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Μεταπτυχιακό Πρόγραμμα Σπουδών Διοίκηση, Τεχνολογία και Ποιότητα

Μεταπτυχιακή Διατριβή



VLE for Artificial Intelligence – A brief introduction to application and challenges

Παρασκευή Κλεάνθους

Επιβλέπουσα Καθηγήτρια

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Η παρούσα μεταπτυχιακή διατριβή υποβλήθηκε προς μερική εκπλήρωση των απαιτήσεων για απόκτηση μεταπτυχιακού τίτλου σπουδών στη Διοίκηση, Τεχνολογία και Ποιότητα από τη σχολή Οικονομικών Επιστημών και Διοίκησης του Ανοικτού Πανεπιστημίου Κύπρου.

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ΛΕΥΚΗ ΣΕΛΙΔΑ

Περίληψη

Η αξιοσημείωτη εξέλιξη της τεχνολογίας ως εναλλακτικού τρόπου κατάρτισης και εκπαίδευσης με χρήση εικονικών περιβαλλόντων μάθησης (ΕΠΜ) γίνεται ολοένα και πιο χρήσιμη στην καθημερινή μας ζωή. Πολλοί άνθρωποι από όλο τον κόσμο είναι σε θέση να αποκτήσουν γνώση, νέες δεξιότητες ή ακόμα και να χρησιμοποιήσουν τις θεωρητικές τους γνώσεις σε καταστάσεις παρόμοιες με την καθημερινότητα. Είναι πολύ σημαντικό για εμάς να χρησιμοποιούμε και να εκμεταλλευόμαστε την τεχνολογία με όλους τους τρόπους που μπορούν να μας βοηθήσουν.

Στην παρούσα διπλωματική εργασία ερευνούμε την πιθανότητα να μπορεί ένα ΕΠΜ να χρησιμοποιηθεί σαν εργαλείο εκπαίδευσης υπαλλήλων ή και απλών χρηστών για ένα συγκεκριμένο θέμα. Στη δική μας περίπτωση, χρησιμοποιήθηκε μελέτη περίπτωσης με θέματα που σχετίζονται με ΔΕΔΗ (Δικαιοσύνη, Ευθύνη, Διαφάνεια, Ηθική). Τα τρία θέματα ήταν Ηθική, Εφαρμογές Τεχνητής Νοημοσύνης και Εξατομίκευση. Ετοιμάσαμε εκπαιδευτικό υλικό σε βίντεο και μερικά κουίζ για να βοηθήσουμε τους χρήστες να αξιολογήσουν τις γνώσεις τους.

Με τη βοήθεια ενός ερωτηματολογίου αξιολογήσαμε την άποψη των συμμετεχόντων μας για το εικονικό μας περιβάλλον μάθησης, τι θα μπορούσαμε να κάνουμε καλύτερα στη δημιουργία του, πόσο χρήσιμο ήταν για αυτούς να μάθουν μέσα από ένα εικονικό περιβάλλον μάθησης και τη συνολική εμπειρία που είχαν μέσα από αυτό.

Επιπλέον, χρησιμοποιήσαμε την ανασκόπηση της βιβλιογραφίας και τις απαντήσεις των συμμετεχόντων στο ερωτηματολόγιο μας για να προτείνουμε κάποιες μελλοντικές εξελίξεις για το εικονικό μας περιβάλλον μάθησης που θα μπορούσαν να βοηθήσουν τους χρήστες μας να μάθουν πιο αποτελεσματικά τα θέματα που θα τους παρέχουμε.

Λέξεις κλειδιά: Εικονικά Περιβάλλοντα Μάθησης, Τεχνητή Νοημοσύνη , Ηθική, Εξατομίκευση

Summary

The remarkable evolution of technology has led to an alternative way for training and education using Virtual Learning Environments (VLE), which is becoming a very useful tool in our daily lives. Many people from all around the world can learn and gain new skills or even to use their theoretical knowledge in practice. It is very important for us to use and take advantage of the technology in all the ways that can help us.

In this dissertation, we will investigate the use of a VLE for training purposes and how efficiently the users can learn a specific topic through a VLE. In this work, the training case study concerns an important issue that has recently come to light – FATE. The three topics related to FATE were Ethics, Artificial Intelligence applications and Personalization. We prepared learning materials through videos and quizzes in order to help the users evaluate their knowledge.

The use of the VLE was evaluated through an online user study. In particular, with the help of a questionnaire, we evaluate the experience with and opinions of our participants for our virtual learning environment. In particular, the goals were to understand any areas for improvement in the VLE development, how useful it was for them to learn through a virtual learning environment and the overall experience.

In addition, we used our literature review and the answers of the participants on our questionnaire to propose some future developments for our virtual learning environment that could help our users to learn more efficiently the topics that we will provide them.

Keywords: Virtual Learning Environments, Artificial Intelligence, Ethics, Personalization

Ευχαριστίες

Η εκπόνηση της συγκεκριμένης διατριβής ήταν αποτέλεσμα μίας μεγάλης προσπάθειας, η οποία δεν θα ήταν εφικτή χωρίς την σημαντική βοήθεια της επιβλέπουσας καθηγήτριάς μου Δρ. Jahna Otterbacher. Θα ήθελα να την ευχαριστήσω θερμά για τη στήριξη και τη βοήθειά της καθ' όλη τη διάρκεια της εκπόνησης αυτής της διατριβής.

Επιπλέον, θα ήθελα να ευχαριστήσω την οικογένεια μου και τους φίλους μου για την εμψύχωση καθ' όλη την διάρκεια των σπουδών μου, που ήταν κοντά μου με τις πολύτιμες συμβουλές τους.

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Chapter 1 Introduction

Nowadays, many of us are using Artificial Intelligence (AI) applications to help us with tasks encountered in our daily lives. Some of us are using AI applications to facilitate access to information; for example, making a query in a search engine. Others may use AI applications to support - or even make - decisions on their daily tasks or procedures and for many other things. AI applications can be very useful for humanity, with many potential benefits. For example, there are many Intelligent Personal Assistants (IPAs) that help us with our everyday tasks, for example add a reminder on our calendar for us or even text a message when our hands are busy (Canbek & Mutlu, 2016). In addition, there are many algorithmic processes that collect data from our browsing history or location and provide us with personalized results in our queries in a search engine or in our social media timelines (Araujo & Helberger & Kruikemeier & Kruikemeier, 2020; Van Dijck & Poell & De Waal, 2018; Thurman & Schiferes, 2012; Diakopoulos & Koliska, 2017; Carlson, 2018; Boerman & Kruikemeier & Zuiderveen Borgesius, 2017).

Beyond making tasks easier in our personal lives, AI is also being used in the workplace to streamline various processes. In particular, there are many companies that are using Decision Support Systems, in order to solve problems. For instance, in a bank a system can help the managers to reject a client for a loan or accept the client, or even a Decision Support System can handle many processes, in order to reduce the workload for an employee to let him/her handle other important cases (Aye, 2020; Power, 2002; Nowduri, 2011).

However, there are many challenges in terms of ensuring the *ethical use* of such Artificial Intelligence applications. First of all, there are many examples in which Google Search Engines provided discriminatory results to its users. For instance, for prestigious jobs Google provides images of men and not women¹, or in some cases when you search about professional hairstyles there are many white women in the images and for unprofessional hairstyles there are more black women images². In a similar vein, the Decision Support Systems (DSS) that many companies use to make decisions can reject someone either for a loan or for a job position because of their race or gender, sharing the same characteristics with a previous employee with bad behavior or with other clients at a bank that did not pay their loan. For the users of DSS, it is very important to understand that one of the reasons that such an algorithmic system may demonstrate a discriminatory behavior is because of the data that are used to train the algorithm or the input data that the user inserts in the system (Lepri, Oliver, Letouze, Pentland, Vinck, 2018). The users should ensure that the data are correct and there are no mistakes. Again, someone can lose an opportunity because the system denies him/her based on some characteristics that they may share with a group of people (Lepri, Oliver, Letouze, Pentland, Vinck, 2018). In summary, the need for AI systems to be transparent, unbiased, and fair is a big challenge and it is very important for the companies and the users to become aware of the issues related to fairness in the algorithmic system they use.

¹ 'Google's algorithm shows prestigious job ads to men, but not to women. Here's why that should worry you.' Available at: <u>https://www.washingtonpost.com/news/the-</u> <u>intersect/wp/2015/07/06/googles-algorithm-shows-prestigious-job-ads-to-men-but-not-to-</u> <u>women-heres-why-that-should-worry-you/</u> Accessed 15 November 2021

² ' Do Google's 'unprofessional hair' results show it is racist?', Available at: <u>https://www.theguardian.com/technology/2016/apr/08/does-google-unprofessional-hair-results-prove-algorithms-racist-</u> Accessed 15 November 2021

The main objective of this thesis is to help users to understand the necessity of fair, unbiased, and transparent algorithms through a Virtual Learning Environment, where they would be able to access information and educational activities, in order to be aware of those issues. The COVID-19 pandemic has shown the necessity to invest in remote solutions. There are many companies that during the pandemic decided either to work fully remote or they gave the opportunity to their employees to work a few days a week from home remotely. Based on a survey that was conducted globally with many CIOs of many companies as participants in March of 2021 70% of companies were working remotely and 31% of them answered that they would continue that working method permanently³. This is the reason that a virtual learning environment can be considered as an alternative platform where all the users of AI applications can access information on the above topic. Virtual learning environments are also less expensive than the traditional seminars/training and all the participants will be able to use the environment in their free time from their homes.

Due to the current situation with COVID-19 pandemic, going abroad is getting more difficult than it was before for many people or attending work and university. Even if someone wants to attend training it may be difficult for her/him. To continue, in many cases visiting another country either to study, work or get trained on a specific topic is more expensive than to stay in your country.

The need for Virtual Learning Environments is highly rising and as we saw earlier in our dissertation many companies are already using remote solutions for their employees in order to be able to work from their spaces without having to be physically present in the workplace. In the same way, the needs of training remain the same, so we had to find a solution to continue building our skills or gain new skills. In addition, many universities engage in distance learning for their students that were

³'Mlitz, K. (2021). CIO COVID survey current and future trends in remote work worldwide from 2020 to 2021'. Available at: <u>https://www.statista.com/statistics/1199110/remote-work-trends-covid-survey-september-december/</u>. Accessed 23 November 2021

not able to go abroad for their studies, giving them the chance to participate in all of their classes and examinations online either through online learning or virtual learning environments⁴.

Initially a literature review will be performed in order to understand what solutions are currently available for providing training with alternative ways rather than the face-to-face training through Virtual Learning Environments. Based on the review, a virtual learning environment will be designed and populated with educational material and reading resources related to transparent, fair, and unbiased algorithmic applications. User studies will be then run for assessing the effectiveness of the environment and the educational material designed as well as the experience of the participants of the training in our Virtual Learning Environment.

As we explained in the previous paragraphs, with this dissertation we aim to evaluate the efficiency and effectiveness of training through a Virtual Learning Environment without any trainer or lecturer. We will measure if the users find our VLE interesting and helpful in order for them to learn new skills based on topics related to FATE and how easy or difficult it was for them to learn on their own.

The main goal of our dissertation is to prove based on previous studies and with the help of our user study that learning a new skill or practice existing skills and theory that users learned in universities is very helpful through a Virtual Learning Environment (VLE). Through our thesis we will explain that there is no need for a trainer or a lecturer to help people learn a new skill if a VLE has all the materials that a user needs to gain knowledge.

⁴'Chen, C. (2021). Distance Learning Statistics and Growth of Online Education in 2021'. Available at: <u>https://blog.otter.ai/distance-learning-statistics/</u> Accessed 23 November 2021

Chapter 2 Literature Review

2.1 Introduction

In this chapter, we will discuss how important it is to improve virtual learning environments and how helpful those environments can be for learning and training purposes. Due to the COVID-19 pandemic, there is an increased need for virtual learning. We will define what a virtual learning environment is and the benefits that this alternative learning approach offers to the users, in which they can access information on what is Artificial Intelligence (AI), what ethics is and how ethics can be applied to AI and what is personalization. We will then discuss the different types of e-learning. We will also see some other virtual learning environments examples to better understand how this alternative learning way works. In the end, we will discuss the disadvantages of virtual learning environments.

In this dissertation we will use a 3D Virtual Learning Environment, we will use fairness, transparency, and unbiased AI as a case study to explore the use of a Virtual Learning Environment in training. This topic was chosen as it is currently receiving a good deal of attention, due to the increased use of algorithmic processes and AI applications. As will be explained we will discuss three particular topics related to FATE. The topics are what is Artificial Intelligence (AI), what ethics in AI is and finally what is personalization.

2.2 Virtual Learning Environment

In this section, we will define the virtual learning environments and how this alternative form of learning can be beneficial to train the users. Later, we will see the types of e-learning and some examples of other virtual learning environments (VLE).

2.2.1 Definition

As Wann and Mon-Williams said, "a virtual environment provides the user with access to information that would not otherwise be available at that place or time, capitalizes upon natural aspects of human perception by extending visual information in three spatial dimensions and may supplement this information with other sensory and temporal changes" (Wann & Mon-Williams 1996: 833). In other words, a virtual learning environment can provide the user with all the information that she/he needs at the time and place that he/she wants. For example, in our case, the users of our 3D virtual learning environment can have the opportunity to take the training during their break, or after their work, at a cafeteria, at the office or simply at home. In order for the users to interact with the objects in a virtual learning environment or the information provided, it is necessary to use avatars (Peña Pérez Negrón & Jiménez, 2012; Guye-Vuillème & Capin & Pandzic & Thalmann & Thalmann, 1999; Salem & Earle, 2000). Each user can customize or have an avatar that helps them move around the environment. The avatars can walk, sit on chairs, and interact with the VLE as the real humans in the physical environment. There are many 3D Virtual Environment (VE) that can be used by many users at the same time - multi-user environments - for collaborating and interacting with each other. There are also the first person VE that do not have the avatars. The user is moving with the keyboard's arrows and clicking with the mouse on the interactive objects of the environment. In our case, we developed a first person VLE.

2.2.3 Advantages and Disadvantages

There are many benefits to the users that are using Virtual Learning Environments (VLE) based on various studies (Klein and Ware, 2003; Hameed & Badii & Cullen, 2008; Algahtani,

2011; Marc, 2002; Nichols, 2003; Wentling & Waight & Gallagher & La Fleur & Wang & Kanfer, 2000). The most important advantage of following a training course in a VLE is that the learners can study at their own pace (Arkorful & Abaidoo, 2015). A key advantage of the Virtual Learning Environments is that everyone can take part in the training at the time and place most convenient to them. Similarly, if a person is sick or unavailable to visit a traditional class, he/she has to be absent from the lecture/training (Dung, 2020). In that case, the use of a VLE is very beneficial because that person can have the opportunity to be taught the lecture online. Another essential advantage (Arkorful & Abaidoo, 2015). The users can have the opportunity to enroll in new courses at institutions or universities in other countries but attend from their homes. They will not need to go abroad or find a place to stay in order to have the training or course.

Another critical advantage of Virtual Learning Environments is that the trainee can watch the training more than one time (Gupta & Anand & Brough & Schwartz & Kavetsky, 2008). For example, if the trainee does not understand something in the training material, he or she has the opportunity to watch the session over and over again until he/she fully understands the content. In a traditional training, this is not an option for him/her, because once the training is over, one does not have the opportunity to re-watch it. Moreover, the Virtual Learning Environments can resemble a game-like environment (Chau & Sung & Lai & Wang & Wong & Chan, & Li, 2013). This gives the trainee the opportunity to learn new things and new skills that will be useful to him/her for his/her work in a more playful way, minimizing boredom and fatigue from this process. This is a very crucial advantage for the Virtual Learning Environments in comparison with traditional methods of training. Last but not least, many people can have the opportunity to concentrate on a specific part of the course and that means that there are lower levels of stress to the user (Arkorful & Abaidoo, 2015; Marc, 2002; Klein and Ware, 2003; De Freitas & Yapp, 2005). For example, someone may know the first part of the course and need to concentrate on the second part, while another person needs to learn both parts. In that way, both of them can follow and benefit from the VLE in their way.

Of course, based on many studies (Akkoyuklu and Soylu, 2006; Almosa, 2002; Collins & Harmond & Wellington, 2002; Dowling & Godfrey & Gyles, 2003; Klein and Ware, 2003; Hameed & Badii & Cullen, 2008; Lewis, 2000) there are also some disadvantages for the Virtual Learning Environments. First of all, it might be difficult for the trainee to take all the knowledge and the skills that he/she learned from the training into the real world (Gupta & Anand & Brough & Schwartz & Kavetsky, 2008). For instance, it will be easier to achieve all the goals of the training in the Virtual Learning Environment than in the real world, in which the situation may differ in ways that are not predictable. In addition, in some cases that the training is on a very specific topic, it is very difficult to develop a very unique Virtual Learning Environment. In addition, a lot of money must be spent in order to achieve this, and it may take a lot of time to create the environment along with the training material (Gupta & Anand & Brough & Schwartz & Kavetsky, 2008).

In addition, many users find it difficult to navigate through the Virtual Learning Environments (Chau & Sung & Lai & Wang & Wong & Chan, & Li, 2013). Lastly, some studies show that there are many problems based on technical issues (De Freitas & Rebolledo-Mendez & Liarokapis & Magoulas & Poulovassilis, 2010). For example, if a user has a slow internet connection, this can cause many problems with the access to the training materials. Likewise, in some cases there are problems with the many hours that trainees need to spend in front of their digital screen (Dung, 2020). Another disadvantage of VLE, is that it is very difficult for participants to meet new people and it is also difficult for them to improve their social skills (Posey & Burgess & Eason & Jones, 2010). For example, in a traditional classroom people can have the opportunity to meet new people, make friends and exchange their ideas on many topics. Using a VLE, this is not always possible, especially if it is not a multi-users VLE. Last but not least, if there is a trainer/lecturer for the training/lecture may she/he delay answering the questions of the trainee (Rene & Liz, 2009).

As discussed in the previous paragraphs, there are many advantages and disadvantages in Virtual Learning Environments that are used for training. Although we recognize the difficulties that Virtual Learning Environments can have, in this work we aim to develop a 3D Virtual Learning Environment using as a case study three hot topics related to FATE. The reason on why we had chosen those topics as we mentioned before is because we understand how important is for the users to understand what Artificial Intelligence is, how the algorithmic processes behind personalization on our social media, on many websites or search engines works, why it is important those algorithms to be transparent and unbiased and how ethics work on an AI application or system. The structure as well as the material that will be included will be tailored to the needs of the end users, taking into account that they are not experts in algorithmic process or expect them to have special skills for navigating a 3D virtual learning environment. Hence, there is no need for a multi-user virtual learning environment, but rather a single user - first person environment is more suitable for the users to be able to follow their training program independently.

2.2.4 Types of e-learning

There are three types of virtual learning. First type is the *asynchronous course* (Dung, 2020; Algahtani, 2011; Almosa and Almubarak, 2005). This type is a self-directed method, and it does not take place in real time. This course may or may not have a trainer, and there is no need for the trainee to go to a meeting in a class. It is very flexible, and users can study in their own time and space and organize their schedule. The second type is the *synchronous course* (Dung, 2020; Algahtani, 2011; Almosa and Almubarak, 2005). This type of course takes place in real time, the trainer and the trainee should meet online and interact with each other. The third type of virtual learning is the *hybrid course* (Dung, 2020). In this case, the trainer and the trainee should meet in person during the course but also should have online classes.

2.2.5 Examples of virtual learning environment

In this subchapter, we will examine some examples of virtual learning environments that used to train people in different areas and see how successful that process was. In our first example we will take a Virtual Learning Environment developed by Yufang Cheng and Shwu-Huey Wang (2011), in which they designed a 3D Virtual Supermarket to help business students to practice all the theory that they learned in their university courses (Cheng & Wang, 2011). In this Virtual Learning Environment, there was a female character that entered the supermarket as a customer and asked questions based on the products that she saw. The participant took the role of the employee and had to answer those questions based on the knowledge that his/her lecturer gave to him/her during the years of his/her studies (Cheng & Wang, 2011). In that way, the students were able not only to take notes to learn the material for their examinations but also, practice these materials in a real-life experience (Cheng & Wang, 2011). There were two groups of students with previous backgrounds in Business Administration and also both groups took the marketing course (Cheng & Wang, 2011). The procedure of this experiment was to first ask all the students to answer the pretest, focusing on the topic of how a student can apply everything that they learn in a course in real life (Cheng & Wang, 2011). Then the students had a thirty-minute orientation in the VLE to understand how it works and then they had two hours to finish the experiment (Cheng & Wang, 2011). After they finished the experiment in the 3D VLE the students had to answer a posttest with the same topic as the pretest in order for the experts to understand how the students' answers changed (Cheng & Wang, 2011). After that, the developers of the 3D Virtual Supermarket gave to the participants a questionnaire to give their opinions anonymously about the Supermarket (Cheng & Wang, 2011). Then three professionals had to grade the pretest and protest in order to understand if the training via the VLE was successful or not (Cheng & Wang, 2011). The results of this experiment showed that the ability of the students to practice the theory that they learned was increased when using the VLE as compared to a traditional classroom course. Their ability to solve problems increased as well and they found the experience of VLE more interesting as a way of training (Cheng & Wang, 2011).

Our second example is a VLE created by Ageel Mohammed and Wollard John (2012) in order to help teachers at Jazan University (Saudi Arabia) to use Information and communication technologies more effectively. Participants consisted of five teachers at each school of the university - eight schools in total (Ageel & Wollard, 2012). The experiment involved following a six-week program and the participants took a pretest before the start of the six weeks and a posttest after (Ageel & Wollard, 2012). At the end of the six weeks the results showed that the VLE helped the teachers to understand the capabilities of various information and communication technologies and that these technologies could make their professional lives easier if they used them (Ageel & Wollard, 2012).

To continue VLE can help in foreign language education. With the anonymity that users have by using any of the Virtual Learning Environments that are currently available they can learn a foreign language more efficiently than when they are in a traditional classroom with other people (Zhao & Lai, 2008). In other words, when users feel comfortable behind the anonymity provided by VLE they can learn a new language faster either by talking to others or by material provided to them. Berns, Gonzalez-Pardo and Camacho developed a 3D Virtual Learning Environment ('The supermarket game) in which 85 students were enrolled in the beginner level of German language course (Berns & Gonzalez-Pardo & Camacho, 2013). The purpose of this environment was to motivate the students in learning new languages and to improve both their listening and reading skills (Berns & Gonzalez-Pardo & Camacho, 2013). Before the students entered the VLE they were asked to answer a pre-test, in order for the researchers to know their prior knowledge in vocabulary, and after the students finished the game, they were asked to answer a posttest quiz (Berns & Gonzalez-Pardo & Camacho, 2013). In that way the developers were able to get their final results. Also, the students answered a questionnaire to share their opinion on that VLE (Berns & Gonzalez-Pardo & Camacho, 2013). Based on their results in 93& of the students passed the pre-test and 100% the posttest (Berns & Gonzalez-Pardo & Camacho, 2013). In addition, the motivation of most students (86%) increased because of gamify learning and 88% of the students believed that learning was easier (Berns & Gonzalez-Pardo & Camacho, 2013).

Our last example of VLE, is the development of an environment in which candidate teachers from universities and teachers on an entry level were trained to improve their in-class skills. The developers of this VLE were Reinking and the purpose of that VLE was to reduce teachers' stress and make them feel confident in a classroom (Reinking, 2021). There were 89 participants, the novice teachers trained on how to manage their behavior and candidate teachers took two courses in which they practiced different management techniques that they learned in their university courses and in the other course they learned how to reduce stress and co-teach with another teacher (Reinking, 2021). When they all completed their tasks, they had to interact with some virtual students that had bad behaviors (Reinking, 2021). By the end of this experiment all the participants had to give feedback to the others for their overall behavior during this experiment and answer a questionnaire (Reinking, 2021). The results of this experiment were impressive as most of the participants answered that they felt the confidence to use the techniques that they learned in action in their real classrooms and the feedback that they received from the other participants was very helpful (Reinking, 2021).

2.3 Fairness, bias, and transparency in AI

In this subchapter, we will explain the three topics that we used as a case study to prove that VLE is an alternative way of training. The topics related to FATE as we mentioned earlier in this chapter will discuss the necessity of end users of Artificial Intelligence applications (IPAs, Search Engines, Robotic vacuums, Decision Support Systems, etc.), to understand how those applications work and how using their data the applications learn from them on what to show to a specific user etc. It is very important for all of us -end users- to fully understand how an application that we are using in our everyday life or systems that make decisions for our lives works and what is the process in the background that helps the application to know us and our needs better. Application functionality should be more transparent. We will also take a look at personalization definition, the three types of personalization, its process, and the phenomenon of the filter bubble. Lastly, we will see what ethics is and how it can apply to everyday Artificial Intelligence applications.

2.3.1 What is Artificial Intelligence

First of all, we need to understand what Artificial Intelligence (AI) is and see some of the characteristics that AI applications have. Based on Kaplan and Haenlein, *"AI is the system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation"* (Kaplan & Haenlein 2019: 17). In other words, AI applications are systems or processes that are trained by users' data and that aim to help the users in everyday tasks.

There are many examples of these types of applications and processes that we as users can see every day and we will explain some of them later on in this chapter. Firstly, let's see some of the processes and decisions that AI takes for us. The most common process is our timeline on social media that algorithms decide which news to provide to us either from our friend or groups that we might follow or news from the entire world or even what advertisements are we going to see (Araujo & Helberger & Kruikemeier & Kruikemeier, 2020; Van Dijck & Poell & De Waal, 2018; Thurman & Schiferes, 2012; Diakopoulos & Koliska, 2017; Carlson, 2018; Boerman & Kruikemeier & Zuiderveen Borgesius, 2017).

To continue, the Intelligent Personal Assistants (IPAs) that many popular companies developed to provide their customers with many special services. Some examples of the most popular IPAs are Alexa (Amazon), Cortana (Microsoft), Siri (Apple), Google Assistant (Lopatowska & Rink & Knight & Raines & Cosenza & Williams & Martinez, 2019). IPAs are triggered when they hear a word (for example Siri - the user has to say, "Hey Siri", Google Assistant - the user has to say, "Okay Google", etc.) or from the touch screen of a mobile, tablet or computer⁵ (Clauser, 2017). The user can use these IPAs to help them in daily tasks such as playing music, setting calendar reminders, finding the nearest cafe or restaurant, answering a question, sending text messages and emails etc. (Canbek & Mutlu, 2016). Many of these devices, like Amazon Alexa, can help its user using many smart home devices (Lopatowska & Rink & Knight & Raines & Cosenza & Williams & Martinez, 2019). For instance, Alexa has the ability to connect to the air conditioner and change the temperature of the room (through temperature sensors) and turn on and off the air conditioner on her own etc.⁶

In addition, another AI everyday life application is the robot vacuum. Those robot vacuums can navigate through the house and detect with their sensors the dirtier areas and make the

⁵ 'What is alexa? what is the amazon echo, and should you get one?', Available at: <u>https://www.nytimes.com/wirecutter/reviews/best-alexa-speakers/</u> (Accessed 28 October 2021)

⁶ 'Smart Home Skill APIs ', Available at: <u>https://developer.amazon.com/en-US/docs/alexa/device-apis/smart-home-general-apis.html</u>, Accessed 28 October 2021

decision to start the cleaning routine⁷. Another AI application that all of us use in our everyday life is the Google Search Engine. Google Search Engine learns from their logged in users in order to give them best results. They are collecting some data like their location, their language, and the type of the device that they are having to give them best results⁸. For example, if a user is searching for a restaurant or a cafe the Google Search Engine will show the results from the nearest restaurants.

Another example of AI applications are social media. In social media such as Facebook, Twitter, LinkedIn etc. we are getting recommendations to add someone as a friend or to follow a page (Parveen & Varma, 2021; Adamic & Adar, 2003; Xie & Wang, 2008). For example, Facebook's algorithm uses some information from the users' profiles like their work, university, country etc. or groups that users follow and photos the users are tagged in to find matching links with other users and suggest them as friend to one another⁹. Another example is LinkedIn, that uses the user's shared connections or similar information on different profiles work positions and if some users work on the same company or even the users where at the same school and university and in that way makes the connection recommendations¹⁰. Last but not least is the Twitter recommendations that uses user's location, tweets, and the activity of the account (the tweets that the user interact with in any way), if a user uploaded his/her contacts etc. the algorithm may suggest adding them¹¹.

Another example of Artificial Intelligence is autonomous vehicles. Autonomous vehicles are driverless cars that tend to make our everyday lives easier (Davidson & Spinoulas, 2015; Faisal & Kamruzzaman & Yigitcanlar & Currie, 2019; Waldrop, 2015; Nunes & Reimer & Coughlin, 2018; Liu & Gaudiot, 2020). Those innovative vehicles were developed in order to decrease road accidents that were mainly caused by human mistakes such as destruction by

 ⁷ 'Roomba® Robot Vacuums ', Available at: <u>https://www.irobot.com/roomba</u>, Accessed 28 October 2021
 ⁸ 'The basics of how Search works ', Available at: <u>https://developers.google.com/search/docs/basics/how-</u>

search-works , Accessed 28 October 2021

⁹ 'How does Facebook use my information to show suggestions in People you may know? ', Available at: <u>https://www.facebook.com/help/1059270337766380</u>, Accessed 13 November 2021

¹⁰ "People You May Know" Feature - Overview', Available at:<u>https://www.linkedin.com/help/linkedin/answer/29/-people-you-may-know-feature-overview?lang=en</u>, Accessed 13 November 2021

¹¹ 'About Twitter's account suggestions', Available at: <u>https://help.twitter.com/en/using-twitter/account-suggestions</u>, Accessed 13 November 2021

the phone, sleepiness on the wheel, tiredness etc. (Waldrop, 2015; Santana & Covas & Duarte & Santi & Ratti & Kon, 2021). Google was one of the many companies that since 2009 they were testing autonomous vehicles on the roads close to the company's Headquarters (Davidson & Spinoulas, 2015; Faisal & Kamruzzaman & Yigitcanlar & Currie, 2019; Waldrop, 2015). In addition, the pollution of the environment can be minimized with the help of electrical autonomous vehicles, because the traffic will be minimized (Henao & Marshall, 2019; Waldrop, 2015)

In many organizations Decision Support Systems are becoming a necessary tool for problem solving. Based on McLeod and Schell, a Decision Support System is "a system that supports a single manager or a relatively small group of managers working as a problem-solving team in the solution of a semi structured problem by providing information or making suggestions concerning specific decisions" (McLeod & Schell 2007: 13-5). The help that those systems provide is to suggest possible solutions to problems and/or bring to the managers' attention information that is needed in order for a problem to be solved. Semi structured problems are those that have some structured phases, and they can be solved with algorithms and decision rules. In contrast, the unstructured phases are the decisions that are new at the organization and as such, need a new plan to be solved (McLeod & Schell, 2007). As previously mentioned, those systems are basically designed in order to help the responsible members of the company that take the semi structured decisions. Those members can be either the high hierarchical members or the low hierarchical managers, designers, developers, or any other member of an organization that needs to make decisions. A DSS can also help groups of people from different departments in the company. To continue, a DSS can learn over time based on the data that it receives from the end user and can improve the way that they support the company (Aye, 2020; Poch & Comas & Rodríguez-Roda & Sànchez-Marrè & Cortés, 2004; Cortès & Sànchez-Marrè & Ceccaroni & Poch, 2000). A DSS collects different data, analyzes those data, and then gives an output that will make the case clearer to the responsible member of the company to make a decision (Aye, 2020; Power, 2002). The information that the DSS exports is designed to be easy to understand by the end user. Second, a DSS can make the decision-making process more efficient and quicker than it was before. Those systems can make faster calculations and can analyze the available data easier

than a human. Another benefit from DSS that a company can have, will be that those systems encourage learning and training by the employees and employers (Aye, 2020). The end users of those systems must learn how to use those systems efficiently to get the most out of them. Thus, it is very important for all the companies to train the DSS users before they start to work with them. To continue, DSS can help the managers with many processes that can be automated (Aye, 2020; Power, 2002; Nowduri, 2011). The managers have a lot of responsibilities in a company, and it will be beneficial if a DSS can decrease their workload in order to focus on other more important tasks (Nowduri, 2011; Jarboe, 2005).

The way that all those applications and systems work is using machine learning methods. This is a four-step process in which the developer creates a task for the machine and provides a solution that the machine should solve the problem (Schmidt & Stephens, 2019). Then the measurements to evaluate the machine's performance are given to the system and finally through the data that the machine collects and its experience on using a specific task the machine learns to do it better (Schmidt & Stephens, 2019). In other words, a machine is able to learn and help its users by the data that each user inputs to the machine and through its experience.

The biggest risk of AI and machine learning is that due to the fact that all those algorithms are trained and gain their experience from the users' input (typically reflect in historical training data), there is a possibility that the results will be biased and unfair for minorities and other protected groups (Schmidt & Stephens, 2019; Barokas & Selbst, 2016; Lepri & Oliver & Letouzé &Pentland & Vinck, 2018). In many cases, when an algorithm uses data to make a decision for the user, it can unintentionally lead to discrimination because of the existing stereotypes and biased patterns in society, which are reflected in the data (Lepri & Oliver & Letouzé &Pentland & Vinck, 2018; Crawford & Schultz, 2014; O'Neil, 2016).

We can now revisit the Google Search Engine example. Autocomplete was developed to minimize the typing time when a user searches for a query in a search engine (Roy & Ayalon, 2020). The prediction is made using the location of the user and his/her previous searches, the most common searches around the world, and based on what is a hot topic at the time of

the query is made¹². The autocomplete function of Google Search Engine suggests and spreads (without intending to) stereotypical beliefs surrounding gender, age, color etc. (Eisend, 2019; Al-Abbas & Haider & Hussein, 2020; Roy & Ayalon, 2020; Baker & Potts, 2013; De Corniere & Taylor, 2014). For instance, when the user searches Google for the word 'older people,' the autocomplete suggests sickness, mental health, not able to learn etc. All those predictions are stereotyped by the beliefs that old people are sick, and they are not able to learn anything new after a specific age (Rowe & Khan, 1998; Roy & Ayalon, 2020). Another example concerns the use of Google Images. For example, when a user searches for "surgeons" there are more women than men, with the gender gap being greater than would be expected given offline labor statistics (Otterbacher & Checco & Demartini & Clough, 2018; Kay & Matuszek & Munson, 2015).

So, how can we avoid those discriminatory behaviors? There are many techniques that researchers have found to avoid bias in machine learning. In order to minimize these biased outcomes a developer can try to remove the human involvement in the system and biased or discriminated data could be decreased, so AI models could give unbiased results (Schmidt & Stephens, 2019). There is also a solution that has three steps and can help avoid discrimination and bias from decision making algorithms. The first step of the solution is the detection of bias, there are many tools that can help the end-users to find any type of bias (Orphanou et al.,2020). The second step is the fairness management, which includes the following methods: Fairness sampling (pre-processing), Fairness Learning (in-processing) and finally Fairness Certification (post -processing). In this step the developers use some techniques in which they detect any type of bias they removed and certify that the system is fairness aware. The third step of this solution is the explainability management, it includes some approaches that are used to make the system transparent and make the end-users trust the system).

¹² 'Sullivan, D. (2018). How Google autocomplete works in Search. 'Available at: <u>https://blog.google/products/search/how-google-autocomplete-works-search/</u>. Accessed 14 November 2021

Last but not least, it is a must for the developers to develop algorithms with transparency in mind. All of the end users need to be able to understand the process behind the decisions that a system will make in order to spot and avoid discrimination (Lepri & Oliver & Letouze & Pentland & Vinck, 2018). Thus, user training is a particularly important part of addressing the problems surrounding algorithmic bias, and the promotion of more ethical use of AI.

2.3.2 Personalization

The definition of personalization based on Searby (2003) is "Whenever something is modified in its configuration or behavior by information about the user, this is personalization" (Searby, 2003). By this definition, Searby means that every information that we receive fits our needs exactly the time that we need that information is personalization. The needs of all people in our world are different and companies, in order to gain the trust of their customers, should provide personalized information, services or products. In businesses, personalization is a very important topic because of the customers' needs to buy products or services based on their needs as we said before. There are many online companies like Amazon and eBay that are trying to personalize the browsing of items for their customers. For instance, the recommendations that those websites provide to their consumers are based on their previously viewed objects, what other people buy with a specific product or even their device location (Searby, 2003; Berry & Linoff, 2000; Shardanand & Maes, 1995). On Social media companies can get the data from the users' profiles and create customer profile based on those data and the activity of those users on the web and provide personalized advertisements to them (Shanahan & Train & Taylor, 2019; Ansari & Mela, 2003; Lavie & Sela & Oppenheim & Inbar & Mayer, 2010).

2.3.2.1 Types of Personalization

In e-business, there are two types of Personalization. The first type of personalization is found in adaptable *systems* (Fan & Poole, 2006; Anke & Sundaram, 2006). In this type the user has the ability to modify most of the aspects of the system to make it more personalized to them based on their needs (Fan & Poole, 2006; Adomavicius & Tuzhilin, 2005; Anke & Sundaram, 2006). For example, at the Google home page the user can modify their background picture, the color, and the theme and also the shortcuts that will appear in their

home page. The second type is the *adaptive systems* (Fan & Poole, 2006; Anke & Sundaram, 2006) in which the system makes all the modifications based on the data that it collects from the users (Fan & Poole, 2006; Adomavicius & Tuzhilin, 2005; Anke & Sundaram, 2006). For this type, a well-known example is the Google Search Engine. When a user tries to search for a query the system tries to predict that query with the autocomplete. The autocomplete method that Google uses is based on the user's previous searches, location, and many other data. And lastly, we have the hybrid type of the systems that combine the two previous types and make adjustments for each user (Adomavicius & Tuzhilin, 2005). For instance, in Amazon the system gives some recommendations to the user, and he/she decides if she/he is going to make the purchase or not.

2.3.2.2 The process of Personalization

In this subchapter we will discuss the process of personalization and how this procedure helps the systems to succeed in fitting their content to their customer needs. The process of personalization has four steps. The first step of personalization is called 'Modelling Customer Profiles' and it is a requirement analysis (Schubert & Koch, 2002). The data that the system collects from the users is called 'customer profile' and it contains the data that the users provide to the system such as username, IP-address, etc. (Schubert & Koch, 2002). 'Data input' is the second step of the personalization process and it contains all the data that the system collects from the activities of the user on the web (Schubert & Koch, 2002). In the third step of personalization 'Data Processing' the system is filtering and processing all of the above data that were collected using data mining techniques and then add the user in different stereotypes groups or in groups based on their interests, in order to have the opportunity to further process these data when the system needs to (Schubert & Koch, 2002). And finally, in the fourth step that is called 'Information Output' the system provides the user with specific options either to buy or to read etc. based on the data and interests that the system believes (with the above steps) that the specific user needs (Schubert & Koch, 2002).

2.3.2.3 Filter bubble

Based on Eli Pariser (2011) the Filter Bubble is *"A personal ecosystem of information that's been catered by algorithms to who they think you are"*. For instance, two different users (user A and user B) can make the same query in Google Search Engine and Google's algorithm will provide different results. This can happen because the algorithm knows that the user A is in Cyprus, let's say, and user B is in Greece, so when they both ask for a restaurant the Google Search Engine will provide results for restaurants in their countries. The main problem is that most of the users do not know that the results that a search engine shows to them are personalized, so they are not able to understand that having 100% faith on those results is a mistake (Hannak & Sapiezynski & Molavi Kakhki & Krishnamurthy & Lazer & Mislove & Wilson, 2013; Pan & Hembrooke & Joachims & Lorigo & Gay & Granka, 2007).

Sometimes users that get personalized results from the algorithm can end up having a very wrong view for a specific topic. When an algorithm puts a user in a group that has some specific characteristics and the results will be based on those characteristics, the user will end up not knowing all views related to a given topic. That means that the user will not be able to make a decision and not have a balanced view of a specific topic (Bozdag & Van Den Hoven, 2015; Bohman, 2006; Landemore, 2012). In other words, the user will receive results only based on their interests and can end up living in his/her 'own world' without knowing the point of view of other people that they may disagree with that topic. With Filter Bubble some news or political topics sometimes never showed to some users because of their interests and data that Google Search has from their previous searches, so they end up with their preexisting knowledge and beliefs without knowing the others' opinions (Kliman-Silver & Hannak & Lazer & Wilson & Mislove, 2015; Pariser, 2011).

2.3.3 Ethics

To define ethics, we can use the Oxford dictionary definition: "ethics is the moral principles that control or influence a person's behavior"¹³. In other words, ethics is a set of moral

¹³ 'Definition of ethic ', Available at:

https://www.oxfordlearnersdictionaries.com/definition/english/ethic?q=ethics, Accessed on 29 October 2021

principles such as honesty, responsibility, integrity, right, fairness etc. that helps people to identify the right or wrong behaviors towards individuals or the society.

According to Harcey Cinthia (2019), in order to apply ethics in AI, we have to follow five main steps. The first step is to comply with the data privacy regulations. For example, in Europe all the developers of Artificial Intelligence must comply with the General Data Protection Regulation (GDPR) in which all users have access to the data that a system collects and can decide whether or not to give the permission to the system to continue analyzing the data or not¹⁴. The second step is to use the best practices of data science and by this we mean to have 'clean' data, in other words to remove any socially biased data so that data will not affect systems' behavior¹⁵. The third step is to have in mind the end user and the AI systems should be developed with a human-centric character, by this we mean that AI systems should not cause any intentional or unintentional harm to the user or other humans¹¹. All AI systems should help people with their everyday life, they should not either replace them or even cause them any harm (Russell, 2015). The fourth step is for the developers to develop a transparent system that allows users to understand the procedures that the system uses to offer them results etc¹¹. Everyone should be able to understand the procedure behind the final result, for example, at a bank the end user should fully understand why the system rejected a client for taking a loan or a user should understand why she/he gets specific results on her/his query (Yudkowsky & Bostrom, 2011; Dignum, 2018). The next step that is very important, is the feedback from the users. All the developers should receive feedback for their systems that they developed in order for them to improve them¹¹. As is commonly known, feedback is the best practice to better understand how satisfied or unsatisfied the users of a system are and is very important for the developers to receive feedback to make improvements on an AI system and how that system helps its users (Dikici et al.2020)

¹⁴ 'Article 15 EU GDPR "Right of access by the data subject"', Available at, <u>https://www.privacy-regulation.eu/en/15.htm</u>, Accessed 29 October 2021

¹⁵ '9 Steps Toward Ethical AI', Available at: <u>https://www.informationweek.com/big-data/ai-machine-learning/9-steps-toward-ethical-ai/d/d-id/1334703?page_number=3</u>, Accessed 29 October 2021

2.4 Conclusion

In this chapter, we discussed what a virtual learning environment is and how it can help facilitate training on a topic of interest. Then we examined the advantages and disadvantages of the use of a VLE in training and we examined the types of e-learning. In the end of the subchapter, we presented some examples of Virtual Learning Environments and the findings surrounding their use and evaluation.

We continued to examine what is Artificial Intelligence, what is personalization, and how it can help with some examples. After that we discussed the process of personalization and the types, and what is the phenomenon of the filter bubble. In the end, we discussed what is ethics and how it can apply to Artificial Intelligence with five main steps.

In this dissertation we aim to answer the following research questions:

- Given the urgent need to raise the awareness of those who rely on algorithmic DSS as to their ethical issues, at a time when the pandemic challenges efforts for face-to-face training, does VE provide an efficient and effective alternative?
- 2. Based on the belief that many people find it difficult to concentrate in a real training room, is VE an alternative way to help those people learn?
- 3. Nowadays there are many people that work many hours, and they are finding it very difficult to have some time for them to learn something new, even though technology is highly rising through the years. Can a VE support those people to follow their own way and study whenever they are able?
- 4. Given the urgent need for all of us that are using AI in everyday life to know all the ethical issues and the need of AI systems to be transparent, unbiased, and fair to all of us, does VE provide a low-cost way to train?

Chapter 3 Methodology

In this chapter, we will discuss the methodology that we used to conduct the empirical part of the research. We will mainly discuss the tools that we used to develop the Virtual Learning Environment and how the videos and the quizzes were made. We will also discuss the development of the questionnaire, the target group of our study and how we recruited the users. Lastly, we will view our research questions.

3.1 Development of the Virtual Learning Environment

Our 3D Virtual Learning Environment (VLE) was developed in the Unity platform, and we used a server from Amazon.com to install it there. In order to access the Unity¹⁶ platform we

¹⁶ 'Unity', Available at: <u>https://unity.com/</u>, Accessed 25 October 2021

had to make a free student plan subscription in which we had the opportunity to access many of the services that Unity has.

To build the entire building which, as will be shown is the main object in the VLE, we used the Building Crafter tool¹⁷ from the Unity Asset Store developed by 8Bit Goose Games, Inc. It is a very helpful tool that generates a building in a very short time and one can add doors and windows. It also allows the developer to paint the walls and change the floors without using any script. For the terrain and the main garden of the VLE, we used the basic terrain tool that Unity offers to its users, and it provides the main paint options to use like grass that we used. Below, we will present some of the main scripts that were used in the VLE, and those scripts are in C# programming language. The camera needed a collider in the shape of a box, and we assigned a rigid body to prevent the falling from the terrain or skipping the walls and whiteboards. To move the camera with the keyboard arrows we used the following script in order for the camera to move forward and rotate:

¹⁷ 'Asset store Unity', Available at: <u>https://assetstore.unity.com/packages/tools/modeling/building-crafter-56380</u>, Accessed 25 October 2021

```
□using System.Collections;
 using System.Collections.Generic;
 using UnityEngine;

    Unity Script | 0 references

□public class movecamerakeyboard : MonoBehaviour
 {
     // Start is called before the first frame update

    Unity Message | 0 references

     void Start()
      {
      }
     float inputX, inputZ;
     O Unity Message | 0 references
     void Update()
     {
          inputX = Input.GetAxis("Horizontal");
          inputZ = Input.GetAxis("Vertical");
          //Rotate the camera using left and right
          if (inputX != 0)
              rotate();
          //Move forward using up and down
          if (inputZ != 0)
              move();
      }
     //How to move the camera
     1 reference
     private void move()
     {
          transform.position += transform.forward * inputZ * Time.deltaTime;
      }
     //How to rotate the camera speed etc.
     1 reference
     private void rotate()
     {
          transform.Rotate(new Vector3(0f, inputX * Time.deltaTime * 9, 0f));
      }
 }
```

Figure 1: The script that makes the camera move
In addition, to make the videos, quizzes, and the final questionnaire work with URL we used the following script:



Figure 2: The script that allow us to open the videos

3.2 Training development

We developed training materials concerning Ethics in AI and more specifically, the topics reviewed in Section 2.3. The goal was to develop an introductory training, with material that everyone should be able to understand without any prior knowledge on topics related to FATE as we explained in the previous chapters. The training was meant to take not more than 20 to 25 minutes. The materials developed included 6 videos, along with accompanying readers, as well as a quiz for each topic. Thus, the training was designed to be self-directed and allowed the participant to evaluate if he or she wants his or her own understanding of the materials via the quizzes. At the end of the training, the participants should be able to know the basic procedures of how Artificial Intelligence applications work, what is personalization and how it affects those applications, what is the filter bubble and how it works in search engines and how ethics can be applied on AI applications.

The videos that we made for our training in Artificial Intelligence, ethics and Personalization were made with the Loom¹⁶ application, using a MacBook. Loom¹⁸ is an application that helps the user to record their screen or presentation using the user's camera and microphone and after the video is uploaded to their webpage a URL is available for the user to share the video with others. The quizzes were created in Google Forms, so everyone with the link has access to the quiz.

We developed the material and made all the preparation of the courses along with the videos. We did research on those topics (Artificial Intelligence, Ethics and Personalization) and we tried to simplify the material and all the terminology in order for everyone to be able to learn without prior knowledge on the fields of computer science or any related field. The main goal for these training sessions was to help the users of AI applications to learn what those applications are and their capabilities, to understand how the algorithms behind the personalization work and how ethics can be applied to AI.

3.3 User study

As mentioned previously, we created this Virtual Learning Environment in order to explore whether it can be an alternative way for people to receive training on a specific topic. In our case, we provide training on artificial intelligence, personalization, and ethics.

Nowadays, more and more people are using Artificial Intelligence applications, but they do not know how these applications work and the procedures behind some of the most common interactions that we have with those applications. The above topics along with the necessity of VLE to give the opportunity to people that they cannot travel or are not able to get in a traditional classroom gave us the idea to develop this VLE. Through our VLE we are trying to understand whether people can be trained on a specific topic with the help of technology through a virtual learning environment.

To evaluate our approach, we chose to collect data through a questionnaire that all the users answered before they left our VLE. To better understand our users, we had some

¹⁸ 'Loom', Available at: <u>https://www.loom.com/</u> Accessed 25 October 2021

demographic questions to help us. We asked our users their educational level if they are currently employed¹⁹ and in which field and their age. To continue, the next section of our questionnaire was based on questions that could make it clear if the users had previous knowledge on VLE in the past, how enjoyable the experience was to learn through our VLE and if they were interested in that. After those questions, the user had the opportunity to let us know how important it is for her/him to have a lecturer or a trainer with her/him in a training, how difficult is it to learn the material on their own and to stay focused on that procedure while they were using a VLE. We also wanted to explore the claim that using a VLE to be trained on a specific topic is a more low-cost way, so we asked our users to tell us about their opinion on that. After that, the questions were more focused on the VLE experience of the users. The questionnaire developed with questions to answer by examining if the VLE helped the users to learn the material on their own space and time and how stressful was the idea to learn a new topic on their own and how motivated they were to learn. Moreover, we asked the users questions to understand how the overall experience was to navigate through the VLE and how easy it was for them to find the material. Lastly, we asked users to provide short answers (i.e., free text) if they would prefer a face-to-face training or a training through a VLE, how did they find the colors in our VLE, if they wanted the VLE to have something else and finally what was the most difficult thing in their experience.

In this research we aimed to attract people that wanted to learn more about the three topics Artificial Intelligence, Personalization and Ethics through a VLE without any fees and in their own space and time. We had shared the thesis scenario through social media to attract people from all over the world and as we mentioned before to attract any adult who was interested to learn about these topics. All the materials are introductory videos that everyone without prior knowledge on the above topics could have the opportunity to understand and without any special terminology in order to be understandable by everyone.

¹⁹ 'Employment Status Questionnaire', Available at:

https://www.criticalcarenutrition.com/docs/reenergize_def/Employment%20Status%20Questionnaire.pdf Accessed 11 October 2021

Chapter 4

Training Module: Artificial Intelligence - A brief introduction to applications and challenges

This chapter will focus on the development of our Virtual Learning Environment in Unity²⁰ platform. Here we will discuss the way that we build the thesis environment, and we will define the list of all the capabilities users can perform in our Virtual Learning Environment.

As we mentioned before, in the previous chapter, our goal for this project was to help students understand three topics related to FATE, therefore the concept of our world is an environment in which users will be able to learn efficiently at their own time and space. For this dissertation purposes the user can follow a scenario that we prepared in order to be able to take a look at the entire VLE and see all the six videos in the three rooms.

²⁰ <u>https://unity.com/</u>

Hello everyone and welcome to my world!

This Virtual Environment (VE) aims to familiarize you with some of the basic characteristics and applications of Artificial Intelligence (AI), which is increasingly being used to transform the modern workplace. It also provides information concerning the ethical considerations surrounding the use of AI.

In particular, while exploring the VE, you will encounter three introductory learning modules: Introduction to AI, AI Ethics, and Personalization.

Please follow these steps:

- 1. Use this link to go to the VE: https://testvkpk.s3.amazonaws.com/Thesis+Version+6.1/index.html
- The first thing that you will see in the VE are two boards that explain to you how to move your camera using your keyboard arrows. Try it yourself.
- Enter the first room of the world following the pink arrows on the floor, which is the Artificial Intelligence room.
- 4. Watch the two videos (Part 1 & Part 2) and then take the quiz to test your knowledge.
- Move to the second room which is the Ethics room and again watch the two videos (Part 1& Part 2) and answer the quiz.
- Navigate to the Personalization room, watch the two videos (Part 1 & Part 2) and answer the guiz.
- Fill in the Evaluation Questionnaire. You will find it on the board in front of the Personalization room and it will take only 5 - 10 minutes.

Thank you very much for your time!

Figure 3: Our scenario

First of all, when a user enters our VLE, he or she will see two whiteboards with navigation instructions and many pink arrows that will help them find the classes easier. The whiteboard on the right shows, with the navigation arrows, how the user can move the camera forward or backwards and the whiteboard on the left shows how the camera can be rotated using the keyboard arrows.



Figure 4: View of the VLE upon the user's entry.

The first room that a user should visit in the VLE is the Artificial Intelligence room and it contains two videos related to the AI applications. Then she/he has the opportunity to answer the quizzes that we created to test their knowledge on this topic.



Figure 5: Entry to the Artificial Intelligence room.

The next step that the user must follow is to visit the second room of ethics. This room mainly focuses on teaching the user what ethics are and how ethics can be applied in AI applications. To do this, we used two introductory videos and a quiz to take after the user views the two videos.



Figure 6: Entry to the Ethics room.

The last room that the user should visit is the Personalization room, which is related to topics such as what personalization is, the Filter Bubble and many other topics related to personalization. The user must watch the two videos to better understand the above topics and then answer the quiz.



Figure 7: Entry to the Personalization room.

The user before leaving our VLE should take the last questionnaire which is focused on questions that as we explained in the previous chapter will help us take the final results of this dissertation to understand how the user took the learning experience through a VLE. The user can find the questionnaire in front of the personalization room.



Figure 8: Thank you board and the link to the questionnaire.

Chapter 5 Evaluation

In this chapter we will review the results from our user study, considering the answers to the questionnaire that the 22 participants gave us. As explained in the previous chapter, invitations to participate in the study were distributed via social media (Facebook, Twitter, and LinkedIn). The number of the participants is just a sample, and it is not necessarily representative of a particular population of users.

We will take a look at the percentages that each question has, and we will explain what those percentages mean for our study. Then we will see some of our conclusions based on those percentages.

5.1 Demographic

The first section of our questionnaire was a demographic section, and the questions were the gender of the participant, the age, the educational background, and their employment field. As we can see in the next graph the 50% of the participants were females, the 45.5% were male and the 4.5% preferred not to reveal their gender.



Graph 1: Participants' Gender

The next question of our user study was asking the participants if they were employed or not and if yes, what is the field of their work. The results in the next graph showed that 95.5% were employed and in Graph 3 we can see the employment areas of our participants.



Graph 2: Are you currently employed?



If yes, in which area do you work?

Graph 3: If yes, in which area do you work?

Most of our participants were between 25 - 29 years old but as we can see in the next graph, we have many participants from other age ranges.



Graph 4: What is your age?

Graph 5 shows the educational level of our participants. They had to choose between High School, Bachelor's Degree, Master's Degree and Ph.D. when indicating their level of educational attainment.





5.2 Participants' prior knowledge

After the demographic section, the next section of our user study was specified on questions that could make us understand the prior knowledge of our participants on Virtual Learning Environments, how long the training took, how enjoyable the experience was and how interested they were in getting trained through a VLE.

In the following graph (Graph 6) we can see that most of our participants (36.36%) answered that the training took around 20 minutes (Median time $(\tilde{x}) = 20$). And as the Graph 7 shows most of our participants (86.4%) had no previous experience with VLE before the day that they took the training with our VLE.

Approximately how long did the training take (in minutes)? 22 responses



Graph 6: Approximately how long did the training take (in minutes)?



Have you had any experience in learning through a Virtual Environment? 22 responses

Graph 7: Have you had any experience in learning through a Virtual Environment?

The next graph shows that most of our participants (68.2%) found the experience of the training through a VLE enjoyable on a scale of 1(Definitely not) to 5 (Very much so), but only 45.5% were interested at first to learn through a Virtual Learning Environment on a scale of 1 (Not interested) to 5(Very interested).

Did you enjoy learning through a Virtual Environment? 22 responses



Graph 8: Did you enjoy learning through a Virtual Environment?



How interested were you to learn through the Virtual Environment? 22 responses

Graph 9: How interested were you to learn through the Virtual Environment?

The next question was 'How important is for you to have a face-to-face communication with a lecturer or a trainer?' 36.4% of the participants answered that it was not important for them to have someone to guide them through their training. In addition, on Graph 9 we can see that for the question on how easy it was for them to focus on the learning material most of the participants (40.9%) answered that they found it pretty easy to stay focused on a scale of 1 (Very Difficult) to 5 (Very easy).

How important is for you to have a face-to-face communication with a lecturer or a trainer? ^{22 responses}



Graph 10: How important is for you to have a face-to-face communication with a lecturer or a trainer?



How difficult or easy was it for you to stay focused on the learning material? 22 responses

Graph 11: How difficult or easy was it for you to stay focused on the learning material?

5.3 Efficiency of Virtual Learning Environment

On the next questions we tried to measure how efficient it was to learn the material through our VLE and how helpful it was. On a scale of 1 (Very Difficult) to 5 (Very Easy), most of our participants (54.5%) answered that it was easy enough for them to learn the material through the Virtual Learning Environment, but the 36.4% did not find the Virtual Learning Environment helpful for them to learn.



Was it easy for you to learn the material through the Virtual Environment? ^{22 responses}

Graph 12: Was it easy for you to learn the material through the Virtual Environment?



Did the Virtual Environment help you to learn the material? 22 responses

Graph 13: Did the Virtual Environment help you to learn the material?

A big portion of our participants (72.7%) believes that learning through a Virtual Learning Environment is a low-cost way to have training.



Learning through a Virtual Environment is a low-cost way to obtain needed training. 22 responses

Graph 14: Learning through a Virtual Environment is a low-cost way to obtain needed training.

In the next two graphs (15 and 16), we can see that most of our participants (graph 15 - 72.7% and graph 16 - 59.1%) preferred to get trained on their own space and time on the scale of 1 (Definitely not) or 5(Very much so).

Was Virtual Environment a useful tool to learn, from your own physical space (e.g., home, work)? 22 responses



Graph 15: Was Virtual Environment a useful tool to learn from your own physical space (e.g., home, work)?



Was the Virtual Environment a useful tool to learn on your own time? 22 responses

Graph 16: Was the Virtual Environment a useful tool to learn on your own time?

The Virtual Learning Environment did not make the participants more motivated to learn compared to a face-to-face training session as we can see in the next graph (17). On a scale of 1 (Definitely not) or 5(Very much so). To continue, on the same scale, 45.5% find it pretty easy to navigate through our Virtual Learning Environment.



Graph 17: Were you more motivated to learn through a Virtual Environment as compared to being in a face-to-face training session?



Did you find it easy to navigate through the Virtual Environment? 22 responses

Graph 18: Did you find it easy to navigate through the Virtual Environment?

On the same scale as the previous graphs, on the two following graphs we can see that 45.5% of our participants would not prefer to have a trainer while they are learning. From Graph 19, we can see that 59.1% did not find it stressful at all to learn on their own the learning material.



Would you prefer to have a trainer or a lecturer with you while you learning? 22 responses

Graph 19: Would you prefer to have a trainer or a lecturer with you while you are learning?

Was it stressful for you to know that you will have to learn the material on your own? ^{22 responses}



Graph 20: Was it stressful for you to know that you will have to learn the material on your own?

Furthermore, 40.9% find it very easy to have access to the learning material.



Was it easy for you to have access to the learning material? 22 responses

Graph 21: Was it easy for you to have access to the learning material?

In the next short answer question, most of our participants preferred to have a training through a Virtual Learning Environment (72.73%), and the graph 23 shows us that the colors of our Virtual Learning Environment are very nice and bright. Both of the above questions were short answer questions, so we gathered the answers of our participants and mixed them in order to be able to create the graphs below.





Graph 22: If you have the opportunity to take a face-to-face training abroad or to have it online through a Virtual Environment, which one will you prefer and why?



Graph 23: How did you find the colors of the Virtual Environment? (e.g., distractive, nice, etc.)

After that, we asked our participants if there was anything missing in our VLE, and every participant believed that there was not anything missing except a 4.5% that preferred the navigation arrows to be bigger. This question was a short answer question, so we collected all the data and made the following graph.



Graph 24: Is there anything else that you believe was needed in the Virtual Environment and you did not find it?

On the last question, almost all of the participants answered that they did not find anything difficult in our Virtual Learning Environment, except a 4.5% that preferred the terminology and the language of the videos. This question was a short answer question, so we collected all the data and made the following graph.



Graph 25: What has been the most difficult part about your learning experience in the Virtual Environment?

Chapter 6 Conclusion

In this chapter we will summarize the insights of the study. In particular, we examine the findings and the limitations that we faced in the development of our dissertation with some future development ideas that we have for our Virtual Learning Environment.

Using Virtual Learning Environments for training has many benefits and challenges. As we explained in previous chapters, one of the biggest advantages of VLE training is that users can study at their own pace without worrying if they are falling behind (Arkorful & Abaidoo, 2015). If they have any questions or if they missed something from the training, they have the opportunity to rewatch or to watch again the specific point that they missed (Gupta & Anand & Brough & Schwartz & Kavetsky, 2008). In addition, because of the game-like environments the boredom of learning can be minimized (Chau & Sung & Lai & Wang & Wong & Chan, & Li, 2013).

There are also many challenges of training in Virtual Learning Environments. There is a difficulty for the users to use their new skills into the real world with unpredicted situations (Gupta & Anand & Brough & Schwartz & Kavetsky, 2008). The user of a Virtual Learning Environment can face many technical issues like internet connection problems and other health issues because of the many hours spend in front of a digital screen (De Freitas & Rebolledo-Mendez & Liarokapis & Magoulas & Poulovassilis, 2010; Dung, 2020).

The three topics related to FATE that we used as a case study in our dissertation are Artificial Intelligence, Ethics and Personalization. We explained some of the main processes of algorithms in our social media and on Google Search Engine and how these processes help us find exactly what we need or who we might want to make friends on a social media platform (Araujo & Helberger & Kruikemeier & Kruikemeier, 2020; Van Dijck & Poell & De Waal, 2018; Thurman & Schiferes, 2012; Diakopoulos & Koliska, 2017; Carlson, 2018; Boerman & Kruikemeier & Zuiderveen Borgesius, 2017). To continue, we saw how Decisions Support Systems can help a company and its employees by automated some of the daily procedures (Aye, 2020; Power, 2002; Nowduri, 2011). We saw some examples of Artificial Intelligence applications like the robot vacuum, the IPA's that can help the users in many daily tasks, the autonomous vehicles that can reduce the car accidents caused by human errors (Canbek & Mutlu, 2016; Waldrop, 2015; Santana & Covas & Duarte &Santi & Ratti & Kon, 2021).

Furthermore, we discussed how all of the above applications are created with the four-step machine learning method, along with the risks that may accompany them. Due to the fact that the machines gain experience mainly with the data that the users' put into them, the AI applications can bring some discriminative and socially biased behaviors that reproduce racism, sexism, etc. that is observed in the broader society (Schmidt & Stephens, 2019; Barokas & Selbst, 2016; Lepri & Oliver & Letouzé &Pentland & Vinck, 2018). To avoid these behaviors, we provided an overview for the VLE leaders on the techniques that developers can use in the development process of the machines such as to remove or minimize the human involvement in the system (Schmidt & Stephens, 2019).

To continue, we explained the three topics Personalization, Filter bubble and Ethics. We defined the Personalization and explained how personalization affect us in AI applications that we are using daily for example the advertisements that we see in our social media (Shanahan & Train & Taylor, 2019; Ansari & Mela, 2003; Lavie & Sela & Oppenheim & Inbar & Mayer, 2010). Then we reviewed some of the processes of personalization and its types. In addition, we saw what the Filter Bubble effect is, examining the definition provided by Eli Pariser (2011), and we explained how this phenomenon works and how a user can end up

living in her/his 'own world' avoiding other opinions (Bozdag & Van Den Hoven, 2015; Bohman, 2006; Landemore, 2012). Lastly, we explained Ethics through a commonly used definition, and some techniques that can help us apply ethical principles in AI applications.

In this study we aimed to explore whether Virtual Learning Environments are equally helpful as face-to-face training and that users can learn a specific topic on their own time and space.

6.1 Findings

Although most of our participants did not have the opportunity to experience learning with a Virtual Learning Environment before our case study, and they were not very interested and motivated to learn through a VLE, they found it pretty easy to learn and focus on the learning material. There are many studies (Arkorful & Abaidoo, 2015; Marc, 2002; Klein and Ware, 2003; De Freitas & Yapp, 2005) that demonstrate that because the users are able to concentrate on a point that they find difficult the levels of the stress are low, so it is easier to focus and learn. In addition, the results of our user study showed that 36,4% do not think that having face-to-face communication with a lecturer is important to learn the material easily and they did not prefer to have a trainer with them on that experience

To continue, many of our participants believe that training through a VLE is a low-cost way as we saw in Arkorful and Abaidoo (2015) research and it is a useful tool that helps them to gain more knowledge on a specific topic from their own space and on their own time. Learning on their own was not stressful at all because of the game-like environment that helps them (Chau & Sung & Lai & Wang & Wong & Chan, & Li, 2013) and most of them found it easy to access the material on their own through the VLE.

Most of our participants reported finding it easy enough to navigate through our Virtual Learning Environment and most of them in comparison with face-to-face training VLE or hybrid they preferred the training through a VLE and as we explained in previous chapters this is caused by the more gamify environment (Chau & Sung & Lai & Wang & Wong & Chan,

& Li, 2013). The participants found that the colors of our VLE were nice, and most of the participants answered that they did not find anything difficult in their experience.

6.2 Limitations

In this subchapter, we will review some of the limitations that we faced during the conduct of this research. Because of those limitations that we will discuss further in this subchapter, the results could be different if we did not face them as we will explain in the next subchapter as well. Thus, the reader should interpret our study with this in mind.

At the beginning of the research, because of the time limitations, we were not able to develop avatars for the users to have a more personalized experience, either with characters that they shared similar characteristics with them or avatars that they created and also, we could not create a multi users' environment in which they would have the chance to interact with each other and make the experience more interesting. Furthermore, a convenience sampling method was used to identify the participants of our user study. If we had more time, we could attract more people to participate in our user study. Similarly, if an employer was evaluating a VLE in a real-life s, situation, they might require employees to take part in the study. In our research, the participants were not compensated, and thus, they needed to have an interest in the subject. In addition, we were not able to attract participants that did not have a computer or a laptop because we developed our VLE to be used only on Windows and iOS. So, if the users had only a tablet or a mobile phone, they would not be able to participate in our user study. Finally, we only have the opportunity to attract people with prior knowledge on using a computer or laptop. It was a must for all of our participants to know how to use a computer or a laptop in order to be able to enter our VLE and navigate through it. In summary, the participants in our user study had particular characteristics and are not representative of the general population.

6.3 Future Development

Based on the literature review, as well as the results of the current research, we found that if we expand our Virtual Learning Environment into a multiuser environment in which users

would be able to interact with each other as we saw in the examples of Reinking's VLE (2021) and Berns, Gonzalez-Pardo and Camacho VLE (2013), this might help the users to better understand and practice the skills that they learned and be more motivated to learn. To continue, as we saw in the example of using a VLE to learn a foreign language, the anonymity provided by the VLE helped the users to be more confident to talk to the other users and learn the language easier (Berns & Gonzalez-Pardo & Camacho, 2013). In addition, users will have the opportunity to create their avatars, change their clothes, hair etc. in order for the VLE to be more personalized based on the users' characteristics (Peterson, 2005). We can create more classrooms in the VLE, and users would be able to learn more things by adding additional material and maybe real-life cases in which the users would be able to practice everything that they learn (Cheng & Wang, 2011; Reinking, 2021). Lastly, we would create an application for tablets and mobile phones in order for the users' to be able to use it everywhere and not limit them to having a laptop or computer. The results of our questionnaire, shows that most of our participants preferred to take the training on their own space and time, so this will be achieved if we create a mobile phone application in which could have access whenever and any time they want.

Virtual Learning Environments are being very useful tools in our society. There is evidence that users find them more motivational than other training techniques. VLEs can help the users to learn new skills, practice their existing skills and also practice anything that they learn in theory. In addition, it is necessary for further research to teach the users of Artificial Intelligence applications on specific issues of FATE, for example, ethics, transparency and fairness on those applications.

Appendix A

Questionnaire
Thesis Questionnaire

Thesis Questionnaire

* Required

1. Gender: *

Mark only one oval.

- Female
- 🔵 Male
- Prefer not to say
- 2. Are you currently employed? *

Mark only one oval.



No

3. If yes, in which area do you work? *

- Management
- Business and Financial Operations
- Computer and Mathematical
- Architecture and Engineering
- Life, Physical, and Social Science
- Community and Social Services
- 🔵 Legal
- Education, Training, and Library
- Arts, Design, Entertainment, Sports, and Media
- Healthcare Practitioner and Technical
- Healthcare Support
- Protective Service
- Food Preparation and Serving Related
- Building and Grounds Cleaning and Maintenance
- Personal Care and Service
- Sales and Related
- Office and Administrative Support
- Farming, Fishing, and Forestry
- Construction and Extraction
- Installation, Maintenance, and Repair
- Production
- Transportation and Material Moving

4. What is your age? *

Mark only one oval.

5. Education level: *

Mark only one oval.

- High School
 - Bachelor's Degree
 - Master's Degree

🔵 Ph.D.

- 6. Approximately how long did the training take (in minutes)? *
- 7. Have you had any experience in learning through a Virtual Environment?*

Mark only one oval.

- Yes
- 8. Did you enjoy learning through a Virtual Environment? *



9. How interested were you to learn through the Virtual Environment? *

Mark only one oval.

	1	2	3	4	5	
Not Interested	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	Very Interested

10. How important is for you to have a face-to-face communication with a lecturer or a trainer?*

Mark only one oval.

	1	2	3	4	5	
Not important	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	Very important

11. How difficult or easy was it for you to stay focused on the learning material? *

Mark only one oval.

	1	2	3	4	5	
Very Difficult	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	Very Easy

12. Was it easy for you to learn the material through the Virtual Environment?*

Mark only one oval.



13. Did the Virtual Environment help you to learn the material? *



14. Learning through a Virtual Environment is a low-cost way to obtain needed training.*

Mark only one oval.								
	1	2	3	4	5			
Totally Disagree	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	Totally Agree		

 Was Virtual Environment a useful tool to learn, from your own physical space (e.g., home, work)? *

-	1	2	3	4	5	
Definitely not	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	Very much so

Mark only one oval.

Mark only one oval.

16. Was the Virtual Environment a useful tool to learn on your own time? *



 Were you more motivated to learn through a Virtual Environment as compared to being in a face-to-face training session? *

 1
 2
 3
 4
 5

 Definitely not
 Image: Constraint of the second sec

18. Did you find it easy to navigate through the Virtual Environment? *

Mark only one oval.

 1
 2
 3
 4
 5

 Definitely not
 O
 O
 Very much so

19. Would you prefer to have a trainer or a lecturer with you while you learning? *

Mark only one oval.



20. Was it stressful for you to know that you will have to learn the material on your own?*

Mark only one oval.

	1	2	3	4	5	
Definitely not	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	Very much so

21. Was it easy for you to have access to the learning material? *



22. If you have the opportunity to take a face-to-face training abroad or to have it online through a Virtual Environment, which one will you prefer and why? *

23. How did you find the colors of the Virtual Environment? (e.g. distractive, nice, etc.) *

24. Is there anything else that you believe was needed in the Virtual Environment and you did not find it? *

25. What has been the most difficult part about your learning experience in the Virtual Environment? *

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Google Forms

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