial Competence Level presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

4.6.5.2 Reliability of Post-Course Survey

Learning Experience

Users rate the agreement to 7 statements from "Strongly Disagree" to "Strongly Agree" (5-point likert scale) about their learning experience.

Table 20: Cronbach's Alpha for Learning Experience

Cronbach's Alpha	N of items
0,831	7

As it is shown in **Table 20**, Learning Experience presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

Platform Ease of Use

Users rate their agreement to 5 statements from "Strongly Disagree" to "Strongly Agree" (5-point likert scale) about the experience of platform's use.

Table 21: Cronbach's Alpha for Platform Ease of Use

Cronbach's Alpha	N of items
0,846	5

As it is shown in **Table 21**, Platform Ease of Use presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

Continuance Intention

Users rate their agreement to 2 statements from "Strongly Disagree" to "Strongly Agree" (5-point likert scale) about their continuance intention towards MOOC.

Table 22: Cronbach's Alpha for Continuance Intention

Cronbach's Alpha	N of items
0,821	2

As it is shown in **Table 22**, Continuance Intention presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

Overall Gamification experience

Users rate their agreement to total 32 statements from "Strongly Disagree" to "Strongly Agree" (regarding Satisfaction, Enjoyment, Motivation, Autonomy, Competence, Accomplishment, Guided, Social Experience, Competition, Challenge, Usefulness) about their experience with the gamification of the MOOC.

- ***Satisfaction (Gamification)***

Table 23: Cronbach's Alpha for Satisfaction (Gamification)

Cronbach's Alpha	N of items
0,850	2

As it is shown in **Table 23**, Satisfaction (Gamification) presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Enjoyment***

Table 24: Cronbach's Alpha for Enjoyment

Cronbach's Alpha	N of items
0,844	2

As it is shown in **Table 23**, Enjoyment presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Motivation***

Table 25: Cronbach's Alpha for Motivation

Cronbach's Alpha	N of items
0,846	3

As it is shown in **Table 25**, Motivation presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Competence***

Table 26: Cronbach's Alpha for Competence

Cronbach's Alpha	N of items
0,868	3

As it is shown in **Table 26**, Competence presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Autonomy***

Table 27: Cronbach's Alpha for Autonomy

Cronbach's Alpha	N of items
0,819	3

As it is shown in **Table 27**, Autonomy presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Accomplishment***

Table 28: Cronbach's Alpha for Accomplishment

Cronbach's Alpha	N of items
0,856	2

As it is shown in **Table 28**, Accomplishment presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted).**

- ***Guided***

Table 29: Cronbach's Alpha for Guided

Cronbach's Alpha	N of items
0,894	3

As it is shown in **Table 29**, Guided presents a great reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Social Experience***

Table 30: Cronbach's Alpha for Social Experience

Cronbach's Alpha	N of items
0,902	3

As it is shown in **Table 30**, Social Experience presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Competition***

Table 31: Cronbach's Alpha for Competition

Cronbach's Alpha	N of items
0,907	3

As it is shown in **Table 31**, Competition presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Challenge***

Table 32: Cronbach's Alpha for Challenge

Cronbach's Alpha	N of items
0,906	3

As it is shown in **Table 32**, Challenge presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Usefulness***

Table 33: Cronbach's Alpha for Usefulness

Cronbach's Alpha	N of items
0,952	4

As it is shown in **Table 33**, Usefulness presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Overall Gamification Experience***

Table 34: Cronbach's Alpha for Overall Gamification Experience

Cronbach's Alpha	N of items
0,962	11

As it is shown in **Table 34**, Overall Gamification Experience presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

Gamification Experience per Element: Points, Badges, Levels, Progress bar, Leaderboard

Users are asked to rate their agreement to 10 statements from "Strongly Disagree" to "Strongly Agree" (5-point likert scale) for each gamification element separately (Points, Badges, Levels, Progress Bar, Leaderboard). The 10 statements are the same for every element.

Table 35: Cronbach's Alpha for Gamification Experience per Element

	Points	Badges	Levels	Progress Bar	Leaderboard	N of items
Cronbach's Alpha	0,971	0,975	0,976	0,964	0,964	10

As it is shown in **Table 35**, every element's Gamification Experience presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted for every

element's Gamification Experience shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

Achieved Competence Level

Users are asked to rate the achieved competence level of total 17 statements from the 6 EDL Competence Dimensions (2 for Data Collection, 4 for Data Management, 2 for Data Analysis, 4 for Data Comprehension and Interpretation, 2 for Data Application, 3 for Data Ethics) with possible options: Novice, Advanced Beginner, Competent, Proficient, Expert.

- ***Data Collection (Achieved)***

Table 36: Cronbach's Alpha for Data Collection (Achieved)

Cronbach's Alpha	N of items
0,919	2

As it is shown in **Table 36**, Data Collection (Achieved) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Management (Achieved)***

Table 37: Cronbach's Alpha for Data Management (Achieved)

Cronbach's Alpha	N of items
0,934	4

As it is shown in **Table 37**, Data Management (Achieved) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Analysis (Achieved)***

Table 38: Cronbach's Alpha for Data Analysis (Achieved)

Cronbach's Alpha	N of items
0,906	2

As it is shown in **Table 38**, Data Analysis (Achieved) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Comprehension and Interpretation (Achieved)***

Table 39: Cronbach's Alpha for Data Comprehension and Interpretation (Achieved)

Cronbach's Alpha	N of items
0,952	4

As it is shown in **Table 39**, Data Comprehension and Interpretation (Achieved) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Application (Achieved)***

Table 40: Cronbach's Alpha for Data Application (Achieved)

Cronbach's Alpha	N of items
0,953	2

As it is shown in **Table 40**, Data Application (Achieved) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***Data Ethics (Achieved)***

Table 41: Cronbach's Alpha for Data Ethics (Achieved)

Cronbach's Alpha	N of items
0,953	3

As it is shown in **Table 41**, Data Ethics (Achieved) presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

- ***EDL Achieved Competence Level***

Table 42: Cronbach's Alpha for EDL Achieved Competence Level

Cronbach's Alpha	N of items
0,966	6

As it is shown in **Table 42**, EDL Achieved Competence Level presents a strong reliability. The calculation of Cronbach's Alpha coefficient if each item is deleted shows that none of the items need to be deleted as their removal will not offer substantially greater reliability (see **Appendix 4 – Cronbach's Alpha if Item Deleted**).

4.6.6 Validity Analysis

4.6.6.1 Content Validity

In order to secure the content validity of pre- and post-course survey's questionnaires, the items were retrieved from studies that have already used and validated them. Questionnaires that had been used in L2A MOOC have been validated by Sofia Mougiakou (2020), while the additional items about the evaluation of the gamification have been validated from studies and they are popular in research (see **3.4 Dimensions of the evaluation framework**).

4.6.6.2 Criterion Validity

With the intention to examine the criterion validity of pre- and post-course survey's questionnaires, Spearman's Correlation coefficient is used. In order to decide whether each item of the questionnaires is valid, its score and the total score are examined. When there is a significance correlation between these two scores, the item can be characterized as valid.

4.6.6.2.a Criterion Validity of Pre-Course Survey

Gamification User Types

Philanthropist, Socializer, Achiever, Free Spirit, Disruptor, Player

The calculation of Spearman's Correlation coefficient for each of the 6 Gamification User type questionnaire shows strong correlation for each item of questionnaire with the total score's item (**Table 43**).

Table 43: Spearman's rho for each of the 6 Gamification User Type questionnaire

	Spearman's rho		N items
	From	To	
Philanthropist	0,813	0,856	4
Socializer	0,827	0,881	4
Achiever	0,799	0,820	4
Free Spirit	0,707	0,768	4
Disruptor	0,653	0,803	4
Player	0,698	0,850	4

EDL Initial Competence Level

The calculation of Spearman's Correlation coefficient for each of the 6 EDL Competence Dimensions questionnaire shows very strong correlations for each item of questionnaire with the total score's item (**Table 44**).

Table 44: Spearman's rho for each of the 6 EDL Competence Dimensions questionnaire

	Spearman's rho		N items
	From	To	
Data Collection	0,950	0,964	2
Data Management	0,893	0,926	4
Data Analysis	0,913	0,953	2
Data Comprehension and Interpretation	0,906	0,942	4
Data Application	0,963	0,975	2
Data Ethics	0,902	0,950	3

4.6.6.2.b Criterion Validity of Post-Course Survey

Learning Experience

The calculation of Spearman's Correlation coefficient for the Learning Experience questionnaire shows strong correlation for 6 of the 7 items of questionnaire and one item low correlation with the total score's item (**Table 45**).

Table 45: Spearman's rho Learning Experience questionnaire

	Spearman's rho			N items
	From	To	And	
Learning Experience	0,637	0,827	0,475	7

Platform Ease of Use

The calculation of Spearman's Correlation coefficient for Platform Ease of Use questionnaire shows strong correlation for each item of questionnaire with the total score's item (**Table 46**).

Table 46: Spearman's rho for Platform Ease of Use questionnaire

	Spearman's rho		N items
	From	To	
Platform Ease of Use	0,680	0,829	5

Continuance Intention

The calculation of Spearman's Correlation coefficient for Continuance Intention questionnaire shows very strong correlation for each item of questionnaire with the total score's item (**Table 47**).

Table 47: Spearman's rho for Continuance Intention questionnaire

	Spearman's rho		N items
	From	To	
Continuance Intention	0,910	0,943	2

Overall Gamification Experience

The calculation of Spearman's Correlation coefficient of Satisfaction, Enjoyment, Motivation, Autonomy, Competence, Accomplishment, Guided, Social Experience,

Competition, Challenge, and Usefulness questionnaires shows very strong correlations for each item of questionnaires with the total score (**Table 48**). Same results are found for Overall Gamification Experience. (**Table 49**).

Table 48: Spearman's rho for Satisfaction, Enjoyment, Motivation, Autonomy, Competence, Accomplishment, Guided, Social Experience, Competition, Challenge, and Usefulness questionnaires

	Spearman's rho		N items
	From	To	
Satisfaction	0,920	0,933	2
Enjoyment	0,916	0,957	2
Motivation	0,868	0,899	3
Autonomy	0,847	0,867	3
Competence	0,846	0,921	3
Accomplishment	0,922	0,930	2
Guided	0,876	0,915	3
Social Experience	0,873	0,937	3
Competition	0,870	0,933	3
Challenge	0,884	0,916	3
Usefulness	0,808	0,944	4

Table 49: Spearman's rho for Overall Gamification Experience

	Spearman's rho		N items
	From	To	
Overall Gamification Experience	0,720	0,890	11

Gamification Experience per Element

The calculation of Spearman's Correlation coefficient for Points, Badges, Levels, Progress Bar, and Leaderboard questionnaires shows very strong correlations for each item of questionnaires with the total score's item (**Table 50**).

Table 50: Spearman's rho for Points, Badges, Levels, Progress Bar, and Leaderboard questionnaire

	Spearman's rho		N items
	From	To	
Points	0,825	0,891	10
Badges	0,840	0,909	10
Levels	0,815	0,921	10
Progress Bar	0,820	0,890	10
Leaderboard	0,905	0,949	10

EDL Achieved Competence Level

The calculation of Spearman's Correlation coefficient for each of the 6 EDL Achieved Competence Dimensions questionnaire shows strong and very strong correlations for each item of questionnaire with the total score's item (**Table 51**).

Table 51: Spearman's rho for each of the 6 EDL Achieved Competence Dimensions questionnaire

	Spearman's rho		N items
	From	To	
Data Collection	0,951	0,956	2
Data Managment	0,870	0,919	4
Data Analysis	0,947	0,951	2
Data Comprehension and Interpretation	0,898	0,948	4
Data Application	0,970	0,975	2
Data Ethics	0,944	0,957	3

EDL Competence Level Advancement

The calculation of Spearman's Correlation coefficient for EDL Competence Level Advancement questionnaire shows strong correlation for each item of questionnaire with the total score's item (**Table 52**).

Table 52: Spearman's rho for EDL Competence Level Advancement questionnaire

	Spearman's rho		N items
	From	To	
EDL Competence Level Advancement	0,826	0,896	6

Every calculation of Spearman's Correlation rho coefficient is thoroughly presented in **Appendix 5 – Spearman's Correlation rho**.

Chapter 5 – Results

5.1 Introduction

The Learn2Analyze MOOC 2021 started on March 1st, 2021, and ended on June 6th, 2021, with a total enrollment of **2188** users from **83** different countries around the world. The users that were already enrolled and started the course had the opportunity to continue and finish it. Pre- and post-course survey data were finally collected on June 10th, 2021, with **1252** submissions in pre- and **282** in post-course survey. After the deduplication, **1249** submissions were kept from pre-course survey. As the submission of the pre-course survey was obligatory to continue inside the course, **1249** users were considered to have started the MOOC. From the entirety of users, only the data from **1235** was analyzed as 14 users could not be identified in the IMC's MOOC platform data and were removed to avoid missing values. None of them had submitted the post-course survey and the total number of users stayed the same (**282** users).

5.2 Learners' Profile

5.2.1 Course-Participated Learners' Profile

Sample N = 1235

Demographics

From the total, one third of them stated male as their gender (32,6%) while the other two thirds identified as female (65,9%), with 1,5% of users opting not to answer.

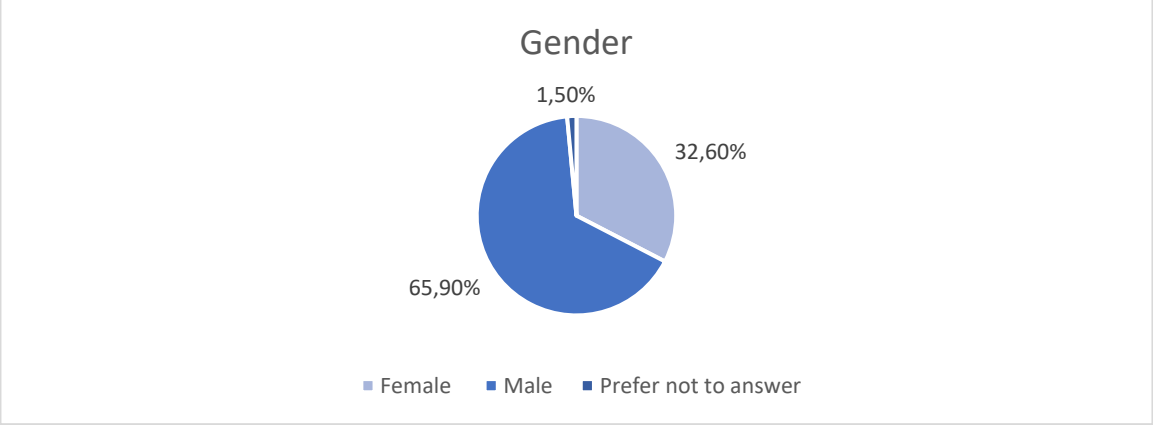

Figure 11: Gender of Users

In regards to age, 35,1% were between 20 and 39 years old, while the majority were between 40 and 59 years old (61,5%), with the mean age at 42,8.

Table 53: Age of users

Age	Frequency	Percentage
20-29	178	14,41%
30-39	256	20,73%
40-49	432	34,98%
50-59	327	26,48%
>60	42	3,4%

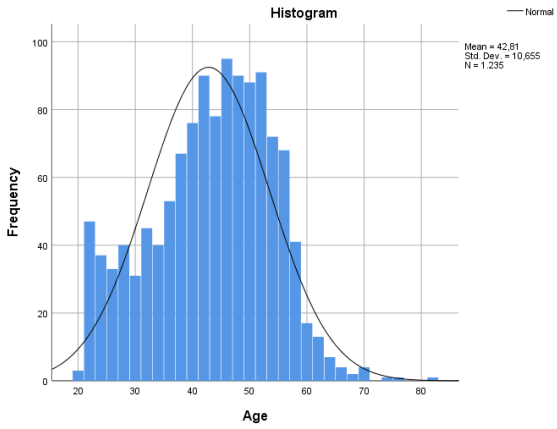

Figure 12: Age distribution of users

Even though 67 countries are showed in users' response, more than one half of them are located in Greece (59,8%). Trailing that, 164 users were from Germany (13,3%) and 90 from Italy (7,3%).

Table 54: Users' region (countries)

Country	Frequency	Percentage
Greece	739	59,8%
Germany	164	13,3%
Italy	90	7,3%
Other	From 1 to 27	19,6%

General Background

The majority of users had high education level, with more than half of them holding a Master's Degree (695 users – 56,3%) and few less than a fifth holding a Bachelor's degree (231 users – 18,7%). As for their English Proficiency level, a 70% (864 users) presented to rate their level to high and almost high. Similar high results appear when they were asked about their comfort with technology. A total of 993 (80,4%) users responded with comfort and much comfort. Less than a third answered (367 users – 29,7%) that he/she have never enrolled in a MOOC before. Numbers of completed MOOCs were a little lower, with a

38,5% (475 users) to never have completed one. However, 327 users (26,5%) seems to have completed from 2 to 4 MOOCs until now.

Regarding their current job sector, almost a half of them works in K-12 Education (580 users – 47%) while 230 users responded University (18,6%) and 96 (7,8%) to Governmental Education Agency.

Table 55: Job sector of users

Job Sector	Frequency	Percentage
K-12 Education	580	47%
University	230	18,6%
Governmental Education Agency	96	7,8%
Self-employed	66	5,3%
Large (>100 people) for-profit company	58	4,7%
Non-Employed	56	4,5%
Small (<100 people) for-profit company	47	3,8%
College	39	3,2%
Small (<100 people) non-profit company	19	1,5%
Large (>100 people) non-profit company	16	1,3%
Other Governmental Agency	14	1,1%
Other	14	1,1%

When it came to professional role, users could give multiple responses selecting from 16 professional roles and one extra “Other” option. All professional roles were later grouped according to **Appendix 8 – Groups of Professional Roles** and every user was categorized in one of them. These are the same guidelines used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC. More than half of users reported to be a school teacher (689 users – 55,8%), followed by a 23% (284) that characterized as eLearning Professionals (IDs, eTutors).

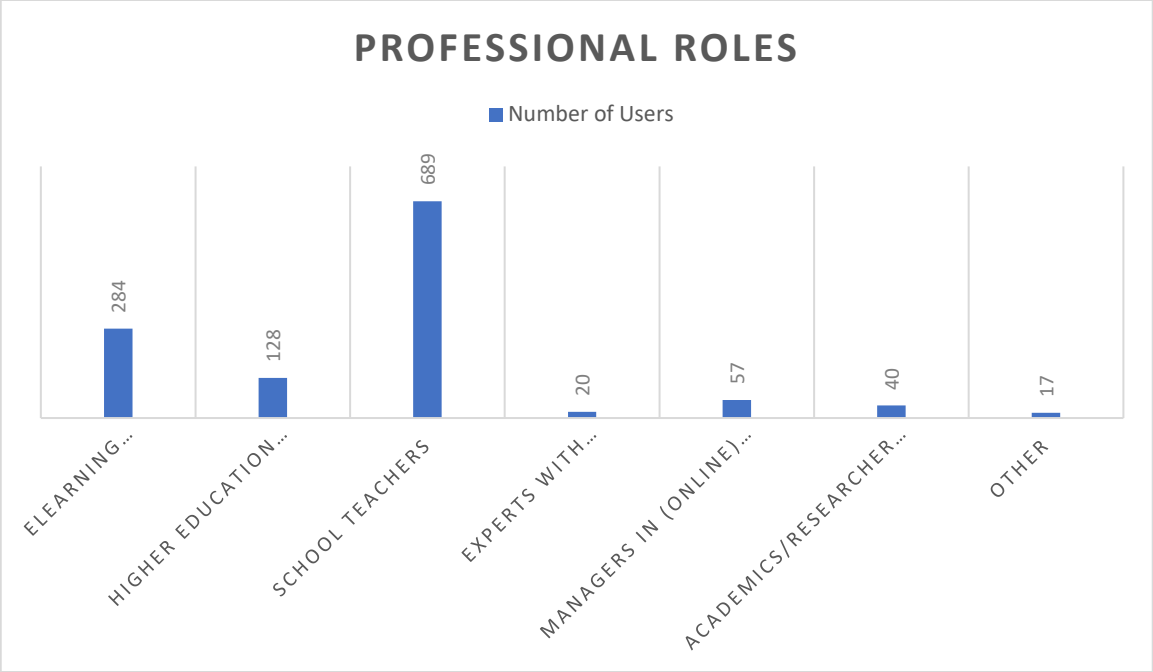

Figure 13: Professional Roles of users

Previous Experience with Gamification

With the purpose of finding user's gamification profile, they were asked about their experience with gamification so far. According to their answers, 6 to 10 users (760 users – 61,5%) were familiar with gamification in teaching and learning so far but half of them never experienced gamification in learning context before. At the same time, only few of them have taken part in at least one gamified MOOC as 883 users (71,5%) stated that he/she never attended in one. Nevertheless, it is interesting that almost half of users (553 users – 44,8%) have used gamification in their educational design.

Attitude towards Gamification

Users showed their general favorable attitude towards gamification as a 68,6% found this statement true or very true. Although there was an option "Not Applicable", only 29 users selected it.

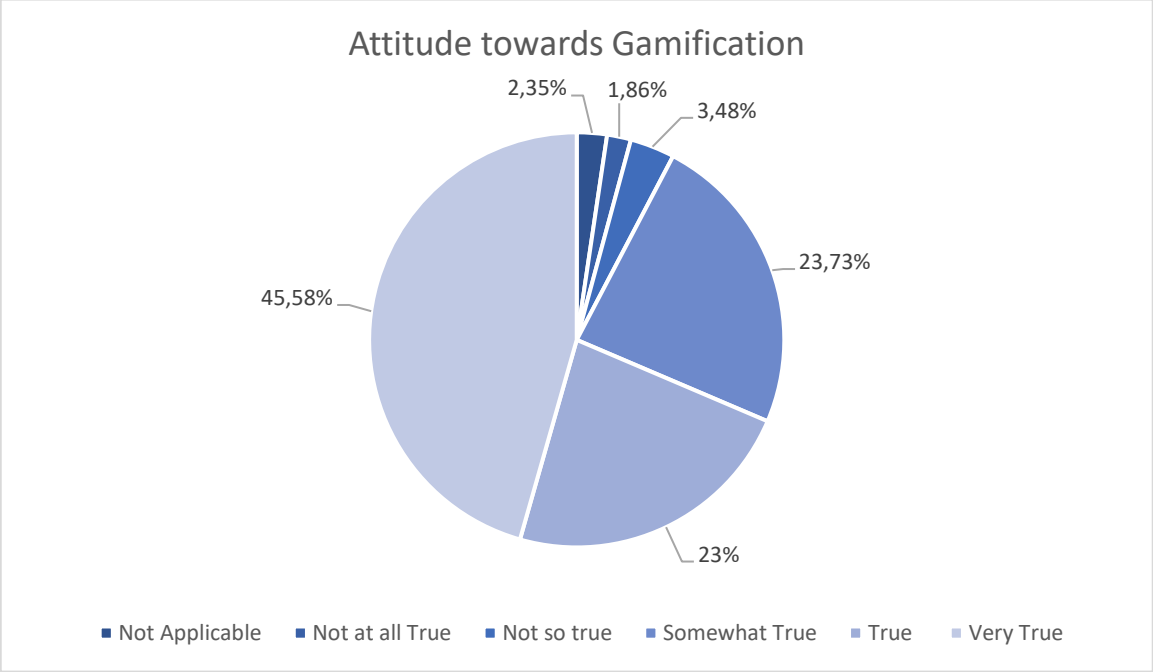

Figure 14: Users' Attitude towards gamification before course

Gamification User Types

Users were asked to state their agreement in 24 questions to find out which gamification user type characterizes them. Many users were characterized by more than one type as they scored equally in them. 53,40% of the users belong to Philanthropists and one third is characterized as Socializer, Achiever, and/or Free Spirit.

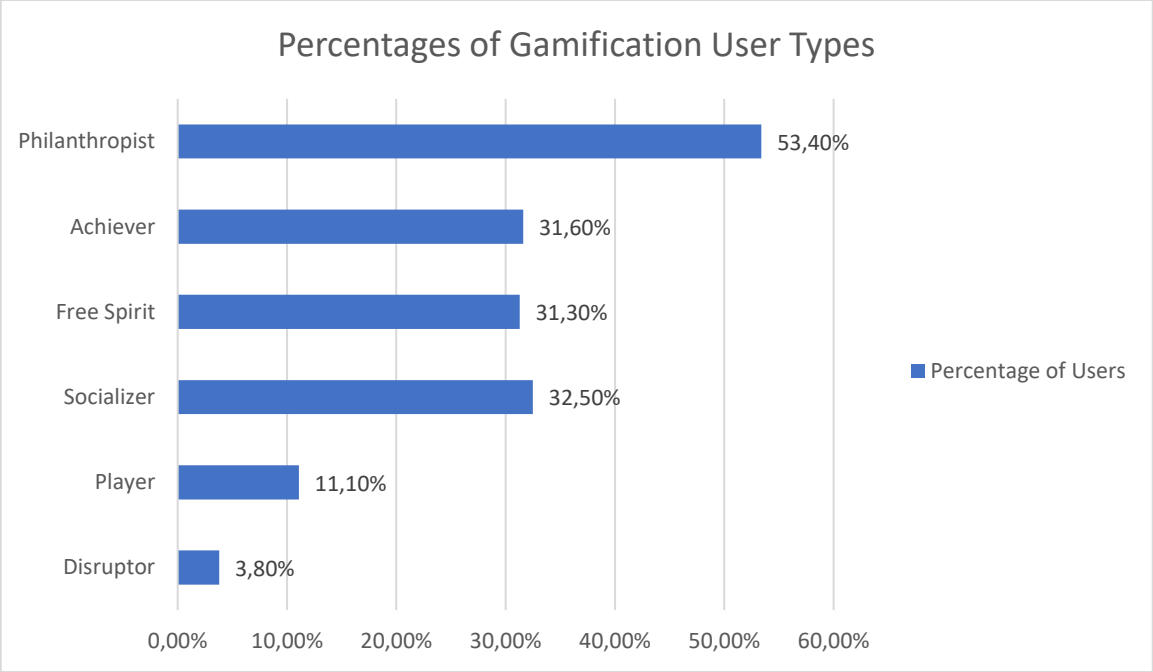

Figure 15: Percentages of gamification user types

Regarding their results, users were grouped in 6 different player types based on their dynamics according to guidelines in **Appendix 7 – Grouping of Player Types**. Philanthropists were the 47,29% of the users, 14,98% consist of Socializers, 14% of Achievers, 13,85% of Free Spirits, Player and/or Disruptor characterized 3,56% while multi types were 6,32% of users.

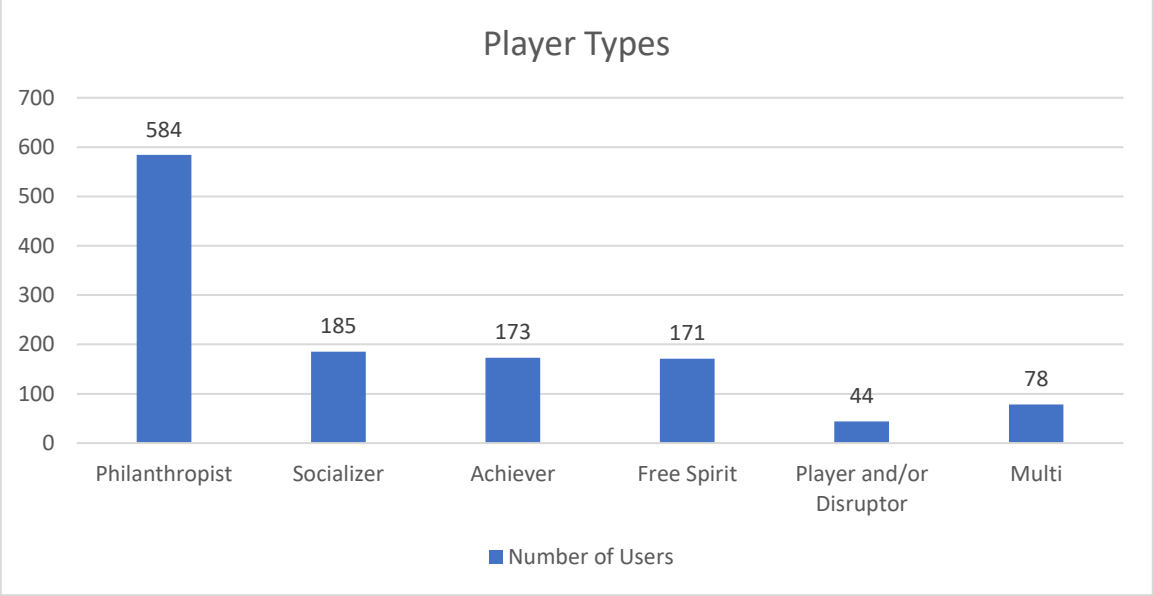

Figure 16: Player Types

The Chi-Square Test revealed that there was a relationship between course completion and player types. Among all player types, a course-participated user is more likely to complete the course if he/she is characterized as Player and/or Disruptor than all of the other types, while a Multi type is less possibly to complete the course compared to all the other types (**Appendix 6.1 - Learners' Profile**).

Intention towards MOOC

Users rated the level of truth that describes 8 different reasons for enrolment. The reason that motivated them most to enroll in MOOC is that it "will extend my current knowledge of the topic" with 85,1% (1051 users) rating it as true or very true. The next most common reason is that "participating in this course is relevant for my personal development" as 944 of users found it true or very true. "I have been advised or ordered to take part in this course" was the less common reason with 902 users describing it as not so true, not at all true or not applicable.

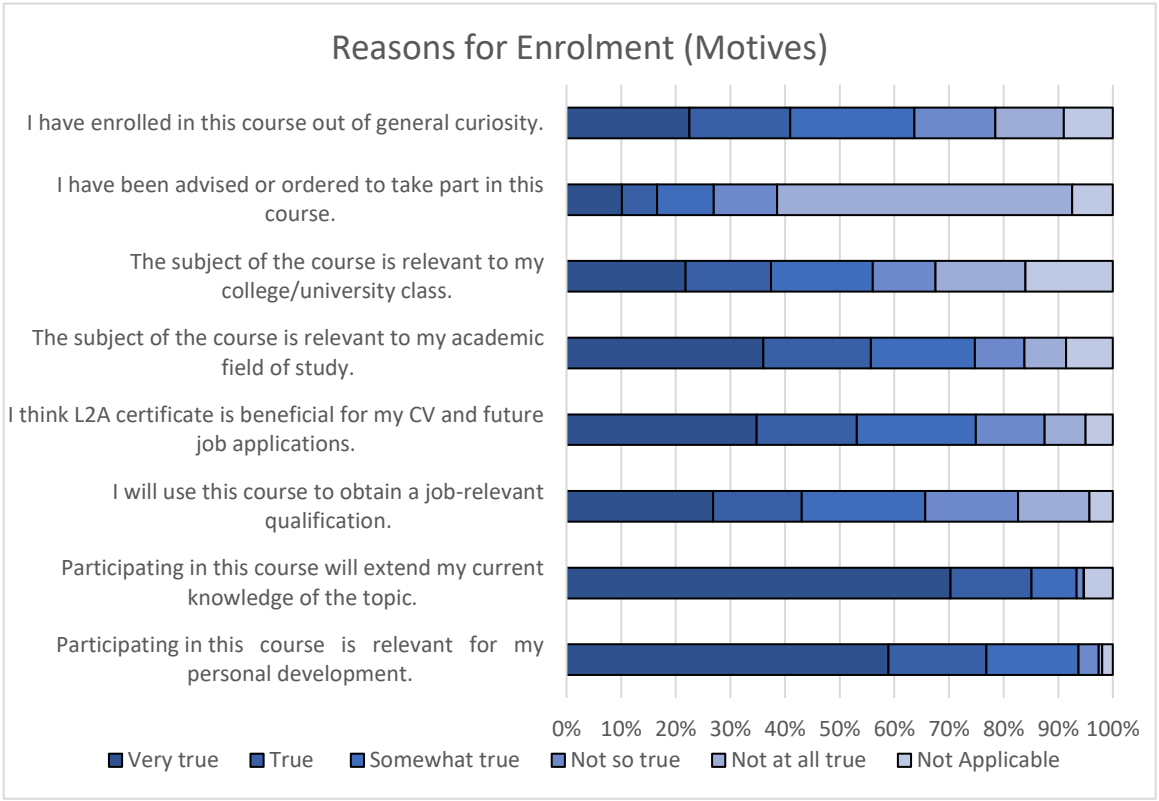

Figure 17: Motives of users

The hours that users planned to spend per week on studying on the course varied. The 39,6% stated that they planned to spend 3-4 hours, 23,6% stated 5-6 hours, 20% less than 3 hours and 16,7% more than 7 hours per week, with mean 4,34 hours and standard deviation 2,14. From the total of users, 71,3% (880 users) intended to complete 81%-100% of the course. UIR mean was 81,74% with standard deviation 14,71 (**Appendix 6.1 – Learners' Profile**).

Table 56: Intention of devoting time

Hours per week	Frequency	Percentage
< 3 hours	247	20,0%
3-4 hours	489	39,6%
5-6 hours	292	23,6%
7-8 hours	130	10,5%
> 8 hours	77	6,2%

Table 57: Users Intention Ratio (UIR)

User Intention Ratio	Frequency	Percentage
0%-20%	8	0,6%
21%-40%	20	1,6%
41%-60%	91	7,4%
61%-80%	236	19,1%
81%-100%	880	71,3%

EDL Initial Competence Level

With the intention to find out users' initial level of the 6 EDL competences, they were asked to self-assess and categorize themselves between 5 levels (1=Novice, 2=Advanced Beginner, 3=Competent, 4=Proficient, 5=Expert). The average initial level of all EDL competences was approximately Advanced Beginner (level 2).

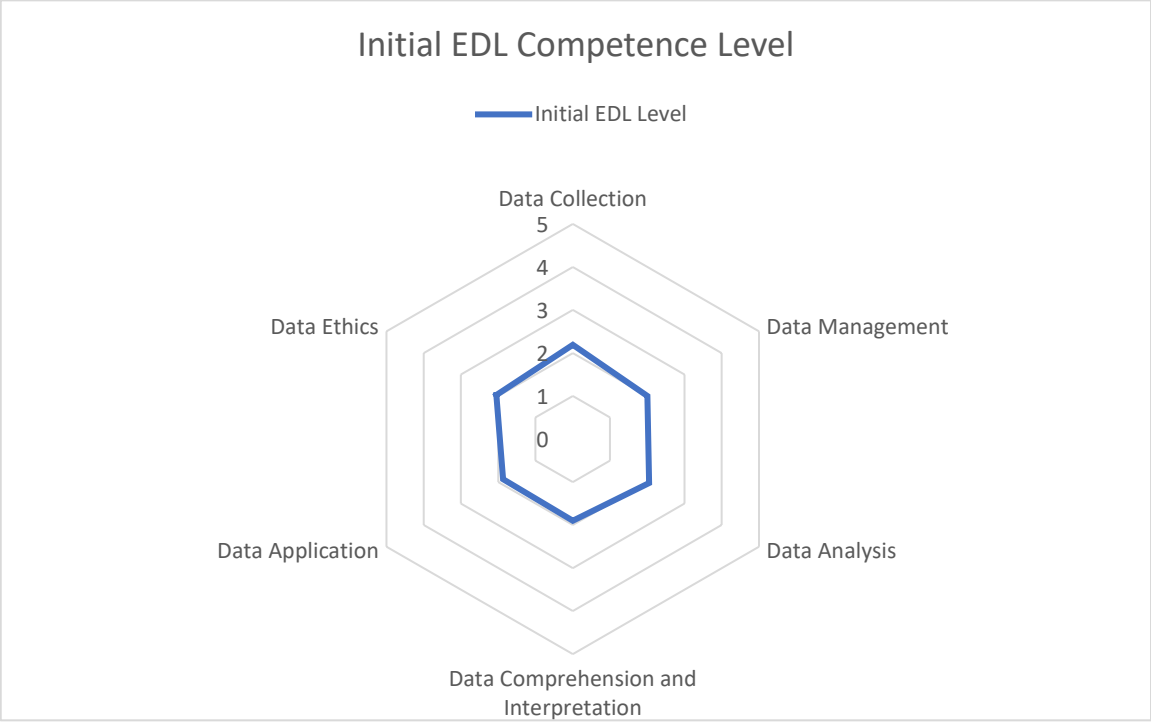

Figure 18: Intitial EDL competence level of course-participated users

5.1.2 Course-Completed Learners' Profile

Sample N = 282

Demographics

The distribution of course-completed users' gender is similar to the total course-participated users, with almost one third stating male (30,9%) while the other two thirds were female (68,9%). Users' age is being distributed slightly different. Groups of 40-49, 50-59 and >60 years old appeared with almost same frequency, percentage of 20-29 was 9 points up, while a reduction was observed to the group of 30-39 years old. The average age was dropped two years (40,92 years old).

Table 58: Course-completed users's age

Age	Frequency	Percentage
20-29	66	23,40%
30-39	42	14,90%
40-49	96	34,04%
50-59	72	25,53%
>60	6	2,13%

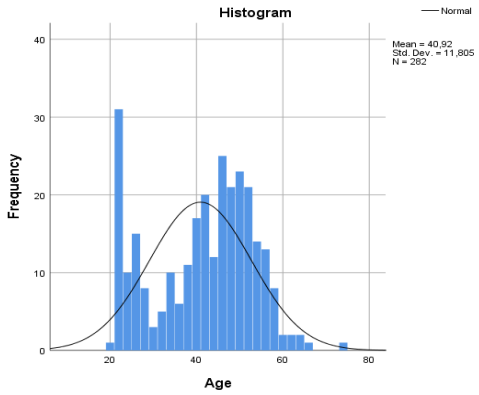

Figure 19: Age distribution of course-completed users

From 67 countries, only 19 presented course-completing users, with Greece and Germany having almost all the contributions.

Table 59: Course-completed users' region (countries)

Country	Frequency	Percentage
Greece	183	64,9%
Germany	67	23,8%
Other	From 1 to 5	11,3%

General Background

The level of education of course-completed users showed the same high level. More than half of them held a Master's Degree (148 users – 52,5%) with one sixth holding a Bachelor's degree (45 users – 16%), 70,5% stated high or almost high English Proficiency level, while a 77,7% was feeling comfort or much comfort with technology Regarding MOOCs, the results seem interesting as one third answered (94 users) that they have never enrolled in one before and 41,8% had never before complete a MOOC, meaning L2A MOOC was the first completed MOOC for 118 users.

Regarding their current job sector, more than half of course-completed users works in K-12 Education (149 users – 52,83%).

Table 60: Job sector of course-completed users

Job Sector	Frequency	Percentage
K-12 Education	149	52,83%
University	63	22,34%
Governmental Education Agency	21	7,45%
Non-Employed	14	4,96%
Other	35	12,42%

In regards to their professional role, School Teachers lead with 175 course-completed users, followed by Higher Education Students with 59 users and 39 e-Learning Professionals (IDs, eTutors).

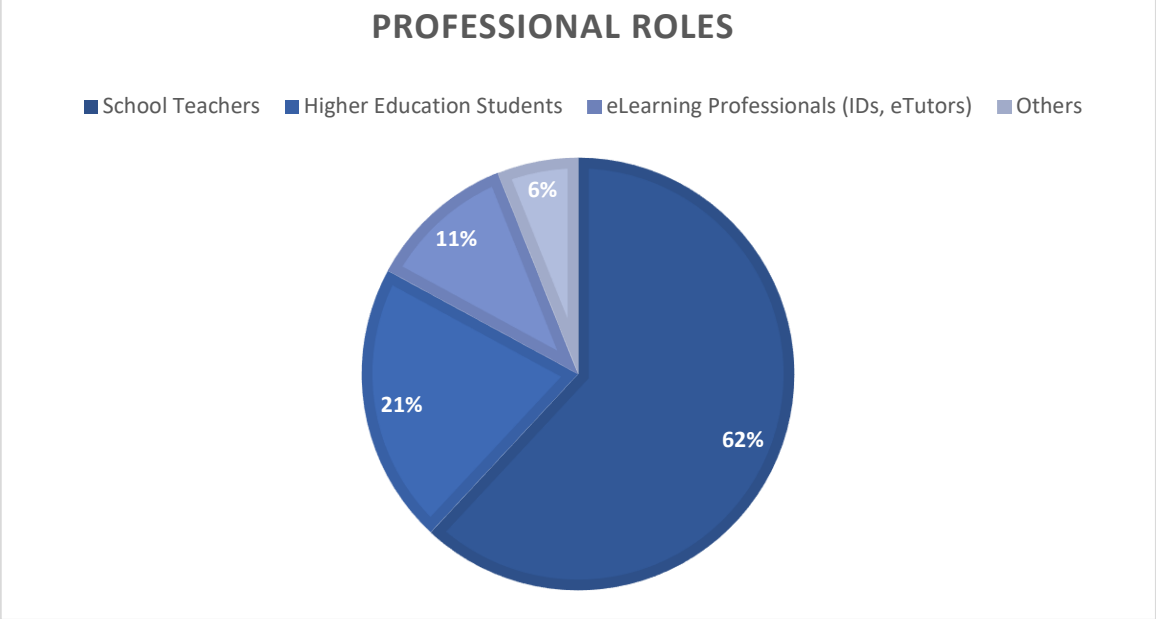

Figure 20: Professional roles of course-completed users' distribution

Previous Experience with Gamification

The analysis of the previous experience with gamification for the users that have completed the MOOC did not indicate a different gamification profile compared to the users that participated in course presented.

Attitude towards Gamification

Again, users that had completed the course are defined with almost the same positive level of attitude towards gamification as 68% found the statement true or very true.

Gamification User Types

Users were asked to state their agreement in 24 questions to find out which gamification user type describes them. Many users were characterized by more than one type as they scored equally in them and grouped in player types' categories (**Appendix 7 - Grouping Player Types**). Again, almost half of them are categorized at least as Philanthropists (**Figure 21**). After grouping, course-completed users were distributed as it is shown in **Figure 22**.

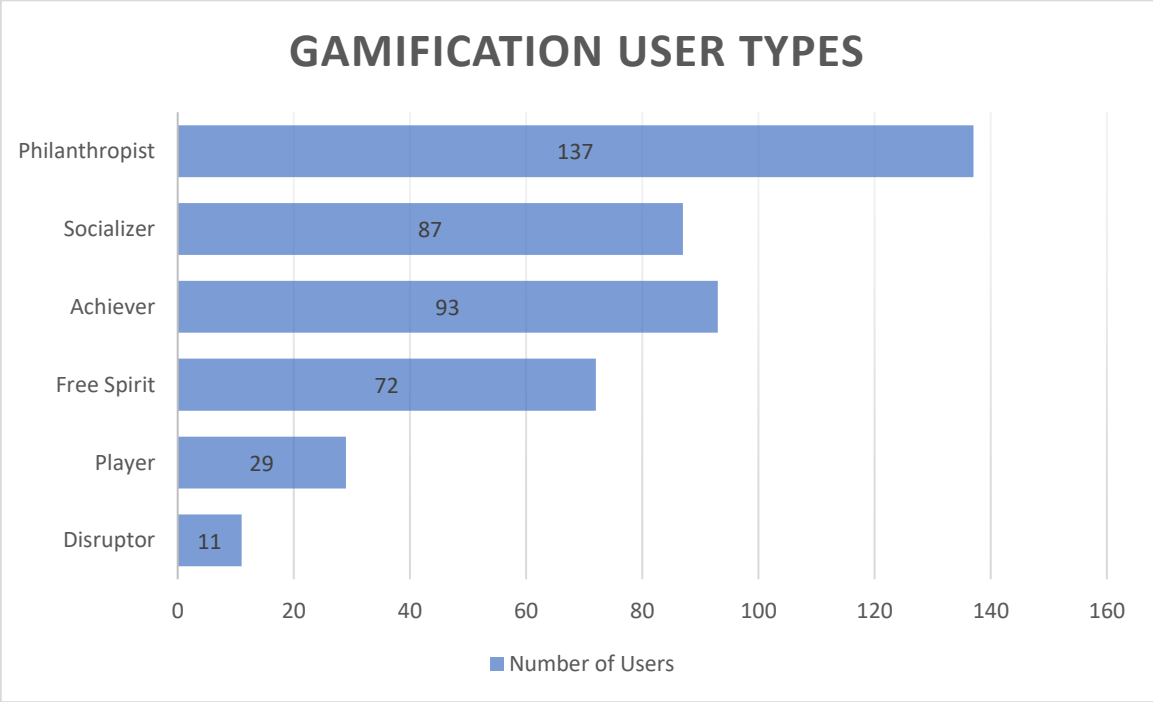

Figure 21: Gamification user types of course-completed users

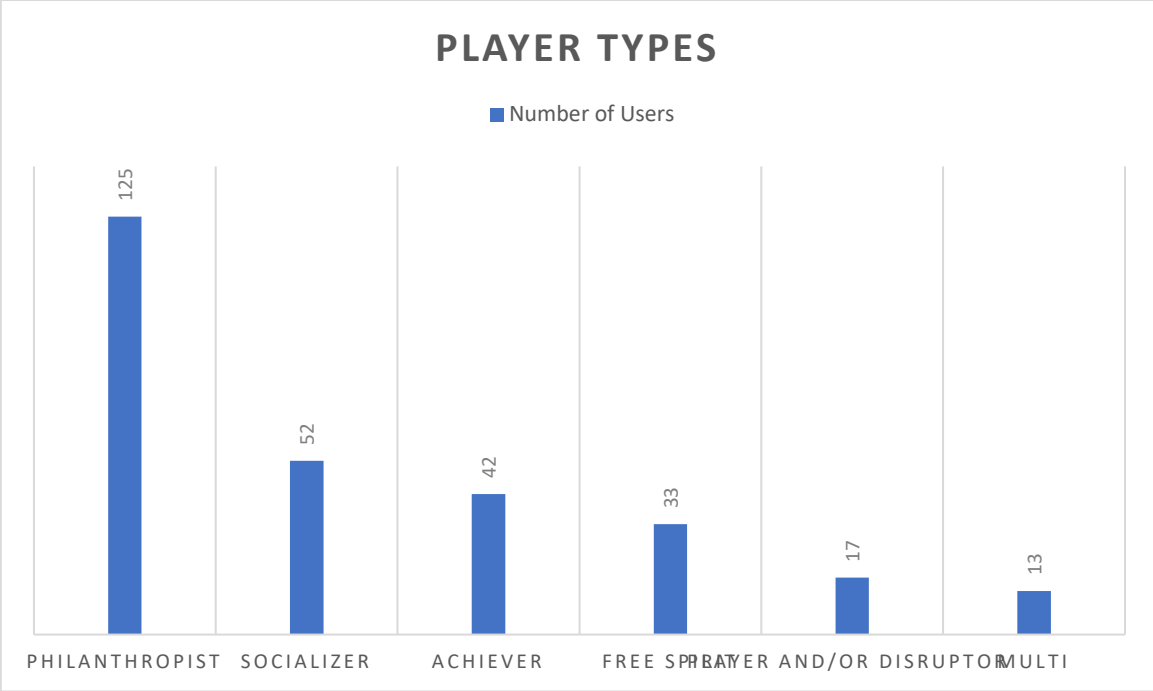

Figure 22: Player types of course-completed users

According to Chi-Square test, a user that had completed the course is more likely to have been characterized as Philanthropist than as any other player type, while it is less likely to be characterized as Multi than as any other category (**Appendix 6.1 - Learners' Profile**).

Intention towards MOOC

Almost all of course-completed users participated in this course because it was relevant for their personal development and/or because it would extend their current knowledge.

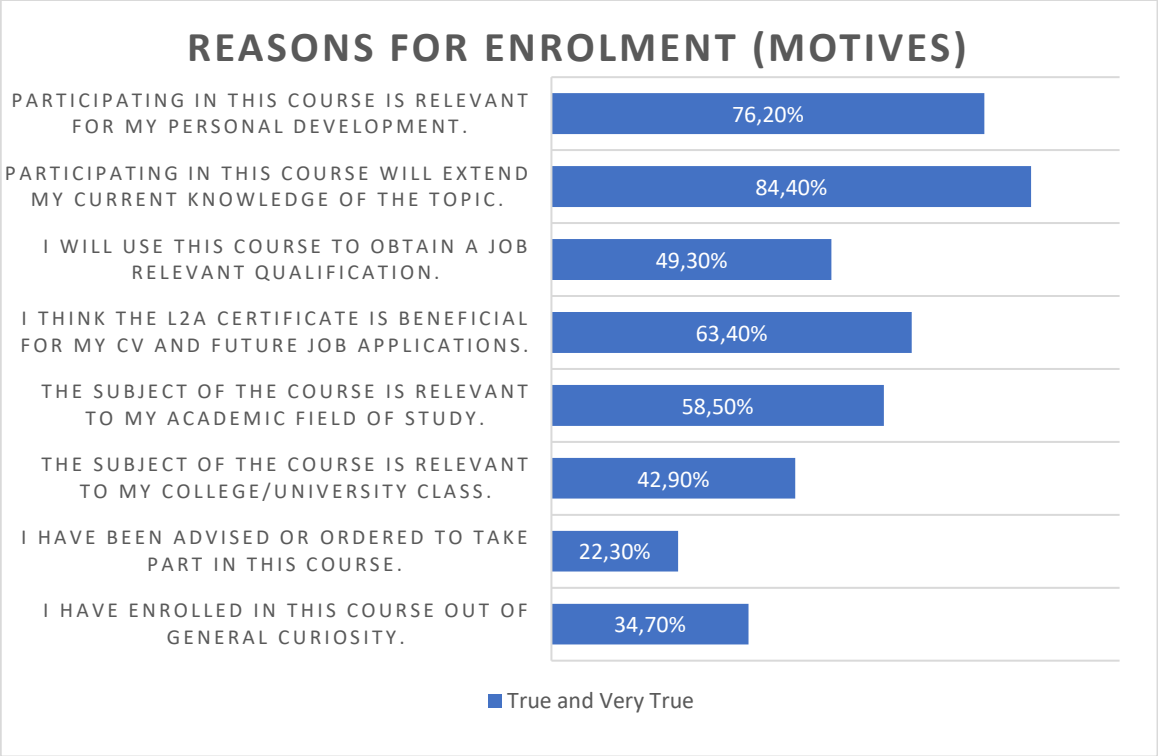

Figure 23: Motives of course-completed users

Most users (189 users – 67%) who completed the MOOC planned to study 3 with 6 hours per week. A positive finding was that one in four users (25,6%) who completed the MOOC did not have such an intention.

Table 61: UIR of course-completed users

User Intention Ratio	Frequency	Percentage
0%-80%	72	25,5%
81%-100%	210	74,5%

EDL Initial Competence Level

The average initial level of all EDL competences for course-completed users shown the same level, approximately Advanced Beginner (level 2).

5.3 Psychological Outcomes

Sample N = 282

5.3.1 Overall Gamification Experience

To find out the overall gamification experience users had during the course, the 282 users were asked to rate their agreement in 31 statements about 11 psychological outcomes with regards to gamification. Enjoyment, accomplishment, satisfaction, autonomy, and usefulness were most rated from users with true and very true. The mean overall gamification experience is measured to 3,77, with 110 users having score from 4 to 5 (in a 5-point scale).

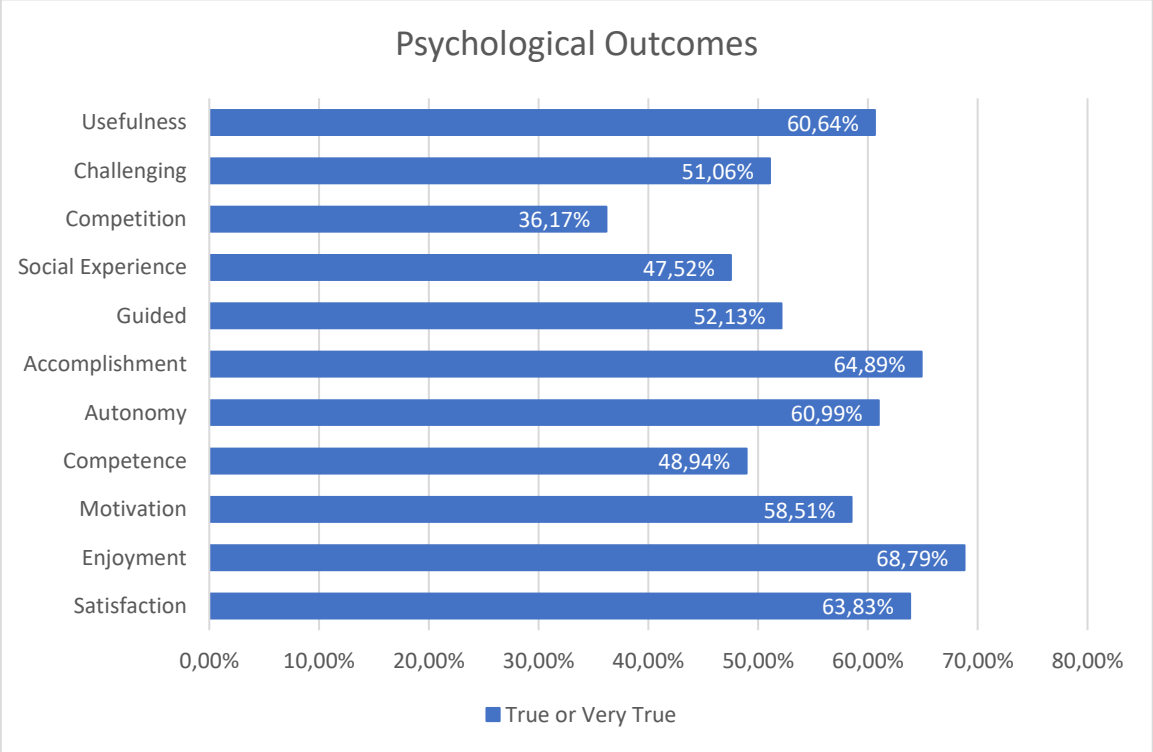

Figure 24: Course-completed users' psychological outcomes of overall gamification experience

Overall gamification experience per general characteristics

After examining the mean differences per general characteristics, it was found that gender, English proficiency, comfortable with technology and number of MOOCs enrollment did not show a significant mean difference between groups.

The one way ANOVA test revealed that School Teachers' mean overall gamification experience was significantly greater than all the others professional roles' means (mean = 3,97). The means difference can be found also between users who never completed a MOOC before with those who have completed more than 10 MOOCs, with the first ones having greater overall gamification experience (mean = 4,24) (**Appendix 6.2 - Psychological Outcomes**).

Overall gamification experience per previous gamification experience

According to Independent Sample T-Test, the mean overall gamification experience does not differ significantly between users that were already familiar with gamification in teaching and learning and those who were not. The same results appeared between users that had experienced gamified learning experiences in the past and those who had no. On the other hand, the mean overall gamification experience seems to differ significantly between users that had used gamification in their educational design before and those who had not, with the first group having a better overall gamification experience (mean = 3,94). The one way ANOVA test showed that the mean of the overall gamification experience did not differ significantly among the users with different number of gamified MOOCs' participations (**Appendix 6.2 - Psychological Outcomes**).

Overall gamification experience per player types

The one way ANOVA test for the difference of overall gamification experience's means between player types did not show any significant difference between them.

Overall gamification experience and attitude towards gamification relationship

After the calculation of Spearman's rho coefficient, among overall gamification experience, attitude towards gamification before and after participating in the MOOC, a strongly positive correlation (0,5<rho=0,650<1) was found between overall gamification experience and the attitude towards gamification after completing the course, meaning that a positive overall gamification experience can affect users' attitude towards gamification positively (**Appendix 6.2 - Psychological Outcomes**).

5.3.2 Gamification Experience per Element

Approximately, half of the users scored from 4 to 5 in a 5-point scale for points, badges, levels, and progress bar's gamification experience, after answering 10 questions per each element. Leaderboard was having the lowest score, with only one third of users scoring 4 or 5.

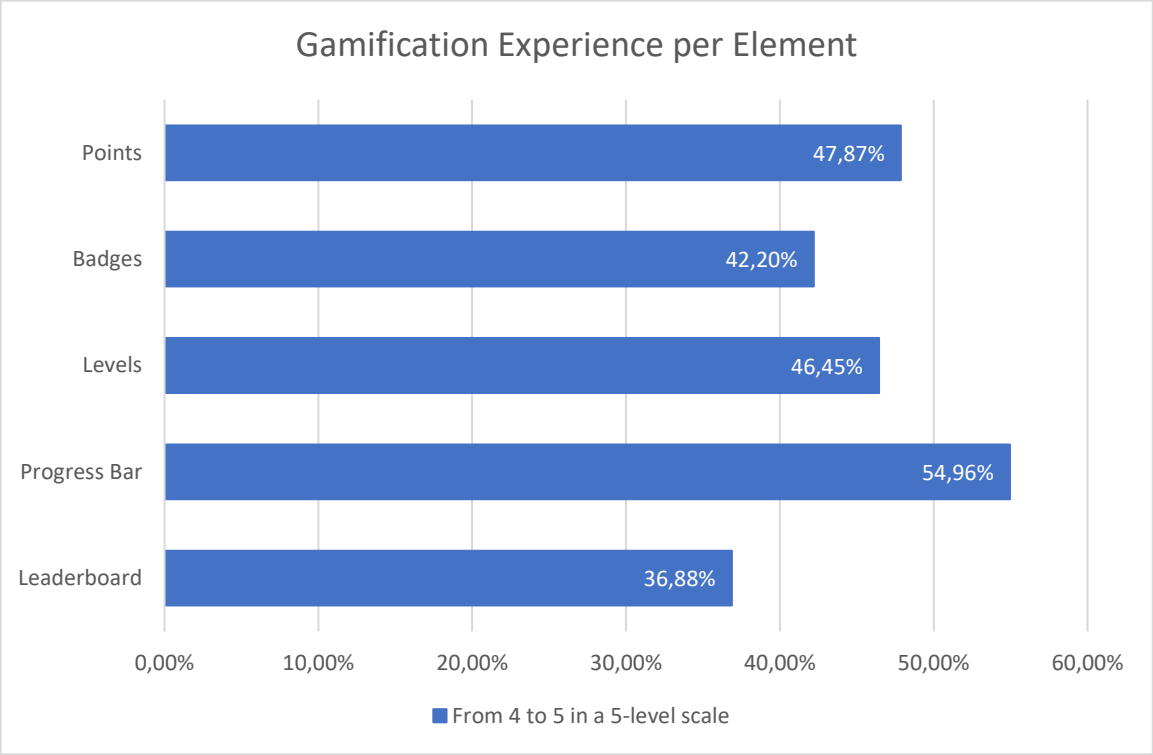

Figure 25: Gamification experience per elements (4 or 5 in a 5-point scale)

Calculating Pearson's correlation of gamification experience among the 5 elements that were used in MOOC showed strongly and very strongly positive correlations, meaning that when a user was having a good and positive experience with one element, they will feel the same and with the other ones. Thus, it can be assumed that the elements were implemented correctly and harmoniously within the MOOC (**Appendix 6.2 - Psychological Outcomes**).

Gamification experience per element per player types

Among the player types, only the gamification experience of Progress Bar showed a significant mean's difference between Philanthropists and Free Spirit (4,01 and 3,38 respectively). All the other groups did not differ significantly in any of gamification experience per element.

Gamification experience per element and overall gamification experience relationship

According to calculation of Pearson's correlation, overall gamification experience was correlating with every element's experience (**Appendix 6.2 - Psychological Outcomes).** A very strongly positive correlation was observed (r=0,881) between Points experience and overall gamification experience (**Figure 26**).

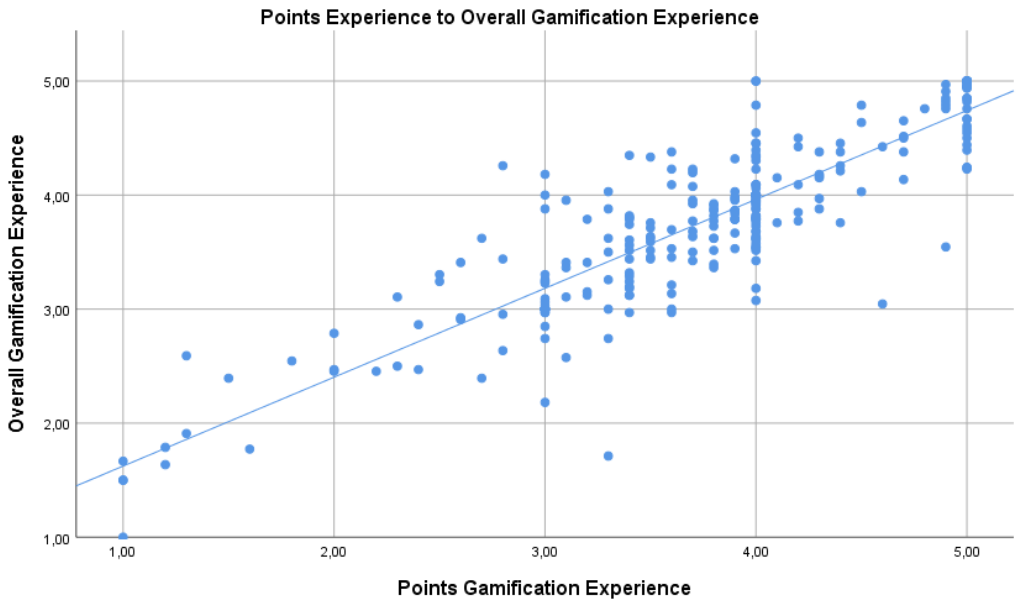

Figure 26: Scatter plot of Points experience to overall gamification experience

Badges and Levels also showed strongly positive correlation with overall gamification experience (r=0,810 and r=0,805 respectively) (**Figure 27 & 28**).

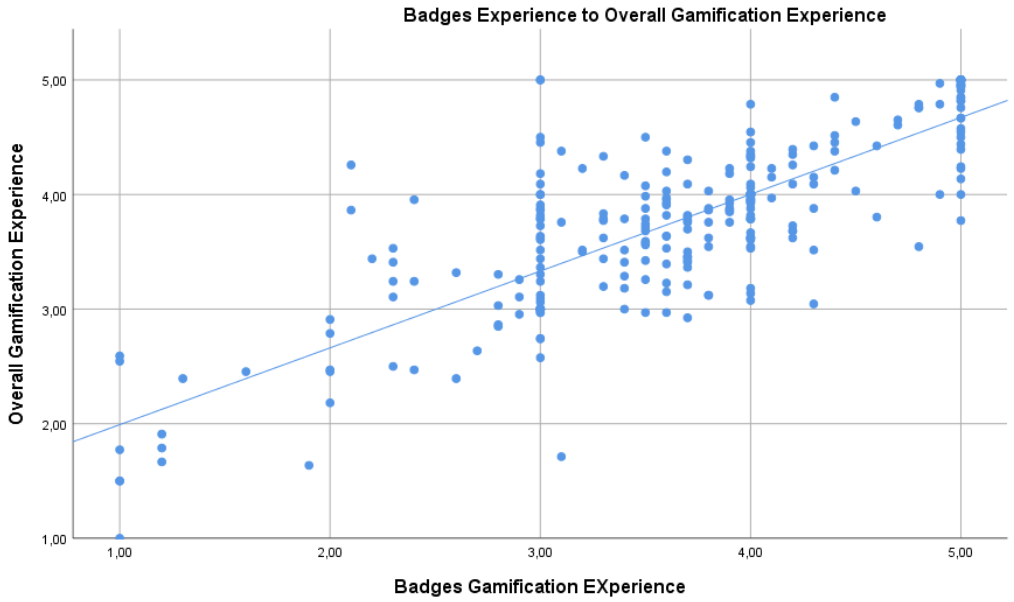

Figure 27: Scatter plot of Badges experience to overall gamification experience

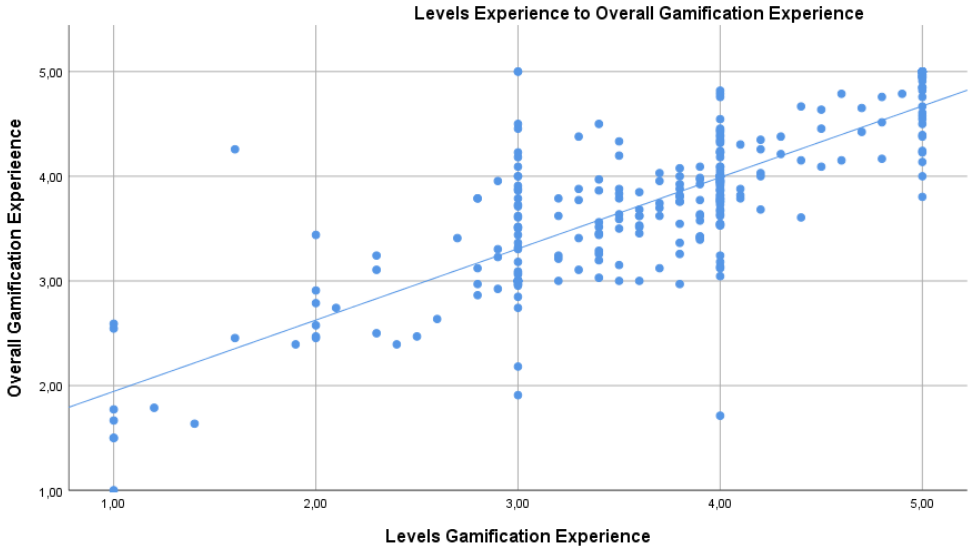

Figure 28: Scatter plot of Levels experience to overall gamification experience

Leaderboard and Progress Bar presented lower but still strong correlation with overall gamification experience (r=0,706 and r=0,655 respectively).

Based on the correlations' results, it is concluded that Points, Badges and Levels affect the users more positively during the course to have a better gamification experience than the other two elements. These findings are in contrast with the fact that Progress Bar scored the most 4-5 (54,96% of users) and it did not seem to affect users the most, regarding to the overall gamification experience.

Figure 29 and **30** show the correlation of the 5 elements with each of overall gamification experience's item in detail. Compared to the other senses of gamification, usefulness seems to affect the experience with elements with the strongest positive way. The sense of competition scored the lowest but still had positive correlation with the elements. With competition generally having a more negative sense, it can be assumed that gamification elements were properly implemented in the instructional design of the MOOC, as users did not feel like competing and discouraging themselves. Among the elements, Points had the strongest positive effect and, out of all senses, usefulness, motivation, satisfaction, accomplishment, guided, social experience and challenging hit the greatest effect. As it was showed previously as well, Progress Bar has the lowest positive correlation. The interesting finding here is that, compared to the other 4 elements, Progress bar hit the lowest score in guided, meaning that other elements helped users more to feel guided during the course. Finally, it is interesting that points helped users feel more competenced in EDL than badges or levels.

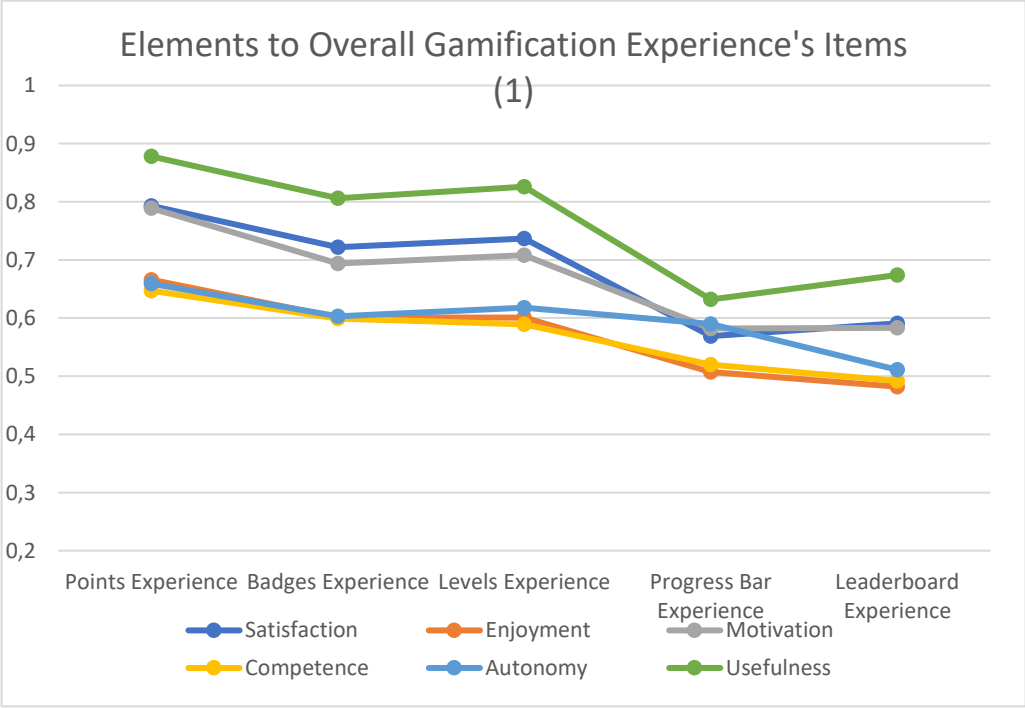

Figure 29: Pearson's correlation r of elements to overal gamification experience's items

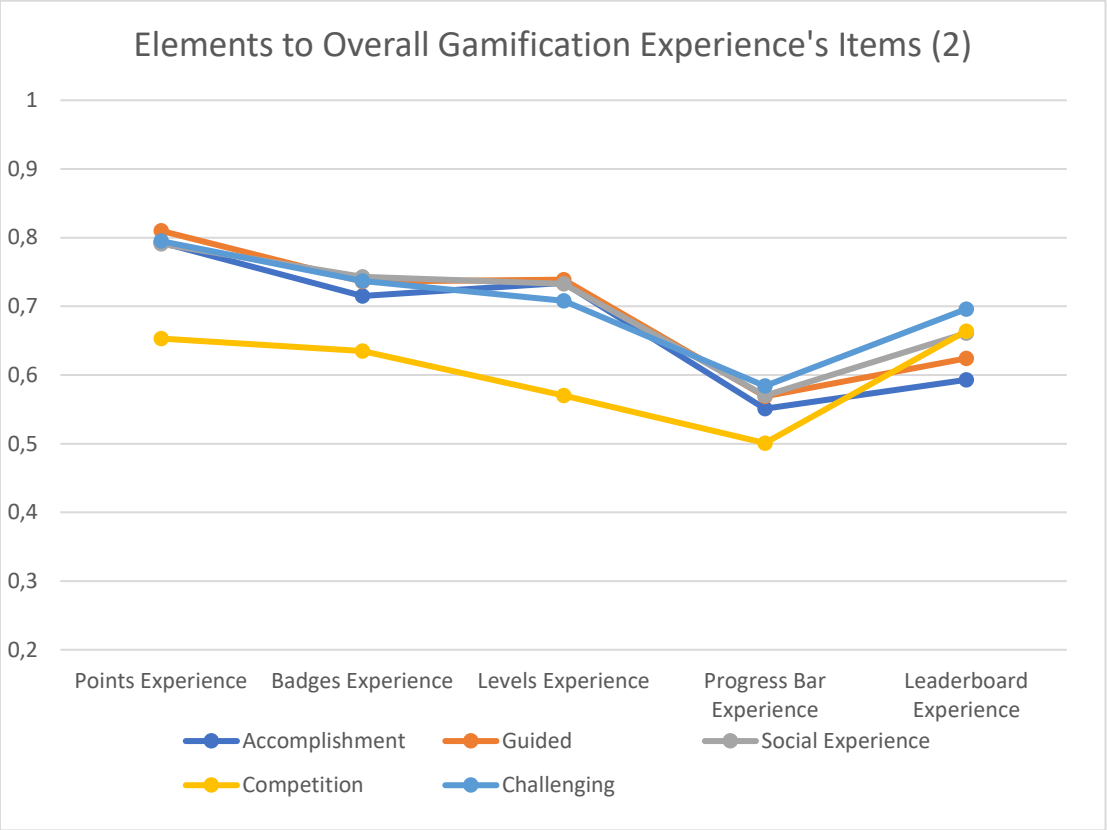

Figure 30: Pearson's correlation r of elements to overall gamification experience's items

Gamification experience per element per previous gamification experience

The results were similar with the calculation of overall gamification experience mean differences between the different previous gamification experience. For all the 5 elements, there was not observed any significant difference of gamification experience per element either between users that were familiar with the and those who were not, nor between users with experience in gamified learning in the past and without this experience. Respectively, the mean gamification experience per element did not differ significantly between users with different number of participations in gamified MOOCs. However, 4 of the 5 elements, Points, Badges, Levels and Progress Bar, presented a significant difference between means of users that had used gamification in their educational design and those who did not. Those who had used it showed greater gamification experience regarding those elements.

Gamification experience per element and attitude towards gamification relationship

The calculation of Spearman's rho correlation coefficient showed a strong positive correlation between the attitude towards gamification after completing the course and Points, Badges and Levels. Progress Bar and Leaderboard only moderately affect the attitude towards gamification after completing the course. The attitude towards gamification before users taking part in the course does not seem to be related to the elements' gamification experience, leading to the same conclusion with the overall gamification experience correlation that the initial attitude towards gamification does not affect the gamification experience users had during the course (**Appendix 6.2 - Psychological Outcomes**).

5.4 Behavioral Outcomes

Sample N=282

With the purpose of implementation of proposed gamification's evaluation framework into the existing evaluation framework of L2A MOOC, Continued Use Intention equated with Continuance Intention [INT], Perceived Use with module average hours per week [LXM12] and module average posts in discussion forum [LXM13], while Platform Experience was split to Learning Experience [LX] and Platform Ease of Use [PEoU].

5.4.1 Learning Experience and Platform Ease of Use (Platform Experience)

Learning Experience

In regards to different player types, there was not a significant difference of learning experience between them. According to Spearman's correlation, there was a moderate positive correlation between the learning experience users had and their attitude towards gamification after the course's completion. With the average learning experience's score being 3,62 in 5-points scale, it leads to the conclusion that users had a good learning experience which affected them in a way to have a good attitude towards gamification after the completion of the course. At the same time, the overall gamification experience affects the learning experience of users in a strongly positive way. The average overall gamification experience's score 3,77 in a 5-point scale indicates that the positive

gamification experience enhanced strongly the learning experience of users. As for the 5 elements, all of them presented a moderate to strong positive effect on learning experience (**Appendix 6.3 - Behavioral Outcomes**). **Figure 31** shows the scores of Pearson's correlations.

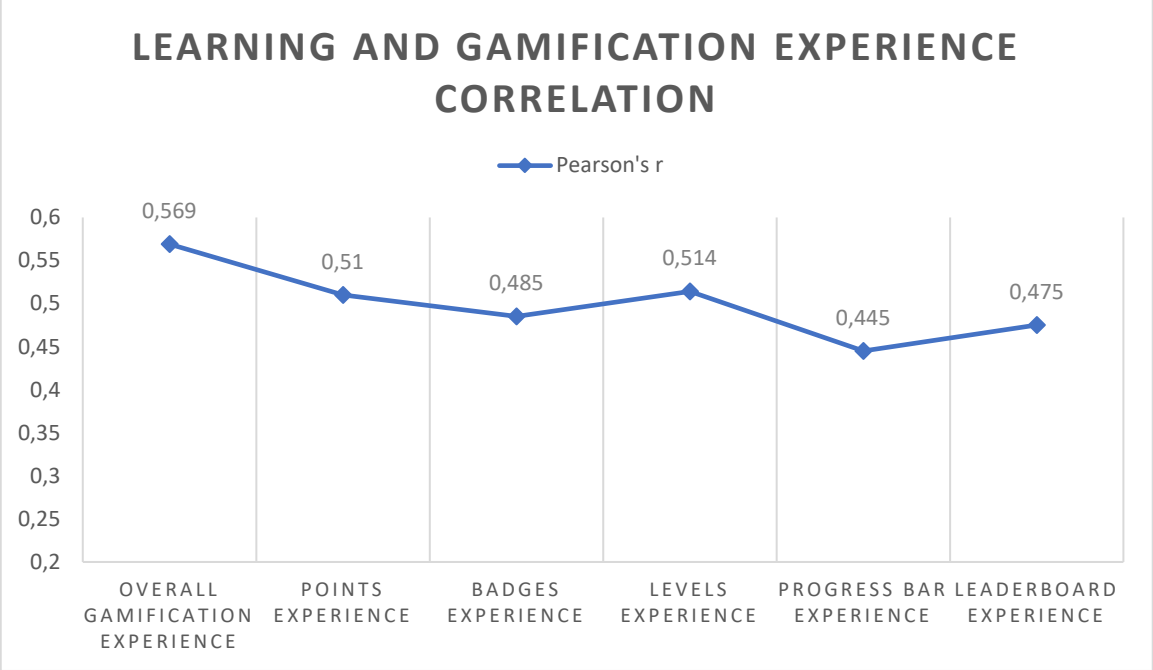

Figure 31: Pearson's correlation r of Learning, overall and per element gamification experience

Platform Ease of Use

The one way ANOVA test showed no significantly different platform ease of use among the different player types. Platform ease of use and attitude towards gamification after the completion of the course presented a positively strong correlation between them. In addition with the average score of platform ease of use at 4,01 in a 5-point scale, the findings indicated that the platform experience was so positive that enhanced users' attitude towards gamification. Similar to learning experience, it was showed that users' positive experience with platform affected strongly and positively the overall gamification experience along with Points, Levels and Progress Bar experience. Badges and Leaderboard experience seemed to be less affected, yet still positively (**Appendix 6.3 - Behavioral Outcomes**).

5.4.2 Continued Use Intention

Comparing the means of continued use intention between player types did not indicate a significant difference between them. Nevertheless, the comparing of continued use intention's means between the different previous gamification experience groups presented 2 cases with significant different means. Users who were familiar with gamification had greater intention to revisit or recommend the course than users who were not familiar. Similar, users who used gamification in their instructional design presented significantly greater continued use intention than those who did not use it. The intention of users to revisit or recommend the course was moderately affected by element's gamification experience, but positively strongly by the overall gamification experience (**Appendix 6.3 - Behavioral Outcomes**).

5.4.3 Perceived Use

Perceived use considered to be the self-reported number of comments in forums and number of hours spending in course per week. Both comments and hours presented significantly different means between users who had used gamification in their educational design and those that had not, with the first group presenting greater perceived use. Pearson's correlation test showed a low positive correlation with overall gamification experience but not with gamification experience per element (**Appendix 6.3 - Behavioral Outcomes**).

5.4.4 Engagement

To measure the engagement of users, total number of Badges and Points along with the average Module Level Experience Tracks are used, as engagement considers to be the actual use, participation, or performance of users. **Figure 32** shows how many course-completed users have earned Badges per Module.

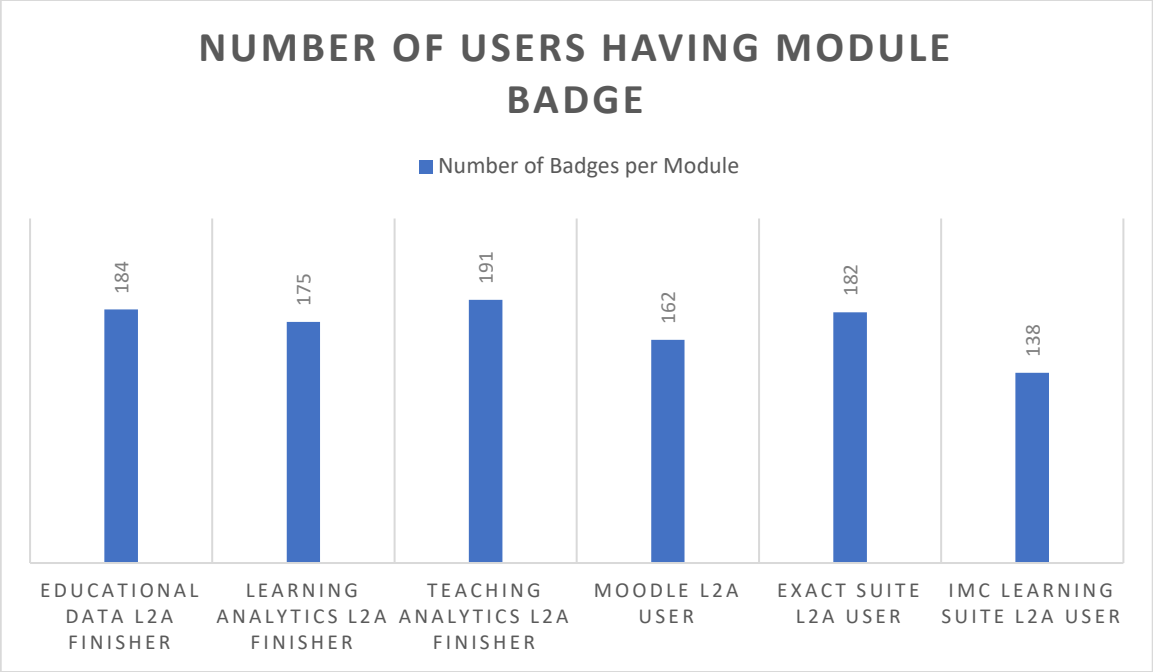

Figure 32: Total number of users per Module Badges

Figure 33 shows how many module badges had been collected by the course-completed users. More than half users have earned 5 or 6 Module Badges while a quarter did not get any, even though they had successfully completed the course. The mean number of Badges per user is at 3,66.

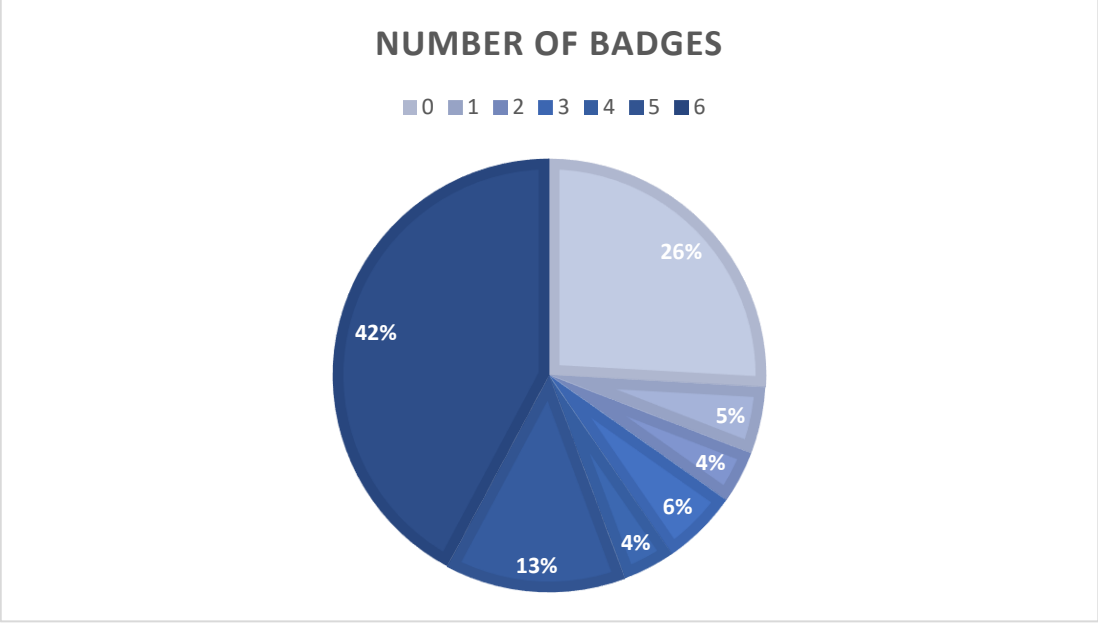

Figure 33: Number of total Module Badges of users

As it is presented in **Figure 34**, the majority of course-completed users had reached level 5 of Engagement and Content. In Test Level, almost half of them reached level 5. It is interesting that one of five users stayed at level 0 or 1 to all categories, indicating that although they wanted to complete the course and get the certificate, they only did the necessary things without trying to earn the gamification rewards.

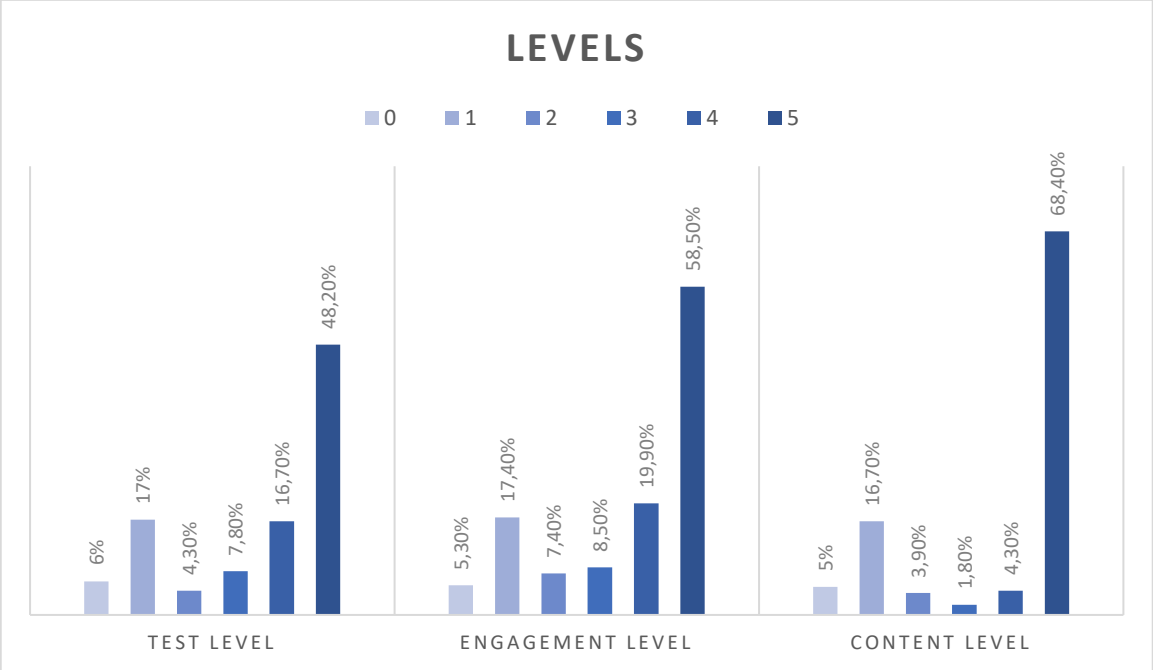

Figure 34: Levels of Test, Engagement and Content tracks

As Points, Badges and Levels are directly connected, with the last two being based on the first one, only Points were examined as engagement.

The correlation's calculation of number of Points with overall gamification experience and attitude towards gamification did not confirm such a relationship. Also, the number of Points and gamification experience per element seemed to be almost unrelated. Although a correlation would be expected, its absence may be due to fact that gamification experience was self-reported while number of Points indicated the actual use. Additional, positive feelings from gamification do not necessarily mean that user would aim for gamification rewards.

Examining the means' differences of number of Points between previous gamification experience group found two significant differences. First, users familiar with gamification

before participating in MOOC had earned significantly more Points during the course than the users who stated no familiarity. Second, users' Points with implemented gamification in their educational design were significantly more than those who had not used it before (**Appendix 6.3 - Behavioral Outcomes).** The same mean's difference examination between player types presented no significant differences.

5.5 EDL Competence Level Advancement

Users self-reported their initial and achieved EDL competence level. The initial EDL level was approximately at level 2 (Advanced Beginner) while the achieved at level 3 (Competent). **Figure 35** shows both initial and achieved level for each of 6 EDL competences.

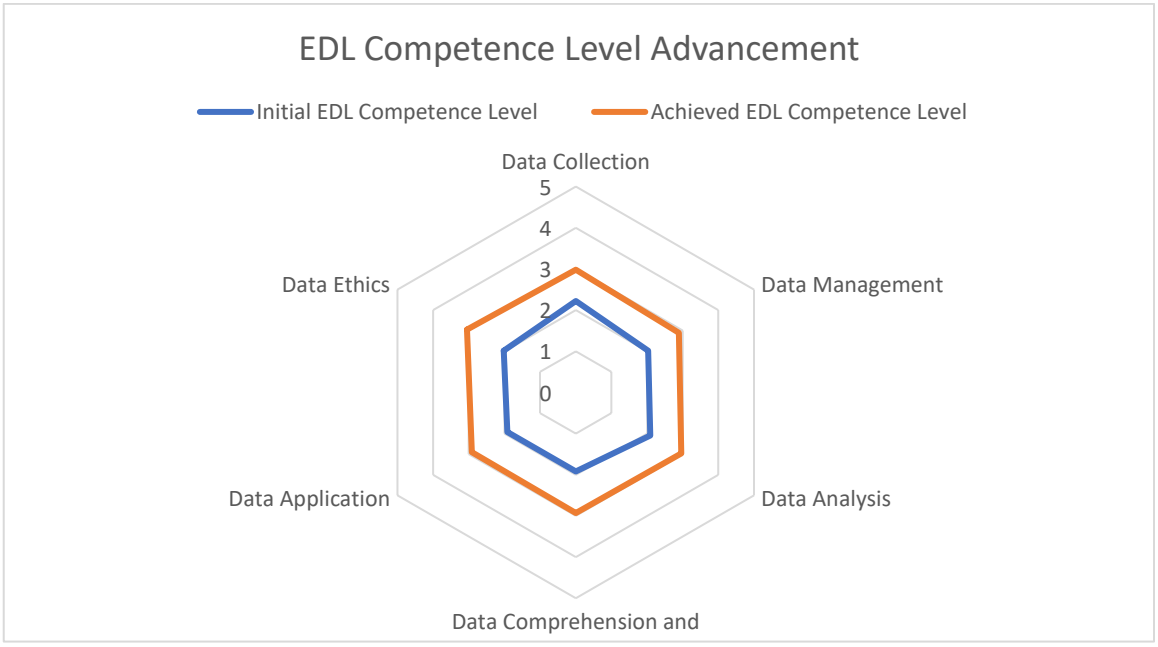

Figure 35: EDL competence level advancement

Between the 4 professional roles in which users were grouped, high education students showed a significantly lower achieved EDL competence level from the other 4 groups. As for the EDL advancement level, school teacher and high education students presented significant different means with school teachers having greater EDL advancement (**Appendix 6.4 -EDL Competence Level Advancement**).

The calculation of correlation showed a low positive one between overall gamification experience and achieved EDL competence level (r=0,278). There was not a significant correlation with EDL competence level advancement due to the fact intial EDL level was almost unrealted with overall gamification experience. Analyzing the correlation with each item of overall gamifiction experience further, a weak relationship was found with the sense of competence that gamification gave to users (r=0,380), leading to the conclusion that the gamification elements being directly connected with EDL competences helped users in a way to self-assess their level (**Appendix 6.4 - EDL Competence Level Advancement**).

Figure 36 shows the relationship between the two corralated variables.

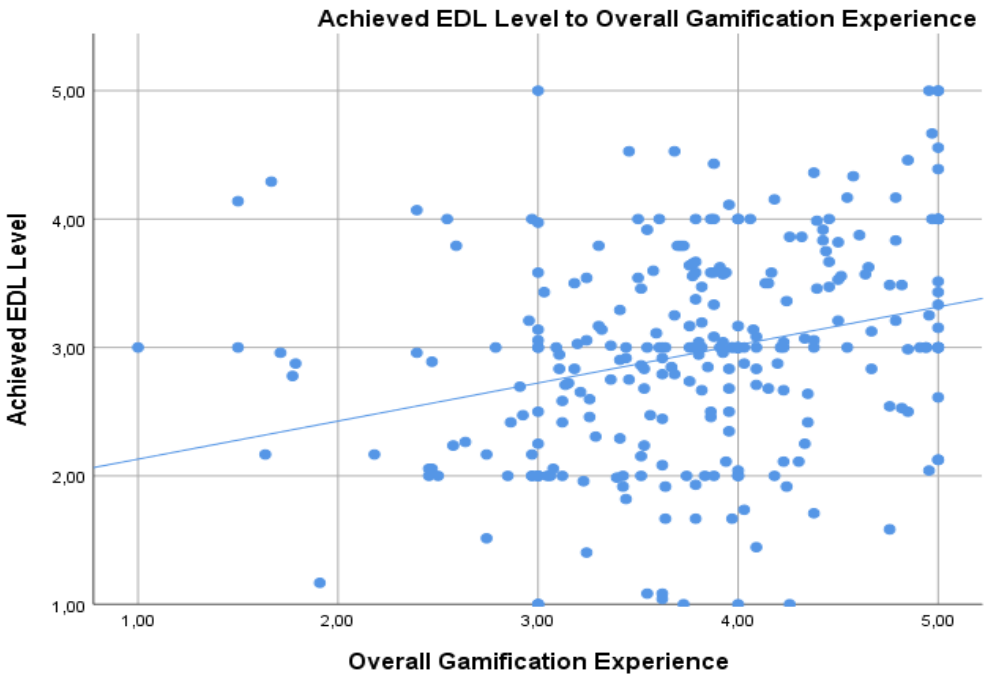

Figure 36: Scatter plot of achieved EDL level to overall gamification experience

Achieved EDL Level seemed to have a low, but still worth mentioning, positive relationship with learning experience and platform ease of use. It is interesting that EDL competence level advancement did not present either a significant relationship with learning experience, a platform ease of use nor overall gamification experience.

5.6 Personal Goal Achievement

Overall Goal Achievement Ratio

Sample N=1235

The calculation of Personal Goal Achievement Ratio (PGA) and Overall Goal Achievement Ratio (OGAR) of MOOC is based on the progress' percentage all participants had based on the completion of Modules #2-#7's content according to IMC's MOOC Platform data (not the completion of the course). From the 1235 users that submitted pre-course survey and considered to have participated in the course, 17,2% reached or exceeded their personal completion intention of MOOC, with OGAR regarding the course's content being at 0,438.

Figure 37 shows the distribution of participants' PGA.

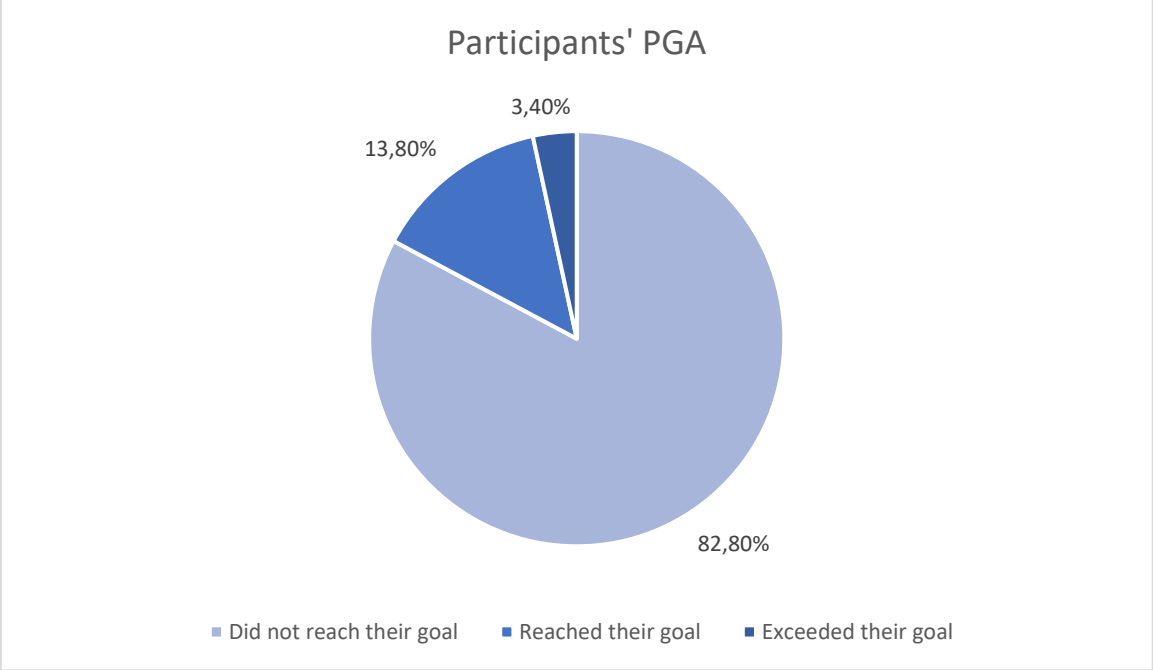

Figure 37: PGA of course-completed users

Course-Completed User's PGA

Sample N=282

Although the total of 282 users who answered the post-course survey considered to have completed the course, the Personal Completion Rate (PCR), which is used for the calculation of PGA, is based on the content's progress and completion, as was mentioned above. Thus, the PGA is for course-completed user was calculated separately and showed 69,10% (195 users) reached or exceeded their personal goal. From the 282 users, 40 of them (14,20%) completed the course, regarding the content, even though they had not such intention. **Figure 38** shows the distribution of course-completed users' PGA. The OGAR regarding the content of the course is 0,898.

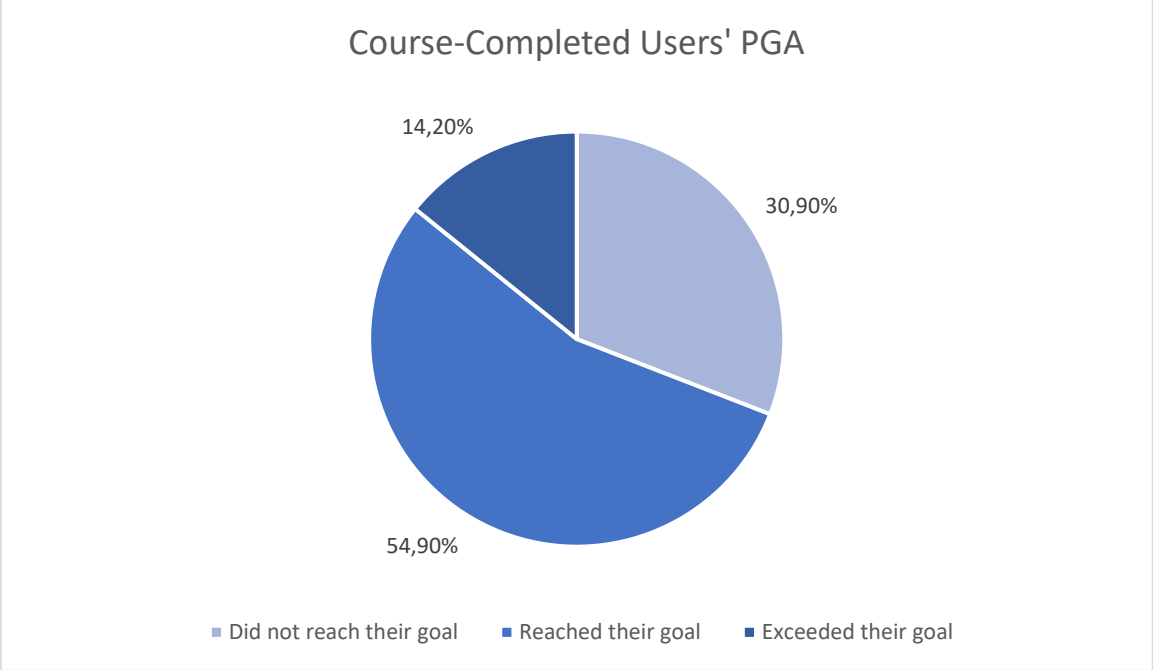

Figure 38: PGA of course-completed users

Personal Goal Achievement relationship

PGA proved to be almost unrelated either with the overall and per element gamification experience, achieved EDL level, EDL advancement level, learning experience, or platform ease of use (**Appendix 6.5 - Personal Goal Achievement**).

5.7 L2A MOOC vs L2A MOOC 2021

The different samples between L2A MOOC and L2A MOOC 2021 did not allow an extended statistical data analysis. Therefore, only descriptive statistics are referred. The following tables present L2A MOOC and L2A MOOC 2021 comparison.

Table 62: Users and Completion Rate

	Enrolled Users	Users of Pre-Course Survey (Participated Course	Users of Post-Course Survey (Completed Course)	**Course Completion Rate**
L2A MOOC	1920	1147	235	**20,45%**
L2A MOOC 2021	2188	1235	282	**22,83%**

Table 63: Demographics

	Male	Female	Average Age	Top 3 Countries	
L2A MOOC	41,67%	55,72%	40,68	Greece Germany Italy	49,9% 19,2% 9,6%
L2A MOOC 2021	32,6%	65,9%	42,80	Greece Germany Italy	59,8% 13,3% 7,3%

**Demographics for L2A MOOC 2021 were calculated from 1235 users.*

Table 64: General Background (1)

	Education Level		Professional Role	
L2A MOOC	Master's Degree	52,30%	School Teachers	36,53%
	Bachelor's Degree	16,70%	eLearning Professionals	29,38%
L2A MOOC 2021	Master's Degree	56,30%	School Teachers	55,8%
	Bachelor's Degree	18,70%	eLearning Professionals	23%

**General Background for L2A MOOC 2021 was calculated from 1235 users.*

Table 65: General Background (2)

	English Proficiency (high or almost high)	Comfort with Technology (true or very true)	Never Enrolled in a MOOC before	Never Complete a MOOC before
L2A MOOC	69%	84,13%	30,60%	41,85%
L2A MOOC 2021	70%	80,40%	29,70%	38,50%

**General Background for L2A MOOC 2021 was calculated from 1235 users.*

Table 66: Motives

	"Participating in this course will extend my current knowledge of the topic" True or Very True	"Participating in this course is relevant for my personal development" True or Very True
L2A MOOC	85,15%	76,63%
L2A MOOC 2021	85,10%	76,44%

**Motives for L2A MOOC 2021 were calculated from 1235 users.*

Table 67: EDL Competence Level

	Initial EDL Level	Achieved EDL Level	**EDL Advancement Level**
L2A MOOC	2=Advanced Beginner	3=Competent	**1-level up**
L2A MOOC 2021	2=Advanced Beginner	3=Competent	**1-level up**

**EDL Competence Level for L2A MOOC 2021 was calculated from 1235 users.*

Chapter 6 – Discussion

6.1 Findings

6.1.1 L2A MOOC 2021' Overall Success

The L2A MOOC 2021 opened on March 1st, 2021, and closed for the public on June 6th, 2021, with a total of 2188 enrollments, 1249 participations and 282 course-completed users. The completion rate was calculated at 22,83%. Additionally, of the 1235 users that were used in data analysis, 25,5% (72 users) completed the MOOC even though they had not such intention. From the course-completed users, 41,80% stated that they had never completed a MOOC before, meaning L2A MOOC 2021 was the first completed MOOC for 118 users.

In regards to the content of the course, the OGAR was at 0,438 for the participants, of whom 17,2% reached or exceeded their personal completion intention of the MOOC (171 and 42 users respectively). For the course-completed users, OGAR was calculated at 0,898, with a 69,10% of them having reached or exceeded their personal goal and 40 of the 282 users (14,20%) having completed the content of the course even though they had not such intention.

The EDL competence level advancement was calculated at one-level up, with the initial EDL competence level of users being at Advanced Beginner (level 2) while the achieved level at Competent (level 3).

6.1.2 Psychological and Behavioral Outcomes

The positive overall gamification experience strongly enhanced the attitude towards gamification of users after the completion of the L2A MOOC. The gamified elements seemed to be integrated correctly and harmoniously within the course, as the users rated their experience with high score and there was a strong correlation between them. All the elements affected strongly and positively the overall gamification experience, with Points, Badges and Levels having the greater effect in it. The triptych PBL also had the strongest effect in the attitude towards gamification after the course's completion. Even though Progress Bar was rated with the most 4-5 in a 5-point scale, users' overall gamification experience was less affected in comparison with the other elements. In addition, Progress Bar did not make users feel as guided as the other elements. From the

total senses of which overall gamification experience was constructed, the sense of usefulness played a major role in the gamification experience per element. With the sense of competition having the least effect, gamification elements seemed to be properly implemented not to cause too much competition between users to make them feel uncomfortable. The initial attitude towards gamification did not affect the final results meaning that users were opened to gamification experience.

Users had positive behavioral outcomes regarding the content and the structure of the MOOC. Both users' learning experience and continued use intention were directly affected by overall gamification experience in a positive way and moderately by the experience of the 5 elements. At the same time, the platform ease of use had strong and positive relationship with overall gamification experience along with the experiences of Points, Levels and Progress Bar, while Badges and Leaderboard affected less but positively. The attitude towards gamification was moderately affected, while perceived use showed only a low positive relationship with overall gamification experience.

In respect of earned Points, engagement did not seem to be affected or affect any psychological and behavioral outcome. Even though a correlation would be expected, its absence may be explained since the number of Points indicated the actual use while all the other outcomes were self-reported by the users. Moreover, gamification's positive experience and feelings do not necessarily mean that the user would aim for gamification rewards. According to Test, Engagement and Content Level, 21,7% to 23% stayed at level 0 or 1, indicated that, although they wanted to complete the course, they did only the necessary things without trying to earn gamification rewards. Similar results were shown with Badges, which presented 3,66 mean number per user, while 26% earned none of the Module Badges.

Personal Goal Achievement Ratio did not show almost any relationship with the overall and per element gamification experience, achieved EDL level, EDL advancement level, learning experience, or platform ease of use.

Although EDL competence level advancement did not show to be related with anything, the achieved EDL competence level was slightly affected by learning experience, platform ease of use, overall gamification experience and more by the sense of competence gamification elements gave to users. This relationship leads to the conclusion that the gamification elements being directly connected with EDL competences helped users to self-assess their level in a way.

6.1.3 Learners' profile Differences

According to the analysis of learners' gamified profile, users were characterized by at least one of six gamification user types, with the majority being described at least as Philanthropists. Based on their result, they were grouped in six different player types (Philanthropist, Socializer, Achiever, Free Spirit, Player and/or Disruptor, Multi). A course participated user would be more likely to complete the course if he/she was characterized as Player and/or Disruptor than all the other types, while a course-completed user was more likely to be characterized as a Philanthropist than any other player type. Multi player type was the least probable to both cases. The only difference that was shown was between Philanthropists and Free Spirits' Progress Bar experience.

As for the previous gamification experience, users who were familiar with gamification before the course had greater intention to visit or recommend the MOOC and earned significantly more Points than those who did not use it. Two other groups that showed significant differences were users that had and had not used gamification in their educational design. Overall gamification experience, Points, Badges, Levels and Progress bar experience, along with continued use intention, perceived use and engagement were pointed significantly greater for the users that had used gamification in their educational design. School teachers, instructional designers, e-tutors and educators, who have used gamification in their educational design, could possibly have such greater psychological and behavioral outcomes due to the fact that they already trust gamification as an effective strategy and recognize its added value to learning experience and outcomes.

6.2 Limitations

The main limitation refers to the answers of the post-course survey, as they only originate from users who have completed the course. Undoubtedly, this fact leads to the conclusion that most of course-completed users had more positive experience and were more motivated. Responses from drop-out users would give extra information not only for the overall experience of all participants but also for the reason of dropping-out.

Next, data analysis' results of L2A MOOC and L2A MOOC 2021 could not be compared to determine in which users had better experience and outcomes as they were different samples and might have come from different parts of population.

Eventually, pre- and post-course survey responses were not directly connected with IMC's MOOC Platform data, from which Community Badges could not be retrieved. Additional, personal completion rate was calculated only from the percentage of users' progress per module retrieved from with IMC's MOOC Platform data, which was based only on the manual checking of users' content completion.

6.3 Further Research

It would be useful for further research to investigate deeper into the gamification profile of users and what additional factors can be revealed that affect users' outcomes. In this context, different player or personality types of participants could be examined along with an extended analysis of motives towards the participation in the course.

Furthermore, the qualitative analysis of open-ended questions for course-completed users might indicate an important area of further research about the learning and gamification experience and what improvements could be made not only in the MOOC but also in the evaluation framework.

In addition, an extension of the evaluation framework could be conducted to investigate the learning and gamification experience of users who dropped out of the course in combination with the reasons behind this attrition.

Finally, the proposed framework could be implemented in non-educational context MOOCs with single or double versions (gamified and non-gamified), where the potential different factors and outcomes of users can be examined.

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Appendix 1 – L2A MOOC 2021 Evaluation Instruments

Appendix 1.1 – L2A MOOC 2021 Pre-Course Survey[10]

Section 1 – Invitation

Learn2Analyze MOOC Pre-Course Survey

You are invited to participate in the Learn2Analyze MOOC Pre-Course Survey. Your responses to this survey will help us to evaluate the Learn2Analyze MOOC and improve it in future versions.

The survey is expected to take approximately 25 minutes to complete. You will be asked to provide answers to a series of questions related to your demographics and general background, your motives for enrolling in the Learn2Analyze (L2A) MOOC and your existing competence level per "Educational Data Literacy (EDL) Competence Profile (CP) Statement" for each competence dimension of the Learn2Analyze EDL Competence framework. Upon completion of the Pre-Course Survey you will receive the Learn2Analyze MOOC "Unlock Code". After the course opening (1st of March 2021), you can return to the Learn2Analyze MOOC (https://learn2analyze.imc-learning.de) and use this code as a key to unlock the Learn2Analyze MOOC content.

We greatly appreciate your willingness to share your time by participating. Your responses to these surveys will help us to improve the quality of the learning experience and to better our course offerings.

On behalf of the Learn2Analyze Consortium, we express our sincere thanks for your participation in our survey acknowledging that your insights on the questions in this survey will prove invaluable.

1. How did you learn about the Learn2Analyze MOOC?
    - A Mailing List
    - A Facebook Group posting
    - A LinkedIn Group posting
    - A Twitter Group posting

[10] This is the same pre-course survey used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC with the addition of the Gamification Profile section, that consists of twenty-nine (29) questions, along with one (1) question about User Intention Ratio.

- A Ning Group posting
- A Blog Posting
- A Newsletter Posting
- An Article Posted Online or Printed
- A MOOC Aggregator or Course Catalogue Posting
- A Physical Event
- Other

2. Please define (name which one)

   _____

Section 2 - Consent form to Participate in Web-based Survey

Title of Survey: Learn2Analyze MOOC Pre-course survey Questionnaire

Purpose and Procedure:
The Learn2Analyze (L2A) is an Academia-Industry Knowledge Alliance for enhancing Online Training Professionals' (Instructional Designers and e-Trainers) Competences in Educational Data Analytics. L2A is an action co-funded by the European Commission through the Erasmus+ Program of the European Union (Cooperation for innovation and the exchange of good practices - Knowledge Alliances, Agreement n. 2017-2733 / 001-001, Project No 588067-EPP-1-2017-1-ELEPPKA2-KA).
More information about the project is available at www.learn2analyze.eu.

Please note:
1. The survey will be carried out from 01/02/2021 to 01/05/2021.
2. Before you proceed to the survey questions, you will be asked to indicate your consent.
3. Should you decide you do not wish to further participate, you may leave the survey at any time, just by exiting your browser.
4. The questionnaire consists of 6 sections and needs approximately 20-25 minutes to be completed.
5. The first section includes the consent form for participating in the survey.
6. The second section includes a set of questions about demographics and general background.

7. The third section includes a set of questions about your background and attitude towards Gamification
8. The fourth section includes a set of questions on your motives for enrolling in the Learn2Analyze (L2A) MOOC.
9. The fifth section includes a set of questions on your existing competence level per "Educational Data Literacy (EDL) Competence Profile (CP) Statement" for each competence dimension of the Learn2Analyze EDL Competence framework.
10. In the final section, you will be asked for your email address in order to receive the Learn2Analyze MOOC "Unlock Code". You will need it as a key to unlock the Learn2Analyze MOOC content, after the 1st of March 2021, when the course starts.

Legal basis for processing personal and sensitive data:
Personal Data:
In connection with this research, the Learn2Analyze Consortium's collection and processing of the following Personal Data is lawful based on consent (Article 6.1(a), GDPR):
□ Name, Email Address
□ Education Information
Sensitive Data:
In connection with this research, the Learn2Analyze Consortium's collection and processing of the following Sensitive Data is lawful based on consent (Article 9.2(a), GDPR):
□ Gender

Potential Benefits:
There are no direct benefits for participating in the survey. The survey results will help us evaluate the L2A MOOC and improve its future versions.

Potential Risk or Discomforts:
We do not perceive any risk or discomfort in the completion of the survey.

Storage of Data:
The survey is completed in a Google Docs form and stored in a secure GoogleDrive folder under the e-mail l2a.r12.survey@gmail.com, for the time required by the purposes described in this document, for maximum 2 years.

Data transfer outside the European Union:

We may share some of the data collected with services located outside the European Union, in particular through the aforementioned Google services. The transfer is authorized on the basis of provisions of the European Union, on the adequacy of the protection offered by the EU-US privacy shield scheme.

Right to Withdraw:
Your participation in this survey is voluntary. You are under no obligation to complete the survey and you can withdraw from the survey prior to submitting it. If you do not want to participate simply stop participating or close the browser window. You can simply exit the Web Browser without saving your responses, and they will not be recorded.

Rights of research participants:
You have the right to request access to, a copy of, rectification, restriction in the use of, or erasure of your information in accordance with all applicable laws, contacting the lead Learn2Analyze researcher for this survey in l2a.r12.survey@gmail.com. The erasure of your information shall be subject to the Learn2Analyze Consortium's need to retain certain information pursuant to any other identified lawful basis.
If the Learn2Analyze Consortium's use of your information is pursuant to your consent, you have the right to withdraw consent without affecting the lawfulness of the Learn2Analyze Consortium's use of the information prior to receipt of your request.
If you think your data protection rights have been breached you have the right to lodge a complaint with your national Data Protection Authority (DPA).

Participant Concerns and Reporting:
If you have any questions concerning the survey or experience any discomfort related to the survey, please contact the lead Learn2Analyze researcher for this survey in l2a.r12.survey@gmail.com

Conflict of Interest:
We do not perceive any conflicts of interest in the development of this survey.

Compensation:
There is no compensation for participants in this survey.

Confidentiality:
The only people processing your input will be the researcher(s) involved in the Learn2Analyze project. The researcher(s) undertake to keep any information provided herein confidential, not to let it out of our possession and to report on the findings from

the perspective of the entire participating group and not from the perspective of an individual. Please note that confidentiality cannot be guaranteed while data are in transit over the Internet.

How will results be used:
The results of the survey will be used for evaluating the L2A MOOC. The results from the survey may be used for research study, for scholarly purposes only and might be presented in conferences, published in journals or articles for educational purposes.
By indicating consent to participate in this survey you also indicate consent for the possible secondary use of this data at a later date if we decide to undertake a further longitudinal study for the enhancement of the Learn2Analyze MOOC.

Debriefing and Dissemination of Results:
The final report will be made publicly available through the official website of the project www.learn2analyze.eu.
On behalf of the Learn2Analyze Consortium, we would like to sincerely thank you for your participation in our survey acknowledging that your insights on the questions in this survey will prove invaluable.

Selecting "I Agree" below indicates that:
You have read the above information;
You voluntarily agree to participate in this survey;
You understand the procedures described above;
You give consent for the use of your Personal Data for the purposes outlined in this notice;
You give consent for the use of your Sensitive Data for the purposes outlined in this notice;

You are at least 18 years of age.

- I Agree

Section 3 – Create your Unique Code ID

To create your unique code ID please use:

1. The first letter of your first name (e.g. U)
2. The last 2 digits of your cell phone (if none use 00) (e.g. 17)
3. Your month of birth (e.g. 03)

4. The first letter of your middle name (if none, use X) (e.g. M)
5. The first letter of city/town you were born in (e.g. V)

(The above example would generate the unique code ID: U1703MV)

Please provide your unique code ID as per instructions:

_____

Section 4- Demographics & General Background

You will be asked to provide answers to a series of questions related to your demographics and educational/professional background.

Number of questions in current section: 12

1. What is your year of birth? Please enter (YYYY)
   _____

2. What is your gender?
   - Female
   - Male
   - I prefer not to answer

3. Please specify your country of residence.
   (Select from drop-down list)

4. What is the highest level of education you have completed?
   - High School Diploma (or equivalent)
   - Associate degree / technical diploma - occupational / technical / vocational program
   - Associate degree - academic program

- Bachelor's degree (e.g., BSc, BA, AB, BS, BPS)
- Master's Degree (e.g., MA, MS, MSc, MEng, MEd, MSW, MBA)
- Professional School Degree (e.g., JD, MD, DDS, DVM, LLB)
- Doctoral Degree (e.g., PhD, EdD)
- Other

5. What is your current job sector?
   - Self-employed
   - Large (>100 people) for-profit company
   - Small (>100 people) for-profit company
   - Large (>100 people) non-profit
   - Small (<100 people) non-profit
   - K-12 Education
   - College
   - University
   - Governmental Education Agency
   - Other Governmental Agency
   - Not-employed
   - Other

6. What is your professional role? (select all that apply)

   □ Higher Education Students

   □ Professional Instructional Designer of Online and/or Blended Courses

   □ (e-) Tutor of Online and or Blended Courses

   □ School Teacher in K-12 Education

   □ Professional involved in supporting Teaching & Learning in Higher Education and/or Professional involved in supporting Professional Development

   □ Professional involved in supporting Educational Data in Higher Education and/or Professional Development

   □ Manager in a Higher Education Institute

   □ Manager in a Professional Development Service Provider

   □ Manager in an e-Learning Service Provider

   □ Manager in a Governmental Education Policy Making Institute

   □ Academic involved in teaching Higher Education Courses on Digital Learning and/or Learning Technologies

   □ Academic involved in teaching Higher Education Courses specifically for Instructional Designers and/or (e-) Tutors

□ Academic involved in teaching Higher Education Courses specifically for Educational Data Literacy
□ Researcher in Digital Learning and/or Learning Technologies
□ Researcher in Instructional Design of Online and/or Blended Courses
□ Researcher in Educational Data Literacy
□ Other

7. How many years are you involved in this role?
    - 1-5
    - 6-10
    - 11-20
    - 21+

8. How many years are you involved in the field of Digital Teaching and Learning?
    - 1-5
    - 6-10
    - 11-20
    - 21+

9. On a scale from 1 (low) to 5 (high), please rate your English proficiency

10. On a scale from 1 (low) to 5 (high), please rate your comfort with Technology

11. In how many MOOCs have you enrolled?
    - None
    - 1
    - 2-4
    - 5-10
    - >10

12. How many have you completed?
    - None
    - 1
    - 2-4
    - 5-10
    - >10

Section 5 – Gamification

You will be asked to provide answers to a series of questions related to your background and attitude towards Gamification, as well as, to rate your intrinsic and extrinsic motivation that determines your player type.

Number of questions in current section: 6

1. Are you familiar with gamification in teaching and learning?
   - Yes
   - No

2. Have you experienced gamified learning experiences in the past?
   - Yes
   - No

3. In how many gamified MOOCs have you take part?
   - None
   - 1
   - 2-4
   - 5-10
   - >10

4. Have you used gamification in your educational design?
   - Yes
   - No

5. Attitude towards Gamification
   Please select the number [1..5] that best describes what you think.

	Not at all true	2	Somewhat true	4	Very true	Not Applicable
My attitude towards gamification is favorable.						

6. Gamification User Types based on intrinsic and extrinsic motivation

   Please rate your agreement to the following statements from 1= “Strongly Disagree to 7= “Strongly Agree”:

	1	2	3	4	5	6	7
SOC1. Interacting with others is important to me.							
PHIL1. It makes me happy if I am able to help others.							
FS1. It is important to me to follow my own path.							
SOC2. I like being part of a team.							
DIS1. I like to provoke.							
PR1. I like competitions where a prize can be won.							
SOC3. It is important to me to feel like I am part of a community.							
FS2. I often let my curiosity guide me.							
DIS2. I like to question the status quo.							
PR2. Rewards are a great way to motivate me.							
FS3. I like to try new things.							
AR1. I like defeating obstacles.							
PHIL2. I like helping others to orient themselves in new situations.							
DIS3. I see myself as a rebel.							
SOC4. I enjoy group activities.							
AR2. It is important to me to always carry out my tasks completely.							
DIS4. I dislike following rules.							
PHIL3. I like sharing my knowledge							
AR3. It is difficult for me to let go of a problem before I have found a solution.							
PR3. Return of investment is important to me.							
FS4. Being independent is important to me.							
AR4. I like mastering difficult tasks.							
PHIL4. The well-being of others is important to me.							
PR4. If the reward is sufficient, I will put in the effort.							

Section 6 – Motives for enrolling in the L2A MOOC

You will be asked to answer a series of questions on your motives for enrolling in the Learn2Analyze (L2A) MOOC.

Number of questions in current section: 6

1. Which of the following best describes your goal in taking this course? Please select one of the following
   - Planning to follow the course schedule and complete all activities to earn a certificate of completion
   - Auditing, but intend to follow the course schedule
   - Auditing, but do not intend to follow the course schedule
   - Just checking what this course is about
   - Bookmaking it as a learning resource
   - Interested in a small subset of course topics
   - General curiosity
   - Other

2. Can you tell us why you have enrolled in this course?
   Please select the number [1..5] that best describes what you think.

	Not at all true	2	Somew hat true	4	Very True	Not Applica ble
M2.1 Participating in this course is relevant for my personal development.						
M2.2 Participating in this course will extend my current knowledge of the topic.						
M2.3 I will use this course to obtain a job relevant qualification.						

M2.4 I think the L2A certificate is beneficial for my CV and future job applications.						
M2.5 The subject of the course is relevant to my academic field of study.						
M2.6 The subject of the course is relevant to my college/university class						
M2.7 I have been advised or ordered to take part in this course.						
M2.8 I have enrolled in this course out of general curiosity.						

3. How confident are you in your ability to learn the material in this course?
   - Not confident at all
   - A little confident
   - Moderately confident
   - Very confident
   - Extremely confident

4. How would you rate your possibility of finishing this course according to the anticipated time commitment as defined in the syllabus?
   (On a scale from 1 (least likely) to 5 (most likely), please rate your opinion)

5. How many hours per week do you plan to spend studying on this course?
   - less than 3 hours
   - 3-4 hours
   - 5-6 hours
   - 7-8 hours
   - More than 8 hours

6. What is the percentage of the course you intend to complete?
   - 0%-20%
   - 21%-40%
   - 41%-60%

- 61%-80%
- 81%-100%

7. Do you target Certificate Level A (core EDL competences), Certificate Level B (advanced EDL competences) or both?
   - Certificate Level A
   - Certificate Level B
   - Both
   - None

8. How would you describe yourself?
   Please select the choice that best describes what you think.

	Very much like me	Mostly like me	Somewhat like me	Not much like me	Not like me at all
G8.1 New ideas and projects sometimes distract me from previous ones.					
G8.2 Setbacks don't discourage me					
G8.3 I have been obsessed with a certain idea or project for a short time but later lost interest.					
G8.4 I am a hard worker.					
G8.5 I often set a goal but later choose to pursue a different one					
G8.6 I have difficulty maintaining my focus on projects that take more than a few months to complete					
G8.7 I finish whatever I begin.					
G8.8 I am diligent.					

Section 7 - Existing Competence Level per L2A EDL-CP Statement

Dimension 1: Data Collection

1.1 Obtain, access and gather the appropriate data and/or data sources

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

1.2 Apply data limitations and quality measures (e.g., validity, reliability, biases in the data, difficulty in collection, accuracy, completeness)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 2: Data Management

2.1 Apply data processing and handling methods (i.e., methods for cleaning and changing data to make it more organized – e.g., duplication, data structuring)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

2.2 Apply data description (i.e., metadata)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

2.3 Apply data curation processes (i.e., to ensure that data is reliably retrievable for future reuse, and to determine what data is worth saving and for how long)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

2.4 Apply the technologies to preserve data (i.e., store, persist, maintain, backup data), e.g., storage mediums/services, tools, mechanisms

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 3: Data Analysis

3.1 Apply data analysis and modelling methods (e.g. application of descriptive statistics, exploratory data analysis, data mining)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

3.2 Apply data presentation methods (e.g., pictorial visualisation of the data by using graphs, charts, maps and other data forms like textual or tabular representations)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 4: Data Comprehension & Interpretation

4.1 Interpret data properties (e.g., measurement error, outliers, discrepancies within data, key take-away points, data dependencies)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

4.2 Interpret statistics commonly used with educational data (e.g., randomness, central tendencies, mean, standard deviation, significance)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

4.3 Interpret insights from data analysis (e.g., explanations of patterns, identification of hypotheses, connection of multiple observations, underlying trends)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

4.4 Elicit potential implications/links of the data analysis insights to instruction

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 5: Data Application

5.1 Use data analysis results to make decisions to revise instruction

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

5.2 Evaluate the data-driven revision of instruction

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 6: Data Ethics

6.1 Use the informed consent

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

6.2 Protect individuals' data privacy, confidentiality, integrity and security

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

6.3 Apply authorship, ownership, data access (governance), re-negotiation and datasharing

- Novice

- Advanced beginner
- Competent
- Proficient
- Expert

Section 8 – Instructions to unlock the L2A MOOC content

Thank you for your participation.

Submit the form and get access to the Learn2Analyze MOOC.

Please provide your email address to receive an email with the Learn2Analyze MOOC Unlock Code.

After the course opening (1st of March 2021), you can return to the Learn2Analyze MOOC (https://learn2analyze.imc-learning.de) and use this code as a key to unlock the Learn2Analyze MOOC content.

What is your Email address

Enter the email address you used when you made your OpenCourseWorld account.

_____

Appendix 1.2 – L2A MOOC 2021 Post-Course Survey[11]

Section 1 – Invitation

You are invited to participate in this survey because you have registered for the online course administered by Learn2Analyze Consortium. Your responses to this survey will help us to evaluate the Learn2Analyze MOOC and improve it in future versions.

The Post-Course Survey is expected to take approximately 30 minutes to complete and it is a requirement for the Certificate of Achievement.

In the Post-Course Survey you will be asked questions about your level of satisfaction and learning experience per module, as well as the overall learning experience of the Learn2Analyze (L2A) MOOC. Furthermore, you will be requested to answer questions about your overall gamification experience and the experience per gamification element. Finally, you will report on your achieved competence level per "Educational Data Literacy (EDL) Competence Profile (CP) Statement" for each competence dimension of the Learn2Analyze EDL Competence framework, after attending the Learn2Analyze (L2A) MOOC.

Submit the form and get the key to unlock the Level A and/or Level B Learn2Analyze Certificate of Achievement. Return to the https://learn2analyze.imc-learning.de platform and use this key to download your certificate.

We greatly appreciate your willingness to share your time by participating. Your responses to this survey will help us to improve the quality of the learning experience and to better our course offerings, acknowledging your insights will prove invaluable.

Section 2 – Consent form to participate in Web-based Survey

Title of Survey: Learn2Analyze MOOC Post-course Survey Questionnaire

Purpose and Procedure:
The Learn2Analyze (L2A) is an Academia-Industry Knowledge Alliance for enhancing Online Training Professionals' (Instructional Designers and e-Trainers) Competences in

[11] This is the same post-course survey used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC with the addition of the Overall Gamification Experience section with thirty-two (32) questions and the Gamification Experience per Element section with ten (10) question for each integrated gamification element.

Educational Data Analytics. L2A is an action co-funded by the European Commission through the Erasmus+ Program of the European Union (Cooperation for innovation and the exchange of good practices - Knowledge Alliances, Agreement n. 2017-2733 / 001-001, Project No 588067-EPP-1-2017-1-EL-EPPKA2-KA).
More information about the project is available at www.learn2analyze.eu.

Please note:
1. The survey will be carried out from 01/03/2021 to 06/06/2021.
2. Before you proceed to the survey questions, you will be asked to indicate your consent.
3. Should you decide you do not wish to further participate, you may leave the survey at any time, just by exiting your browser.
4. The questionnaire consists of 8 sections and needs approximately 30 minutes to be completed.
5. In the first section, you are invited to participate in the post-course survey.
6. The second section includes the consent form for participating in the survey.
7. The third section includes a set of questions on your level of satisfaction and learning experience per module of the Learn2Analyze (L2A) MOOC.
8. The fourth section includes a set of questions on your overall level of satisfaction and learning experience after attending the Learn2Analyze (L2A) MOOC.
9. The fifth section includes a set of questions on your overall gamification experience after attending the Learn2Analyze (L2A) MOOC.
10. The sixth section includes a set of questions on your experience per every implemented gamification element after attending the Learn2Analyze (L2A) MOOC.
10. The seventh section includes a set of questions on your competence level per "Educational Data Literacy (EDL) Competence Profile (CP) Statement" for each competence dimension of the Learn2Analyze EDL Competence framework, after attending the Learn2Analyze (L2A) MOOC.
11. In the final section, you will be asked for your name and email address in order to receive a key to unlock the Learn2Analyze Certificate of Achievement. Return to the https://learn2analyze.imc-learning.de platform and use this key to download your Level A and/or Level B Certificate.

Legal basis for processing personal and sensitive data:
Personal Data:
In connection with this research, the Learn2Analyze Consortium's collection and processing of the following Personal Data is lawful based on consent (Article 6.1(a), GDPR):
□ Name, Email Address
□ Education Information
Sensitive Data:
In connection with this research, the Learn2Analyze Consortium's collection and processing of the following Sensitive Data is lawful based on consent (Article 9.2(a), GDPR):

□ Gender

Potential Benefits:
There are no direct benefits for participating in the survey. The survey results will help us evaluate the L2A MOOC and improve its future versions.

Potential Risk or Discomforts:
We do not perceive of any risk or discomfort in the completion of the survey.

Storage of Data:
The survey is completed in a Google Docs form and stored in a secure GoogleDrive folder under the e-mail l2a.r12.survey@gmail.com, for the time required by the purposes described in this document, for maximum 2 years.

Data transfer outside the European Union:
We may share some of the data collected with services located outside the European Union, in particular through the aforementioned Google services. The transfer is authorized on the basis of provisions of the European Union, on the adequacy of the protection offered by the EU-US privacy shield scheme.

Right to Withdraw:
Your participation in this survey is voluntary. You are under no obligation to complete the survey and you can withdraw from the survey prior to submitting it. If you do not want to participate simply stop participating or close the browser window. You can simply exit the Web Browser without saving your responses, and they will not be recorded.

Rights of research participants:
You have the right to request access to, a copy of, rectification, restriction in the use of, or erasure of your information in accordance with all applicable laws, contacting the lead Learn2Analyze researcher for this survey in l2a.r12.survey@gmail.com. The erasure of your information shall be subject to the Learn2Analyze Consortium's need to retain certain information pursuant to any other identified lawful basis.
If the Learn2Analyze Consortium's use of your information is pursuant to your consent, you have the right to withdraw consent without affecting the lawfulness of the Learn2Analyze Consortium's use of the information prior to receipt of your request.
If you think your data protection rights have been breached you have the right to lodge a complaint with your national Data Protection Authority (DPA).

Participant Concerns and Reporting:

If you have any questions concerning the survey or experience any discomfort related to the survey, please contact the lead Learn2Analyze researcher for this survey in l2a.r12.survey@gmail.com

Conflict of Interest:
We do not perceive any conflicts of interest in the development of this survey.

Compensation:
There is no compensation for participants in this survey.

Confidentiality:
The only people processing your input will be the researcher(s) involved in the Learn2Analyze project. The researcher(s) undertake to keep any information provided herein confidential, not to let it out of our possession and to report on the findings from the perspective of the entire participating group and not from the perspective of an individual. Please note that confidentiality cannot be guaranteed while data are in transit over the Internet.

How will results be used:
The results of the survey will be used for evaluating the L2A MOOC. The results from the survey may be used for research study, for scholarly purposes only and might be presented in conferences, published in journals or articles for educational purposes.
By indicating consent to participate in this survey you also indicate consent for the possible secondary use of this data at a later date if we decide to undertake a further longitudinal study for the enhancement of the Learn2Analyze MOOC.

Debriefing and Dissemination of Results:
The final report will be made publicly available through the official website of the project www.learn2analyze.eu.
On behalf of the Learn2Analyze Consortium, we would like to sincerely thank you for your participation in our survey acknowledging that your insights on the questions in this survey will prove invaluable.

Selecting “I Agree” below indicates that:

You have read the above information;
You voluntarily agree to participate in this survey;
You understand the procedures described above;
You give consent for the use of your Personal Data for the purposes outlined in this notice;
You give consent for the use of your Sensitive Data for the purposes outlined in this notice;
You are at least 18 years of age.

Do you consent?

- o I Agree

Section 3 - Create you Unique Code ID

To create your unique code ID please use:
1. The first letter of your first name (e.g. U)
2. The last 2 digits of your cell phone (if none use 00) (e.g. 17)
3. Your month of birth (e.g. 03)
4. The first letter of your middle name (if none, use X) (e.g. M)
5. The first letter of city/town you were born in (e.g. V)

(The above example would generate the unique code ID: U1703MV)

Please provide your unique code ID as per instructions:

_____

Section 4 - Learning experience per module

Number of questions in current section: 13

1. Learning objectives per module were clearly stated.
2. The content per module was presented in a comprehensible manner.
3. The educational materials and content per module were relevant and addressed the topic identified in the title.
4. The educational materials and content per module were based on current up-to-date information.
5. The instructional videos per module supported my learning and added value to the course content.
6. The graphics per module supported my learning and added value to the course content.
7. There was a good variety of content types (i.e., written notes, videos, graphics, etc.).
8. Further Readings per module were relevant and supported my learning.
9. Learning activities (Polls, Discussions and Workshops) used in the module were effective and helped me construct explanations/solutions.
10. Assessment tasks (quiz learning activities) used per module challenged my thinking and supported my learning.
11. The assessment tasks (quiz learning activities) per module were relevant to the learning objectives.

for question 1 to 11	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Module 2 Online and Blended Teaching and Learning supported by Educational Data					
Module 3 Learning Analytics					
Module 4 Teaching Analytics					
Module 5 Applying Teaching & Learning Analytics with Moodle					
Module 6 Applying Teaching & Learning Analytics with eXact Suite					
Module 7 Applying Teaching & Learning Analytics with IMC Learning Suite					

12. How many hours per week did you spend on each module?

	< 3 h	3 – 4 h	5 – 6 h	7 – 8 h	> 8 h
Module 2 Online and Blended Teaching and Learning supported by Educational Data					
Module 3 Learning Analytics					
Module 4 Teaching Analytics					
Module 5 Applying Teaching & Learning Analytics with Moodle					
Module 6 Applying Teaching & Learning Analytics with eXact Suite					
Module 7 Applying Teaching & Learning Analytics with IMC Learning Suite					

13. How many posts did you contribute to discussion forums per module?

	None	1 -2 posts	3 – 4 posts	> 5 posts
Module 2 Online and Blended Teaching and Learning supported by Educational Data				
Module 3 Learning Analytics				
Module 4 Teaching Analytics				

Module 5 Applying Teaching & Learning Analytics with Moodle				
Module 6 Applying Teaching & Learning Analytics with eXact Suite				
Module 7 Applying Teaching & Learning Analytics with IMC Learning Suite				

Section 5 – Overall learning experience

Number of questions in current section: 25

Please rate [1..5] your agreement to the following statements:
Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

1. The course platform was easy to use.
2. The overall visual design of the course was appealing.
3. The course environment was well structured, topics and subtopics were logically arranged in a predictable pattern.
4. The learning path was easy to navigate.
5. Course objectives and learning goals were clearly stated.
6. The workload was reasonably spread.
7. The workload was in line with my expectations.
8. The course difficulty was in line with my expectations at the start of the course.
9. The difficulty level of assessment tasks (quiz learning activities) was appropriate for the course.
10. The level of interaction with peer learners was adequate.
11. The discussion forums were an effective tool for collaborating with other learners.
12. Final Assessment for the Level A Certificate required the learner to have acquired a basic set of competences for EDL.
13. The difficulty level of assessments was appropriate for the Level A Certificate.
14. Assessment for the Level B Certificate required demonstration of a higher expertise in EDL.
15. Assessment for the Level B Certificate included hands-on assignments based on simulated practice scenarios.
16. The difficulty level of assessments was appropriate for the Level B Certificate.
17. Help and support provided on the course platform were adequate.
18. I can apply the knowledge created in this course to my work or other related activities.
19. I was motivated to work through the course.
20. I feel like I achieved my personal goals for this course.
21. I enjoyed the course.
22. It is very likely to revisit the course materials in the future.

23. It is very likely to recommend this course e.g. to a colleague or friend.

24. What did you enjoy most about your course experience?

_____

25. What did you like least about taking part in the course?

_____

Section 6 – Overall Gamification Experience

Number of questions in current section: 4

Please rate [1..5] your agreement to the following statements:
Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

1. Satisfaction, Enjoyment and Motivation of Gamification Experience

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1.1 I found the experience of the course enjoyable.					
1.2 I found the course stimulating.					
1.3 I enjoyed the gamified elements in the course so much that I was motivated to be retained.					
1.4 I found the experience of the course interesting.					
1.5 My interest on EDL has increased during the course.					
1.6 It was a pleasure to work through such well-designed gamified course.					
1.7 Gamification elements encouraged me to participate in the course.					

1.8 I feel competent on EDL after completing the course.					
1.9 The course provided me with interesting options and choices.					
1.10 I feel very capable and effective on EDL after completing the course.					
1.11 I experienced a high level of freedom in the course.					
1.12 My ability to be retain in the course is well matched with the course's challenges.					
1.13 The course allows me to do useful activities related to EDL practice.					

2. During the course, the gamification elements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
2.1 Made me feel that success comes through accomplishments.					
2.2 Made me feel like someone is keeping me on track.					
2.3 Gave me the feeling that I was not on my own.					
2.4 Made me feel guided.					
2.5 Gave me a sense of knowing what I needed to do to do better.					
2.6 Gave me a sense of having someone to share my endeavors with.					
2.7 Gave me the feeling that I need to reach goals.					
2.8 Gave me a sense of being noticed for what I have achieved.					
2.9 Felt like participating in a competition.					
2.10 Pressured me in a positive way by its high demands.					
2.11 Made me want to be in first place.					

2.12 Challenged me.					
2.13 Made me feel that I needed to be on top to succeed.					
2.14 Motivated me to do things that felt highly demanding.					

3. During the course I felt that:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
3.1 Using gamification elements helped me to improve my performance.					
3.2 Using gamification elements helped me to increase my productivity.					
3.3 Using gamification elements made me feel more effective reaching learning goals.					
3.4 Having gamification elements was useful.					

4. My attitude towards gamification is favorable.
   On a scale from 1 (not at all true) to 5 (very true)

Section 7 – Gamification Experience per Element

Number of questions in current section: 5

Please rate [1..5] your agreement to the following statements:
Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree

1. How would you describe your experience with the gamification element "Points"?
2. How would you describe your experience with the gamification element "Badges"?
3. How would you describe your experience with the gamification element "Levels"?
4. How would you describe your experience with the gamification element "Progress Bar"?

5. How would you describe your experience with the gamification element "Leaderboard"?

for question 1 to 5	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I found it enjoyable.					
I found it motivating.					
It made me feel competent on EDL.					
It made me to participate and work in the course.					
It made me feel that my ability to be retain in the course was well matched with the course's challenges.					
It helped me feel very capable and effective on EDL.					
It made it easier for me to set clear goals.					
It made me feel guided.					
It helped me to improve my performance.					
Having it in the course was useful.					

Section 8 – Achieved Competence Level per L2A EDL-CP Statement

Please rate your achieved competence level for each statement of the L2A Educational Data Literacy Competence Dimensions addressed in this course

You can find additional information about L2A EDL-CP in http://www.learn2analyze.eu/

Dimension 1: Data Collection

1.3 Obtain, access and gather the appropriate data and/or data sources

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

1.4 Apply data limitations and quality measures (e.g., validity, reliability, biases in the data, difficulty in collection, accuracy, completeness)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 2: Data Management

2.2 Apply data processing and handling methods (i.e., methods for cleaning and changing data to make it more organized – e.g., duplication, data structuring)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

2.2 Apply data description (i.e., metadata)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

2.3 Apply data curation processes (i.e., to ensure that data is reliably retrievable for future reuse, and to determine what data is worth saving and for how long)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

2.4 Apply the technologies to preserve data (i.e., store, persist, maintain, backup data), e.g., storage mediums/services, tools, mechanisms

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 3: Data Analysis

3.1 Apply data analysis and modelling methods (e.g. application of descriptive statistics, exploratory data analysis, data mining)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

3.2 Apply data presentation methods (e.g., pictorial visualisation of the data by using graphs, charts, maps and other data forms like textual or tabular representations)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 4: Data Comprehension & Interpretation

4.1 Interpret data properties (e.g., measurement error, outliers, discrepancies within data, key take-away points, data dependencies)

- Novice
- Advanced beginner
- Competent
- Proficient

- Expert

4.2 Interpret statistics commonly used with educational data (e.g., randomness, central tendencies, mean, standard deviation, significance)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

4.3 Interpret insights from data analysis (e.g., explanations of patterns, identification of hypotheses, connection of multiple observations, underlying trends)

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

4.4 Elicit potential implications/links of the data analysis insights to instruction

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 5: Data Application

5.1 Use data analysis results to make decisions to revise instruction

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

5.2 Evaluate the data-driven revision of instruction

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Dimension 6: Data Ethics

6.1 Use the informed consent

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

6.2 Protect individuals' data privacy, confidentiality, integrity and security

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

6.3 Apply authorship, ownership, data access (governance), re-negotiation and datasharing

- Novice
- Advanced beginner
- Competent
- Proficient
- Expert

Section 9 – Certificate

Congratulations, you have reached the end of our trip. You have successfully completed the L2A MOOC and submitted the Pre- and Post-Course Surveys. Thank you for your participation.

Please provide your name, surname and email address in order to receive a personalized Certificate of Achievement of the Learn2Analyze MOOC. Submit the form and get the key to unlocking the Learn2Analyze Certificate of Achievement. Return to the https://learn2analyze.imc-learning.de platform and use this key to download your Level A and/or Level B Certificate.

What is your email address?

_____

Name

_____

Surname

_____

Appendix 2 – Educational Design Considerations and Syllabus of Learn2Analyze MOOC 2021

Educational Design Considerations

Gamification Elements of the course

Throughout the course[12]:

- **Experience Points (XPs)** can be gained by completing activities within the MOOC. By accumulating Experience Points (XPs) participants can reach higher **levels** in an Experience Track. There are 4 Experience Tracks: Content, Engagement, Test and Module. There is a **Leaderboard**, a ranking list displayed per experience track.
- Participants can be awarded **Badges**. There are 6 Module Badges one for each module (Module #2 to Module #7) and 3 Community Badges. There is a **Progress bar** to display progress towards next or ultimate performance level.

Experience Tracks[13]:

- **Content track** shows participant's progress on course content such as text, videos, slides, documents.
- **Engagement track** shows the participation in the activities of the course. Points are awarded for completing quizzes, exercises, and other interactive learning objects, regardless of your result.
- **Test track** shows participant's progress on tests. Points are awarded for successfully completing quiz tests.
- **Module track** shows participant's progress in a module (Module #2 to Module #7). Points are awarded if a learning object is completed within respective module (Module #2 to Module #7).

Module Badges, one for each module (Module #2 to Module #7)[14]:

- Educational Data L2A Finisher
- Learning Analytics L2A Finisher

[12] https://learn2analyse.eu/proj/l2a-mooc/
[13] https://learn2analyse.eu/proj/l2a-mooc/
[14] https://learn2analyse.eu/proj/l2a-mooc/

- Teaching Analytics L2A Finisher
- Moodle L2A User
- eXact Suite L2A User
- IMC Learning Suite L2A User

To earn each of these badges, participant must gain at least 75% of XP points and pass the self-assessed assignment in the respective module.

Community Badges[15]:

- L2A Commentator
- L2A Moderator
- L2A Forum Master

To earn each of these community badges, participant must post a certain number of posts in the discussion fora, calculated across all the modules (Commentator: At least 3 posts, Moderator: At least 10 posts, Forum Master: At least 20 posts).

Learning Activities and Self-Assessed Assignment of the course[16]

There are learning activities as single question quiz tests, added after some content subtopics, related to the video watched or the topic studied.

At the end of each module, there is a concluding self-assessed assignment. This self-assessed assignment is a real-life scenario activity (e.g., based on a use case), using a rubric across three proficiency levels and an exemplary solution rating. The evaluation of the outcomes is done by participant as self-assessment, using a rubric which includes the criteria that each response should meet and guidelines to assess themselves.

These types of assignments do not directly contribute participant's final grade for this course in order to receive the L2A Certificate of Achievement (Level A and Level B). Nevertheless, it is recommended that participant complete them, so as to evaluate his/her understanding, as well as, to gain points and respective badges.

[15] https://learn2analyse.eu/proj/l2a-mooc/
[16] https://learn2analyse.eu/proj/l2a-mooc/

Final Assessment Method, Grading Policy and Certification[17]

This course is graded as **Pass or Fail**, meaning participant will either be given a passing score or a failing score.

There are two levels of the L2A Certificate of Achievement: **Level A Certificate** and **Level B Certificate of Achievement on Educational Data Literacy**.

L2A Certificate of Achievement Level A requires developing a basic set of competences for EDL. In order to gain Certificate of Achievement Level A, participant must gain a mark of **60% or greater** overall to the corresponding set of level A 100 multiple choice quiz questions, aiming to assess his/her understanding of the core concepts presented in the 6 core modules.

L2A Certificate of Achievement Level B requires demonstration of a higher expertise assessed through hands-on assignments based on simulated practice scenarios. More specifically, for the Certificate of Achievement Level B, there is a final concluding assessment, where participant is requested to undertake complex tasks, by going through several steps (e.g., by following a use case) and answer a set of 100 Multiple-Choice Questions (MCQs) which are automatic graded by the platform. In order to gain his/her Certificate of Achievement Level B, participant must gain a mark of 60% or greater overall to the corresponding set of 100 level B multiple choice quiz questions.

Both sets of Multiple Choice Questions are included at the end of the course and participant may complete the Multiple Choice Questions Assessments **at any time** as there are no 'due dates'.

If participant successfully completes the course, he/she will receive a Certificate of Achievement (Level A or Level B or both). Successful completion of the course requires:

- completing the corresponding Multiple Choice Questions Assessment for Level A and/or Level B Certificate (with 60% success each to obtain both Levels)
- completing the Pre-course and the Post-course Surveys

The certificate is **free of charge**.

[17] https://learn2analyse.eu/proj/l2a-mooc/

Course Syllabus[18]

Module 1: Orientation

This module offers the opportunity to become familiar with the MOOC platform, the course structure, and the course policies.

Estimated Effort to complete: 4 hours

Module 2: Educational Data

This module will introduce the concept of educational data as a key success factor for online and blended teaching and learning, present the Learn2Analyze framework for educational data literacy competences and discuss the fundamentals of educational data collection and management, including issues related with ethics and privacy.

Estimated Effort to complete: 15 hours

Estimated Effort to complete Module 2 concluding Self-Assessed Assignment: 1 hour

Module 3 – Learning Analytics

This module will introduce the basics of methods and tools for analysing and interpreting online learners' data to facilitate their personalised support. It will focus on organising, analysing, presenting and interpreting learner-generated data within their learning context, as well as on ethical concerns and policies for protecting learner-generated data from mistreatment and misuse.

Estimated Effort to complete: 12 hours

Estimated Effort to complete Module 3 concluding Self-Assessed Assignment: 1 hour

Module 4 – Teaching Analytics

[18] https://learn2analyse.eu/proj/l2a-mooc/

This module will introduce the basics of methods and tools for analysing and interpreting educational data for facilitating educational decision making, including course and curricula design.

Estimated Effort to complete: 10 hours

Estimated Effort to complete Module 4 concluding Self-Assessed Assignment: 1 hour

Module 5 – Educational Data Analytics with Moodle

This module will present tools for educational data analytics in Moodle and focus on the use of these tools to support school teachers in the design and delivery of their online and blended learning courses.

Estimated Effort to complete: 15 hours

Estimated Effort to complete Module 5 concluding Self-Assessed Assignment: 1 hour

Module 6 – Educational Data Analytics with eXact Suite

This module will present tools for educational data analytics in the eXact Suite and focus on the use of these tools to help instructional designers and e-tutors of online courses in supporting online learners.

Estimated Effort to complete: 12 hours

Estimated Effort to complete Module 6 concluding Self-Assessed Assignment: 1 hour

Module 7 – Educational Data Analytics with IMC Learning Suite

This module will present tools for educational data analytics in the IMC Learning Suite. The focus is on how the tools can support instructional designers of online courses in reflecting on their educational design and re-design the courses. The module also shows how the tools can help e-tutors to support online learners.

Estimated Effort to complete: 10 hours

Estimated Effort to complete Module 7 concluding Self-Assessed Assignment: 1 hour

Module 8 – Concluding the MOOC

This concluding module will allow participants to finalize their assignments, discuss their overall MOOC learning experience with their peers, and reflect on their learning experience by submitting the course feedback survey.

Estimated Effort to complete: 4 hours

Final Assessment

Assessment Multiple Choice Questions for **Level A Certificate**: 100

Estimated Effort to complete: 6 hours

Assessment Multiple Choice Questions for **Level B Certificate**: 100

Estimated Effort to complete: 6 hours

Appendix 3 – L2A MOOC 2021 Coding of Questions[19]

Appendix 3.1 – L2A MOOC 2021 Pre-Course Survey

Table 68: Coding of Pre-course survey questions

A. Demographics & General Background	
a. Demographics	
[Age]	Q1*. What is your year of birth? Please enter (YYYY)
[Gender]	Q2*. What is your gender?
[Country]	Q3*. Please specify your country or region of residence.
b. General Background	
[EducLevel]	Q4*. What is the highest level of education you have completed?
[JobSector]	Q5*. What is your current job sector?
[ProfRole]	Q6*. What is your professional role? (select all that apply)
[YoEinPR]	Q7*. How many years are you involved in this role?
[YoEinDTL]	Q8*. How many years are you involved in the field of Digital Teaching and Learning?
[EnglProf]	Q9*. On a scale from 1 (low) to 5 (high), please your English proficiency
[ComfTech]	Q10*. On a scale from 1 (low) to 5 (high), please rate your comfort with Technology
[MOOCsEnr]	Q11*. In how many MOOCs have you enrolled?
[MOOCsCompl]	Q12*. How many MOOCs have you completed?
B. Gamification Profile	
a. Previous experience with Gamification	
[GFamiliar]	Q1. Are you familiar with gamification in teaching and learning?
[GLXP]	Q2. Have you experienced gamified learning experiences in the past?
[GMOOCs]	Q3. In how many gamified MOOCs have you take part?
[GEdDesign]	Q4. Have you used gamification in your educational design?
b. Attitude towards Gamification	
[AGa]	Q5. Attitude towards Gamification
c. Gamification User Types [GUT]	

[19] This is the coding of questions for pre- and post-course survey used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC in addition with the coding of the questions about the Gamification Profile, the User Intention Ratio, the Overall Gamification Experience, and the Gamification Experience per Element used in the gamification's evaluation of L2A MOOC 2021.

	Q6. Gamification User Types based on intrinsic and extrinsic motivation Please rate your agreement to the following statements from 1= "Strongly Disagree to 7= "Strongly Agree"
	i. Philanthropist [PHIL]
[PHIL1]	Q6.2. It makes me happy if I am able to help others.
[PHIL2]	Q6.13. I like helping others to orient themselves in new situations.
[PHIL3]	Q6.18. I like sharing my knowledge
[PHIL4]	Q6.23. The well-being of others is important to me.
	ii. Socialiser [SOC]
[SOC1]	Q6.1. Interacting with others is important to me.
[SOC2]	Q6.4. I like being part of a team.
[SOC3]	Q6.7. It is important to me to feel like I am part of a community.
[SOC4]	Q6.15. I enjoy group activities.
	iii. Free Spirit [FS]
[FS1]	Q6.3. It is important to me to follow my own path.
[FS2]	Q6.8. I often let my curiosity guide me.
[FS3]	Q6.11. I like to try new things.
[FS4]	Q6.21. Being independent is important to me.
	iv. Achiever [AR]
[AR1]	Q6.12. I like defeating obstacles.
[AR2]	Q6.16. It is important to me to always carry out my tasks completely.
[AR3]	Q6.19. It is difficult for me to let go of a problem before I have found a solution.
[AR4]	Q6.22. I like mastering difficult tasks.
	v. Disruptor [DIS]
[DIS1]	Q6.5. I like to provoke.
[DIS2]	Q6.9. I like to question the status quo.
[DIS3]	Q6.14. I see myself as a rebel.
[DIS4]	Q6.17. I dislike following rules.
	vi. Player [PR]
[PR1]	Q6.6. I like competitions where a prize can be won.
[PR2]	Q6.10. Rewards are a great way to motivate me.
[PR3]	Q6.20. Return of investment is important to me.
[PR4]	Q6.24. If the reward is sufficient, I will put in the effort.
C. Motives	
a. Goal	

[GOAL]	Q1*. Which of the following best describes your goal in taking this course? Please select one of the following ○ Planning to follow the course schedule and complete all activities to earn a certificate of completion ○ Auditing, but intend to follow the course schedule ○ Auditing, but do not intend to follow the course schedule ○ Just checking what this course is about ○ Bookmaking it as a learning resource ○ Interested in a small subset of course topics ○ General curiosity ○ Other - Please specify
b. Reasons for Enrolment (internal – external motives)	
	Q2*. Can you tell us why you have enrolled in this course? Please select the number [1..5] that best describes what youthink.
[M2.1]	M2.1. Participating in this course is relevant for my personal development.
[M2.2]	M2.2. Participating in this course will extend my current knowledge of the topic.
[M2.3]	M2.3. I will use this course to obtain a job-relevant qualification.
[M2.4]	M2.4. I think L2A certificate is beneficial for my CV and future job applications.
[M2.5]	M2.5. The subject of the course is relevant to my academic field of study.
[M2.6]	M2.6. The subject of the course is relevant to my college/university class.
[M2.7]	M2.7. I have been advised or ordered to take part in this course.
[M2.8]	M2.8. I have enrolled in this course out of general curiosity.
c. Self-Confidence	
[ConfAbility]	Q3. How confident are you in your ability to learn the material in this course?
[ConfTime]	Q4. How would you rate your possibility of finishing this course according to the anticipated time commitment as defined in the syllabus?
[Hours]	Q5. How many hours per week do you plan to spend studying on this course?
[UIR]	Q6. What is the percentage of the course you intend to complete?
[CLevel]	Q7. Do you target Certificate Level A (core EDL competences), Certificate Level B (advanced EDL competences) or both?
d. GRIT	
	Q8. How would you describe yourself?

[G8.1]	G8.1. New ideas and projects sometimes distract me from previous ones.
[G8.2]	G8.2. Setbacks don't discourage me.
[G8.3]	G8.3. I have been obsessed with a certain idea or project for a short time but later lost interest.
[G8.4]	G8.4. I am a hard worker.
[G8.5]	G8.5. I often set a goal but later choose to pursue a different one.
[G8.6]	G8.6. I have difficulty maintaining my focus on projects that take more than a few months to complete.
[G8.7]	G8.7. I finish whatever I begin.
[G8.8]	G8.8. I am diligent.
D. EDL Initial Competence Level [IntEDL]	
1. Data Collection [D1a]	
[D1S1a]	1.1 Obtain, access and gather the appropriate data and/or data sources
[D1S2a]	1.2 Apply data limitations and quality measures (e.g., validity, reliability, biases in the data, difficulty in collection, accuracy, completeness)
2. Data Management [D2a]	
[D2S1a]	2.1 Apply data processing and handling methods (i.e., methods for cleaning and changing data to make it more organized – e.g., duplication, data structuring)
[D2S2a]	2.2 Apply data description (i.e., metadata)
[D2S3a]	2.3 Apply data curation processes (i.e., to ensure that data is reliably retrievable for future reuse, and to determine what data is worth saving and for how long)
[D2S4a]	2.4 Apply the technologies to preserve data (i.e., store, persist, maintain, backup data), e.g., storage mediums/services, tools, mechanisms
3. Data Analysis [D3a]	
[D3S1a]	3.1 Apply data analysis and modelling methods (e.g. application of descriptive statistics, exploratory data analysis, data mining).
[D3S2a]	3.2 Apply data presentation methods (e.g., pictorial visualisation of the data by using graphs, charts, maps and other data forms like textual or tabular representations)
4. Data Comprehension and Interpretation [D4a]	
[D4S1a]	4.1 Interpret data properties (e.g., measurement error, outliers, discrepancies within data, key take-away points, data dependencies)

[D4S2a]	4.2 Interpret statistics commonly used with educational data (e.g., randomness, central tendencies, mean, standard deviation, significance)
[D4S3a]	4.3 Interpret insights from data analysis (e.g., explanations of patterns, identification of hypotheses, connection of multiple observations, underlying trends)
[D4S4a]	4.4 Elicit potential implications/links of the data analysis insights to instruction
5. Data Application [D5a]	
[D5S1a]	5.1 Use data analysis results to make decisions to revise instruction
[D5S2a]	5.2 Evaluate the data-driven revision of instruction
6. Data Ethics [D6a]	
[D6S1a]	6.1 Use the informed consent
[D6S2a]	6.2 Protect individuals' data privacy, confidentiality, integrity and security
[D6S3a]	6.3 Apply authorship, ownership, data access (governance), re-negotiation and data-sharing

Appendix 3.2 – L2A MOOC 2021 Post-Course Survey

Table 69: Coding of Post-course survey questions

A. OVERALL LEARNING EXPERIENCE						
1. Learning Experience per Module [LXM]						
[LXM]	Module 2 LXMiM2	Module 3 LXMiM3	Module 4 LXMiM4	Module 5 LXMiM5	Module 6 LXMiM6	Module 7 LXMiM7
Q1*. Learning objectives per module were clearly stated. [LXM1]	LXM1M2	LXM1M3	LXM1M4	LXM1M5	LXM1M6	LXM1M7
Q2*. The content per module was presented in a comprehensible manner. [LXM2]	LXM2M2	LXM2M3	LXM2M4	LXM2M5	LXM2M6	LXM2M7

Q3*. The educational materials and content per module were relevant and addressed the topic identified in the title. [LXM3]	LXM3M2	LXM3M3	LXM3M4	LXM3M5	LXM3M6	LXM3M7
Q4*. The educational materials and content per module were based on current up-to-date information. [LXM4]	LXM4M2	LXM4M3	LXM4M4	LXM4M5	LXM4M6	LXM4M7
Q5*. The instructional videos per module supported my learning and added value to the course content. [LXM5]	LXM5M2	LXM5M3	LXM5M4	LXM5M5	LXM5M6	LXM5M7
Q6*. The graphics per module supported my learning and added value to the course content. [LXM6]	LXM6M2	LXM6M3	LXM6M4	LXM6M5	LXM6M6	LXM6M7
Q7*. There was a good variety of content types (i.e., written notes, videos, graphics, etc.). [LXM7]	LXM7M2	LXM7M3	LXM7M4	LXM7M5	LXM7M6	LXM7M7
Q8*. Further Readings per module were relevant and supported my learning. [LXM8]	LXM8M2	LXM8M3	LXM8M4	LXM8M5	LXM8M6	LXM8M7
Q9*. Learning activities (Polls, Discussions and Workshops) used in the module were effective and helped me construct explanations /solutions. [LXM9]	LXM9M2	LXM9M3	LXM9M4	LXM9M5	LXM9M6	LXM9M7

Q10*. Assessment tasks (quiz learning activities) used per module challenged my thinking and supported my learning. [LXM10]	LXM10M2	LXM10M3	LXM10M4	LXM10M5	LXM10M6	LXM10M7
Q11*. The assessment tasks (quiz learning activities) per module were relevant to the learning objectives. [LXM11]	LXM11M2	LXM11M3	LXM11M4	LXM11M5	LXM11M6	LXM11M7
Q12*. How many hours per week did you spend on each module? [LXM12]	LXM12M2	LXM12M3	LXM12M4	LXM12M5	LXM12M6	LXM12M7
Q13*. How many posts did you contribute to discussion forums per module? [LXM13]	LXM13M2	LXM13M3	LXM13M4	LXM13M5	LXM13M6	LXM13M7

2. Overall Learning Experience	
a. Learning Experience [LX]	
[LX1]	Q5. Course objectives and learning goals were clearly stated.
[LX2]	Q6. The workload was reasonably spread.
[LX3]	Q7. The workload was in line with my expectations.
[LX4]	Q8. The course difficulty was in line with my expectations at the start of the course.
[LX5]	Q9. The difficulty level of assessments tasks (quiz learning activities) was appropriate for the course.
[LX6]	Q10. The level of interaction with peer learners was adequate.
[LX7]	Q11. The discussion forums were an effective tool for collaborating with other learners.
b. Platform Ease of Use [PEoU]	
[PEoU1]	Q1. The course platform was easy to use.
[PEoU2]	Q2. The overall visual design of the course was appealing.
[PEoU3]	Q3. The course environment was well structured, topics and subtopics were logically arranged in a predictable pattern.
[PEoU4]	Q4. The learning path was easy to navigate.

[PEoU5]	Q17. Help and support provided on the course platform were adequate.
c. Satisfaction [SAT]	
[SAT1]	Q19. I was motivated to work through the course.
[SAT2]	Q21. I enjoyed the course.
d. Confirmation [CONF]	
[CONF1]	Q18. I can apply the knowledge created in this course to my work or other related activities.
[CONF2]	Q20. I feel like I achieved my personal goals for this course.
e. Continuance Intention [INT]	
[INT1]	Q22. It is very likely to revisit the course materials in the future.
[INT2]	Q23. It is very likely to recommend this course e.g. to a colleague or friend.
f. Certificate Assessment [CA]	
[CALA1]	Q12. Final Assessment for the Level A Certificate required the learner to have acquired a basic set of competences for EDL.
[CALA2]	Q13. The difficulty level of assessments was appropriate for the Level A Certificate.
[CALB1]	Q14. Assessment for the Level B Certificate required demonstration of a higher expertise in EDL.
[CALB2]	Q15. Assessment for the Level B Certificate included hands-on assignments based on simulated practice scenarios.
[CALB3]	Q16. The difficulty level of assessments was appropriate for the Level B Certificate.
B. GAMIFICATION EXPERIENCE	
1. Overall Gamification Experience [OGX]	
a. Satisfaction of Gamification [SATG]	
[SAT3]	Q1.3. I enjoyed the gamified elements in the course so much that I was motivated to be retained.
[SAT4]	Q1.6. It was a pleasure to work through such well-designed gamified course.
b. Enjoyment [ENJ]	
[ENJ1]	Q1.1. I found the experience of the course enjoyable.
[ENJ2]	Q1.4. I found the experience of the course interesting.
c. Motivation [MOT]	
[MOT1]	Q1.2. I found the course stimulating.
[MOT2]	Q1.5. My interest on EDL has increased during the course.

[MOT3]	Q1.7. Gamification elements encouraged me to participate in the course.
d. Competence [CMPTENCE]	
[CMPTENCE1]	Q1.8. I feel competent on EDL after completing the course.
[CMPTENCE2]	Q1.10. I feel very capable and effective on EDL after completing the course.
[CMPTENCE3]	Q1.12. My ability to be retain in the course is well matched with the course's challenges.
e. Autonomy [AUT]	
[AUT1]	Q1.9. The course provided me with interesting options and choices.
[AUT2]	Q1.11. I experienced a high level of freedom in the course.
[AUT3]	Q1.13. The course allows me to do useful activities related to EDL practice.
f. Accomplishment [ACCMPL]	
[ACCMPL1]	Q2.1. Made me feel that success comes through accomplishments.
[ACCMPL2]	Q2.7. Gave me the feeling that I need to reach goals.
g. Guided [GUID]	
[GUID1]	Q2.2. Made me feel like someone is keeping me on track.
[GUID2]	Q2.4. Made me feel guided.
[GUID3]	Q2.5. Gave me a sense of knowing what I needed to do to do better.
h. Social Experience [SCLXP]	
[SCLXP1]	Q2.3. Gave me the feeling that I was not on my own.
[SCLXP2]	Q2.6. Gave me a sense of having someone to share my endeavors with.
[SCLXP3]	Q2.8. Gave me a sense of being noticed for what I have achieved.
i. Competition [CMPTITION]	
[CMPTITION1]	Q2.9. Felt like participating in a competition.
[CMPTITION2]	Q2.11. Made me want to be in first place.
[CMPTITION3]	Q2.13. Made me feel that I needed to be on top to succeed.
j. Challenge [CHLLNG]	
[CHLLNG1]	Q2.10. Pressured me in a positive way by its high demands.
[CHLLNG2]	Q2.12. Challenged me.
[CHLLNG3]	Q2.14. Motivated me to do things that felt highly demanding.

k. Usefulness [USFL]	
[USFL1]	Q3.1. Using gamification elements helped me to improve my performance.
[USFL2]	Q3.2. Using gamification elements helped me to increase my productivity.
[USFL3]	Q3.3. Using gamification elements made me feel more effective reaching learning goals.
[USFL4]	Q3.4. Having gamification elements was useful.
l. Attitude towards Gamification	
[AGb]	Q4. My attitude towards gamification is favorable.

2. Gamification Experience per Element

	Points [PNTGX]	Badges [BDGGX]	Levels [LVLGX]	Progress Bar [PBARGX]	Leaderboard [LBRDGX]
Q1. I found it enjoyable.	[PNTENJ]	[BDGENJ]	[LVLENJ]	[PBARENJ]	[LBRDENJ]
Q2. I found it motivating.	[PNTMOT1]	[BDGMOT1]	[LVLMOT1]	[PBARMOT1]	[LBRDMOT1]
Q3. It made me feel competent on EDL.	[PNTCOM1]	[BDGCOM1]	[LVLCOM1]	[PBARCOM1]	[LBRDCOM1]
Q4. It made me to participate and work in the course.	[PNTMOT2]	[BDGMOT2]	[LVLMOT2]	[PBARMOT2]	[LBRDMOT2]
Q5. It made me feel that my ability to be retain in the course was well matched with the course's challenges.	[PNTCOM2]	[BDGCOM2]	[LVLCOM2]	[PBARCOM2]	[LBRDCOM2]
Q6. It helped me feel very capable and effective on EDL.	[PNTCOM3]	[BDGCOM3]	[LVLCOM3]	[PBARCOM3]	[LBRDCOM3]
Q7. It made it easier for me to set clear goals.	[PNTUSFL1]	[BDGUSFL1]	[LVLUSFL1]	[PBARUSFL1]	[LBRDUSFL1]
Q8. It made me feel guided.	[PNTGUID]	[BDGGUID]	[LVLGUID]	[PBARGUID]	[LBRDGUID]
Q9. It helped me to improve my performance.	[PNTUSFL2]	[BDGUSFL2]	[LVLUSFL2]	[PBARUSFL2]	[LBRDUSFL2]
Q10. Having it in the course was useful.	[PNTUSFL3]	[BDGUSFL3]	[LVLUSFL3]	[PBARUSFL3]	[LBRDUSFL3]

C. EDL ACHIEVED COMPETENCE LEVEL [AchEDL]	
1. Data Collection [D1b]	
[D1S1b]	1.1 Obtain, access and gather the appropriate data and/or data sources
[D1S2b]	1.2 Apply data limitations and quality measures (e.g., validity, reliability,biases in the data, difficulty in collection, accuracy, completeness)
2. Data Management [D2b]	
[D2S1b]	2.1 Apply data processing and handling methods (i.e., methods for cleaning and changing data to make it more organized – e.g., duplication, data structuring)
[D2S2b]	2.2 Apply data description (i.e., metadata)
[D2S3b]	2.3 Apply data curation processes (i.e., to ensure that data is reliably retrievable for future reuse, and to determine what data is worth saving and for how long)
[D2S4b]	2.4 Apply the technologies to preserve data (i.e., store, persist, maintain, backup data), e.g., storage mediums/services, tools, mechanisms
3. Data Analysis [D3b]	
[D3S1b]	3.1 Apply data analysis and modelling methods (e.g. application of descriptive statistics, exploratory data analysis, and data mining).
[D3S2b]	3.2 Apply data presentation methods (e.g., pictorial visualisation of the data by using graphs, charts, maps and other data forms like textual ortabular representations)
4. Data Comprehension and Interpretation [D4b]	
[D4S1b]	4.1 Interpret data properties (e.g., measurement error, outliers, discrepancies within data, key take-away points, data dependencies)
[D4S2b]	4.2 Interpret statistics commonly used with educational data (e.g., randomness, central tendencies, mean, standard deviation, significance)
[D4S3b]	4.3 Interpret insights from data analysis (e.g., explanations of patterns, identification of hypotheses, connection of multiple observations, underlying trends)
[D4S4b]	4.4 Elicit potential implications/links of the data analysis insights to instruction
5. Data Application [D5b]	
[D5S1b]	5.1 Use data analysis results to make decisions to revise instruction
[D5S2b]	5.2 Evaluate the data-driven revision of instruction

6. Data Ethics [D6b]	
[D6S1b]	6.1 Use the informed consent
[D6S2b]	6.2 Protect individuals' data privacy, confidentiality, integrity and security
[D6S3b]	6.3 Apply authorship, ownership, data access (governance), re-negotiation and data-sharing

Appendix 4 – Cronbach's Alpha if Item Deleted

Gamification User Types

Philanthropist

Table 70: Cronbach's Alpha for Philanthropist if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PHIL1	0,722	0,837
PHIL2	0,757	0,823
PHIL3	0,726	0,836
PHIL4	0,697	0,847

Socializer

Table 71: Cronbach's Alpha for Socializer if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SOC1	0,711	0,871
SOC2	0,784	0,845
SOC3	0,752	0,856
SOC4	0,774	0,848

Free Spirit

Table 72: Cronbach's Alpha for Free Spirit if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
FS1	0,501	0,701
FS2	0,540	0,677
FS3	0,566	0,667
FS4	0,534	0,680

Achiever

Table 73: Cronbach's Alpha for Achiever if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
AR1	0,683	0,763
AR2	0,642	0,782
AR3	0,597	0,805
AR4	0,681	0,765

Disruptor

Table 74: Cronbach's Alpha for Disruptor if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
DIS1	0,502	0,680
DIS2	0,524	0,665
DIS3	0,607	0,610
DIS4	0,449	0,704

Player

Table 75: Cronbach's Alpha for Disruptor if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
DIS1	0,619	0,747
DIS2	0,730	0,689
DIS3	0,519	0,791
DIS4	0,590	0,760

Data Collection (Initial)

Table 76: Cronbach's Alpha for Data Collection (Initial) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D1S1a	0,825	-
D1S2a	0,825	-

Data Management (Initial)

Table 77: Cronbach's Alpha for Data Management (Initial) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D2S1a	0,866	0,915
D2S2a	0,865	0,915
D2S3a	0,893	0,907
D2S4a	0,793	0,939

Data Analysis (Initial)

Table 78: Cronbach's Alpha for Data Analysis (Initial) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D3S1a	0,756	-
D3S2a	0,756	-

Data Comprehension and Interpretation (Initial)

Table 79: Cronbach's Alpha for Comprehension and Interpretation (Initial) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D4S1a	0,873	0,933

D4S2a	0,868	0,935
D4S3a	0,911	0,921
D4S4a	0,852	0,940

Data Application (Initial)

Table 80: Cronbach's Alpha for Data Application (Initial) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D5S1a	0,884	-
D5S2a	0,884	-

Data Ethics (Initial)

Table 81: Cronbach's Alpha for Data Ethics (Initial) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D6S1a	0,869	0,891
D6S2a	0,878	0,884
D6S3a	0,831	0,922

EDL Initial Competence Level

Table 82: Cronbach's Alpha for EDL Initial Competence Level if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D1a	0,828	0,941
D2a	0,879	0,935
D3a	0,861	0,937
D4a	0,873	0,935
D5a	0,848	0,938
D6a	0,772	0,947

Learning Experience

Table 83: Cronbach's Alpha for Learning Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
LX1	0,363	0,836
LX2	0,686	0,790
LX3	0,706	0,785
LX4	0,548	0,814
LX5	0,667	0,796
LX6	0,607	0,803
LX7	0,490	0,824

Platform Ease of Use

Table 84: Cronbach's Alpha for Platform Ease of Useif item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PEoU1	0,718	0,797
PEoU2	0,718	0,798
PEoU3	0,708	0,804
PEoU4	0,657	0,816
PEoU5	0,491	0,855

Continuance Intention

Table 85: Cronbach's Alpha for Continuance Intention if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
INT1	0,699	-
INT2	0,699	-

Satisfaction (Gamification)

Table 86: Cronbach's Alpha for Satisfaction (Gamification) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SAT3	0,739	-
SAT4	0,739	-

Enjoyment

Table 87: Cronbach's Alpha for Enjoyment if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ENJ1	0,735	-
ENJ2	0,735	-

Motivation

Table 88: Cronbach's Alpha for Motivation if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
MOT1	0,761	0,752
MOT2	0,700	0,800
MOT3	0,708	0,811

Competence

Table 89: Cronbach's Alpha for Competence if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CMPTENCE1	0,748	0,813
CMPTENCE2	0,830	0,736

CMPTENCE3	0,670	0,884

Autonomy

Table 90: Cronbach's Alpha for Autonomy if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
AUT1	0,711	0,716
AUT2	0,605	0,843
AUT3	0,728	0,704

Accomplishment

Table 91: Cronbach's Alpha for Accomplishment if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ACCMPL1	0,748	-
ACCMPL2	0,748	-

Guided

Table 92: Cronbach's Alpha for Guided if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
GUID1	0,762	0,873
GUID2	0,832	0,812
GUID3	0,780	0,858

Social Experience

Table 93: Cronbach's Alpha for Social Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SCLXP1	0,799	0,865
SCLXP2	0,864	0,808
SCLXP3	0,757	0,900

Competition

Table 94: Cronbach's Alpha for Competition if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CMPTITION1	0,753	0,916
CMPTITION2	0,842	0,843
CMPTITION3	0,852	0,834

Challenge

Table 95: Cronbach's Alpha for Challenge if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CHLLNG1	0,788	0,888
CHLLNG2	0,820	0,861
CHLLNG3	0,836	0,846

Usefulness

Table 96: Cronbach's Alpha for Usefulness if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
USFL1	0,884	0,936
USFL2	0,880	0,938

USFL3	0,911	0,928
USFL4	0,855	0,945

Overall Gamification Experience

Table 97: Cronbach's Alpha for Overall Gamification Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SATG	0,857	0,957
ENJ	0,775	0,960
MOT	0,882	0,956
COMPTENCE	0,778	0,959
AUT	0,807	0,959
ACCMPL	0,872	0,956
GUID	0,861	0,957
SCLXP	0,860	0,957
CMPTITION	0,661	0,965
CHLLNG	0,867	0,956
USFL	0,851	0,957

Points Gamification Experience

Table 98: Cronbach's Alpha for Points Gamification Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PNTENJ	0,844	0,968
PNTMOT1	0,881	0,967
PNTMOT2	0,860	0,968
PNTCOM1	0,863	0,967
PNTCOM2	0,889	0,967
PNTCOM3	0,868	0,967
PNTUSFL1	0,864	0,967
PNTGUID	0,817	0,969
PNTUSFL2	0,878	0,967
PNTUSFL3	0,865	0,967

Badges Gamification Experience

Table 99: Cronbach's Alpha for Badges Gamification Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
BDGENJ	0,819	0,974
BDGMOT1	0,881	0,972
BDGMOT2	0,878	0,972
BDGCOM1	0,908	0,971
BDGCOM2	0,905	0,971
BDGCOM3	0,895	0,972
BDGUSFL1	0,834	0,972
BDGGUID	0,834	0,974
BDGUSFL2	0,897	0,971
BDGUSFL3	0,880	0,972

Levels Gamification Experience

Table 100: Cronbach's Alpha for Levels Gamification Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
LVLENJ	0,894	0,974
LVLMOT1	0,902	0,973
LVLMOT2	0,870	0,974
LVLCOM1	0,918	0,973
LVLCOM2	0,901	0,973
LVLCOM3	0,910	0,973
LVLUSFL1	0,892	0,974
LVLGUID	0,795	0,977
LVLUSFL2	0,882	0,974
LVLUSFL3	0,899	0,973

Progress Bar Gamification Experience

Table 101: Cronbach's Alpha for Progress Bar Gamification Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PBARENJ	0,852	0,959
PBARMOT1	0,858	0,959
PBARMOT2	0,849	0,959
PBARCOM1	0,844	0,960
PBARCOM2	0,849	0,960
PBARCOM3	0,833	0,960
PBARUSFL1	0,845	0,960
PBARGUID	0,776	0,962
PBARUSFL2	0,844	0,960
PBARUSFL3	0,819	0,961

Leaderboard Gamification Experience

Table 102: Cronbach's Alpha for Leaderboard Gamification Experience if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
LBRDENJ	0,919	0,985
LBRDMOT1	0,912	0,985
LBRDMOT2	0,921	0,985
LBRDCOM1	0,937	0,984
LBRDCOM2	0,929	0,985
LBRDCOM3	0,938	0,984
LBRDUSFL1	0,937	0,984
LBRDGUID	0,907	0,985
LBRDUSFL2	0,953	0,984
LBRDUSFL3	0,937	0,984

Data Collection (Achieved)

Table 103: Cronbach's Alpha for Data Collection (Achieved) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted

D1S1b	0,850	-
D1S2b	0,850	-

Data Management (Achieved)

Table 104: Cronbach's Alpha for Data Management (Achieved) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D2S1b	0,857	0,911
D2S2b	0,856	0,911
D2S3b	0,878	0,904
D2S4b	0,793	0,932

Data Analysis (Achieved)

Table 105: Cronbach's Alpha for Data Analysis (Achieved) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D3S1b	0,828	-
D3S2b	0,828	-

Data Comprehension and Interpretation (Achieved)

Table 106: Cronbach's Alpha for Comprehension and Interpretation (Achieved) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D4S1b	0,897	0,933
D4S2b	0,864	0,944
D4S3b	0,923	0,925
D4S4b	0,857	0,946

Data Application (Achieved)

Table 107: Cronbach's Alpha for Data Application (Achieved) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D5S1b	0,911	-
D5S2b	0,911	-

Data Ethics (Achieved)

Table 108: Cronbach's Alpha for Data Ethics (Achieved) if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D6S1a	0,896	0,935
D6S2a	0,926	0,912
D6S3a	0,882	0,946

EDL Achieved Competence Level

Table 109: Cronbach's Alpha for EDL Achieved Competence Level if item deleted

Cronbach's Alpha	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
D1b	0,901	0,959
D2b	0,913	0,957
D3b	0,896	0,959
D4b	0,921	0,956
D5b	0,895	0,959
D6b	0,822	0,967

Appendix 5 – Spearman's Correlation rho

Appendix 5.1 – Pre-Course Survey

Gamification User Types

- ***Philanthropist***

Table 110: Spearman's rho for Philanthropist

Spearman's rho		PHIL1	PHIL2	PHIL3	PHIL4
PHIL	Correlation Coefficient	0,813	0,856	0,814	0,827
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Socializer***

Table 111: Spearman's rho for Socializer

Spearman's rho		SOC1	SOC2	SOC3	SOC4
SOC	Correlation Coefficient	0,827	0,871	0,847	0,881
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Free Spirit***

Table 112: Spearman's rho for Free Spirit

Spearman's rho		FS1	FS2	FS3	FS4
FS	Correlation Coefficient	0,732	0,768	0,707	0,726
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Achiever***

Table 113: Spearman's rho for Achiever

Spearman's rho		AR1	AR2	AR3	AR4
AR	Correlation Coefficient	0,820	0,779	0,809	0,799
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Disruptor***

Table 114: Spearman's rho for Disruptor

Spearman's rho		DIS1	DIS2	DIS3	DIS4
DIS	Correlation Coefficient	0,754	0,709	0,803	0,653
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Player***

Table 115: Spearman's rho for Player

Spearman's rho		PR1	PR2	PR3	PR4
PR	Correlation Coefficient	0,802	0,850	0,698	0,769
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

EDL Initial Competence Level

- ***Data Collection (Initial)***

Table 116: Spearman's rho for Initial Data Collection

Spearman's rho	D1S1a	D1S2a

D1a	Correlation Coefficient	0,964	0,950
	Sig. (2- tailed)	0,000	0,000

- ***Data Management (Initial)***

Table 117: Spearman's rho for Initial Data Management

Spearman's rho		D2S1a	D2S2a	D2S3a	D2S4a
D2a	Correlation Coefficient	0,926	0,914	0,922	0,893
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Data Analysis (Initial)***

Table 118: Spearman's rho for Initial Data Analysis

Spearman's rho		D3S1a	D3S2a
D3a	Correlation Coefficient	0,913	0,953
	Sig. (2- tailed)	0,000	0,000

- ***Data Comprehension and Interpretation (Initial)***

Table 119: Spearman's rho for Initial Data Comprehension and Interpretation

Spearman's rho		D4S1a	D4S2a	D4S3a	D4S4a
D4a	Correlation Coefficient	0,918	0,931	0,942	0,906
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Data Application (Initial)***

Table 120: Spearman's rho for Initial Data Application

Spearman's rho		D5S1a	D5S2a
D5a	Correlation Coefficient	0,975	0,963
	Sig. (2- tailed)	0,000	0,000

- ***Data Ethics (Initial)***

Table 121: Spearman's rho for Data Ethics

Spearman's rho		D6S1a	D6S2a	D6S3a
D6a	Correlation Coefficient	0,937	0,950	0,902
	Sig. (2- tailed)	0,000	0,000	0,000

Appendix 5.2 – Post-Course Survey

Learning Experience

Table 122: Spearman's rho for Learning Experience

Spearman's rho		LX1	LX2	LX3	LX4	LX5	LX6	LX7
LX	Correlation Coefficient	0,475	0,787	0,827	0,688	0,757	0,710	0,637
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000	0,000

Platform Ease of Use

Table 123: Spearman's rho for Platform Ease of Use

Spearman's rho		PEoU1	PEoU2	PEoU3	PEoU4	PEoU5
PEoU	Correlation Coefficient	0,829	0,809	0,783	0,812	0,680
	Sig. (2- tailed)	0,000	0,000	0,000	0,000	0,000

Continuance Intention

Table 124: Spearman's rho for Continuance Intention

Spearman's rho		INT1	INT2
INT	Correlation Coefficient	0,910	0,943
	Sig. (2- tailed)	0,000	0,000

Overall Gamification Experience

- ***Satisfaction (Gamification)***

Table 125: Spearman's rho for Satisfaction

Spearman's rho		SAT3	SAT4
SATG	Correlation Coefficient	0,920	0,933
	Sig. (2- tailed)	0,000	0,000

- ***Enjoyment***

Table 126: Spearman's rho for Enjoyment

Spearman's rho		ENJ1	ENJ2
ENJ	Correlation Coefficient	0,957	0,916
	Sig. (2- tailed)	0,000	0,000

- ***Motivation***

Table 127: Spearman's rho for Motivation

Spearman's rho		MOT1	MOT2	MOT3
MOT	Correlation Coefficient	0,877	0,868	0,899
	Sig. (2- tailed)	0,000	0,000	0,000

- ***Competence***

Table 128: Spearman's rho for Competence

Spearman's rho		COMPTENCE1	COMPTENCE2	COMPTENCE3
COMPTENCE	Correlation Coefficient	0,869	0,921	0,846
	Sig. (2-tailed)	0,000	0,000	0,000

- ***Autonomy***

Table 129: Spearman's rho for Autonomy

Spearman's rho		AUT1	AUT2	AUT3
AUT	Correlation Coefficient	0,862	0,847	0,867
	Sig. (2- tailed)	0,000	0,000	0,000

- ***Accomplishment***

Table 130: Spearman's rho for Accomplishment

Spearman's rho		ACCMPL1	ACCMPL2
ACCMPL	Correlation Coefficient	0,930	0,922
	Sig. (2- tailed)	0,000	0,000

- ***Guided***

Table 131: Spearman's rho for Guided

Spearman's rho		GUID1	GUID2	GUID3
GUID	Correlation Coefficient	0,876	0,915	0,880
	Sig. (2- tailed)	0,000	0,000	0,000

- ***Social Experience***

Table 132: Spearman's rho for Social Experience

Spearman's rho		SCLXP1	SCLXP2	SCLXP3
SCLXP	Correlation Coefficient	0,919	0,937	0,873
	Sig. (2- tailed)	0,000	0,000	0,000

- ***Competition***

Table 133: Spearman's rho for Competition

Spearman's rho		COMPTITION1	COMPTITION2	COMPTITION3
COMPTITION	Correlation Coefficient	0,870	0,933	0,932
	Sig. (2-tailed)	0,000	0,000	0,000

- ***Challenge***

Table 134: Spearman's rho for Challenge

Spearman's rho		CHLLNG1	CHLLNG2	CHLLNG3
CHLLNG	Correlation Coefficient	0,884	0,904	0,916
	Sig. (2- tailed)	0,000	0,000	0,000

- ***Usefulness***

Table 135: Spearman's rho for Usefulness

Spearman's rho		USFL1	USFL2	USFL3	USFL4
USFL	Correlation Coefficient	0,944	0,935	0,924	0,808
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Overall Gamification Experience***

Table 136: Spearman's rho for Overall Gamification Experience

Spearman's rho	SATG	ENJ	MOT	COMPTENCE	AUT

OGX	Correlation Coefficient	0,864	0,808	0,890	0,822	0,819	
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	
Spearman's rho		ACCMPL	GUID	SCLXP	CMPTITION	CHLLNG	USFL
OGX	Correlation Coefficient	0,865	0,848	0,879	0,720	0,886	0,869
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	0,000

Gamification Experience per Element

Points

Table 137: Spearman's rho for Points

Spearman's rho		PNTENJ	PNTMOT1	PNTCOM1	PNTMOT2	PNTCOM2
PNTGX	Correlation Coefficient	0,838	0,873	0,890	0,863	0,877
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000
Spearman's rho		PNTCOM3	PNTUSFL1	PNTGUID	PNTUSFL2	PNTUSFL3
PNTGX	Correlation Coefficient	0,884	0,876	0,825	0,891	0,836
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000

Badges

Table 138: Spearman's rho for Badges

Spearman's rho		BDGENJ	BDGMOT1	BDGCOM1	BDGMOT2	BDGCOM2
BDGGX	Correlation Coefficient	0,840	0,881	0,886	0,905	0,897
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000
Spearman's rho		BDGCOM3	BDGUSFL1	BDGGUID	BDGUSFL2	BDGUSFL3
BDGGX	Correlation Coefficient	0,900	0,899	0,845	0,909	0,886
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000

Levels

Table 139: Spearman's rho for Levels

Spearman's rho		LVLENJ	LVLMOT1	LVLCOM1	LVLMOT2	LVLCOM2
LVLGX	Correlation Coefficient	0,897	0,890	0,893	0,914	0,889
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000
Spearman's rho		LVLCOM3	LVLUSFL1	LVLGUID	LVLUSFL2	LVLUSFL3
LVLGX	Correlation Coefficient	0,921	0,895	0,815	0,897	0,878
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000

Progress Bar

Table 140: Spearman's rho for Progress Bar

Spearman's rho		PBARENJ	PBAR MOT1	PBAR COM1	PBARMOT2	PBARCOM2
PBAR GX	Correlation Coefficient	0,866	0,871	0,890	0,864	0,866
	Sig. (2- tailed)	0,000	0,000	0,000	0,000	0,000
Spearman's rho		PBARCOM3	PBAR USFL1	PBAR GUID	PBARUSFL2	PBARUSFL3
PBAR GX	Correlation Coefficient	0,873	0,881	0,820	0,888	0,822
	Sig. (2- tailed)	0,000	0,000	0,000	0,000	0,000

Leaderboard

Table 141: Spearman's rho for Leaderboard

Spearman's rho		LBRDENJ	LBRD MOT1	LBRD COM1	LBRDMOT2	LBRDCOM2
LBRD GX	Correlation Coefficient	0,928	0,912	0,905	0,928	0,921
	Sig. (2- tailed)	0,000	0,000	0,000	0,000	0,000
Spearman's rho		LBRDCOM3	LBRD USFL1	LBRD GUID	LBRDUSFL2	LBRDUSFL3
LBRD GX	Correlation Coefficient	0,930	0,938	0,922	0,949	0,937
	Sig. (2- tailed)	0,000	0,000	0,000	0,000	0,000

EDL Achieved Competence Level

- ***Data Collection (Achieved)***

Table 142: Spearman's rho for Achieved Data Collection

Spearman's rho		D1S1b	D1S2b
D1b	Correlation Coefficient	0,951	0,956
	Sig. (2- tailed)	0,000	0,000

- ***Data Management (Achieved)***

Table 143: Spearman's rho for Achieved Data Management

Spearman's rho		D2S1b	D2S2b	D2S3b	D2S4b
D2b	Correlation Coefficient	0,913	0,915	0,919	0,870
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Data Analysis (Achieved)***

Table 144: Spearman's rho for Achieved Data Analysis

Spearman's rho		D3S1b	D3S2b
D3b	Correlation Coefficient	0,947	0,951
	Sig. (2- tailed)	0,000	0,000

- ***Data Comprehension and Interpretation (Achieved)***

Table 145: Spearman's rho for Achieved Data Comprehension and Interpretation

Spearman's rho		D4S1b	D4S2b	D4S3b	D4S4b
D4b	Correlation Coefficient	0,932	0,929	0,948	0,898
	Sig. (2- tailed)	0,000	0,000	0,000	0,000

- ***Data Application (Achieved)***

Table 146: Spearman's rho for Achieved Data Application

Spearman's rho		D5S1b	D5S2b
D5b	Correlation Coefficient	0,975	0,970
	Sig. (2- tailed)	0,000	0,000

- ***Data Ethics (Achieved)***

Table 147: Spearman's rho for Achieved Data Ethics

Spearman's rho		D6S1b	D6S2b	D6S3b
D6b	Correlation Coefficient	0,944	0,957	0,952
	Sig. (2- tailed)	0,000	0,000	0,000

EDL Competence Level Advancement

Table 148: Spearman's rho for EDL Competence Level Advancement

Spearman's rho		D1adv	D2adv	D3adv	D4adv	D5adv	D6adv
EDLadv	Correlation Coefficient	0,826	0,881	0,879	0,896	0,884	0,828
	Sig. (2- tailed)	0,000	0,000	0,000	0,000	0,000	0,000

Appendix 6 – Hypotheses' Tests

Appendix 6.1 – Learners' Profile

Player types – course completion relationship

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12,936[a]	5	,024
Likelihood Ratio	12,250	5	,032
N of Valid Cases	1235		

GUT * Completed Crosstabulation					
			Completed		Total
			0	1	
GUT	Philanthropist	Count	459	125	584
		Expected Count	450,6	133,4	584,0
		% within GUT	78,6%	21,4%	100,0%
		% within Completed	48,2%	44,3%	47,3%
		% of Total	37,2%	10,1%	47,3%
	Socializer	Count	133	52	185
		Expected Count	142,8	42,2	185,0
		% within GUT	71,9%	28,1%	100,0%
		% within Completed	14,0%	18,4%	15,0%
		% of Total	10,8%	4,2%	15,0%
	Achiever	Count	131	42	173
		Expected Count	133,5	39,5	173,0
		% within GUT	75,7%	24,3%	100,0%
		% within Completed	13,7%	14,9%	14,0%
		% of Total	10,6%	3,4%	14,0%
	Free Spirit	Count	138	33	171
		Expected Count	132,0	39,0	171,0
		% within GUT	80,7%	19,3%	100,0%
		% within Completed	14,5%	11,7%	13,8%
		% of Total	11,2%	2,7%	13,8%
	Player and/or Disruptor	Count	27	17	44
		Expected Count	34,0	10,0	44,0
		% within GUT	61,4%	38,6%	100,0%
		% within Completed	2,8%	6,0%	3,6%

		% of Total	2,2%	1,4%	3,6%
	Multi	Count	65	13	78
		Expected Count	60,2	17,8	78,0
		% within GUT	83,3%	16,7%	100,0%
		% within Completed	6,8%	4,6%	6,3%
		% of Total	5,3%	1,1%	6,3%
Total		Count	953	282	1235
		Expected Count	953,0	282,0	1235,0
		% within GUT	77,2%	22,8%	100,0%
		% within Completed	100,0%	100,0%	100,0%
		% of Total	77,2%	22,8%	100,0%

Mean Intention of devoting time

Intention of devoting time	c_i=center	c_i^2	fi=frequency	c_i^2*fi	c_i*fi	%
< 3 hours	1,5	2,25	247	555,75	370,5	20,0%
3-4 hours	3,5	12,25	489	5.990,25	1.711,5	39,6%
5-6 hours	5,5	30,25	292	8.833	1.606	23,6%
7-8 hours	7,5	56,25	130	7.312,5	975	10,5%
8-10 hours	9	81	77	6.237	693	6,2%
Total			1235	28.928,5	5.356	100%

$$\tilde{x} = \frac{\sum(c_i \times f_i)}{\sum f_i} = 4{,}34$$

$$s = \sqrt{\frac{\sum(f_i \times {c_i}^2)}{n} - \tilde{x}^2} = 2{,}14$$

Mean User Intention Ratio (UIR)

Intention of devoting time	c_i=center	c_i^2	fi=frequency	c_i^2*fi	c_i*fi	%
0%-20%	10	100	8	800	80	0,6%
21%-40%	30	300	20	6.000	600	1,6%
41%-60%	50	2500	91	227.500	4.550	7,4%

61%-80%	70	4.900	236	1.156.400	16.520	19,1%
81%-100%	90	8.100	880	7.128.000	79.200	71,3%
Total			1235	8.518.700	100.950	100%

$$\tilde{x} = \frac{\sum(c_i \times f_i)}{\sum f_i} = 81{,}74$$

$$s = \sqrt{\frac{\sum(f_i \times {c_i}^2)}{n} - \tilde{x}^2} = 14{,}71$$

Appendix 6.2 – Psychological Outcomes

Overall Gamification Experience differences per Professional role

ANOVA					
OGX					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18,414	3	6,138	11,521	,000
Within Groups	148,113	278	,533		
Total	166,526	281			

Multiple Comparisons						
Dependent Variable: OGX						
Scheffe						
(I) ProfRole	(J) ProfRole	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
eLearning Professionals (IDs, eTutors)	HES	,01675	,16192	1,000	-,4387	,4722
	School Teacher	-,49834	,14224	,007	-,8984	-,0983
	Other	,10730	,22029	,971	-,5123	,7269
HES	eLearning Professionals (IDs, eTutors)	-,01675	,16192	1,000	-,4722	,4387

	School Teacher	-,51509	,10988	,000	-,8242	-,2060
	Other	,09055	,20092	,977	-,4746	,6557
School Teacher	eLearning Professionals (IDs, eTutors)	,49834	,14224	,007	,0983	,8984
	HES	,51509	,10988	,000	,2060	,8242
	Other	,60564	,18543	,015	,0841	1,1272
Other	eLearning Professionals (IDs, eTutors)	-,10730	,22029	,971	-,7269	,5123
	HES	-,09055	,20092	,977	-,6557	,4746
	School Teacher	-,60564	,18543	,015	-1,1272	-,0841

Overall Gamification Experience differences per MOOCs Completion

ANOVA					
OGX					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7,852	4	1,963	3,427	,009
Within Groups	158,674	277	,573		
Total	166,526	281			

Multiple Comparisons						
Dependent Variable: OGX						
Scheffe						
(I) MOOCsCompl	(J) MOOCsCompl	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0	1	-,20918	,14732	,733	-,6660	,2477
	2-4	-,09014	,11368	,960	-,4427	,2624
	5-10	-,14349	,14904	,920	-,6057	,3187
	>10	-,59235	,16397	,012	-1,1008	-,0839
1	0	,20918	,14732	,733	-,2477	,6660
	2-4	,11904	,15785	,966	-,3705	,6085
	5-10	,06568	,18495	,998	-,5079	,6392
	>10	-,38318	,19718	,439	-,9947	,2283

2-4	0	,09014	,11368	,960	-,2624	,4427
	1	-,11904	,15785	,966	-,6085	,3705
	5-10	-,05336	,15946	,998	-,5479	,4411
	>10	-,50222	,17349	,082	-1,0402	,0358
5-10	0	,14349	,14904	,920	-,3187	,6057
	1	-,06568	,18495	,998	-,6392	,5079
	2-4	,05336	,15946	,998	-,4411	,5479
	>10	-,44886	,19847	,279	-1,0643	,1666
>10	0	,59235	,16397	,012	,0839	1,1008
	1	,38318	,19718	,439	-,2283	,9947
	2-4	,50222	,17349	,082	-,0358	1,0402
	5-10	,44886	,19847	,279	-,1666	1,0643

Overall Gamification Experience per previous gamification experience

Dependent variable: OGX

Independent variable: GFamiliar

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
OGX	Equal variances assumed	3,368	,068	,901	280	,369	,08415	,09344	-,09979	,26810
	Equal variances not assumed			,941	273,030	,348	,08415	,08947	-,09199	,26029

Dependent variable: OGX

Independent variable: GLXP

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
OGX	Equal variances assumed	1,922	,167	,479	280	,632	,04398	,09185	-,13682	,22477
	Equal variances not assumed			,481	276,481	,631	,04398	,09141	-,13596	,22392

Dependent variable: OGX

Independent variable: GEdDesign

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
OGX	Equal variances assumed	,062	,804	3,405	280	,001	,30740	,09028	,12969	,48511
	Equal variances not assumed			3,392	268,802	,001	,30740	,09061	,12900	,48580

Group Statistics					
	GEdDesign	N	Mean	Std. Deviation	Std. Error Mean
OGX	Yes	130	3,9386	,77483	,06796
	No	152	3,6312	,73897	,05994

Dependent variable: OGX

Independent variable: GMOOCs

ANOVA					
OGX					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6,152	3	2,051	3,554	,015
Within Groups	160,375	278	,577		
Total	166,526	281			

Multiple Comparisons						
Dependent Variable: OGX						
Scheffe						
(I) GMOOCs	(J) GMOOCs	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
None	1	-,27173	,12397	,189	-,6204	,0770
	2-4	,00382	,16095	1,000	-,4489	,4565
	5-10	-,74189	,29196	,094	-1,5631	,0793
1	None	,27173	,12397	,189	-,0770	,6204
	2-4	,27555	,18872	,546	-,2553	,8064
	5-10	-,47017	,30815	,508	-1,3369	,3966
2-4	None	-,00382	,16095	1,000	-,4565	,4489
	1	-,27555	,18872	,546	-,8064	,2553
	5-10	-,74571	,32479	,156	-1,6592	,1678
5-10	None	,74189	,29196	,094	-,0793	1,5631
	1	,47017	,30815	,508	-,3966	1,3369
	2-4	,74571	,32479	,156	-,1678	1,6592

Overall gamification experience relationship with attitude towards gamification

Correlations				
Spearman's rho		AGa	AGb	OGX
AGa	Correlation Coefficient	1,000	,258	,200
	Sig. (2-tailed)	.	,000	,001
	N	282	282	282
AGb	Correlation Coefficient	,258	1,000	,650

	Sig. (2-tailed)	,000	.	,000
	N	282	282	282
OGX	Correlation Coefficient	,200	,650	1,000
	Sig. (2-tailed)	,001	,000	.
	N	282	282	282

Gamification Experience per Element Correlation

Correlations						
		PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX
PNTGX	Pearson Correlation	1	,891**	,887**	,658**	,769**
	Sig. (2-tailed)		,000	,000	,000	,000
	N	282	282	282	282	282
BDGGX	Pearson Correlation	,891**	1	,909**	,641**	,811**
	Sig. (2-tailed)	,000		,000	,000	,000
	N	282	282	282	282	282
LVLGX	Pearson Correlation	,887**	,909**	1	,667**	,807**
	Sig. (2-tailed)	,000	,000		,000	,000
	N	282	282	282	282	282
PBARGX	Pearson Correlation	,658**	,641**	,667**	1	,657**
	Sig. (2-tailed)	,000	,000	,000		,000
	N	282	282	282	282	282
LBRDGX	Pearson Correlation	,769**	,811**	,807**	,657**	1
	Sig. (2-tailed)	,000	,000	,000	,000	
	N	282	282	282	282	282

Overall Gamification Experience and Gamification Experience per Element Correlation

Correlations							
		PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX	OGX
PNTGX	Pearson Correlation	1	,891**	,887**	,658**	,769**	,881**
	Sig. (2-tailed)		,000	,000	,000	,000	,000
	N	282	282	282	282	282	282
BDGGX	Pearson Correlation	,891**	1	,909**	,641**	,811**	,810**
	Sig. (2-tailed)	,000		,000	,000	,000	,000
	N	282	282	282	282	282	282
LVLGX	Pearson Correlation	,887**	,909**	1	,667**	,807**	,805**
	Sig. (2-tailed)	,000	,000		,000	,000	,000
	N	282	282	282	282	282	282

PBARGX	Pearson Correlation	,658**	,641**	,667**	1	,657**	,655**
	Sig. (2-tailed)	,000	,000	,000		,000	,000
	N	282	282	282	282	282	282
LBRDGX	Pearson Correlation	,769**	,811**	,807**	,657**	1	,706**
	Sig. (2-tailed)	,000	,000	,000	,000		,000
	N	282	282	282	282	282	282
OGX	Pearson Correlation	,881**	,810**	,805**	,655**	,706**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	
	N	282	282	282	282	282	282

Gamification experience per element per previous gamification experience

Gamification experience per element differences – Gamification in educational design

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PNTGX	Equal variances assumed	,219	,640	3,082	280	,002	,31574	,10244	,11408	,51740
	Equal variances not assumed			3,079	272,151	,002	,31574	,10255	,11385	,51763
BDGGX	Equal variances assumed	,249	,618	2,123	280	,035	,23450	,11048	,01704	,45197
	Equal variances not assumed			2,120	271,611	,035	,23450	,11064	,01669	,45232
LVLGX	Equal variances assumed	,027	,869	2,385	280	,018	,25695	,10776	,04483	,46907
	Equal variances not assumed			2,374	267,578	,018	,25695	,10826	,04381	,47010

PBARGX	Equal variances assumed	2,057	,153	2,296	280	,022	,21982	,09576	,03132	,40831
	Equal variances not assumed			2,308	277,919	,022	,21982	,09523	,03235	,40728
LBRDGX	Equal variances assumed	2,191	,140	1,660	280	,098	,18881	,11377	-,03514	,41275
	Equal variances not assumed			1,648	264,364	,100	,18881	,11454	-,03673	,41434

Gamification experience per element and attitude towards gamification relationship

Correlations								
Spearman's rho		PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX	AGa	AGb
AGa	Correlation Coefficient	,135	,142	,149	,117	,056	1,000	,258
	Sig. (2-tailed)	,023	,017	,012	,049	,345	.	,000
	N	282	282	282	282	282	282	282
AGb	Correlation Coefficient	,601	,507	,541	,458	,363	,258	1,000
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	.
	N	282	282	282	282	282	282	282

Appendix 6.3 – Behavioral Outcomes

Learning Experience

Learning Experience and attitude towards gamification correlation

Correlations				
Spearman's rho		AGa	AGb	LX
AGa	Correlation Coefficient	1,000	,258	,123
	Sig. (2-tailed)	.	,000	,039
	N	282	282	282
AGb	Correlation Coefficient	,258	1,000	,396

	Sig. (2-tailed)	,000	.	,000
	N	282	282	282
LX	Correlation Coefficient	,123	,396	1,000
	Sig. (2-tailed)	,039	,000	.
	N	282	282	282

Learning experience, overall gamification experience, items of overall gamification experience and gamification experience per element correlations

Correlations							
		SATG	ENJ	MOT	COMPTENCE	AUT	ACCMPL
LX	Pearson Correlation	,543	,531	,531	,568	,546	,460
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000
	N	282	282	282	282	282	282
		ACCMPL	GUID	SCLXP	CMPTITION	CHLLNG	USFL
LX	Pearson Correlation	,478	,498	,364	,440	,460	,569
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000
	N	282	282	282	282	282	282
		OGX	PNTGX	BDGGX	LVLGX	PBARGX	
LX	Pearson Correlation	,510	,485	,514	,445	,475	
	Sig. (2-tailed)	,000	,000	,000	,000	,000	
	N	282	282	282	282	282	

Platform Ease of Use

Platform Ease of Use, overall gamification experience and gamification experience per element correlations

Correlations							
		PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX	OGX
PEoU	Pearson Correlation	,529	,475	,502	,519	,399	0,583

	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000
	N	282	282	282	282	282	282

Platform Ease of Use and attitude towards gamification correlation

Correlations				
Spearman's rho		AGa	AGb	PEoU
AGa	Correlation Coefficient	1,000	,258	,163
	Sig. (2-tailed)	.	,000	,006
	N	282	282	282
AGb	Correlation Coefficient	,258	1,000	,549
	Sig. (2-tailed)	,000	.	,000
	N	282	282	282
PEoU	Correlation Coefficient	,163	,549	1,000
	Sig. (2-tailed)	,006	,000	.
	N	282	282	282

Continued Use Intention

Continued Use Intention, overall gamification experience and gamification experience per element correlations

Correlations							
		PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX	OGX
INT	Pearson Correlation	,487	,432	,450	,468	,390	0,604
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000
	N	282	282	282	282	282	282

Continued Use Intention – Gamification Familiar

Independent Samples Test		
	Levene's Test for Equality of Variances	t-test for Equality of Means

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
INT	Equal variances assumed	,591	,443	2,052	280	,041	,2177	,1061	,0089	,4266
	Equal variances not assumed			2,022	230,096	,044	,2177	,1077	,0056	,4299

Group Statistics					
	GFamiliar	N	Mean	Std. Deviation	Std. Error Mean
INT	Yes	168	4,161	,8465	,0653
	No	114	3,943	,9139	,0856

Continued Use Intention – Gamification Educational Design

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
INT	Equal variances assumed	2,137	,145	2,968	280	,003	,3075	,1036	,1036	,5115
	Equal variances not assumed			3,004	279,999	,003	,3075	,1024	,1060	,5091

Group Statistics

	GEdDesign	N	Mean	Std. Deviation	Std. Error Mean
INT	Yes	130	4,238	,7929	,0695
	No	152	3,931	,9262	,0751

Perceived Use

Perceived Use (comments and posts), overall gamification experience and gamification experience per element sorrelations

	Correlations		
		LXM12	LXM13
LXM12	Pearson Correlation	1	,390**
	Sig. (2-tailed)		,000
	N	282	282
LXM13	Pearson Correlation	,390**	1
	Sig. (2-tailed)	,000	
	N	282	282
OGX	Pearson Correlation	,200**	,203**
	Sig. (2-tailed)	,001	,001
	N	282	282
PNTGX	Pearson Correlation	,173**	,183**
	Sig. (2-tailed)	,003	,002
	N	282	282
BDGGX	Pearson Correlation	,146*	,168**
	Sig. (2-tailed)	,014	,005
	N	282	282
LVLGX	Pearson Correlation	,159**	,137*
	Sig. (2-tailed)	,008	,022
	N	282	282
PBARGX	Pearson Correlation	,196**	,111
	Sig. (2-tailed)	,001	,063
	N	282	282
LBRDGX	Pearson Correlation	,094	,062
	Sig. (2-tailed)	,116	,301
	N	282	282

Engagement

Engagement (total number of Points) and overall gamification experience correlation

Correlations			
		POINTSadd	OGX
POINTSadd	Pearson Correlation	1	,138*
	Sig. (2-tailed)		,020
	N	282	282
OGX	Pearson Correlation	,138*	1
	Sig. (2-tailed)	,020	
	N	282	282

Engagement and gamification experience per element correlation

Correlations							
		POINTS add	PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX
POINTSadd	Pearson Correlation	1	,123*	,075	,112	,162**	-,036
	Sig. (2-tailed)		,039	,211	,061	,006	,548
	N	282	282	282	282	282	282
PNTGX	Pearson Correlation	,123*	1	,891**	,887**	,658**	,769**
	Sig. (2-tailed)	,039		,000	,000	,000	,000
	N	282	282	282	282	282	282
BDGGX	Pearson Correlation	,075	,891**	1	,909**	,641**	,811**
	Sig. (2-tailed)	,211	,000		,000	,000	,000
	N	282	282	282	282	282	282
LVLGX	Pearson Correlation	,112	,887**	,909**	1	,667**	,807**
	Sig. (2-tailed)	,061	,000	,000		,000	,000
	N	282	282	282	282	282	282
PBARGX	Pearson Correlation	,162**	,658**	,641**	,667**	1	,657**
	Sig. (2-tailed)	,006	,000	,000	,000		,000
	N	282	282	282	282	282	282
LBRDGX	Pearson Correlation	-,036	,769**	,811**	,807**	,657**	1
	Sig. (2-tailed)	,548	,000	,000	,000	,000	

	N	282	282	282	282	282	282

Engagement per previous gamification experience

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
POINTS add	Equal variances assumed	3,185	,075	2,284	280	,023	1057,54543	463,05265	146,03902	1969,05184
	Equal variances not assumed			2,258	233,076	,025	1057,54543	468,30673	134,89019	1980,20066

Group Statistics					
	GFamiliar	N	Mean	Std. Deviation	Std. Error Mean
POINTS add	Yes	168	7260,0893	3723,47123	287,27204
	No	114	6202,5439	3948,87329	369,84587

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper

POINTS add	Equal variances assumed	9,169	,003	2,965	280	,003	1343,26447	453,04254	451,46270	2235,06625
	Equal variances not assumed			2,990	279,342	,003	1343,26447	449,22955	458,95942	2227,56953

Group Statistics					
	GEdDesign	N	Mean	Std. Deviation	Std. Error Mean
POINTS add	Yes	130	7556,6000	3566,70553	312,82077
	No	152	6213,3355	3974,97847	322,41333

Appendix 6.4 – EDL Competence Level Advancement

EDL Advancement and Achieved EDL per professional groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
AchEDL	Between Groups	23,931	3	7,977	13,396	,000
	Within Groups	165,546	278	,595		
	Total	189,477	281			
EDLadv	Between Groups	9,908	3	3,303	4,367	,005
	Within Groups	210,262	278	,756		
	Total	220,171	281			

Multiple Comparisons							
Dependent Variable: OGX							
Scheffe							
	(I) ProfRoles	(J) ProfRoles	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
AchEDL	eLearning Professio	HES	,71286	,17118	,001	,2314	1,1943
		School Teachers	-,01015	,15037	1,000	-,4331	,4128

	nals (ID+eTut)	Others	,09345	,23289	,984	-,5616	,7485
	HES	eLearning Professionals (ID+eTut)	-,71286	,17118	,001	-1,1943	-,2314
		School Teachers	-,72301	,11617	,000	-1,0498	-,3963
		Others	-,61941	,21242	,039	-1,2169	-,0219
	School Teachers	eLearning Professionals (ID+eTut)	,01015	,15037	1,000	-,4128	,4331
		HES	,72301	,11617	,000	,3963	1,0498
		Others	,10360	,19604	,964	-,4478	,6550
	Others	eLearning Professionals (ID+eTut)	-,09345	,23289	,984	-,7485	,5616
		HES	,61941	,21242	,039	,0219	1,2169
		School Teachers	-,10360	,19604	,964	-,6550	,4478
EDLadv	eLearning Professionals (ID+eTut)	HES	,483377	,192918	,101	-,05924	1,02600
		School Teachers	,039160	,169470	,997	-,43751	,51583
		Others	,323371	,262466	,678	-,41487	1,06161
	HES	eLearning Professionals (ID+eTut)	-,483377	,192918	,101	-1,02600	,05924
		School Teachers	-,444217	,130925	,010	-,81247	-,07597
		Others	-,160006	,239395	,930	-,83335	,51334
	School Teachers	eLearning Professionals (ID+eTut)	-,039160	,169470	,997	-,51583	,43751
		HES	,444217	,130925	,010	,07597	,81247
		Others	,284211	,220935	,647	-,33721	,90563
	Others	eLearning Professionals (ID+eTut)	-,323371	,262466	,678	-1,06161	,41487
		HES	,160006	,239395	,930	-,51334	,83335
		School Teachers	-,284211	,220935	,647	-,90563	,33721

EDL Advancement and overall gamification experience correlations

Correlations		
		EDLadv
OGX	Pearson Correlation	,146*

	Sig. (2-tailed)	,014
	N	282

Achieved EDL and overall gamification experience correlations

Correlations					
			IntEDL	AchEDL	OGX
	IntEDL	Pearson Correlation	1	,443	,116
		Sig. (2-tailed)		,000	,051
		N	282	282	282
	AchEDL	Pearson Correlation	,443	1	,278
		Sig. (2-tailed)	,000		,000
		N	282	282	282
	OGX	Pearson Correlation	,116	,278	1
		Sig. (2-tailed)	,051	,000	
		N	282	282	282

EDL Advancement and overall gamification experience' items correlations

Correlations		
		EDLadv
SATG	Pearson Correlation	,149*
	Sig. (2-tailed)	,012
	N	282
ENJ	Pearson Correlation	,176**
	Sig. (2-tailed)	,003
	N	282
MOT	Pearson Correlation	,168**
	Sig. (2-tailed)	,005
	N	282
COMPTENCE	Pearson Correlation	,169**
	Sig. (2-tailed)	,004
	N	282
AUT	Pearson Correlation	,219**
	Sig. (2-tailed)	,000
	N	282
ACCMPL	Pearson Correlation	,158**
	Sig. (2-tailed)	,008

	N	282
GUID	Pearson Correlation	,091
	Sig. (2-tailed)	,127
	N	282
SCLXP	Pearson Correlation	,079
	Sig. (2-tailed)	,187
	N	282
CMPTITION	Pearson Correlation	-,004
	Sig. (2-tailed)	,947
	N	282
CHLLNG	Pearson Correlation	,091
	Sig. (2-tailed)	,127
	N	282
USFL	Pearson Correlation	,144*
	Sig. (2-tailed)	,015
	N	282

Achieved EDL and overall gamification experience' items correlations

Correlations			IntEDL	AchEDL
	SATG	Pearson Correlation	,058	,221
		Sig. (2-tailed)	,333	,000
		N	282	282
	ENJ	Pearson Correlation	,015	,206
		Sig. (2-tailed)	,802	,001
		N	282	282
	MOT	Pearson Correlation	,077	,262
		Sig. (2-tailed)	,195	,000
		N	282	282
	COMPTENCE	Pearson Correlation	,190	,380
		Sig. (2-tailed)	,001	,000
		N	282	282
	AUT	Pearson Correlation	,064	,303
		Sig. (2-tailed)	,282	,000
		N	282	282
	ACCMPL	Pearson Correlation	,075	,248
		Sig. (2-tailed)	,212	,000
		N	282	282
	GUID	Pearson Correlation	,109	,212
		Sig. (2-tailed)	,067	,000

		N	282	282
	SCLXP	Pearson Correlation	,136	,226
		Sig. (2-tailed)	,023	,000
		N	282	282
	CMPTITION	Pearson Correlation	,181	,184
		Sig. (2-tailed)	,002	,002
		N	282	282
	CHLLNG	Pearson Correlation	,136	,239
		Sig. (2-tailed)	,022	,000
		N	282	282
	USFL	Pearson Correlation	,022	,179
		Sig. (2-tailed)	,707	,003
		N	282	282

Appendix 6.5 – Personal Goal Achievement

PGAR, overall gamification experience and gamification experience per element correlations

Correlations								
		PGAR	OGX	PNTGX	BDGGX	LVLGX	PBARGX	LBRDGX
PGAR	Pearson Correlation	1	,078	,099	,064	,091	,080	,000
	Sig. (2-tailed)		,193	,098	,282	,126	,182	,997
	N	282	282	282	282	282	282	282

PGAR, learning experience and platform ease of use correlations

Correlations				
		PGAR	LX	PEoU
PGAR	Pearson Correlation	1	,048	,193**
	Sig. (2-tailed)		,421	,001
	N	282	282	282
LX	Pearson Correlation	,048	1	,596**
	Sig. (2-tailed)	,421		,000
	N	282	282	282
PEoU	Pearson Correlation	,193**	,596**	1

	Sig. (2-tailed)	,001	,000	
	N	282	282	282

PGAR and Achieved EDL correlation

Correlations			
		PGAR	AchEDL
PGAR	Pearson Correlation	1	,085
	Sig. (2-tailed)		,155
	N	282	282
AchEDL	Pearson Correlation	,085	1
	Sig. (2-tailed)	,155	
	N	282	282

PGAR and EDL advancement correlation

Correlations			
		PGAR	EDLadv
PGAR	Pearson Correlation	1	,053
	Sig. (2-tailed)		,373
	N	282	282
EDLadv	Pearson Correlation	,053	1
	Sig. (2-tailed)	,373	
	N	282	282

Appendix 7 – Grouping of Player Types

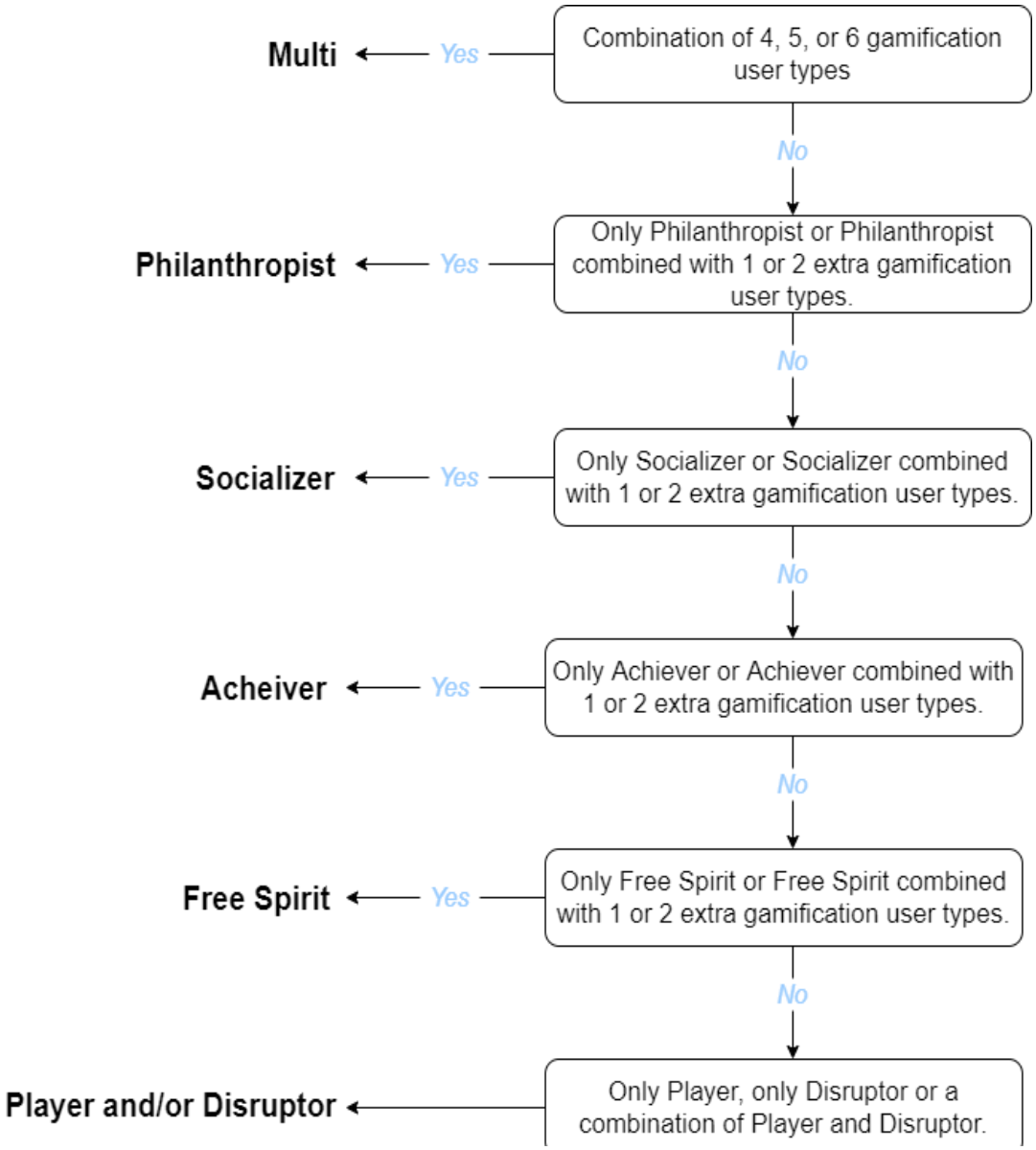

Figure 39: Groups and guidelines for the classification of a user in a player type group, as many users are characterized by more than one type (according to their responses).

Figure 40: Groups and guidelines for the classification of a user in a player type group, as many users are characterized by more than one type (according to their responses).

Appendix 8 – Groups of Professional Roles[20]

1. eLearning Professionals (IDs, eTutors)

a. Professional Instructional Designer of Online and/or Blended Courses

b. (e-) Tutor of Online and/or Blended Courses

c. Professional involved in supporting Teaching & Learning in Higher Education and/or Professional involved in supporting Professional Development

2. Higher Education Students

a. Higher Education Students

3. School Teachers

a. K12 Teachers

4. Others

(i) Experts with Experience in EDL

a. Academic involved in teaching Higher Education Courses specifically for Educational Data Literacy

b. Researchers in Digital Learning and/or Learning Technologies

c. Researcher in Educational Data Literacy

d. Professional involved in supporting Educational Data in Higher Education and/or Professional Development

(ii) Managers in (Online) Education/Training

1. Manager in a Higher Education Institute

2. Manager in a Professional Development Service Provider

3. Manager in an e-Learning Service Provider

4. Manager in a Governmental Education Policy Making Institute

(iii) Academics/Researchers in ID and/or Online Education/Training

1. Academic involved in teaching Higher Education Courses on Digital Learning and/or Learning Technologies

2. Academic involved in teaching Higher Education Courses specifically for Instructional Designers and/or e-Tutors

3. Researcher in Instructional Design of Online and/or Blended Courses

(iv) Others

[20] This is the grouping of professional roles used by Sofia Mougiakou (2020) in the evaluation of L2A MOOC. The gamification's evaluation of L2A MOOC 2021 follows the same guidelines.