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Κατεύθυνση: Ηλεκτρονική Μάθηση

Μεταπτυχιακή Διπλωματική Εργασία

DESIGNING AND EVALUATING AN E-COURSE ON INTERCULTURALISM FOR ADULT EDUCATION

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Η διπλωματική εργασία
αφιερώνεται στους γονείς μου..

Περίληψη

Η ηλεκτρονική μάθηση (e-learning) είναι ένας ταχέως αναπτυσσόμενος τομέας εκπαίδευσης. Έχει πολλά πλεονεκτήματα για τους εκπαιδευόμενους και τους παρέχει τη δυνατότητα να μάθουν σύμφωνα με τον χρόνο και το ρυθμό που επιλέγουν. Οι ενήλικες μαθητές αποδεικνύεται ότι είναι πολύ απαιτητικό κοινό, καθώς χαρακτηρίζονται από έλλειψη χρόνου, έλλειψη αντοχής, πολλών καθηκόντων και ευθυνών. Σε αυτή τη συγκεκριμένη διπλωματική εργασία δημιουργήθηκε ένα ηλεκτρονικό μάθημα για να εκπαιδεύσει τους ενήλικες μαθητές πάνω σε ένα γνωστικό αντικείμενο. Το ηλεκτρονικό μάθημα σχεδιάστηκε με βάση τη θεωρία μάθησης του Albert Bandura, "Γνωστική Μαθητεία". Η Γνωστική Μαθητεία είναι ένα Μοντέλο Μάθησης που χρησιμοποιείται κυρίως στην εκπαίδευση ενηλίκων και αποτελείται από 6 στάδια: Modeling, Coaching, Scaffolding, Articulation, Reflection, Exploration. Το Moodle ήταν το ηλεκτρονικό μαθησιακό περιβάλλον που εφαρμόστηκε για τη δημιουργία του ηλεκτρονικού μαθήματος. Το θέμα που συζητήθηκε στο μάθημα ήταν η διαπολιτισμικότητα και χρησιμοποιήθηκε για την εκπαίδευση αστυνομικών σε αυτό το συγκεκριμένο θέμα. Για να ελεγχθεί πόσο αποτελεσματικό ήταν το ηλεκτρονικό μάθημα για την εκπαίδευση ενηλίκων, ζητήθηκε από 6 εμπειρογνώμονες, ειδικούς στην εκπαίδευση αστυνομικών, να περιηγηθούν στο μάθημα, να το ολοκληρώσουν και στη συνέχεια να το αξιολογήσουν χρησιμοποιώντας μια ρουμπρίκα αξιολόγησης. Η ρουμπρίκα αξιολόγησης δημιουργήθηκε σύμφωνα με τα πρότυπα για τις δεξιότητες του 21ου αιώνα. Τα αποτελέσματα συλλέχθηκαν και αναλύθηκαν με στατιστικά κριτήρια. Τέλος, βγαίνει το συμπέρασμα ότι το ηλεκτρονικό μάθημα είναι ένα αποτελεσματικό μαθησιακό περιβάλλον για ενήλικες εκπαιδευόμενους.

Abstract

E-learning is a really fast growing field of education. It has many advantages on learners and provides them with the potential to learn on their own time and pace. Adult learners prove to be very demanding audience since they are characterized with lack of time, interest and a lot of duties and responsibilities. In this particular thesis an e-course was created in order to train adult learners on a certain topic. The e-course was designed based on Albert Bandura's learning theory, "Cognitive Apprenticeship". Cognitive Apprenticeship is a Learning Model used mainly on adult education and it consists of 6 stages: Modeling, Coaching, Scaffolding, Articulation, Reflection and Exploration. Moodle was the online learning environment that was implemented for the creation of the e-course. The subject discussed in the course was interculturalism and it was used for training Police Officers on this specific topic. In order to test how effective the e-course was for adult education, 6 expertises on Police training were asked to go through the entire course, complete it and then assess it using an evaluation rubric. The rubric was created meeting the standards for the 21st Century Skills. The results were collected and analyzed by statistical criteria. Finally, it was concluded that the e-course is an effective learning environment for adult learners.

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Kioumourtzi Maria

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CHAPTER 1 : INTRODUCTION

1.1 Problem presentation

Nowadays, education keeps taking place more often online through various learning environments than the previous years (Anderson, 2008). Furthermore, adults feel the need to improve their knowledge but lack of time and cost prove to be a great obstacle, along with a huge variety of other factors, such as family, duties and responsibilities (Lehmann, Hahnlein & Ifenthaler, 2014).

Due to lack of technology, there is an increase in cost of education and a restriction in participation. Online learning can reduce that by introducing synchronous and asynchronous learning, which would give the chance to more adults to participate in the learning procedure. By providing some sessions in person and others through distance, online learning gives people much easier access to the learning process since they can adapt their education to their daily time schedule and manage the way each one learns according to his/her learning style and pace (Anderson, 2008, Moore, Dickson- Deane & Galyen, 2011, Naidu, 2006).

Online courses are mostly found to be modular, meaning that they are designed as a series of independent units of study that can be combined in a number of ways. A modular is a course that is shorter than a full term and can start and end any time. Students are encouraged to enroll in modular courses usually when they would like to get trained about a specific subject in a short period of time. Another advantage of a modular is that it gives the capacity to the course manager for material review, collection of results, and adding, changing or discarding material during any period he/she wants, in a way that is not time consuming or demands great effort. An example is CEPOL, which is a web that provides a web platform.

An online course could be used for mobile training teams. On-line could work during work hours in the office but not necessarily. Staff members can be off duty during mobile training. It can also provide learning in remote locations, but still the cost is high.

Further on, K.E.M.E.A research center believes that intercultural training is of extreme importance because it helps strengthen up the wider effort to address a hot issue, multiculturalism management by front-line services. The steep change in the composition of modern societies due to the massive and uncontrolled movement of populations has created an environment of fear, mutual suspicion, but also different forms of criminality, xenophobia and racism.

This differentiation in the composition of modern societies is a key finding in many European countries where policies and mechanisms of intercultural dialogue have been developed to address the social impacts of society in particular. The objective of intercultural training

programs is to formulate tools and methods for managing intercultural heterogeneity. In addition, to train and sensitize executives able to co-operate in a high-standard environment and especially increased difficulties.

1.2 Aim

The aim of this attempt is the design, the development, the implementation and the evaluation of an online learning environment, which will be used in order to train Police Officers through distance, in order to promote emotional development, intercultural skills, communication skills and management skills.

Moreover, to investigate if the designed course, which will be implemented through an online platform, is a useful and effective environment for educating adults. To see if an online platform could be an effective tool of education, especially for adult learners and whether the cost of education will be reduced as the capacity of participation augments. To examine if the asynchronous form of learning will be convenient and efficient for adult learners and last but not least, if online learning can contribute to the emotional development of adults.

A course was designed based on Cognitive Apprenticeship and it was implemented by an online learning environment that consists of the MOODLE platform. This online environment of learning was designed for training Police Officers on better management of interculturalism on their daily workplace and for the improvement of their communication skills, providing better services to migrants and protecting their human rights.

Based on the design the following research questions where formed:

RQ1: Can an online course develop intercultural skills?

RQ2: Is an e-Learning environment an efficient tool for cultivating communication skills?

RQ3: Can the completion of an e-course contribute to better management skills?

RQ4: Can online learning promote the emotional development of adults?

1.3 Theoretical foundation

The instructional design will be based on the "Social Learning Theory", which posits that people learn from one another through observation, imitation, and modeling. People learn by observing other people's behavior, attitudes, and outcomes of those behaviors.

The educational model that will be used is Albert Bandura's "Cognitive Apprenticeship Model" (Dennen & Burner, 2004, Saywer, 2008). Cognitive Apprenticeship places emphasis on the instructional process in which teachers or more experienced or knowledgeable peers provide

"scaffolds" to support learners' cognitive growth and development. It permits students to learn through their interactions, construct knowledge, and share knowledge- building experiences with other members of their learning community. The learning process involves six stages:

1. Modeling (an expert, within the cognitive domain or subject area demonstrates a task explicitly so that novices can experience and build a conceptual model of the task at hand).

2. Coaching (involves observing novice task performance and offering feedback and hints to sculpt the novice's performance to that of an expert's. The expert oversees the novice's task and may structure the task accordingly to assist the novice's development).

3. Scaffolding (is the act of putting into place strategies and methods to support the student's learning. This requires the teacher to have the skill to analyze and assess student abilities in the moment).

4. Articulation (is the use of any method of getting students to articulate their knowledge, reasoning, or problem-solving process in a domain).

5. Reflection (compare their own problem-solving processes with those of an expert, another student, etc. The goal is for students to look back and analyze their performances with a desire for understanding and improvement towards the behavior of an expert).

6. Exploration (involves giving students room to problem solve on their own. It allows the students to frame interesting problems within the domain for themselves and then take the initiative to solve these problems).

Every learning model is supported by certain learning strategies. Some of the learning strategies used for learning according to Cognitive Apprenticeship are the following (Dennen & Burner, 2004, Saywer, 2006):

- Scaffolding

- Expository teaching strategy

*Figure **1**: The phases of Cognitive Apprenticeship*

This specific educational model seems to be very suitable for this research because the audience is adult learners and their educational need is more training on a topic they already know. Adult learners have experience and previous knowledge and all they need is guidance by someone who is even more experienced. In our case, adults need to be trained on a specific topic so, by having a type of mentor showing them how to learn and by helping them do it, the learning procedure will be facilitated and focused right to the point.

In apprenticeship, learners can see the processes of work. In this research, they are shown by someone more experienced how the e-course works and they go through the learning procedure by having either an educator or the e-course (meaning the given instructions that show up on their screens) show them the way.

Furthermore, all human beings are raced to have intelligence, feelings and skills. Adults, and in our case Police Officers, have grown up to showing and expressing their feelings in their daily life, having a variety of skills, both simple and complex, and in order for all these mechanisms to work they need to have intelligence. In this study, Police Officers need to cultivate their already existing intelligence, feelings and skills. This makes Cognitive Apprenticeship even more suitable for our study.

1.4 Overview of methodology

The research methodology of this dissertation will be based on Design science research methodology (DSRM) (Peffers et al., 2008) which is composed by the following steps:

1. **Problem determination**: the problematic of the thesis will be determined, the significance of the problem and a proposed solution will be presented

2. **Determination of goals**: the objectives of the proposed solution will be defined

3. **Design and development**: a course will be implemented on an online learning environment based on Cognitive Apprenticeship

4. **Application**: the course will be designed for police officers but no real students will take the course. Instead, expertise on police training will go through the entire e-course and then research data will be collected from the expertise by evaluation rubrics.

5. **Evaluation**: the research data will be analyzed, compared and then the implementation process of the scenario will be assessed in order to see if the objectives of the proposed solution are fulfilled

6. **Communication**: there will be a selection of appropriate means for communication of findings and then contribution of research

1.5 Contribution and innovation of thesis dissertation

The contribution of the master thesis can be summarized by:

1. Designing an electronic learning environment based on a Socio-cultural theory of learning.

2. The application of the learning environment on adult learners.

   Evaluation of the effectiveness the use of an electronic learning environment has for training by distance, specifically adult students.

Furthermore, this research paper can be considered as innovative due to the application of the Cognitive Apprenticeship Learning Model on an electronic learning environment, in order to train Police Officers on better management of interculturalism on their daily workplace and for

the improvement of their communication skills, providing better services to migrants and protecting their human rights.

1.6 Structure of the report

The Master Thesis has the following structure:

Chapter 1 is called Introduction and it mentions the problematic and the aim of the research. Further, on, it is attempted to state any innovation that has been made and offered. Moreover, the overview of the methodology is discussed and last, there is a brief analysis of the structure of the report.

Chapter 2 presents the theoretical foundation of the master thesis, which includes the conceptual clarification of the terms involved in the research. It is called Relative Literature and Theoretical Focus and a specific reference to learning, distance learning and e-learning is made. Initially, it presents the chronicle of the learning evolution from past to present, and continues by recording the Open Educational Resources that exist. It ends up by analyzing the four factors of this research (interculturalism skills, emotional skills, communication skills and management skills).

On **chapter 3** the research methodology is listed. At first, the research goal, the conceptual and functional definitions of the research variables and the research questions are presented. A detailed description of the scenario followed in the survey is then made. Then, the statistical criteria to be used for the analysis of the results are recorded. Finally, the sample used in the research is analyzed, all the material necessary for the completion of the research are presented, and the research tools and the environment are presented. The data collection means are analyzed and the process of the survey followed is described.

Chapter 4 analyzes the results of the rubrics, based on descriptive and inductive statistics. Many mathematical tools are used, and are explained according to mathematical terminology. These tools are divided into two categories: **location measures** and **measures of variability**. At first, in each subchapter their definitions are given. Later on, they are being calculated so that conclusions can be drawn, all the information contained in the data is highlighted and predictions for the entire population are made. This chapter develops the process of performing parametric and non-parametric statistical checks, as well as the processes of correlation of variables and regression.

Chapter 5 gives an overview of the results and then lists the findings of the survey and presents proposals for further study and future research into the issue we are looking at.

Finally, the bibliography used and the appendices of the diploma thesis are presented. Appendix A includes the terminology of many English language statistical terms and their

translation. Appendix B has the evaluation rubric used for the e-course. Appendix C presents the Aggregate rubric results tables.

CHAPTER 2 : RELATED LITERATURE AND THEORETICAL FOCUS

2.1 Adult Education

2.1.1 Chronicle

It has now been proven by research that adults can learn in a different and more comprehensive way in relation to minors, due to their potential ability for critical thinking. Adult education came up for the first time in Europe and in the USA in the beginning of the 20th century and aimed knowledge improvement for the low class. Soon it recruited many other forms, such as training, education, cultural issues, social and political, and expanded in almost all countries (Kokkos, 2005).

Since the early 80s, there has been a rapid development of the activities of adult education and indeed the European Union supports and finances it. The global phenomenon of expansion in the field of adult education during the last decades is due to the needs arising at two levels (Kokkos, 2005):

a. the economic / technological, globalization and its implications (intensification of international competition , liberalization of international trade) in combination with the successive technological developments, which have led , on the one hand, to a significant portion of people in unemployment and, on the another ,to the need to modernize national economies . Addressing these problems requires constant renewal of working methods and continuous specialization in new skills through continuous education, training and retraining.

b. the social / cultural , significant changes have occurred, such as large population movements, the growth of social exclusion , the crisis of traditional social structures etc. and which augment the need for adult education.

So nowadays, every adult needs to be able, at various stages of his life, to have access to new knowledge and skills, which enable him to evolve, to adapt to changing conditions and to define itself (Kokkos, 2008).

2.1.2 Characteristics of adult learners

The particular characteristics of adult learners that differentiate them from minors are (Ioannou, 2014, Kokkos, 2005, Kokkos, 2008, Roggers, 1991, Vergidis, 2003, Courau 2000):

They come to training with specific objectives, whether they relate to the professional sector or social roles to be undertaken in their adult life, or related to their personal development and broadening their interests.

They get involved in the educational process having specific expectations, stemming from the perception and experience of what learning, such as School years, and result in their specific sockets of the program in which they.

They have much more knowledge and wide range of experience comparing to the one minors have. Their previous experiences are the starting point for new learning. Knowles argues that, for children, the experience is something that just happens while adults experience serves in the creation of their own perception of their identity (Rogers, 1999). The rejection of their experience often perceived as a personal rejection, thus causing negative emotions that lead to negative reactions and attitudes in the learning process.

Adults seek active involvement in their education because, as already mentioned, adult learners consist of empowerment and they have tendency to self-determination. Often they wish to participate in all stages of a training program (design, implementation, educational process).

They have formed personal ways and learning strategies commensurate with their skills, experiences and general characteristics of their personality. In addition, the learning rate from one learner to another varies.

They undergo through an ongoing developmental process. The growth and development processes are not captured in adulthood. Changes occur in adult life on many different levels, the physical condition, the intellectual level, the emotions and relationships, in their professional life, etc. These changes affect the educational process.

They have competing interests, obligations, responsibilities and commitments that become obstacles to learning. Adult learners have many duties and obligations arising from their social roles (spouses, parents, workers, etc.). Sometimes these relationships can benefit the educational process, and sometimes these tasks can become an inhibiting factor in the course of their education.

They develop mechanisms for self-defense in attempt not to question the beliefs and perceptions or even the habits they have had so far. Therefore, the way the trainer handles such issues is important because these defense mechanisms or resignation of trainee create barriers to the educational process.

2.1.3 Barriers to learning

For adults, during a learning course, problems are caused by both external and internal factors. These problems create barriers to the learning procedure and due to their importance, it is hard to overcome or even minimize them. We could classify obstacles as follows (Ioannou, 2014):

- Obstacles arising from the obligations, duties and adult commitments (the different roles that must be fulfilled, create lack of time and energy for dedication and commitment to learning)

- Obstacles arising from the organization of the learning process (unsuitable site, poor relationship of teacher and learners, creating false expectations)

- Internal barriers arising from adult personality such as: a) psychological factors (stress failure, lack of confidence) b) prior knowledge and values, prejudices can create resistance to new knowledge and changing.

2.2 Distance learning and e-learning

Distance education and e-learning provide lots of academic alternatives for adult novices who are very busy. While the two key words appear to be interchangeable and possess quite a few similarities, they additionally have strategic although subtle variations. E-learning is distance training in a wide sense, however distance education is not always e-learning. Diverse distance education programs might also require net use for on-line assessments or to check grades, yet many perform strictly on a correspondence foundation. E-learning programs include digital or educational technology. At the same time, as a few might also require textbooks, e-learning applications generally function completely online (Bates, 2005).

2.2.1 Distance learning

Distance learning is a method through which knowledge and skills are acquired via distributed information and instruction. Distance learning encompasses all technologies and different styles of learning at a distance, consisting of instructor-led activities. Students can observe in their own time, at the location of their preference (home, work or learning center), and without face-to-face contact with an instructor. Technology is an important element of distance education (Mouzakis, 2006).

Distance training initially started out in the form of the earliest correspondence schools in the late 1890s and grew in popularity over the next few decades. Around 1950, speculation amongst educators cast doubt on the legitimacy of correspondence applications and distance education stalled at the same time as researchers studied its probability. Distance training through correspondence packages saw revival within the early 1970s and advanced from that

factor as a possible option for students unable to attend traditional training. Individual courses, in addition to limited degree programs, made pursuit of higher education less costly and handy for grownup learners. The late decade of the twentieth century up to the beginning of the twenty first century showed advanced alternatives for distance education, which included a combination of correspondence and on-line learning (Simonson, Michael, Smaldino, Sharon, Albright, Michael, Zvacek, & Susan, 2000.) Usually providing self-paced programs using textbooks or workbooks. A few faculties might also require students to mail in completed work, but a growing range of faculties now provide online options to publish work, take tests, and evaluation grades. Either way, pursuing a degree via distance training offers a handy, flexible, low-pressure approach to accomplish your academic goals.

2.2.2 Characteristics of Distance Education

The main characteristics that distance education consists of are (Mouzakis, 2006):

- Separation of place and/or time between learners and learning resources.
- Interaction between learners and learning resources conducted through one or more media.
- Processes might employ a variety of deployment methods in the learning experience, for example written correspondence study, interactive audio and/or video material, computer, and other electronic technologies. Each of these can be used alone or in combinations.
- Processes may be synchronous (in “real time”) or "asynchronous" including the access of learning resources by students at any time.

2.2.3 The benefits of distance learning

There are plenty of benefits when it comes to choosing distance learning as an educational tool. Distance learning is becoming more popular as the people who understand the ease and simplicity of learning in their own home augment.

The greatest advantage of distance learning is that you learn at your own pace according to your own schedule. There are no classes to attend at a certain time and no necessity to juggle night school along with daytime job (CRES, 2015).

Other benefits of distance learning are:

- Affordability: Long distance learning is usually cheaper. Moreover, you have the advantage of being able to take as many courses at one time as you can afford. In addition, you can learn in the comfort of your own place.

- Effectiveness: Long distance learning is a very effective tool in the era of technology. It gives the ability to interact with updated and extensive information.

- Interactive: the learner has to interact a lot with the course materials and the other students, without the obligation to meet them.

- Ease and simplicity: It is more convenient to apply online and order course material, as well as having it sent to your home.

- Distance learning is an effective and successful way to continue your education while working from the comfort of your own place. The pace and schedule of learning are entirely in the hands of the student (CRES, 2015).

2.3 E-Learning

According to Ruth C. Clark and Mayer E. Richard (Clark & Mayer, 2016), e Learning can be defined as instructions delivered on a digital device that is intended to support learning. In e-Learning the delivery hardware can range from desktop or laptop computers to tablets or smart phones, but the instructional goal is to support individual learning or organizational performance goals. It is divided into asynchronous, designed for self-study, and synchronous, instruction-led presented at a fixed time, education. The benefits gained from these new technologies depend on the extent to which they are used in ways compatible with human cognitive learning processes and based on research-based principles of instructional design.

2.3.1 Features of e-Learning

Some of the features e-Learning has are:

- Stores and/or transmits educational materials in electronic form on external drives, the cloud, and local internal or external memory, or servers on the internet or intranet.

- Includes content relevant to the learning objective

- Uses media elements such as words and pictures to deliver the content

- Uses instructional methods such as examples, practice, and feedback to promote learning procedure

- May be instructor-led (synchronous learning) or designed for self-paced individual study (asynchronous learning)

- May incorporate synchronous learner collaboration as in breakout rooms or asynchronous collaboration as on discussion boards

- Helps learners build new knowledge and skills linked to individual learning goals or improved organizational performance (Bizhan, 1997, Cosmato, 2011).

2.4 Open Educational Resources

"Open Educational Resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits sharing, accessing, repurposing — including for commercial purposes — and collaborating with others". (National Education Technology Plan, 2010).

Open Educational Resources (OER) are high-quality openly licensed, on-line learning materials that provide a magnificent opportunity for people anywhere to share, use, and reuse knowledge. Further on, they demonstrate big potential as a mechanism for instructional innovation as networks of teachers and students to share best practices. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (Hewlett Foundation, 2017).

"New structures and processes must be developed to accommodate the new reality: Individuals should be able to access knowledge, skills, and information not only by using multiple media at any time or place, but in different formats, structures, and quantities, and for different personally determined purposes" (McCain, 2009).

E-learning technology needs to meet the low-print literacy and digital literacy usability and to be flexible and different for every learner depending on an interaction among learner's skills, the [online] environments they encounter, and the support available. In short, the integration of OERs into instruction likely needs to be differentiated to meet a learner's specific needs and be supportive, providing sufficient face-to-face scaffolding to make the experience useful for the learner. (Reder, Vanek & Wrigley, 2012).

2.5 Intercultural Skills

Intercultural competence according to Weber, is: knowing about other cultures and the ability to interact successfully with people from different cultures. In our contemporary society, the needs for interculturalism keep growing day by day. In business, in work places, in the educational system, in everyday life etc., people meet and have to interact with other people that come from somewhere else. All these situations lead to intercultural encounters which have to be managed and designed in work and learning, as well as in private life situations, in order to be successful.

In a previous study (Weber, 2001), a proposal to teaching effectively intercultural competence was the teaching-learning processes to be organized in an interplay between: knowledge acquisition, acculturation processes and negotiation processes. These processes promote individual knowledge, individual and/or collective knowledge and collective knowledge.

Individuals notice that their familiar patterns of behavior, value systems, beliefs, certain practices, symbols and other artifacts do not function anymore. They feel like nobody understands them, they feel uncertain, excluded, helpless, vulnerable etc. In contrast, others believe that their own behavior is superior and they neglect otherness or mark others behavior as "wrong". It is important for everyone to keep in mind that all human beings have the same basic needs for identity (security, trust, inclusion, connection and stability).

In order to overtake all the above attitudes, ethnocentric people should open up and sensitize their minds. This is a normative goal and in order to obtain it, it should be discussed and legitimized.

Through Weber's research, it was concluded that when somebody tries to be in the other's position and learning becomes an active process, intercultural skills can be promoted.

2.6 Emotional Skills

Social- Emotional learning (S.E.L.) and emotional intelligence are basic to education (Leverett, 2006). Creating a classroom environment that can help the learners develop the knowledge, skills and disposition for emotional development is necessary for success. Academic success is strongly connected to social- emotional learning. SEL cannot develop by itself, it needs to be balanced with the curriculum (Scala, 2006).

In education, some of the objectives that learners, especially young people, should encounter are to (Elias, 2006):

a. develop effective social relationships, such as how to understand and relate to others from different cultures and backgrounds

b. To be caring individuals with concern and respect for others

c. To develop good character and make sound moral decisions

All the above are aspects of education that are known as character education, service learning, citizenship education and emotional intelligence.

Emotional skills are the "missing piece" which represents a part of education that links academic knowledge with those skills that are very important in order to have success in schools, families, communities, workplaces and life in general (Elias, 2006).

2.7 Communication Skills

Communication skills along with intercultural skills have been studied a lot in the past. Learners who communicate with people from other cultures have certain traits (Ting- Toomey, 1991):

- Flexibility and open-mindedness
- Cultural empathy and non-judgmental perceptiveness
- Personal strength and stability
- Ability to manage psychological stress (related to emotional skills)

A previous research on intercultural communication (Williams, 2005) showed that there is a greater increase in intercultural communication skills for people who have greater contact with others from different cultures. Greater exposure to a variety of cultures augments intercultural communication skills. The major factor that influences the change of students' intercultural communication scores was their location and not their academic level, major, gender, age, ethnicity, hometown or exposure.

2.8 Management Skills

In this certain research, the focus is on management in the learning process. This means, that the main concern is on time-management and on the ability for a learner to direct his or her learning procedure.

The aim of education is developing individuals who can assume moral, emotional and intellectual autonomy (Candy, 1991). When talking about education, self-management involves learners' use of learning resources within the learning context (Hill and Song, 2007).

Further on, self-management involved learners taking control of the learning context in order to accomplish their learning objectives. An important aspect of that is that learner control did not mean freedom and independence, but collaboration with other people within the learning context (Garrison, 1997).

Also, some research suggested that time management strategies could help learners develop their online learning experience by having effective online communication with their instructor and fellow peers (Hill, 2002).

CHAPTER 3 RESEARCH METHODOLOGY

3.1 AIM

The aim of this attempt is the design, the development, the implementation and the evaluation of an online learning environment, which will be used in order to train Police Officers through distance, in order to promote emotional development, intercultural skills, communication skills and management skills.

Moreover, to investigate if the designed course, which will be implemented through an online platform, is a useful and effective environment for educating adults. To see if an online platform could be an effective tool of education, especially for adult learners and whether the cost of education will be reduced as the capacity of participation augments. To examine if the asynchronous form of learning will be convenient and efficient for adult learners and last but not least, if online learning can contribute to the emotional development of adults.

A course was designed based on Cognitive Apprenticeship and it was implemented by an online learning environment that consists of the MOODLE platform. This online environment of learning was designed for training Police Officers on better management of interculturalism on their daily workplace and for the improvement of their communication skills, providing better services to migrants and protecting their human rights.

The Police Officers are asked to use their usernames and passwords in order to create a personal account and then register for the course. Once they are active they can follow the course flow, which is organized into sections according the topics they have to learn about. Every week new learning material is uploaded and students work on their own time and pace in order to conclude the course. The topics are four in total and every topic has a variety of material that is uploaded steadily week by week. The aim is to motor how the flow of the course will turn out to be, how will the students be able to work in the way this learning environment is designed and to evaluate if it is an effective way for adults to learn.

This research work is based on a theoretical approach of the application of the online course and its effectiveness will be evaluated by five expertise on police training. The expertise will be given a username and a password in order to have access to the e-course. Once they have gone through the online platform and have studied the material that is to be learnt they will have to follow the course's path and fulfill the activities and the tests in order to conclude the learning procedure of the course. When they are finished with all of the above, they will be given an assessment rubric, (Appendix B) in order to evaluate the course.

3.2 Definitions

3.2.1 Conceptual definitions

At this part of the thesis, the conceptual definition of the research variables will be recorded, as well as the content of the terms just as given to research.

Communication skills

Communication (from Latin commūnicāre, meaning "to share") is the act of conveying intended meanings from one entity or group to another through the use of mutually understood signs and semiotic rules. Communication skills refer to somebody that has an aptitude for clearly and collectedly conveying and receiving messages to and from others both verbally and through body language (facial expressions, eye contact, arm movement, posture, etc.). General communication skills are important for everyday communication in all situations when you are exchanging conversation with someone else. They are helpful from small talk to deep conversation (Harper, Douglas, 2013).

Intercultural skills

Culture can, for instance, be defined as: a system of beliefs and values shared by a particular group of people. 'Culture' means that we and others will expect conformity to certain patterns of behavior as a consequence of the groups we are perceived to belong to. As culture influences every aspect of our lives - from the way we dress to the way we do business - we need to develop certain attitudes and skills to become successful global players, in our own country or abroad. These skills will enable us to interact both effectively and in a way that is acceptable to others when working in a group whose members have different cultural backgrounds. Depending on the type of interaction, you will need a range of skills among them:

- tolerance of ambiguity;
- behavioral flexibility;
- communicative awareness;
- knowledge discovery;
- respect for otherness;
- empathy.

Tolerance of ambiguity: The ability to accept lack of clarity and to be able to deal with ambiguous situations constructively.

Behavioral flexibility: The ability to adapt your own behavior to different requirements and situations.

Communicative awareness: The ability to identify and use communicative conventions of people from other cultural backgrounds and to modify your own forms of expression correspondingly.

Knowledge discovery: The ability to acquire new knowledge of a culture and cultural practices and to use that knowledge in real-time communication and interaction.

Respect for otherness: Curiosity and openness, as well as a readiness to suspend disbelief about other cultures and belief about your own.

Empathy: The ability to understand intuitively what other people think and how they feel in given situations (Spencer- Oatey, 2012).

Emotional skills

Emotional development refers to a child's growing ability to regulate and control emotions and to form secure relationships. It differs from cognitive development, which readies a child for school, in that it prepares a child to take on a greater degree of responsibility for his or her internal state. Growing scientific evidence shows that a child's experiences during the early years play a significant role in emotional development. A child's emotional development is important because it provides a foundation for social development, empathy towards others and the resolution of conflicts without physical aggression. Those children who do not develop emotional maturity are at risk of forming unhealthy attachments, experiencing peer group rejection and suffering from mental illness. Studies have demonstrated that the emotional climate at home and the emotional regulation displayed by parents and caretakers affect a child's emotional development (National Scientific Council on the Developing Child, 2004).

Management skills

Having management skills means having the capacity to run a business. It is being able to make the right choices while managing the overall performance of the company. It means being able to communicate and deliver results by providing employees with a strong business plan to meet the aim for the company. Management skills are required to manage the business and include overseeing workplace issues, employees, teamwork and team development and communication. It also means giving employees their duties and monitoring their performance, while at the same time reaching the business objective (Hamel, 2006).

3.2.2 Operational definitions

0An operational definition is how the researcher decides to measure the variables in the study (variable = anything that can be measured). In order to have operational definitions, participants must exist. In this case, the following factors are necessary to evaluate the operational definitions.

- Population: The entire group of interest.
- Sample: A portion of any population selected for the study.
- Random Selection: Randomly choosing a sample from a population.
- Sampling Biases: Choosing a sample that does not represent your population.

For this research, an e-course was developed, implemented and evaluated through the online learning environment “Moodle”, aiming at developing the skills of the trainees and improving their performance (Communication skills, Intercultural skills, Emotional development, Management skills).

To measure the skills and how successful the e-course is, an assessment rubric called "E-Course Evaluation Rubric" was used. The assessment rubric is found in Appendix B. The rubric is a four-point scale of significant variation. It includes the research questions analyzed in the conceptual definitions, which have the same meaning.

3.3 Research questions

This Master Thesis will study the effectiveness of an online learning environment (an e-course on MOODLE) on adult learners (Police Officers) by distance in order to provide answers to the following research questions:

RQ1: Can an online course develop intercultural skills?

RQ2: Is an e-Learning environment an efficient tool for cultivating communication skills?

RQ3: Can the completion of an e-course contribute to better management skills?

RQ4: Can online learning promote the emotional development of adults?

3.4 Research design

This attempt aims at the design, the development, the implementation and the evaluation of an online learning environment. This environment is an e-course and it will be used in order to train Police Officers through distance, in order to promote emotional development, intercultural skills, communication skills and management skills.

The educational model that will be used is Albert Bandura’s “Cognitive Apprenticeship Model”. Cognitive Apprenticeship places emphasis on the instructional process in which teachers or

more experienced or knowledgeable peers provide “scaffolds” to support learners’ cognitive growth and development. It permits students to learn through their interactions, construct knowledge, and share knowledge- building experiences with other members of their learning community. The learning process involves six stages: modeling, coaching, scaffolding, articulation, reflection and exploration. The structure of the educational scenario was based on 4these six stages.

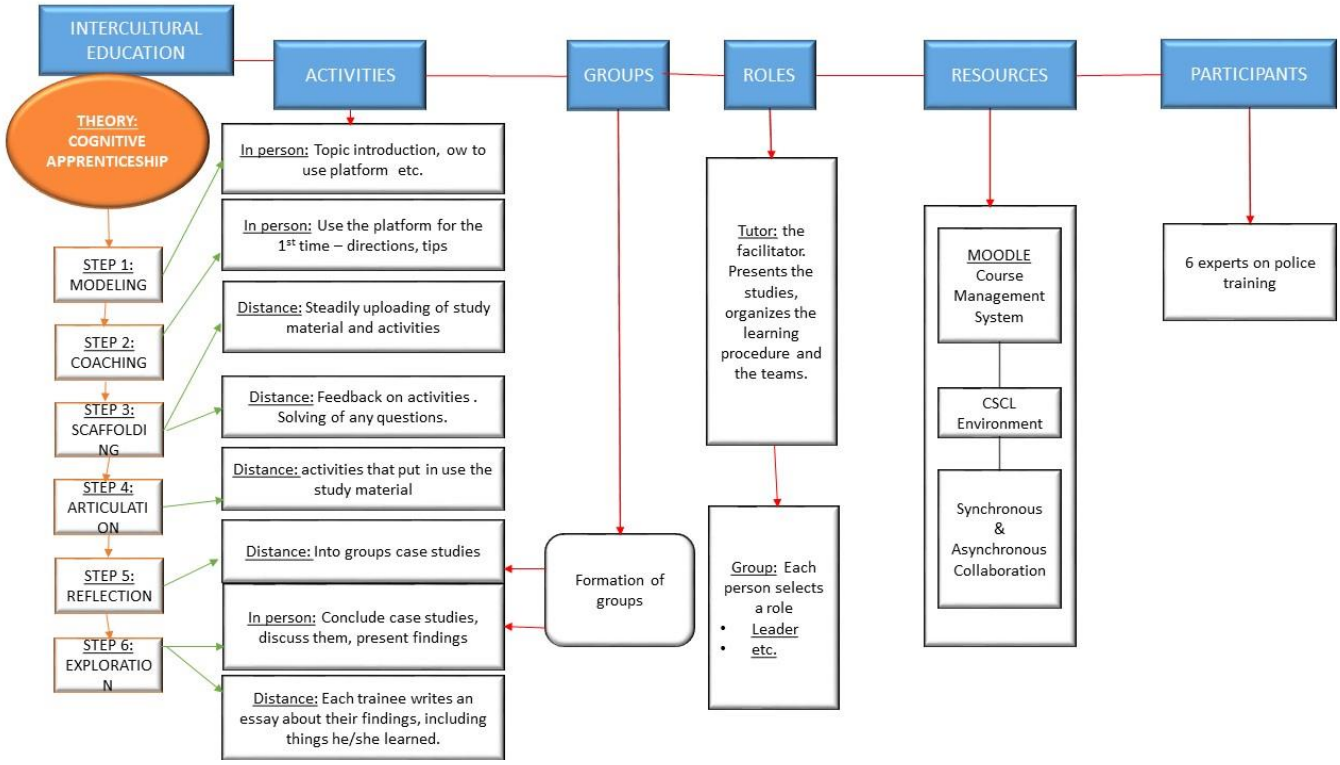


*Figure **2**: Research design for the e-course on Intercultural Education*

All of the learning design will be based on Cognitive Apprenticeship. Every one of the six phases of Cognitive Apprenticeship follow up a set of activities. Some are in person and others are through distance. In a set of two activities trainees form groups. Through the whole scenario, there are two basic roles, the role of the tutor and the role of the student. In the case of group formation, each person selects a role (leader, etc.).

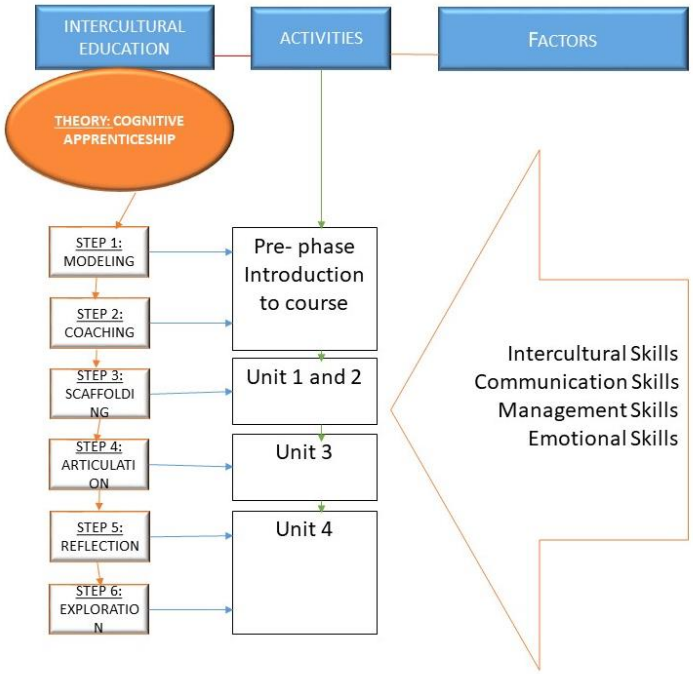


*Figure **3**: Phases of learning theory according to the units and the factors of the scenario*

A course was designed based on Cognitive Apprenticeship and it was implemented by an online learning environment that consists of the MOODLE platform. This online environment of learning was designed for training Police Officers on better management of interculturalism on their daily workplace and for the improvement of their communication skills, providing better services to migrants and protecting their human rights.

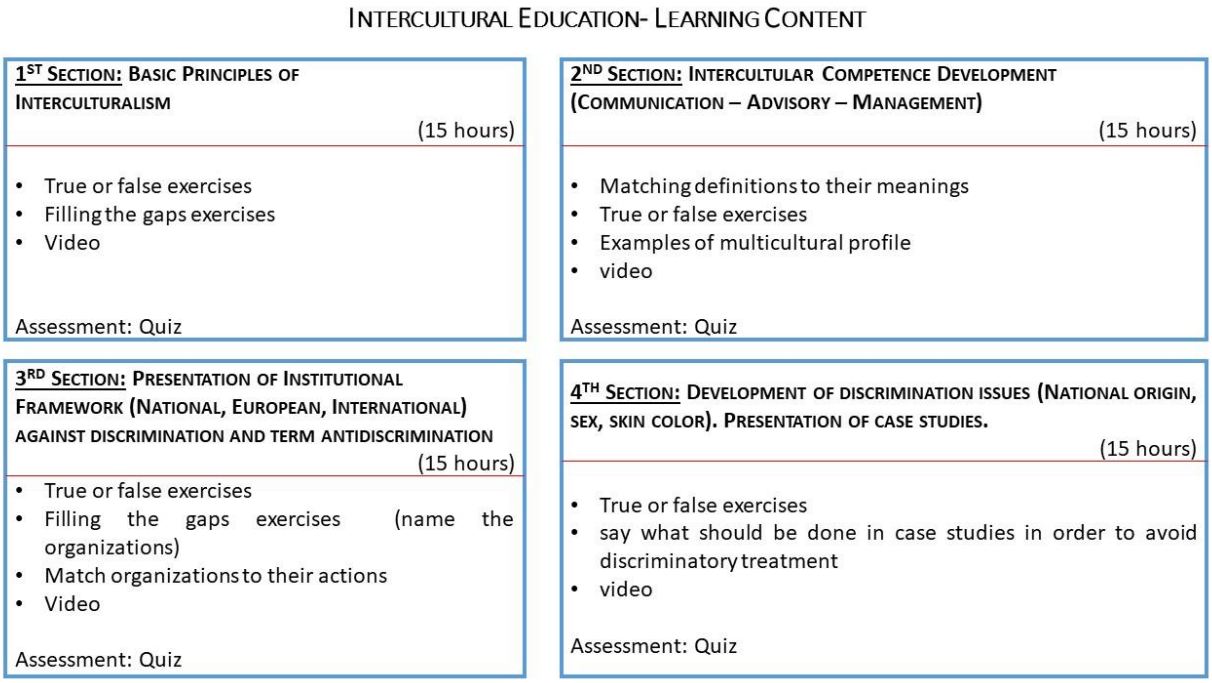


*Figure **4**: The four sections and the learning content of e-course*

The learning material is made up by four sections. The first section is the "Basic principles of interculturalism. The second section is the "Intercultural competence development (communication- advisory- management)". The third section is the "Presentation of institutional framework (National, European, and International) against discrimination and term antidiscrimination". The last section is the "Development of discrimination issues (National origin, sex, skin color) and the presentation of case studies". For each one of the four sections a lot of learning material is provided. After the study of the learning material, there is a variety of exercises, audio-visual material, such as videos, and they are followed up by a short assessment quiz.

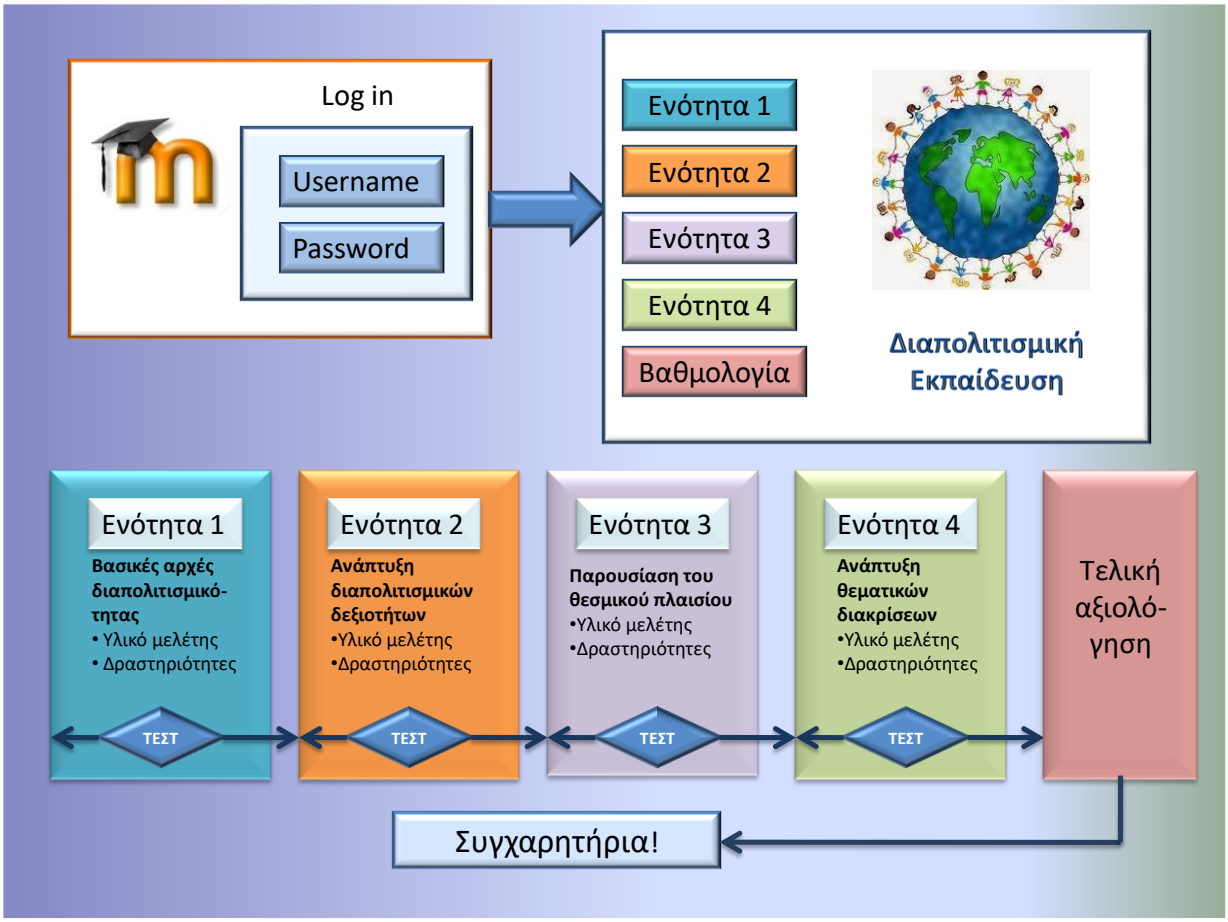


*Figure **5**: E-course flow*

Online courses are mostly found to be modular, meaning that they are designed as a series of independent units of study that can be combined in a number of ways. A modular is a course that is shorter than a full term and can start and end at anytime. Students are encouraged to enroll in modular courses usually when they would like to be trained about a specific subject in a short period of time. Another advantage of a modular is that it gives the capacity to the course manager for material review, collection of results, and adding, changing or discarding material during any period he/she wants, in a way that is not time consuming or demands great effort. An online course could be used for mobile training teams and could work during work hours in the office, but not necessarily. Staff members can be off duty during mobile training. It can also provide learning in remote locations. Due to all the above reasons, it was decided to create an e-course and more specifically to use MOODLE since it is open source and it can be easily managed.

3.5 Selecting a statistic criteria

3.5.1 Quality check

In each of the steps of designing and conducting an investigation, such as the present one, the quality check should also be performed to examine if everything has been done correctly or if omissions, exaggerations or errors have been made and should be corrected. It is necessary to inspect if the sample has been correctly determined and the sample's responses, as well as the features, are those of our interest. We apply Pilot survey so that, in addition to collecting preliminary information for the pre-estimation of some parameters, we are given the opportunity to check the questionnaire. More specifically, if some questions pose problems of understanding or difficulty in reforming. The questionnaires that will be used must be **unbiased, reliable and valid.**

After the data has been collected, several quality checks of these data have to be performed before their analysis. For example, we can generate questions for checking the reliability of the people being asked or to create various cryptographic-decryption methods and digital signature techniques, such as the ones being used in this questionnaire.

Finally, a special check should be made in encoding the replies and if they have been correctly transferred to the computer, where the data will be processed. We can detect some extreme values through various subprograms so that they are being corrected in order to see if they have actually been misplaced or will be removed from the sample.

3.6 Sample

Sampling is a principle that is used to identify, select and provide access to those units that are relevant to the study and which will be used for the production of data (Mason, 2003). For this particular research, random sampling was chosen. The experimental procedure of the online training scenario based on Cognitive Apprenticeship took place during daily work hours. For the needs of the experimental procedure of the Cognitive Apprenticeship e-course 6 expertise on police training were chosen randomly from the KEMEA study and research center in order to go through the e-course and evaluate it. Throughout the entire procedure of sampling complete privacy of participants' information was ensured for both ethical and moral reasons.

When the selection of a small sample from the population (or a larger sample) is made to have exactly the same characteristics as the population the results obtained from the sample will, within "certain limits", be the same as the results taken from the entire population (or from a largest sample). These "certain limits" are determined by criteria of statistical significance. The information contained in the selected sample, which is going to be used in the assessment of the population parameters, is under the control of the researcher. This information depends on the number of sampling units that the sample will include, called **sample size.** Both the procedure used to select the sample and the sample size that was chosen, are important in order to have a **representative sample (cross-section)** of the population being measured. By increasing the sample size, we will certainly have better accuracy in estimating the

characteristics of the population. On the other hand, however, the cost of sampling, processing and presenting results is increasing as the sample size increases. A very large sample is a waste of money and effort. A very small sample may lead to biased assessments. In our case, although the sample is small, we do not expect this to happen because our sample is made up of experts. In a few words, the various factors influencing sample selection are:

a) Sample size.

b) Statistical error - level of accuracy.

c) Confidence level.

d) Coefficient of Variation (CV) of the population, which is being investigated.

e) Available research costs.

f) Sample selection method.

To determine the **sample size**, it will either be given a **margin of error (d)** to the estimator's discrepancy or the **confidence coefficient 1-α,** which will be used to estimate, or both. If θ is a parameter of the population and $\hat{\theta}$ is an estimator of θ, then the margin of error (d) is defined by the formula:

$$P\left[\left|\hat{\theta} - \theta\right| \leq d\right] \geq 1 - a$$

Usually as a **level of significance α** is chosen α = 0.05 or α = 0.01 so we have a confidence factor of 95% or 99%, respectively. It is worth mentioning however, that a "careful" selection of a small sample may yield much better results than a larger sample that is not properly selected. This is what has been implemented in this research.

3.7 Material

For this particular research, the educational material used was given by the KEMEA Research Center and it was transformed in order to be efficient and proper for the MOODLE environment. KEMEA supplied the e-course with a variety of texts that contain all the material wanted to be learnt by the trainees. These texts were made into a variety of material such as:

- Instructions of the use of MOODLE
- Notes on every chapter
- Multiple-choice , matching, fill in the gaps, etc.

- Tests
- Videos
- Rubric of assessment

3.7.1 Research environment-tools

Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments. It is a free and open-source software learning management system written in PHP and distributed under the GNU General Public License. Developed on pedagogical principles, Moodle is used for blended learning, distance education, flipped classroom and other e-learning projects in schools, universities, workplaces and other sectors (Deepwell & Syson, 2006, Samson, 2008).

With customizable management features, it is used to create private websites with online courses for educators and trainers to achieve learning goals. Moodle (acronym for modular object-oriented dynamic learning environment) allows for extending and tailoring learning environments using community-sourced plugins (Deepwell & Syson, 2006, Samson, 2008).

3.7.1.1 Pedagogical approach

The stated philosophy of Moodle includes a constructivist and social constructionist approach to education, emphasizing that learners (and not just teachers) can contribute to the educational experience. Using these pedagogical principles, Moodle provides an environment for learning communities (Deepwell & Syson, 2006, Samson, 2008).

3.8 Means of data collection

In this paragraph, some facts on data collection techniques that require a sample survey are mentioned. Information is usually collected using standard questions. The questions are common to all people in the sample so that every person being interviewed answers exactly the same questions. The information gathered is confidential and in no case should be disclosed. In Greece, the confidentiality of sample surveys is protected by Article 40 of the Law 3627/56 and offenders are punished with strict penalties.

There are several methods to gather the necessary information for our survey. Many of them, however, have no practical value, mainly because of the high cost they require or are extremely complex. The main collection methods used by researchers, especially when using questionnaires, are:

- Postal
- By telephone (telephone interview)
- Personal interview
- Internet
- Combination of the above
- Automatically (via specific accounts)

Each of these methods of collecting information has advantages over others but at the same time each one has its disadvantages.

3.8.1 Rubric of assessment

It is a form that includes a series of structured questions, in which the respondent is asked to respond in writing and in a specific order. Rubrics collect data asking people to answer exactly the same set of questions. They are commonly used in a research strategy to collect descriptive and explanatory data about views, behaviors, features, attitudes, etc. Although there are several definitions, we use the questionnaire as a general term that includes data collection techniques where each respondent answers the same set of questions in a predetermined order.

The main advantages of rubrics are as follows:

- They are cheaper, they can be shipped to a large number of people.
- They are easy to create and use.
- Respondents can express themselves freely (lack of direct communication).
- The ways of analyzing the material are standardized.
- The researcher cannot influence the answers.
- It is the least time-consuming method.

The main disadvantages of rubrics are the following:

- The researcher cannot clarify open-ended questions.

- They oblige the respondent to respond in a specific way.

A rubric is the means of communication between the researcher and the respondents, directly or indirectly, depending on the method of data collection. The structure of rubrics, due to its qualities, is the most critical and delicate task, crucial to the success of a statistical survey. In a survey, when an effective sampling plan or even the most appropriate data analysis is applied, it is not possible to draw proper conclusions if we receive incomprehensible answers from an inappropriate rubric with unclear questions.

3.8.2 The size of an assessment rubric

Firstly, a large rubric is frustrating. The size of a rubric is at first sight perceived by the volume of its pages and by the number of questions. Therefore, in order to reduce the number of pages, we used the appropriate theme font, which had a fairly satisfactory size so that it did not cover much space and the characters were easy to read. In addition, the questions must be concise and comprehensive so they can be easily completed. Unnecessary questions should also be avoided, so that a total of about 20-25 questions is sufficient for useful conclusions.

3.8.3 Collection of results from the internet

There are two basic ways to conduct online surveys. The first way is to conduct the survey via e-mail and the other through a web application. In the first case, rubrics are sent by mail, while in the second case they are posted on a site. More specifically:

- Sending a rubric within an e-mail (with or without attachment) can be done in three ways:

    1) through rubrics generated by conventional emails,

    2) through rubrics generated through HTML and

    3) through rubrics created through a word processor and distributed as attachments.

- An online survey via a rubric posted on a site can be done in two ways:

    1) by e-mailing an introductory note as well as a link to the rubric posted on a website, and

    2) placing a general request for respondents in an online communication environment (e.g. a forum) or on a web site.

3.9 Experimental procedure

The experimental process includes all the necessary steps that must be made by researchers to perform the experiment. These are instructions that need to be detailed and in a clear and logical order, so that the investigator can perform the research successfully.

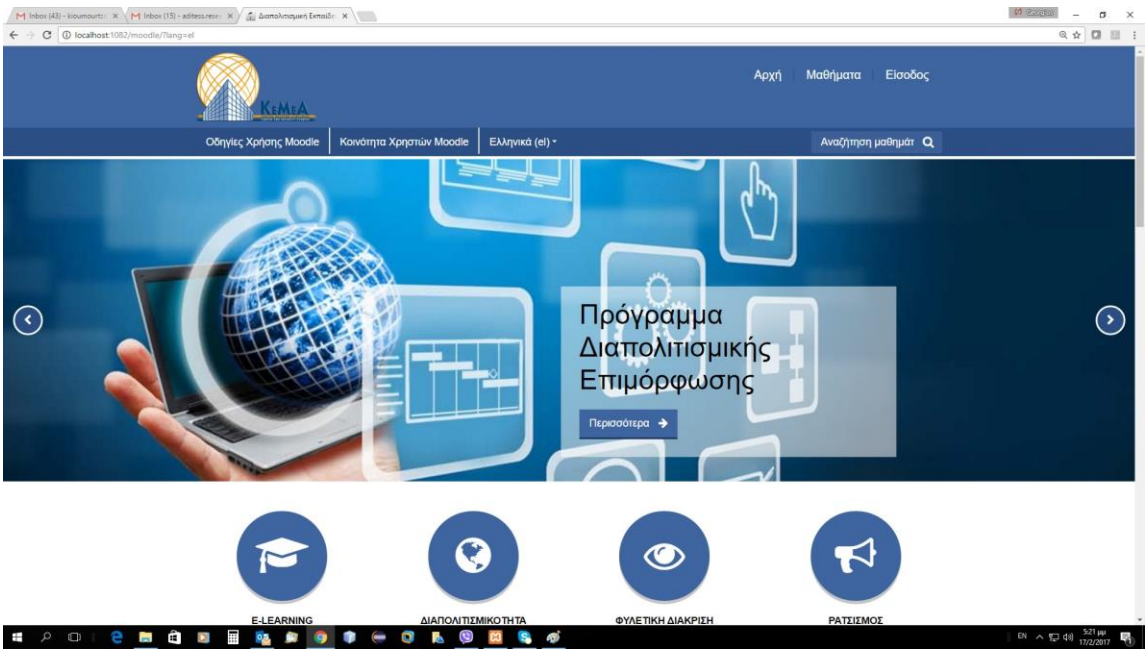


Figure *6*: *E-course front page*

For this certain research, an e-course was designed, developed and then implemented. This e-course took place on the online learning environment Moodle. Everything done on the Moodle platform was designed based on the learning theory of Cognitive Apprenticeship and on every one of its phases.

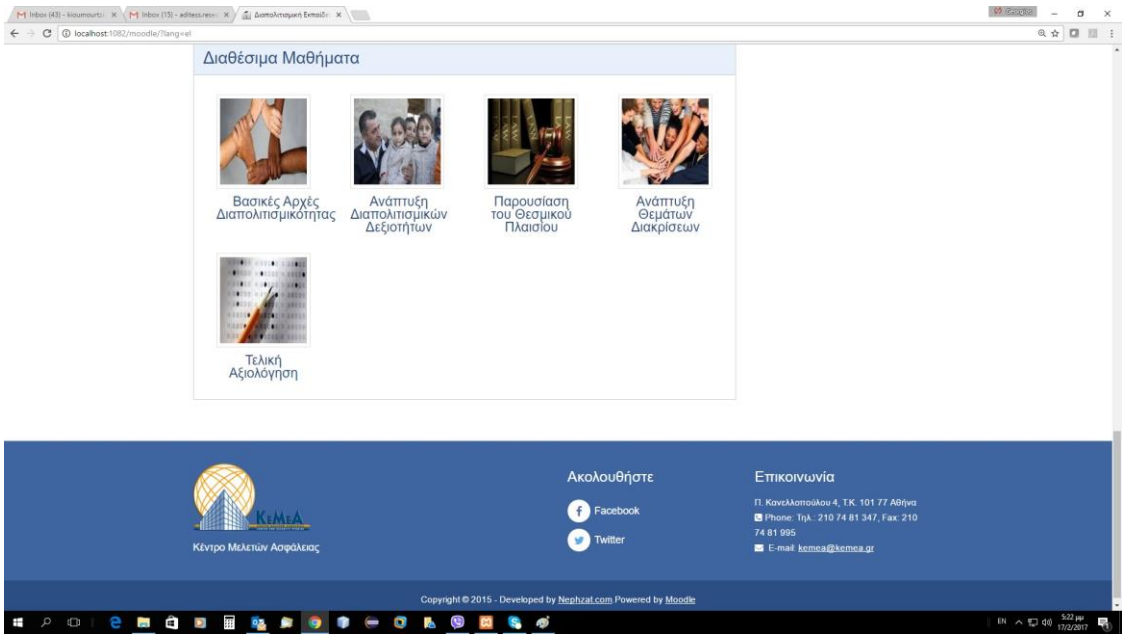


*Figure **7**: Available courses, screenshot from e-course*

When the e-course was complete, an evaluation rubric was created, in order to test its effectiveness. The evaluation rubric aimed at assessing all the necessary things a contemporary online learning environment should have in order to be effective and to promote the learning material that was to be learnt by the novices. This rubric was forwarded to six experts on Police training. These experts were introduced to the experimental procedure and then they were given a username and a password each. They were asked to go through the entire e-course, study it in detail, look at all the learning material, exercises, audio-visuals, tests, graphics, design, flow, etc. and then evaluate it using the rubric. The rubric was on an online environment as well and it was sent by an email to the experts. Again, they were given a username and a password in order to have access to the rubric.

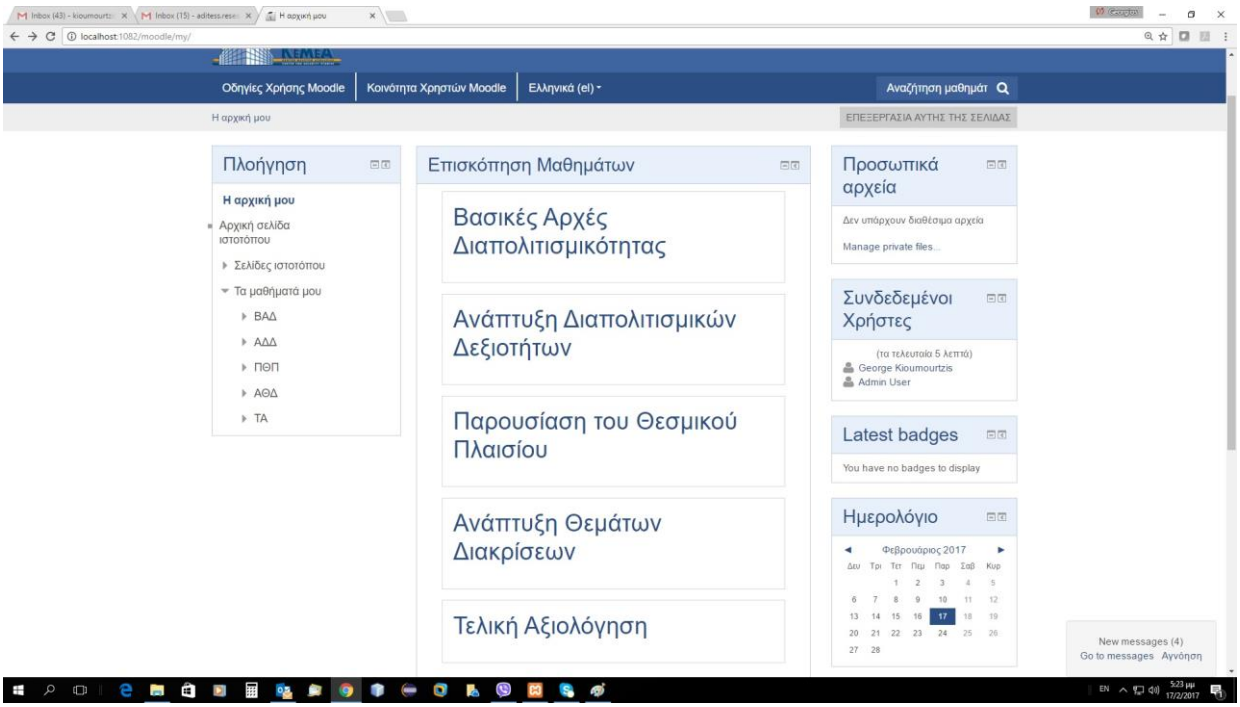


*Figure **8**: Screenshot 1 from Moodle environment*

The results of the rubric were collected electronically and then, they were analyzed in order to draw results and conclusions.

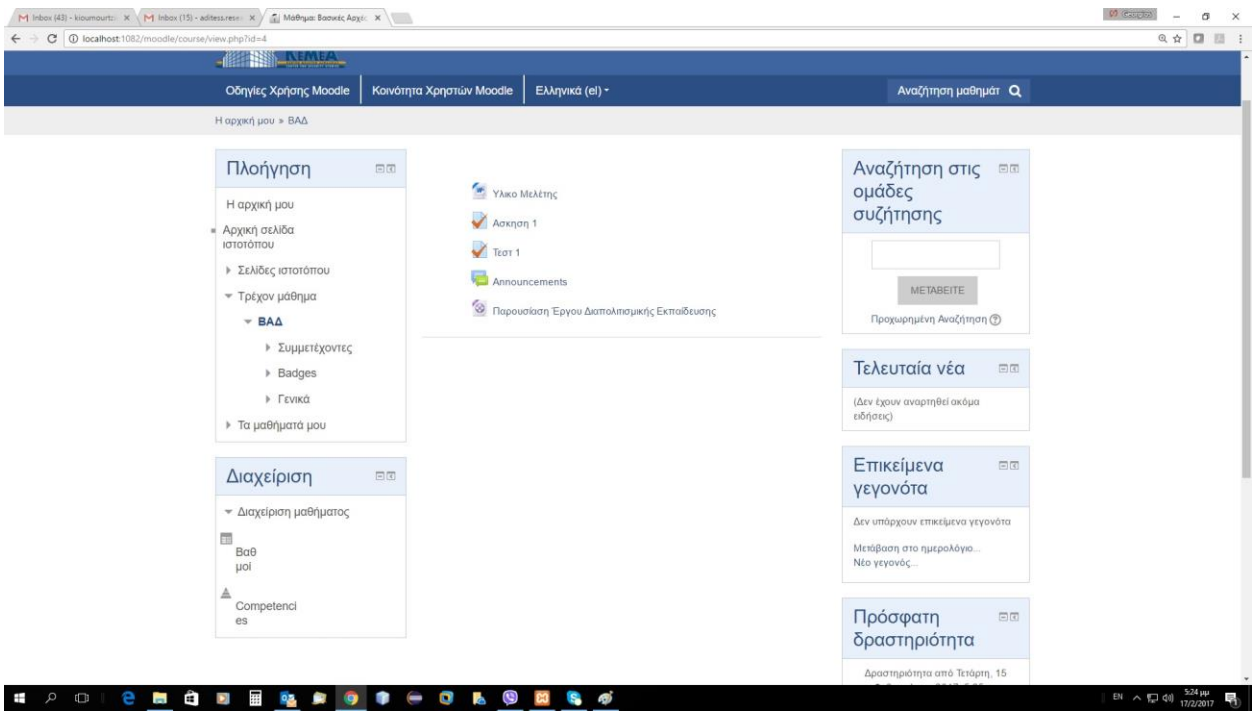


*Figure **9**: Screenshot 2 from Moodle environment*

CHAPTER 4 ANALYSIS AND RESULTS

4.1 Introduction

Our research data is derived from a series of measurements, observations or both, which, in their original form are **raw data**. They are often given in tables, which are known as **statistical tables**. The aim is to analyze these data, to organize sufficiently by appropriate measures (**location measures** and **measures of variability**) and to quantify the trend of the results in order to highlight all the information contained in these data and understand them.

This quantification is done using statistical formulas, such as **arithmetic mean or average**, **median**, **mode, standard deviation**, etc. Descriptive Statistics are studying these statistical formulas and the process is known as **Descriptive Analysis of Results.** This chapter develops basic statistical concepts, such as creating tables, graphs, and statistical calculations for measuring and describing data.

The field of statistics dealing with the above is Induction Statistics and the process is known as **Inductive Analysis of Results**. This chapter develops the process of performing parametric and non-parametric statistical checks, as well as the processes of correlation of variables and regression.

All the above statistical processes are easily implemented using the SPSS statistical package or other similar programs.

4.2 Descriptive Analysis of Results

The main purpose of the descriptive analysis is to present the sample values in such a way that a first interpretation of the results can be made.

In addition, it is important to be able to detect some particular characteristics of sample values that will be analyzed later.

In the descriptive analysis of the results to be presented below the statistical definitions, which will be studied are the following:

- the arithmetic average of the values of the sample (sample mean) or the average **arithmetic mean M**

formula: $M = \sum_{i=1}^{n} \frac{x_i}{n}$

- The value being greater than 50% of the sample values, median
- the prevailing value, i.e. the value displayed more times in the sample, **mode**
- **standard deviation** (sd is used for sample and SD is used for the entire population)

formula 1:

$$sd = s = \sqrt{\sum_{i=1}^{n} \frac{(x_i - M)^2}{n-1}}$$

formula 2:

$$SD = S = \sqrt{\sum_{i=1}^{n} \frac{(x_i - M)^2}{n}}$$

- **variance** (sd^2 is used for sample and SD^2 is used for the entire population)

formula 1: $sd^2 = s^2 = \sum_{i=1}^{n} \frac{(x_i - M)^2}{n-1}$

formula 2: $SD^2 = S^2 = \sum_{i=1}^{n} \frac{(x_i - M)^2}{n}$

Notes:

1. $x_1, x_2, \ldots, x_n$ are defined as the observations of a variable X and
2. $n_1, n_2, \ldots, n_n$ are defined as the frequencies of the observations $x_1, x_2, \ldots, x_n$ of the X variable respectively
3. The reason why in the mathematical formula of the standard deviation is the division with n-1 instead of n, as one would expect, is because the number of degrees of freedom is equal to n-1. Degrees of freedom is a concept with a wide application in physics, chemistry, thermodynamics, and so on. Generally, degrees of freedom express

the minimum number of variables to be determined in order to know the status of a system.

4. Samples with a coefficient of variation less than 10% are characterized as homogeneous, while samples with a coefficient of variation greater than or equal to 10% are characterized as non-homogeneous.

4.2.1 Rating scale

0 *Absent* – Component is missing
1 *Unsatisfactory* – needs significant improvements
2 *Somewhat satisfactory* – needs targeted improvements
3 *Satisfactory* – discretional improvement needed
4 *Very satisfactory* – no improvement needed.

Further on, the results of the rubric of assessment are presented through charts (aggregate rubric results tables are on Appendix C). Each chart presents the collected results of each one of the five sections of the evaluation rubric. The five sections are content evaluation, instructional design evaluation, and student assessment evaluation, evaluation of technology and course evaluation and management.

4.2.2 Analysis of results

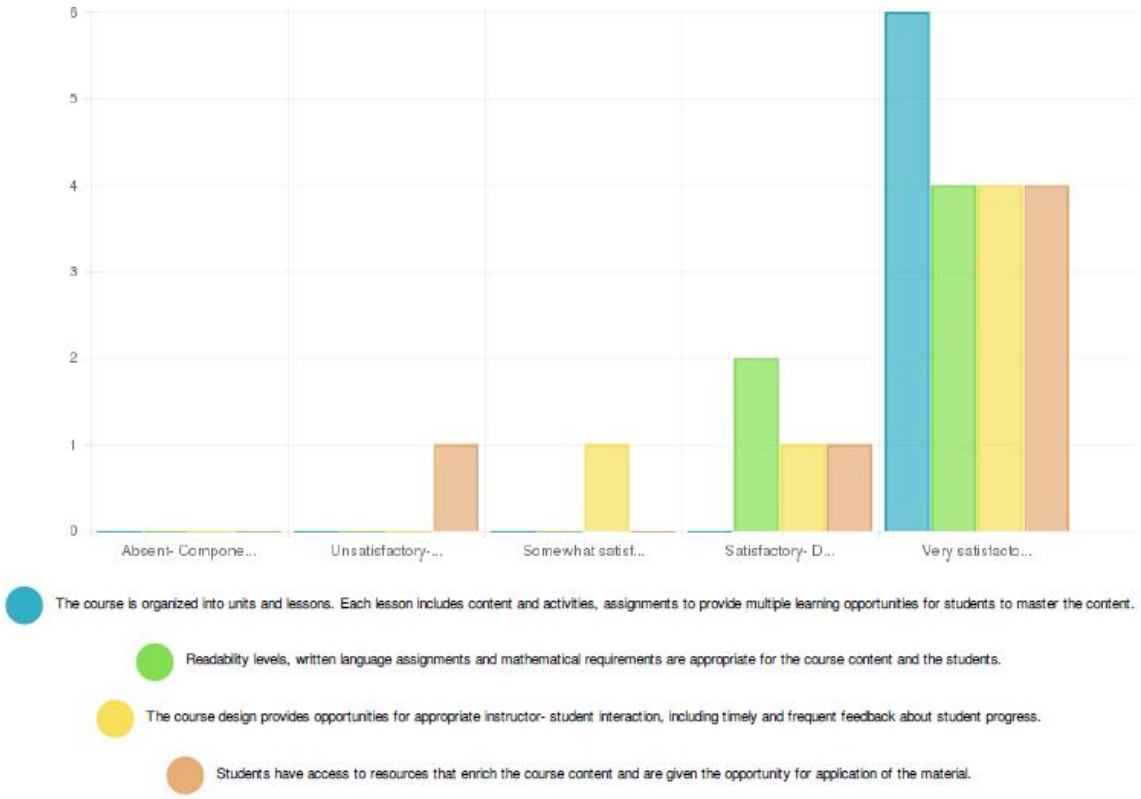
The five sections are content evaluation, instructional design evaluation, and student assessment evaluation, evaluation of technology and course evaluation and management.

Based on the results, we note that content evaluation is judged to be sufficient. This is explained by the fact that knowing that the mean value is the “center of balance” of the data, the average was found to be close enough to 4 for each research question (M1=3.16, M2=3.50, M3=3.50, M4=3.83). Moreover, the variance measures the variability of the observations around the mean value (SD1=1.17, SD2=1.47, SD3=1.47, SD4=1.94). The standard deviation expresses (as its name indicates) the standard deviation of the data from the mean value we see that the calculations show that the content of the course is good enough without significant fluctuations in expert judgment.

Section 1: Content Evaluation

Factors	*M*	*Mdn*	*SD*	s^2	n
intercultural skills	3.16	3.50	1.17	1.37	6
communication skills	3.50	4	1.47	2.16	6
management skills	3.50	3.50	1.47	2.16	6
emotional development	3.83	4	1.94	3.76	6

*Table **1**: Results for content evaluation*



(Where axis y is n)

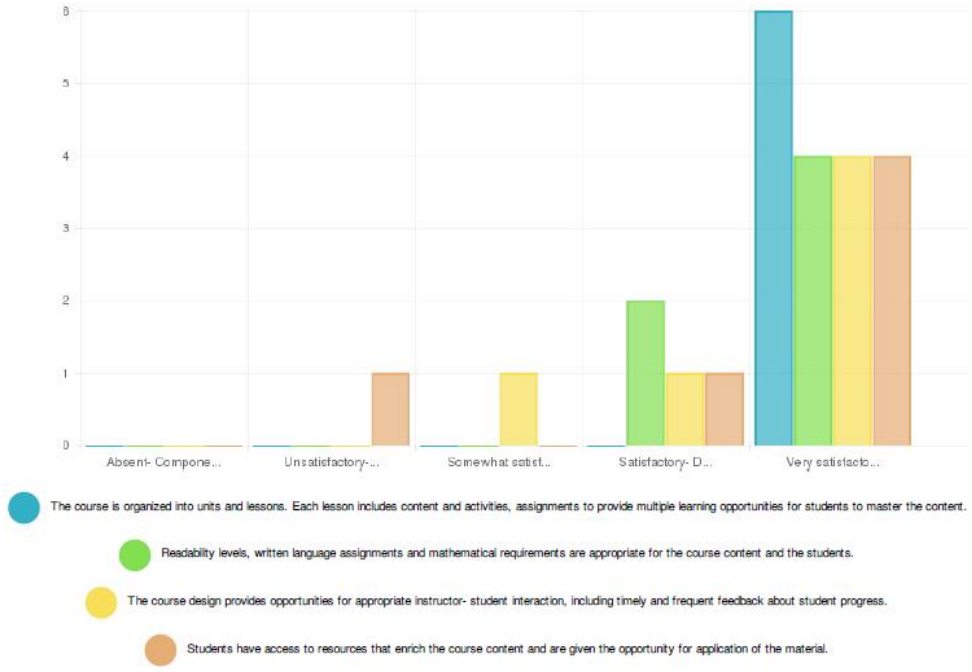
*Figure **10**: Results for content evaluation*

Based on the results, we note that instructional design evaluation is judged to be sufficient. The average was found to be close enough to 4 for each research question (M1=4, M2=3.67, M3=3.50, M4=3.67). Moreover, the calculations of variance (SD1=2.40, SD2=1.60, SD3=1.47, SD4=1.47) show that the content of the course is without significant fluctuations in expert judgment.

Section 2: instructional design evaluation

Factors	*M*	*Mdn*	*SD*	s^2	n
intercultural skills	4	4	2.40	5.37	6
communication skills	3.67	4	1.60	2.56	6
management skills	3.50	4	1.47	2.16	6
emotional development	3.67	4	1.47	2.16	6

*Table **2**: Results for instructional design evaluation*



(Where axis y is n)

*Figure **11**: Results for instructional design evaluation*

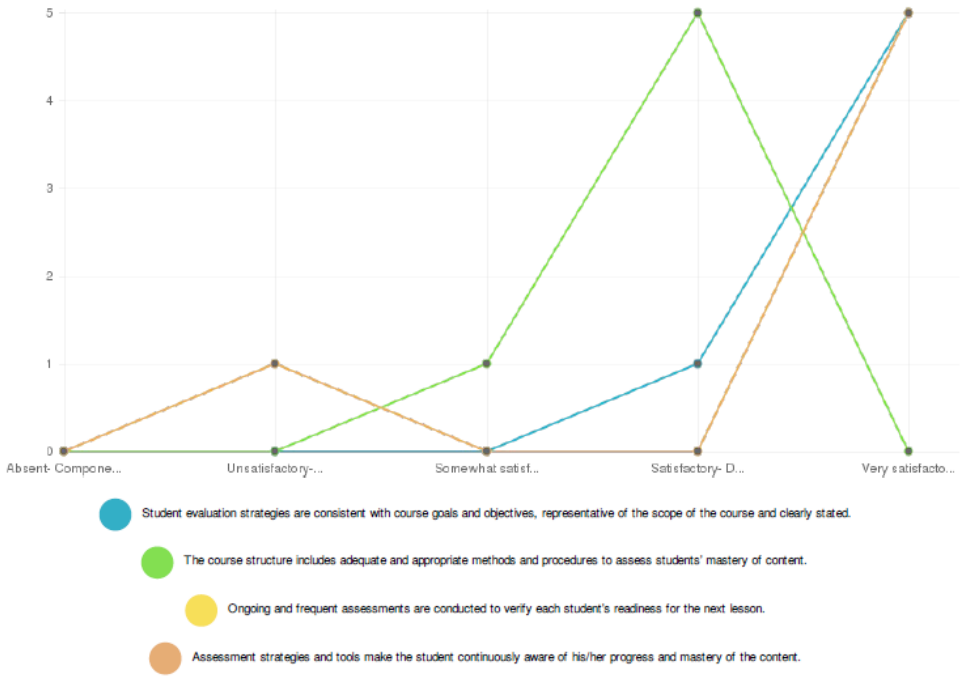
Based on the results, we note that student assessment evaluation is judged to be sufficient. The average was found to be close enough to four for each research question (M1=3.83, M2=2.83, M3=3.50, M4=3.50). Moreover, the calculations of variance (SD1=1.94, SD2=1.94, SD3=1.94, SD4=1.94) the content of the course is without significant fluctuations in expert judgment.

Section 3: student assessment evaluation

Factors	*M*	*Mdn*	*SD*	s^2	n
intercultural skills	3.83	4	1.94	3.76	6

communication skills	2.83	3	1.94	3.76	6
management skills	3.50	4	1.94	3.76	6
emotional development	3.50	4	1.94	3.76	6

*Table **3**: Results for student assessment evaluation*



(Where axis y is n)

*Figure **12**: Results for student assessment evaluation*

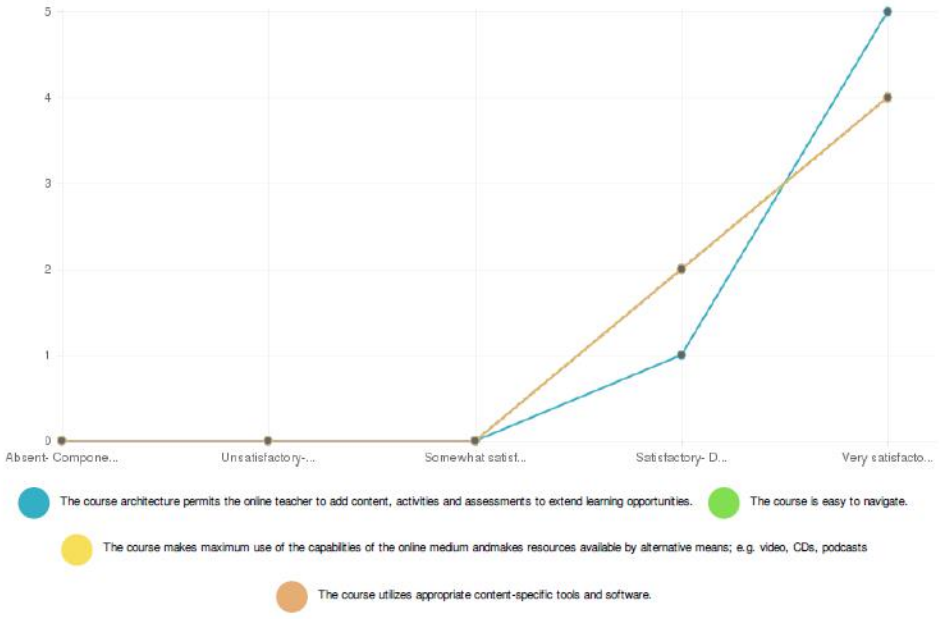
Based on the results, we note that evaluation of technology is judged to be sufficient. The average was found to be close enough to four for each research question (M1=3.83, M2=3.67, M3=3.67, M4=3.67). Moreover, the calculations of variance (SD1=1.94, SD2=1.60, SD3=1.60, SD4=1.60) show the content of the course is without significant fluctuations in expert judgment.

Section 4: evaluation of technology

Factors	***M***	***Mdn***	***SD***	s^2	**n**
intercultural skills	3.83	4	1.94	3.76	6
communication skills	3.67	4	1.60	2.56	6
management skills	3.67	4	1.60	2.56	6

emotional development	3.67	4	1.60	2.56	6

*Table **4**: Results for evaluation of technology*



(Where axis y is n)

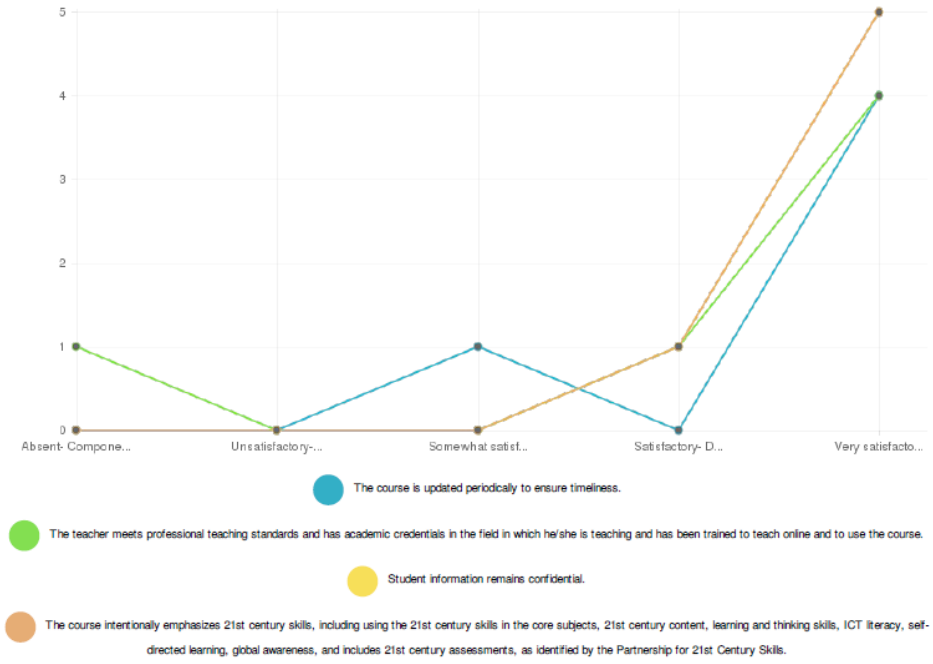
*Figure **13**: Results for evaluation of technology*

Based on the results, we note that course evaluation and management is judged to be sufficient. The average was found to be close enough to four for each research question (M1=3.60, M2=3.17, M3=3.83, M4=3.83). Moreover, the calculations of variance (SD1=1.55, SD2=1.47, SD3=1.94, SD4=1.94) show the content of the course is without significant fluctuations in expert judgment.

Section 5: course evaluation and management

Factors	***M***	***Mdn***	***SD***	s^2	**n**
intercultural skills	3.60	4	1.55	2.40	6
communication skills	3.17	4	1.47	2.16	6
management skills	3.83	4	1.94	3.76	6
emotional development	3.83	4	1.94	3.76	6

*Table **5**: Results for course evaluation and management*



(Where axis y is n)

*Figure **14**: Results for course evaluation and management*

4.3 Inductive Analysis of Results

All the theories and methods used to draw conclusions for the population based on the data of a sample are Inductive Analysis of Results.

The parts of the inductive effects of this research are:

- Statistical hypothesis testing
- Estimation of population parameters
- Significance levels - confidence interval

4.3.1 Statistical hypothesis testing

Very often in the problems we are studying, our primary concern is not to appreciate the value of a parameter, but to check whether its value is less than or greater than a given value, which

is of natural importance to our problem. In such a question, we can answer by setting appropriate statistical assumptions and checking whether they are valid or not.

4.3.1.1 Null and Alternative Hypothesis

In the mind of the researcher, making an observation creates a theory or more specific creates a theory under consideration. For example, in our research to evaluate the Moodle online learning environment, this hypothesis could be formulated as: "Experts judge the electrical lesson as non sufficient".

Generally, in a statistical test, we use two specific statistical formulations known as alternative hypothesis (H1) and null hypothesis (H0). The theory that a researcher develops from an observation usually predicts the appearance of a result. The hypothesis that this result appears is called **Alternative Hypothesis** and is denoted by H1. The opposite of the alternative hypothesis is **Null Hypothesis** and is denoted by H0. In order to understand the above, continuing the previous example, the zero and the alternative hypotheses can be formulated as follows:

- Null hypothesis (H0): "Experts judge the e-course as non sufficient."
- Alternative hypothesis (H1): "Experts judge the e-course as sufficient."

4.3.1.2 Estimation - Significance levels - confidence interval

Very often, we are forced to estimate various statistical parameters, such as mean value, standard deviation, etc., based not on data but on hypothesis.

The decision whether to accept or reject Null hypothesis (H0) is based on probabilities. Thus, we set a confidence level (1-a) for the control decision. The parameter a is called as **significance level** and it determines the range of acceptance and rejection area, i.e. the acceptable error limit.

For example, when we set a materiality level of a = 0.05 we mean that we accept up to 5% error in the probability and the result of the statistical control we have done is correct. In the case of statistical studies in the field of our own research, we set the materiality level at a = 0.05 . The following figure shows a normal distribution with the hatched area representing the rejection area. The area enclosed by it represents the corresponding probability.

We call the confidence interval of the parameter θ for a level of significance a, the interval (θ1, θ2) defined by the relation:

$$P(\theta_1 \leq \theta \leq \theta_2) = 1 - \alpha$$

where P the corresponding probability. The numbers θ1, θ2 are defined as **confidence limits**, θ1 is the **lower confidence limit** (LCL), while θ2 is the upper confidence limit (UCL). The relationship of the acceptance area is the same as the relation a of the confidence interval of θ.

The value of the parameter θ corresponds to a probability value. For this probability value, **p-value** has also prevailed in foreign bibliography. This value (**p-value**) of the control is the probability of observing for parameter θ a value as extreme as the value when the null hypothesis H0 applies.

Intuitively, if the p-value is "close" to 0, then we conclude that it is "unlikely", given hypothesis H0, to display this value and, naturally, we come to the conclusion that null hypothesis H0 should not apply.

Therefore, in every statistical check:

- If the p-value < a then we reject H0 while
- if p-value ≥ a then we do not reject H0

4.3.1.2.1 Calculation of p-value and a in our survey

As mentioned above, we select theses data:

- the materiality level at a = 0.05
- Null hypothesis (H0): "Experts judge the electrical lesson as non sufficient."
- Alternative hypothesis (H1): "Experts judge the electrical lesson as sufficient."
- M = arithmetic mean
- μ = population mean
- sd = standard deviation
- n = sample

The p-value approach involves determining "likely" or "unlikely" by determining the probability — assuming the null hypothesis were true — of observing a more extreme test statistic in the direction of the alternative hypothesis than the one observed. If the P-value is small, say less than (or equal to) 0.05, then it is "unlikely." In addition, if the p-value is large, say more than 0.05, and then it is "likely."

If the P-value is less than (or equal to) 0.05, then the null hypothesis is rejected in favor of the alternative hypothesis. Moreover, if the P-value is greater than 0.05, then the null hypothesis is not rejected.

Specifically, the four steps involved in using the P-value approach to conducting any hypothesis test are:

1. Specify the null and alternative hypotheses.
Null hypothesis (H0): "Experts judge the electrical lesson as non sufficient."
Alternative hypothesis (H1): "Experts judge the electrical lesson as sufficient."

2. Using the sample data and assuming the null hypothesis is true, calculate the value of the test statistic. Again, to conduct the hypothesis test for the population mean μ, we use the t-statistic

$$t^* = \frac{am - \mu}{s/\sqrt{n}}$$

which follows a t-distribution with n - 1 degrees of freedom.

3. Using the known distribution of the test statistic, calculate the P-value

4. Set the significance level, α, the probability of making a Type I error to be small — here we set 0.05. Compare the P-value to α=0.05. If the P-value is less than (or equal to) α, reject the null hypothesis in favor of the alternative hypothesis. If the P-value is greater than α, do not reject the null hypothesis.

In our survey concerning the mean grade point average, suppose that our random sample of n = 6 expertise majoring in mathematics yields a test statistic t* equaling 2.5. Since n = 6, our test statistic t* has n - 1 = 5 degrees of freedom. Also, suppose we set our significance level α at 0.05, so that we have only a 5% chance of making a Type I error.

The P-value for conducting the right-tailed test H0 : μ = 3 versus H1 : μ > 3 is the probability that we would observe a test statistic greater than t* = 2.5 if the population mean μ really were 3. Recall that probability equals the area under the probability curve. The P-value is therefore the area under a tn - 1 = t14 curve and to the right of the test statistic t* = 2.5. It can be shown using statistical software (such as Microsoft Excel or SPSS) that the P-value is *p=.0127*.

Thus,

$$0.0127 < 0.05 \iff \text{p} - \text{value} < \text{a}$$

We conclude that the p-value is less than α. So we reject the null hypothesis (H0): "Experts judge the electronic lesson as non sufficient." in favor of the alternative hypothesis.

Therefore, we accept the Alternative hypothesis (H1): "Experts judge the e-course as sufficient."

CHAPTER 5 CONCLUSIONS

5.1 Overview of results

In the present master thesis, four research questions have been presented in the previous chapters.

The first research question developed intercultural skills. More specifically, the trainees showed respect, better understanding, and interacted more effectively.

Communication skills were developed by the second research question. This is evidenced by the fact that the trainees can convey and receive messages to and from others both verbally and thought body language.

As to the third research question, there is the development of management skills. The trainees have developed the capacity to organize their time, study and are responsible for their deadlines.

Finally, in the fourth and final research question, emotional skills were developed. In particular, trainees managed to regulate and control their emotions while also forming secure relationships. In addition to these, trainees developed their social relationships, empathy and emotional maturity.

All these results come out due to how effective the online course was and by the assessment of the expertise.

All of the above are listed in the table below.

intercultural skills	• Show respect • Have better understanding towards others • interact more effectively
communication skills	• convey and receive messages to others • convey and receive messages from others in both cases verbally and thought body language.
management skills	Capacity to organize: • time • study • deadlines

emotional development	• regulate emotions • control emotions • form secure relationships • develop social relationships • emotional maturity improved • show empathy

*Table **6**: Overview of results*

5.2 Discussion

During this research, some restrictions should certainly be taken under consideration. The most important of them all is the sample size. The population in this research is small, only six people. Statistical methods suggest the size of the sample to be as big as possible because the bigger the population is, the more accurate the results of the research are. Perhaps, if the sample size were greater the results of this certain research would come out to be different.

Having small sample size does not mean that the research is not sufficient. Of course, there are limitations to smaller sample studies, like the one here. The greatest one is the given results limit seeing big differences or big "effects." This means that the results conducted after this research can be used only for descriptive analysis and not for generalization. To be more specific, the results conducted from this certain research can only be used for testing the e-course.

In order to prove the sufficiency of a research that has small sample size, when comparing two proportions: If the data is multiple choice, then the N-1 Two Proportion Test is being used. This has worked in this research as well. Another important benefit is that the results can be obtained after a much lower expenditure of time, money and other research resources. Finding a small number of participants is time consuming. It gives you the ability to focus on the design rather than spend time looking for more participants.

Further, testing with a few users makes it easier to do more rounds and even possible to test and debrief in a short period of time.

Analyzing more thoroughly the findings of the analysis of the research questions, the results that came up are described further on.

Regarding the first research question: Can an online course develop intercultural skills?

To answer the first research question, an assessment rubric was used and the results came out to show that the trainees developed intercultural skills, showed respect, better understanding, and interacted more effectively.

Regarding the second research question: Is an e-Learning environment an efficient tool for cultivating communication skills?

As an answer to the second research question, the findings of the assessment rubric showed that communication skills were developed. This is proven by the fact that the trainees can convey and receive messages to and from others both verbally and thought body language.

Regarding the third research question: Can the completion of an e-course contribute to better management skills?

According to the results of the evaluation rubric as an answer to the third research question, there is development of management skills. The trainees have developed the capacity to organize their time, study and are responsible for their deadlines.

Regarding the forth research question: Can online learning promote the emotional development of adults?

To answer the fourth and final research question, emotional skills were developed. In particular, trainees managed to regulate and control their emotions while also forming secure relationships. In addition to these, trainees developed their social relationships, empathy and emotional maturity. All the above findings were generated from the results the assessment rubric provided.

5.3 Conclusions

For this research, an e-course was developed, implemented and evaluated through the online learning environment “Moodle”, aiming at developing the skills of the trainees and improving their performance. The trainees were Police Officers and the training happened in order to promote emotional development, intercultural skills, communication skills and management skills, based on the learning theory of “Cognitive Apprenticeship”.

Moreover, to see if an online platform could be an effective tool of education, especially for adult learners, and whether the cost of education will reduce as the capacity of participation augments. To examine if the asynchronous form of learning will be convenient and efficient for adult learners. This online environment of learning was designed for training Police Officers on better management of interculturalism on their daily workplace and for the improvement of their communication skills, providing better services to migrants and protecting their human rights.

After the experimental procedure, certain conclusions came up, such as:

1. Police officers managed to cultivate their emotional development, and augment their intercultural, communication and management skills after completing the e-course. These conclude that the aim of the research has succeeded.

2. Cognitive Apprenticeship proved to be a very suitable learning theory for adults and especially for this scenario. It worked well along with the teaching strategies that support it and the certain type of exercises used.

3. An e-course is a nice online environment that supports training. It is suitable for adult learners and it is not time consuming. It has low cost and it can be accessible much easier and faster comparing to learning in a traditional classroom. It makes it easy for people to access the course, with a simple process for them to login and navigate through the course content. People were allowed to go through the course at their own pace. The e-course gave them incentives to keep going.

4. The Moodle environment, when correctly designed within a theoretical framework, offers many advantages to trainees, which are directly linked to the development of superior thinking skills. In the present research, it was observed that the application of cognitive apprenticeship combined with the Moodle environment enhances trainees in many areas. Thus, trainees understand a problem more easily and organize their information (and work together if necessary) in such a way that they reach their solution more quickly. In addition, they implement a specific strategy and finally evaluate their results.

5. Statistics is a methodical mathematical, older technique and contemporary science that attempts to extract valid knowledge using empirical observational or experimental data. The main object of research and study of Statistics is the collection, classification, processing, presentation, analysis and interpretation of various data with the ultimate aim of obtaining safe conclusions for making sound decisions. In the present study, a statistical criterion was applied and the descriptive and inductive statistics were studied. The purpose was to check the correctness of the research results and further on the correctness of the electronic platform.

5.4 Proposals for future research

Here are some suggestions for future research.

One of the fields that tend to grow rapidly is emotional intelligence. Emotional intelligence is the capability of individuals to recognize their own and other people's emotions, discern between different feelings and label them appropriately, use emotional information to guide thinking and behavior, and manage and/or adjust emotions to adapt to environments or achieve one's goal(s).

Another field that has a great outlook is e-learning. One of the greatest advantages of eLearning is its flexibility to adapt to different learning styles. The World Wide Web has thrown the door wide open for learners. They are no longer constrained by what can be accomplished in a classroom. Electronic learning, or eLearning, simply requires an internet service provider and a platform for access. Once those requirements are met, continuing educational possibilities are numerous. Content can exist solely online or it can be combined with in-person learning opportunities. Learners work alone, in groups or with instructors. Interactions with others are either synchronous or asynchronous. Because of its open-ended nature, eLearning has exceptional advantages. Learners can be located anywhere in the world, as long as an ISP is available. Once content is prepared, it often requires little intervention from educators. However, if necessary, they can update material at any time. One of the greatest advantages of eLearning is its flexibility. Educators adapt it to address learners' different drives and learning styles (Claudio de Paiva Franco, 2000).

Perhaps the most misunderstood disabilities that go unnoticed or get obfuscated will be learning disabilities. Most often, learning disabilities such as dyslexia are mislabeled as carelessness or lack of interest because children with such disabilities may perform normally, at times above average, in other areas than learning. For instance, a student with dyslexia may play guitar very well but may not score good grades at school.

Some objects and sounds that normal kids may not notice can attract the attention, often-unwanted attention, of children with learning disabilities. As a result, such kids find noisy classrooms filled with learning materials, charts, and other objects distracting and annoying and may be unable to perform well in the class. Eventually, these kids tend to have low self-confidence and self-esteem."

Systematic teaching, in addition to psychological treatment, can improve kids to cope up with such learning difficulties. For such kids, eLearning can serve as an excellent and effective method to impart learning at their own pace and interest, and on the device of their choice.
E-learning content with rich multimedia elements such as audio, video, pictures, animations and user-based interactions can spark interest in these children and keep them engrossed along with encouragement and support from both parents and teachers.

Most kids today show a strong inclination towards games. A game based learning approach can turn learning complex concepts real fun and engaging thereby driving kids to come back for more. Assessments and tests, which are the most difficult area for these kids, can be modified to game based assessments, leader boards and reward point systems to remove the boring elements of any tests.

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Appendix A

English-Greek dictionary of Statistics

A

acceptance region περιοχή αποδοχής
acceptance sampling δειγματοληψία αποδοχής
accessibility sampling δειγματοληψία προσιτότητας
additive model προσθετικό μοντέλο
algorithm αλγόριθμος
alpha άλφα
alternative hypothesis εναλλακτική υπόθεση
analysis of covariance ανάλυση συνδιακύμανσης
analysis of variance ανάλυση διακύμανσης
antithetic random variables αντίθετες ή αντιθετικές τυχαίες μεταβλητές
approximation προσέγγιση
area sampling δειγματοληψία κατά περιοχές
arithmetic mean αριθμητικός μέσος
assumption υπόθεση
asymptotic ασυμπτωτικός
autocorrelation αυτοσυσχέτιση
autocorrelation function συνάρτηση αυτοσυσχέτισης
average μέσος όρος
axis άξονας

B

backward elimination procedure μέθοδος αποκλεισμού μεταβλητών
bar chart ραβδόγραμμα
Bayes factor παράγοντας του Bayes
Bayes' theorem θεώρημα του Bayes
Bayesian inference συμπερασματολογία κατά Bayes
Bayesian information criterion κριτήριο πληροφορίας του Bayes
Bayesian statistics Μπεϋσιανή στατιστική ή στατιστική κατά Bayes
Beta βήτα
beta distribution κατανομή βήτα
beta function συνάρτηση βήτα
beta-binomial distribution κατανομή βήτα-διωνυμική
bias μεροληψία
bimodal distribution δικόρυφη κατανομή
binary data δυαδικά δεδομένα
binomial coefficient διωνυμικός συντελεστής
binomial distribution διωνυμική κατανομή

binomial test διωνυμικός έλεγχος
biostatistics βιοστατιστική
bivariate distribution διμεταβλητή κατανομή
box plot διάγραμμα πλαισίου απολήξεων ή θηκόγραμμα
branching processes κλαδωτές ανελίξεις
Buffon's needle βελόνα του Buffon

C

canonical correlation analysis ανάλυση κανονικών συσχετίσεων
capability index δείκτης ικανότητας
capture-recapture methods μέθοδοι σύλληψης και επανασύλληψης
categorical variable κατηγορική μεταβλητή
categorical data analysis ανάλυση κατηγορικών δεδομένων
causality αιτιότητα
censored data λογοκριμένα δεδομένα
census απογραφή
central limit theorem κεντρικό οριακό θεώρημα
characteristic function χαρακτηριστική συνάρτηση
chi-square distribution χι-τετράγωνο κατανομή
classification κατάταξη
clinical trials κλινικές δοκιμές
cluster analysis ανάλυση σε ομάδες
clustered bar chart ομαδοποιημένο ραβδόγραμμα
clustered sampling δειγματοληψία κατά ομάδες
coefficient συντελεστής
coefficient of determination συντελεστής προσδιορισμού
coefficient of variation συντελεστής μεταβλητότητας
cohort studies μελέτες κοορτής
collinearity συγγραμμικότητα
compound Poisson process σύνθετη διαδικασία Poisson
concordant pair αρμονικό ζεύγος
conditional distribution δεσμευμένη κατανομή
conditional expectation δεσμευμένη αναμονή
conditional probability δεσμευμένη πιθανότητα
confidence band ζώνη εμπιστοσύνης
confidence interval διάστημα εμπιστοσύνης
confirmatory factor analysis επιβεβαιωτική παραγοντική ανάλυση
confounding factor συγχυτικός παράγοντας
conjugate distribution συζυγής κατανομή
consistency συνέπεια
contingency coefficient συντελεστής συνάφειας
contingency table πίνακας συνάφειας
continuity correction διόρθωση συνέχειας
continuous distribution συνεχής κατανομή

continuous random variable συνεχής τυχαία μεταβλητή
continuous variable συνεχής μεταβλητή
contrasts διαφορές
control chart διάγραμμα ελέγχου
control-cases studies μελέτες μαρτύρων ασθενών
convolution συνέλιξη
correlation συσχέτιση
correlation coefficient συντελεστής συσχέτισης
correlation matrix πίνακας συσχετίσεων
correlogram κορελόγραμμα
correspondence analysis ανάλυση αντιστοιχιών
covariance συνδιακύμανση
covariate συμμεταβλητή
coverage probability πιθανότητα κάλυψης
credibility interval διάστημα αξιοπιστίας
credibility region περιοχή αξιοπιστίας
critical value κριτική τιμή
cross-sectional studies διατμηματικές μελέτες
cumulative distribution function αθροιστική συνάρτηση κατανομής
curve καμπύλη

D

data δεδομένα
data analysis ανάλυση δεδομένων
data mining εξώρυξη δεδομένων
deciles δεκατημόρια
degree of association βαθμός συνάφειας ή σύνδεσης
degrees of freedom βαθμοί ελευθερίας
demography δημογραφία
dendrogram δεντρόγραμμα
dependent variable εξαρτημένη μεταβλητή
descriptive statistics περιγραφικά στατιστική
design matrix πίνακας σχεδιασμού
design of experiments σχεδιασμός πειραμάτων
diffusion process πρότυπα διάχυσης
discordant pair δυσαρμονικό ζεύγος
discrete distribution διακριτή κατανομή
discrete random variable διακριτή τυχαία μεταβλητή
discriminant analysis διαχωριστική ή διακριτική ανάλυση
dispersion διασπορά
distribution κατανομή
dot plot σημειόγραμμα
dummy variable ψευδομεταβλητή

E

efficient estimator αποτελεσματικός εκτιμητής
efficiency αποτελεσματικότητα
epidemiology επιδημιολογία
ergodic theorem εργοδικό θεώρημα
ergodicity εργοδικότητα
error λάθος, σφάλμα
estimation εκτίμηση
estimator εκτιμητής
estimated value εκτιμηθείσα τιμή
event γεγονός
exact test ακριβής έλεγχος
expectation αναμονή
expected value αναμενόμενη τιμή
experimental units πειραματικές μονάδες
explanatory variable επεξηγηματική μεταβλητή
exponential distribution εκθετική κατανομή
exponential family εκθετική οικογένεια

F

factor παράγοντας
factor analysis παραγοντική ανάλυση
factor loadings επιβαρύνσεις των παραγόντων
factorial design παραγοντικός σχεδιασμός
false negative case ψευδή θετική περίπτωση
false positive case ψευδή αρνητική περίπτωση
finite πεπερασμένος
first quartile πρώτο τεταρτημόριο
fixed effects σταθερές επιδράσεις
fixed effects model μοντέλο σταθερών επιδράσεων
follow-up studies μελέτες παρακολούθησης
forecasting methods μέθοδοι προβλέψεων
forward procedure μέθοδος προοδευτικής προσθήκης μεταβλητών
frame πλαίσιο
frequency συχνότητα
frequency polygon πολύγωνο συχνοτήτων

G

game theory θεωρία παιγνίων
gamma distribution κατανομή γάμα
gamma function συνάρτηση γάμα
general linear model γενικό γραμμικό μοντέλο
generalized linear models γενικευμένα γραμμικά μοντέλα
geometric distribution γεωμετρική κατανομή
geometric mean γεωμετρικός μέσος
goodness of fit test έλεγχος καλής προσαρμογής
graph γράφημα

H

harmonic mean αρμονικός μέσος
hazard function συνάρτηση κινδύνου
hazard rate ρυθμός κινδύνου
hazard rate function συνάρτηση βαθμού κινδύνου
heterogeneity ετερογένεια
heteroscedasticity ετεροσκεδαστικότητα
hierarchical model ιεραρχικό μοντέλο
highest posterior density περιοχή υψίστης a-posteriori πυκνότητας
histogram ιστόγραμμα
homogeneity ομοιογένεια
homoscedasticity ομοσκεδαστικότητα
hypergeometric distribution υπεργεωμετρική κατανομή
hypothesis testing έλεγχος υπόθεσης

I

independent variable ανεξάρτητη μεταβλητή
index number αριθμοδείκτης
inertia αδράνεια
infinite άπειρος
information μέτρο πληροφορίας
information matrix πίνακας πληροφορίας
informative prior distribution πληροφοριακή prior κατανομή
interaction αλληλεπίδραση
interquartile range ενδοτεταρτημοριακό εύρος
interval estimation εκτίμηση σε διάστημα
interval scale κλίμακα διαστήματος
irreducible Markov chain αδιαχώριστη αλυσίδα Markov

J

joint distribution από κοινού κατανομή
judgemental or purposive sampling δειγματοληψία κρίσης ή σκοπιμότητας

K

Kurtosis κύρτωση

L

lack of memory έλλειψη μνήμης
latent variables λανθάνουσες μεταβλητές
latin squares λατινικά τετράγωνα
law of large numbers νόμος των μεγάλων αριθμών
least squares estimators εκτιμητές ελαχίστων τετραγώνων
leptokurtic distribution λεπτόκυρτη κατανομή
linear model γραμμικό μοντέλο
location parameter παράμετρος θέσης
logistic model λογιστικό μοντέλο
logistic regression λογιστική παλινδρόμηση
logistics distribution λογιστική κατανομή
loglinear model λογαριθμικό μοντέλο
lognormal distribution λογαριθμοκανονική κατανομή
longitudinal data analysis ανάλυση διαμήκων δεδομένων
longitudinal studies διαμήκεις μελέτες
loss function συνάρτηση απώλειας

M

main effects κύριες επιδράσεις
marginal distribution περιθώρια κατανομή
market research έρευνα αγοράς
Markov chains αλυσίδες Markov ή Μαρκοβιανές αλυσίδες
Maximum μέγιστο
maximum likelihood μέγιστη πιθανοφάνεια
mean μέσος
mean absolute deviation μέση απόλυτη απόκλιση
mean square error μέσο τετραγωνικό σφάλμα
measure theory θεωρία μέτρου
measures of association μέτρα συνάφειας

median διάμεσος
mesokurtic distribution μεσόκυρτη κατανομή
minimum ελάχιστο
missing values εκλειπούσες τιμές
mixed effects model μοντέλο μικτών επιδράσεων
mode κορυφή
model μοντέλο
moment ροπή
moment generating function ροπογεννήτρια συνάρτηση
monotone regression μονότονη παλινδρόμηση
mortality (death) rate ρυθμός θνησιμότητας
moving average κινητός μέσος
multicollinearity πολυσυγγραμμικότητα
multidimensional scaling techniques πολυδιάστατες τεχνικές κλιμακοποίησης
multilevel models πολυεπίπεδα μοντέλα
multinomial distribution πολυωνυμική κατανομή
multiple comparisons πολλαπλοί έλεγχοι
multiple correspondence analysis πολλαπλή ανάλυση αντιστοιχιών
multiple linear regression πολλαπλή γραμμική παλινδρόμηση
multivariate πολυμεταβλητός
multivariate analysis of variance πολυμεταβλητή ανάλυση διακύμανσης
multivariate case πολυμεταβλητή περίπτωση

N

negative binomial distribution αρνητική διωνυμική κατανομή
negative confounder αρνητικός συγχυτικός παράγοντας
negative predicted value αρνητική προβλεπτική τιμή
nested models φωλιασμένα μοντέλα
nominal scale ονομαστική κλίμακα
nominal variable ονομαστική μεταβλητή
non-informative prior distribution μη πληροφοριακή prior κατανομή
non-linear model μη-γραμμικό μοντέλο
nonparametric statistics μη παραμετρική στατιστική
normal distribution κανονική κατανομή
nuisance factor ενοχλητικός παράγοντας
null hypothesis μηδενική υπόθεση

O

observations παρατηρήσεις
observed significance level (p-value) παρατηρηθέν επίπεδο σημαντικότητας (p-τιμή)
odds ratio λόγος συμπληρωματικών πιθανοτήτων ή κλάσμα λόγου πιθανοτήτων
one-sided test μονόπλευρος έλεγχος
one-way ANOVA ανάλυση διακύμανσης κατά ένα παράγοντα
operating characteristic curve χαρακτηριστική λειτουργική καμπύλη
opinion poll σφυγμομέτρηση κοινής γνώμης
ordered data διατεταγμένα δεδομένα
ordinal scale κλίμακα διάταξης
ordinary least squares method μέθοδος ελαχίστων τετραγώνων
orthogonal contrasts ορθογώνιες διαφορές
outliers ακραίες τιμές
overparameterization υπερπαραμετροποίηση

P

parameter παράμετρος
parametric statistics παραμετρική στατιστική
partial correlation coefficient μερικός συντελεστής συσχέτισης
permutation αναδιάταξη
pie chart κυκλικό διάγραμμα ή διάγραμμα πίτας
pivotal quantity αντιστρεπτή ποσότητα
platykurtic distribution πλατύκυρτη κατανομή
plot γράφημα
point estimation σημειακή εκτίμηση
point process σημειακή διαδικασία
population πληθυσμός
population characteristic χαρακτηριστικό του πληθσμού
positive confounder θετικός συγχυτικός παράγοντας
positive predicted value θετική προβλεπτική τιμή
posterior or a-posteriori distribution posterior κατανομή
predicted value προβλεφθείσα τιμή
prediction interval διάστημα πρόβλεψης
prevalence επιπολασμός
principal component analysis ανάλυση κύριων συνιστωσών
principal coordinate analysis ανάλυση κύριων συντεταγμένων
prior or a-priori distribution prior κατανομή
probability πιθανότητα
probability density function συνάρτηση πυκνότητας πιθανότητας
probability generating function πιθανογεννήτρια συνάρτηση
probability sampling δειγματοληψία κατά πιθανότητα
prospective studies προοπτικές μελέτες

Q

qualitative ποιοτικός
quantitative ποσοτικός
queues ουρές
quota sampling δειγματοληψία με προκαθορισμένα ποσοστά

R

random effects τυχαίες επιδράσεις
random effects model μοντέλο τυχαίων επιδράσεων
random factor τυχαίος παράγοντας
random processes τυχαίες διαδικασίες
random sample τυχαίο δείγμα
random variable τυχαία ματαβλητή
random walk τυχαίος περίπατος
randomization τυχαιοποίηση
randomized complete block design τυχαιοποιημένοι πλήρως σχεδιασμοί κατά μπλοκ
range εύρος
ranks τάξεις μεγέθους
ratio scale κλίμακα λόγου
recurrent state επαναληπτική κατάσταση
regression analysis ανάλυση παλινδρόμησης
regression coefficients συντελεστές παλινδρόμησης
regressors παλινδρομητές
rejection region περιοχή απόρριψης
rejection sampling δειγματοληψία απόρριψης
relative risk σχετικός κίνδυνος
reliability αξιοπιστία
reliability coefficient συντελεστής αξιοπιστίας
reliability function συνάρτηση αξιοπιστίας
renewal process ανανεωτική διαδικασία
renewal theory θεωρία ανανέωσης
repeated measures επαναλμβανόμενες μετρήσεις
replication επαναληψιμότητα
residuals κατάλοιπα
response surface επιφάνεια απόκρισης
response variable απαντητική μεταβλητή
retrospective studies αναδρομικές μελέτες
ridge regression αμφικλινής παλινδρόμηση
robust regression εύρωστη παλινδρόμηση
runs test έλεγχος ροών

S

Sample δείγμα
sample surveys δειγματοληπτικές έρευνες
sampling distribution δειγματική κατανομή
sampling frame δειγματοληπτικό πλαίσιο
sampling mean δειγματικός μέσος
sampling techniques δειγματοληπτικές τεχνικές
sampling theory θεωρία δειγματοληψίας
sampling units δειγματοληπτικές μονάδες
saturated (full) model κορεσμένο μοντέλο
scale κλίμακα
scale parameter παράμετρος κλίμακας
scatter plot διάγραμμα διασποράς
seasonality εποχικότητα
semiparametric ημιπαραμετρικός
sensitivity analysis ανάλυση ευαισθησίας
serial correlation coefficient σειριακός συντελεστής συσχέτισης
shape parameter παράμετρος σχήματος
sign test προσημικός έλεγχος
significance level επίπεδο σημαντικότητας
simple linear regression απλή γραμμική παλινδρόμηση
simple random sampling απλή τυχαία δειγματοληψία
simulation προσομοίωση
size effect επίδραση μεγέθους
skewed distribution ασύμμετρη κατανομή
skewness ασυμμετρία
specification limits όρια προδιαγραφών
specificity ειδικότητα
sphericity σφαιρικότητα
split-half reliability αξιοπιστία ημίκλαστου
stable process σταθερή διεργασία
standard deviation τυπική απόκλιση
standard error τυπικό σφάλμα
standardization τυποποίηση
standardized values τυποποιημένες τιμές
state space χώρος καταστάσεων
stationary distribution στάσιμη κατανομή
stationary process στάσιμη διαδικασία
statistical στατιστικός
statistical inference στατιστική συμπερασματολογία
statistically significant στατιστικά σημαντικός
statistician στατιστικός
statistic στατιστική

stem-and-leaf plo διάγραμμα μίσχου-φύλου
stepwise regression βηματική παλινδρόμηση
stochastic models στοχαστικά μοντέλα
stochastic processes στοχαστικές ανελίξεις
stratified analysis στρωματοποιημένη ανάλυση
stratified randomization στρωματοποιημένη τυχαιοποίηση
stratified sampling στρωματοποιημένη δειγματοληψία
study population υπό μελέτη πληθυσμός
subjective probability υποκειμενική πιθανότητα
sufficiency επάρκεια
sum άθροισμα
survival analysis ανάλυση επιβίωσης
survival function συνάρτηση επιβίωσης
symmetric distribution συμμετρική κατανομή
systematic sampling συστηματική δειγματοληψία

T

target population αντικειμενικός πληθυσμός
third quartile τρίτο τεταρτημόριο
time series χρονολογικές σειρές
transformation μετασχηματισμός
transient state μεταβατική κατάσταση
transition matrix πίνακας μετάβασης
transition probability πιθανότητα μετάβασης
trend τάση
trimmed mean περικομμένος μέσος
two-sided test αμφίπλευρος έλεγχος
two-way ANOVA ANOVA κατά δύο παράγοντες

U

unbiased estimator αμερόληπτος εκτιμητής
uniform distribution ομοιόμορφη κατανομή
unimodal distribution μονοκόρυφη κατανομή
univariate case μονομεταβλητή περίπτωση
universe ολότητα
unstable process μη σταθερή διεργασία

V

variability μεταβλητότητα
variable μεταβλητή
variance διακύμανση
variance-covariance matrix πίνακας διακύμανσης-συνδιακύμανσης

W

waiting time χρόνος αναμονής
weighted least squares method μέθοδος σταθμισμένων ελαχίστων τετραγώνων
weighted mean σταθμισμένος μέσος

Appendix B

E-Course Evaluation Rubric

RATING SCALE		
0	*Absent-*	*Component is missing*
1	*Unsatisfactory-*	*Needs significant improvement*
2	*Somewhat satisfactory-*	*Needs targeted improvements*
3	*Satisfactory-*	*Discretional improvement needed*
4	*Very satisfactory-*	*No improvement needed*

A.	**CONTENT EVALUATION**	**RATING**
1.	The course goals and objectives are measurable and clearly state what the participants will know or be able to do at the end of the course.	
2.	The course content and assignments are of sufficient rigor, depth, and breadth to teach the standards being addressed.	
3.	Information is provided to students on how to communicate with the online teacher and course provides, including information on the process for these communications.	
4.	Assessment and assessment answers and explanations are included.	

B.	**INSTRUCTIONAL DESIGN EVALUATION**	**RATING**
1.	The course is organized into units and lessons. Each lesson includes content and activities, assignments to provide multiple learning opportunities for students to master the content.	
2.	Readability levels, written language assignments and mathematical requirements are appropriate for the course content and the students.	
3.	The course design provides opportunities for appropriate instructor-student interaction, including timely and frequent feedback about student progress.	
4.	Students have access to resources that enrich the course content and are given the opportunity for application of the material.	

C.	STUDENT ASSESSMENT EVALUATION	RATING
1.	Student evaluation strategies are consistent with course goals and objectives, representative of the scope of the course and clearly stated.	
2.	The course structure includes adequate and appropriate methods and procedures to assess students' mastery of content.	
3.	Ongoing and frequent assessments are conducted to verify each student's readiness for the next lesson.	
4.	Assessment strategies and tools make the student continuously aware of his/her progress and mastery of the content.	

D.	EVALUATION OF TECHNOLOGY	RATING
1.	The course architecture permits the online teacher to add content, activities and assessments to extend learning opportunities.	
2.	The course is easy to navigate.	
3.	The course makes maximum use of the capabilities of the online medium and makes resources available by alternative means; e.g. video, CDs, podcasts.	
4.	The course utilizes appropriate content-specific tools and software.	

E.	COURSE EVALUATION AND MANAGEMENT	RATING
1.	The course is updated periodically to ensure timeliness.	
2.	The teacher meets professional teaching standards and has academic credentials in the field in which he/she is teaching and has been trained to teach online and to use the course.	
3.	Student information remains confidential.	
4.	The course intentionally emphasizes 21st century skills, including using the 21st century skills in the core subjects, 21st century content, learning and thinking skills, ICT literacy, self-directed learning, global awareness, and includes 21st century assessments, as identified by the Partnership for 21st Century Skills.	

Appendix C

Aggregate rubric results tables

A. CONTENT EVALUATION

	Absent 0	***Unsatisfactory 1***	***Somewhat satisfactory 2***	***Satisfactory 3***	***Very satisfactory 4***	arithmetic mean	maxima	minima	range	median	mode	standard deviation	variance
Q_1	0	1	0	2	3	3.16	4	1	3	3.50	4	1.17	1.37
Q_2	0	0	1	1	4	3.50	4	2	2	4	4	1.47	2.16
Q_3	0	0	0	3	3	3.50	4	3	1	3.50	4-3	1.47	2.16
Q_4	0	0	0	1	5	3.83	4	3	1	4	4	1.94	3.76

B. INSTRUCTIONAL DESIGN EVALUATION

	Absent 0	***Unsatisfactory 1***	***Somewhat satisfactory 2***	***Satisfactory 3***	***Very satisfactory 4***	arithmetic mean	maxima	minima	range	median	mode	standard deviation	variance
Q_1	0	0	0	0	6	4	4	-	-	4	4	2.40	5.76
Q_2	0	0	0	2	4	3.67	4	3	1	4	4	1.60	2.56
Q_3	0	0	1	1	4	3.50	4	3-2	1-2	4	4	1.47	2.16
Q_4	0	1	0	1	4	3.67	4	3-1	1-3	4	4	1.47	2.16

C.STUDENT ASSESSMENT EVALUATION

	Absent 0	***Unsatisfactory 1***	***Somewhat satisfactory 2***	***Satisfactory 3***	***Very satisfactory 4***	arithmetic mean	maxima	minima	range	median	mode	standard deviation	variance
Q_1	0	0	0	1	5	3.83	4	3	1	4	4	1.94	3.76
Q_2	0	0	1	5	0	2.83	3	2	1	3	4	1.94	3.76
Q_3	0	1	0	0	5	3.50	4	1	3	4	4	1.94	3.76
Q_4	0	1	0	0	5	3.50	4	1	3	4	4	1.94	3.76

D. EVALUATION OF TECHNOLOGY

	Absent 0	***Unsatisfactory 1***	***Somewhat satisfactory 2***	***Satisfactory 3***	***Very satisfactory 4***	**arithmetic mean**	**maxima**	**minima**	**range**	**median**	**mode**	**standard deviation**	**variance**
Q_1	0	0	0	1	5	3.83	4	3	1	4	4	1.94	3.76
Q_2	0	0	0	2	4	3.67	4	3	1	4	4	1.60	2.56
Q_3	0	0	0	2	4	3.67	4	3	1	4	4	1.60	2.56
Q_4	0	0	0	2	4	3.67	4	3	1	4	4	1.60	2.56

E. COURSE EVALUATION AND MANAGEMENT

	Absent 0	***Unsatisfactory 1***	***Somewhat satisfactory 2***	***Satisfactory 3***	***Very satisfactory 4***	**arithmetic mean**	**maxima**	**minima**	**range**	**median**	**mode**	**standard deviation**	**variance**
Q_1	0	0	1	0	4	3.60	4	2	2	4	4	1.55	2.40
Q_2	1	0	0	1	4	3.17	4	3	1	4	4	1.47	2.16
Q_3	0	0	0	1	5	3.83	4	3	1	4	4	1.94	3.76
Q_4	0	0	0	1	5	3.83	4	3	1	4	4	1.94	3.76