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APA Citation
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MLA Citation
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The Use of Artificial Intelligence in Higher Education: A Study on Faculty Perspectives in Universities in Egypt

A Thesis Submitted to

The Department of Educational Studies

School of Humanities and Social Sciences

The American University in Cairo

In partial fulfillment of the requirements for

the degree of Master of Arts in

International and Comparative Education by

Farah Sherif Sharawy

Under the supervision of Dr. Teklu Abate Bekele

May 2023

Acknowledgments

I would like to express my heartfelt gratitude to the following individuals, whose support and guidance were indispensable in completing this master's thesis:

First and foremost, I want to thank my supervisor, Dr. Teklu Bekele Abate, for providing invaluable guidance, support, and insightful feedback throughout the entire research process. His expertise and encouragement were instrumental in shaping my research and ensuring its successful completion.

I am also deeply grateful to my committee members, Dr. Maha Bali and Dr. Mostafa Toprak, for their insightful comments and constructive feedback during this thesis. Their valuable suggestions helped me to refine my research and produce a better-quality thesis.

To my CLT family, thank you for your constant support, understanding, and encouragement. Your words of encouragement and support were instrumental in helping me to persevere during times of stress and difficulty. A special thank you goes out to Mariam Hussien, Maha Shawki, Reham Niazi, Hoda Mostafa, Mohamad Saleh, and Ahmad Zorkani. Maha Bali, you have been my role model, and I'm grateful for your support as a colleague and committee member.

My heartfelt gratitude goes to my mother, father, and brother. Mom, you have been my backbone throughout this whole process. Dad, thank you for always pushing me forward and having faith in me. Mohamed, you always had your unique way of pushing me through stressful times and lifting me up. I am grateful for your endless love and support. Thank you all for your constant belief in me throughout my academic journey. I promise to always make you proud.

I am also deeply appreciative and grateful to my fiancée, Mizo. Thank you for your patience, love, and support throughout this entire process and especially during the stressful times. Your constant encouragement and belief in me have been a source of inspiration and motivation to keep going.

Last but not least, I want to thank my friends, especially Aya, Darin, and Nour, for their motivation and uplifting spirit throughout my academic journey. Nounou, my thesis journey wouldn't have been complete without your last push and support.

Thank you all for your contributions, support, and encouragement. I could not have accomplished this without you.

Abstract

Artificial Intelligence (AI) is an emerging technology that is transforming various aspects of society, including higher education. This paper examines faculty perspectives from five different institutions; The American University in Cairo (AUC), The German University in Cairo (GUC), The Arab Academy for Science and Technology (AAST), Ain Shams University, and Cairo University, on the use of AI in higher education in teaching and learning in Egypt, with all its challenges and resources available to support it, and how it can be used to achieve equity and accessibility. This research was conducted through a qualitative study using semi-structured one-on-one interviews with open-ended questions. Purposeful sampling, specifically snowball sampling strategies, was used to select the fifteen participants in this study, and the interviews were conducted at the faculty's respective institution or on Zoom. Moreover, Venkatesh et al. (2003)'s Unified Theory of Acceptance and Use of Technology (UTAUT) model of performance expectancy, effort expectancy, social influence, and facilitating conditions was used as a lens to guide the research. The study sheds light on different faculty perspectives from the five institutions on how AI can be used in teaching and learning with all its advantages and challenges, the support systems available to support the adoption of AI, and how AI can be used to achieve equity and accessibility to higher education. The data is presented according to the UTAUT model. The findings showed that faculty members are willing to adopt AI in their institutions based on their responses to performance expectancy, effort expectancy, and social influence. They also view AI as a tool to achieve equity and accessibility, but after combating the challenges. Results also showed that more work must be done regarding the facilitating conditions and the perceived risks. While the implementation of AI in Egyptian higher education

institutions is still in its early stages and with many issues to be resolved, still, it is impossible to disregard the potential advantages of AI in higher education.

Keywords: Artificial Intelligence, Artificial Intelligence in Higher Education in Egypt, Artificial intelligence for Equity and Accessibility, Higher Education, Egypt, Equity, Accessibility, Teaching and Learning.

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1. Chapter One: Introduction

1.1 Background

Artificial intelligence (AI) is the ability and advancement of data innovation-based personal computer (PC) frameworks or other machines to do tasks that normally need human understanding and rational thought (Jain & Jain, 2019). AI is emerging in many industries, and higher education is among the sectors in which AI has been used. In a McKinsey (2017) report on how AI is used by organizations that have begun to apply these technologies across industries, the authors found that AI can increase efficiency in education, which is crucial to enhancing productivity. With the emergence of the fourth industrial revolution, which is led by AI (Xing & Marwala, 2018), where AI is starting to deliver on its promises of producing value through the availability of relevant data, processing capabilities, and algorithms (Mhlanga, 2021), studying the effect of AI on education is crucial. According to a systematic review of 56 articles on AI's impact on higher education from 1900 to 2021, AI is effective in improving education quality by facilitating improved communication skills for learners and enhances their connection to the global community, advancing higher education curricula, enhancing individualized learning and the creation of e-learning systems, handling organized and unstructured data, which in turn reduces management burden and accelerates decision-making processes (Slimi, 2021). Moreover, AI is effective in improving evaluation methods for a better future job since AI influences future employment, implying that higher education institutions should include more AI to produce better graduates who fulfill future market demands (Slimi, 2021).

The rise of digitalization has led universities nowadays to stay alert to technological advances in their institutions (Aldosari, 2020). According to a survey administered by Microsoft and Times Higher Education (2019), university decision-makers confirm that AI will have great

importance in higher education in the future; however, only 41% had an AI strategy developed for their institution. Additionally, according to a study conducted by Microsoft Asia and IDC Asia/Pacific (2019), AI will increase innovation in higher education institutions and enhance student engagement, enrollment, and funding.

1.2 Problem Statement

AI's fast growth is having a significant influence on education. AI-powered solutions have tremendous promise for social benefit and achieving the Sustainable Development Goals (UNESCO, 2021). AI has also begun to develop new teaching and learning solutions, which are currently being tested in a variety of settings (UNESCO, 2019). Moreover, implementing and using AI in education must be driven by equity and inclusion (UNESCO, 2022). According to an article written by Pedro (2020), which provides an overview of AI applications in higher education, using research from the previous two decades as a starting point, he stated that the potential benefits of using AI in education appear to be improving students' learning experiences and their motivation for learning, which will reduce student drop-out rates, and provide personalized and adaptable learning paths to support the learning process.

There are several potential consequences of higher education institutions not adopting AI. First, without AI, universities may struggle to keep pace with the rapidly changing technological landscape and may fail to prepare students for the workforce of the future (OECD, 2018). Second, AI can significantly enhance student engagement, enrollment, and funding while improving communication skills, individualized learning, and e-learning systems (Microsoft & Times Higher Education, 2020). Universities that fail to embrace AI may struggle to create better learning opportunities and attract and retain students and funding. Finally, the integration of AI into higher education can promote equity, inclusion, and accessibility in education (UNESCO,

2019). Without AI, universities may struggle to provide personalized learning experiences that cater to the unique needs and abilities of every student, potentially exacerbating existing inequalities.

1.3 Research Gap

It is important to research how AI is used in Egyptian higher education for several reasons. Egypt is facing several challenges in higher education relating to limited resources, infrastructure, and access to quality education (Loveluck, 2012). The use of AI and tools, such as personalization, automation, virtual teacher-aids, and smart campus planning, can serve as an opportunity to overcome the challenges (Akinwalere & Ivanov, 2022). The aspect of how AI can be used in Higher Education in Egypt is currently not studied. Thus, with the growing popularity of AI and with its promise to revolutionize education, studying it and contextualizing the use of AI in the Egyptian context is important since, currently, no literature exists regarding this topic.

1.4 Purpose Statement

Accordingly, with the increasing appeal of the use of AI in education, and with not much literature existing in relation to Egypt's uses of AI in higher education, this research aims to explore the use of AI in higher education institutions and how this could either potentially create equity and accessibility or widen the gap in higher education in Egypt. Moreover, this research also highlighted challenges and support systems and resources available for adopting AI in Egypt. For the aim of this research, equity is defined as including everyone regardless of differences in order to promote access, participation, and educational advancement (Parveen & Awan, 2019). Moreover, accessibility is defined as ensuring that education is available to all pupils. This guarantees that education is provided to all children, including girls, refugees, migrants, and disabled children, without discrimination (Tomasevski, 2001). SDG 4 Goal 4.3

states that by 2030, we must "ensure equal access for all women and men to affordable quality technical, vocational and tertiary education, including university", which is in tandem with accessibility and equity in higher education (UNESCO, 2020). In this research, accessibility has been used to assess how AI in teaching and learning can make education more accessible.

1.5 Research Questions

1. What are the faculty experiences on the use of AI in higher education in Egypt in teaching and learning?
2. How could AI be used in teaching and learning in higher education to achieve equity and accessibility in Egypt?

1.6 Significance

The research questions generally shed light on how AI can be used in higher education institutions in Egypt, both practically and in terms of support systems are resources that are available and aid the adoption of AI in Egypt. The research questions are in tandem with the rise of the fourth industrial revolution. They will aid in the development of education since, according to UNESCO (2019), AI is among the fields which will be utilized to achieve sustainable development goals in an efficient way.

The first and second research questions give an overview of the experiences and viewpoints of stakeholders in higher education institutions on the use of AI in higher education generally and the potential uses of AI in teaching and learning. These questions will shed light on the areas where AI can be implemented, providing insights on practical uses and serving as a guide for policymakers and educational institutions. Through the research questions and through studying the uses of AI in teaching and learning, the contribution of AI to equity and accessibility will be studied. This aspect serves to explain how the use of AI in teaching and

learning can support all students, regardless of their backgrounds and abilities, through equitable and accessible education. This aspect will also aid in achieving SDG4, and specifically SDG 4.3, which seeks to provide all people with access to high-quality education and encourage lifelong learning opportunities.

2. Chapter Two: Literature Review

In this chapter, a review of the literature on AI and its use in education will be presented. The literature review section sheds light on the existing literature on the topic, which aids in identifying the gap and in identifying challenges in the current research. The section is organized as follows: What is Artificial Intelligence, Artificial Intelligence in Education, Artificial Intelligence in Higher Education, Artificial Intelligence Applications in Teaching and Learning(Chatbots and digital assistants, Adaptive and Personalized Learning, Automated Grading and Feedback, Emotional AI), Artificial Intelligence for Equity and Accessibility, Artificial Intelligence in Education in Africa, Artificial Intelligence in Egypt, AI and Ethical Considerations, and the Literature Review Conclusion.

A list of key phrases and words that will be used to search a database was identified and used as a search strategy. The terms and phrases used were artificial intelligence in education, artificial intelligence in higher education, artificial intelligence to achieve equity and accessibility, artificial intelligence in Egypt, artificial intelligence in Africa, what is artificial intelligence, artificial intelligence in teaching and learning, and emotion AI in education. Moreover, a bibliographic search of the literature was used to find more literature where the references of relevant articles were searched for additional relevant articles. Google, Google scholar, the American University in Cairo library database, and ERIC (Education Resources Information Center) were used to search for the literature. After finding the relevant literature, the literature was categorized into topics based on findings from the literature review and was used accordingly.

The literature review is presented using a general to a specific approach, through the categorization that was utilized in the literature search. Accordingly, the literature review starts

off broadly with the definition of AI, then how AI is used in education, after that how it is explicitly used in teaching and learning, then how it is used to achieve equity and accessibility, and then moves to how AI used in education in Africa, then in Egypt, in education, and concludes with ethical considerations to AI implementations. This is relevant to the research questions since the questions aim to understand the uses of AI in education, specifically in teaching and learning, as well as how it can or cannot be used to achieve equity and accessibility.

2.1 What is Artificial Intelligence?

AI is the development of systems that would necessitate advanced human intelligence to perform tasks requiring a high degree of "inference, deduction, and perception" (Aldosari, 2020, p.145). It refers to intelligence displayed by machines rather than people. A significant difference between humans or animals and AI is that human or animal intelligence encompasses awareness and emotions, whereas AI lacks these characteristics (August et al., 2021). Luckin (2017) added that AI is the capacity of computer systems to act in ways that we would consider human. August and Tsaima (2021) defined AI as the study of how to make computers accomplish activities that appear to need intelligence when performed by people. This broad concept of artificial intelligence includes machine learning and deep learning.

Machine learning is a subset of AI, and it entails the use of algorithms that can recognize patterns in data, learn from those patterns, improve over time, and draw conclusions when presented with new information (Ramlakhan et al., 2022). So basically, machine learning is a technique that allows computers to learn from data via the use of algorithms. According to Mitchell (1997), depending on the type of learning task, machine learning algorithms can be supervised, unsupervised, or reinforcement-based. Training a model on a labeled dataset, where the desired result is known for each input, is referred to as supervised learning. While

reinforcement learning includes learning via trial and error while getting input from the environment, unsupervised learning involves identifying patterns and structures in unlabeled data. Deep learning is a subset of machine learning. Deep learning is a type of machine learning that uses artificial neural networks to learn (Janiesch et al., 2021). According to LeCun et al. (2015), deep learning has demonstrated to be particularly successful in tasks that demand hierarchical models for the data as well as those that require processing vast volumes of unstructured input, such as pictures, audio, and natural language.

There are two types of AI: narrow (weak) AI and general (strong) AI. Narrow AI or weak AI is used to perform one specific, specialized task and is the most common type of AI used now (Bartneck et al., 2020). On the other hand, general AI, or strong AI, is used to construct machines that can use cognitive reasoning and think in the same way as humans (Bartneck et al., 2020). The latter is where the field of AI aspires to reach.

In this research, AI will be operationally defined as creating systems that require a high level of human intelligence and act in human ways in the education sector. So, in other words, AI will be defined as a research paradigm for which we try to mimic human intelligence and invent that intelligence into the machine. So, we're trying to make the machine think like a human and make decisions like a human.

2.2 Artificial Intelligence in Education

AI has already been popular in the corporate sector, but now it is gaining popularity in the education sector, both in teaching and learning and overall campus management (Dhawan & Batra, 2021). The origins of AI are traced back to a workshop hosted by John McCarthy at Dartmouth College in the United States in 1956. He used the phrase artificial intelligence for the first time when explaining that a computer can be built to replicate any part of learning (Pedró,

2020). On the other hand, Luckin et al. (2016) argue that it is since 1970 that AI has been in the field of education and has been focused on creating computer programs that allow for individualized learning and creating automated evaluation and feedback. This shows that AI is nothing new and has been there for ages; the term just became more known and received propaganda around it.

Moreover, Miao et al. (2021) already established a UNESCO Artificial Intelligence and Education Guidance for Policy-makers in order to guide policy-makers to better understand the potential and implications of AI for teaching and learning and create policies for their institution. This document was also done in order to ensure that the use of AI in educational contexts actually aids in the achievement of SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This UNESCO guidance aims to help policy-makers better understand the potential and implications of AI for teaching and learning (Miao et al., 2021). According to the document, providing low-cost models for developing AI technologies, ensuring that the interests of low- and middle-income countries are represented in meaningful discussions and decisions, and building bridges between these countries and those with more advanced AI implementation are all necessary if AI is to support SDG 4 (Miao et al., 2021). However, this document doesn't take into consideration different contexts and countries with different resources than others.

2.3 Artificial Intelligence in Higher Education

AI-driven systems and technology have enormous potential to change the way higher education institutions worked in the past (Dhawan & Batra, 2021). Dhawan and Batra (2021) added that according to the United States (US) Education Sector Report, the growth of AI in the education sector in the US is expected to grow by around 48% from 2018 to 2022. In a report,

Baker and Smith (2019) stated three angles to address AI technologies: “learner-facing, teacher-facing, and system-facing AIEd” (p.11). Learner-facing refers to software that students utilize to study a particular subject, teacher-facing refers to automating functions like administration, evaluation, feedback, and plagiarism detection to assist teachers and minimize their effort and help them learn about the student’s learning progress, and system-facing refers to technologies that deliver institutional-level information to administrators and managers (Richter et al., 2019).

AI can be used in higher education institutions to enhance the student’s learning experience, reduce drop-out rates, and create a personalized learning environment for students (Pedro, 2020). Microsoft Education Transformation Framework (ETF) for Higher Education offers hands-on guidance to develop a well-rounded digital transformation strategy for higher education institutions (Papaspyridis, 2020). The EFT incorporates four main pillars in which AI can successfully be integrated to ensure efficient and effective outcomes in the institution; student success, teaching and learning, secure and connected campus, and academic research. The three pillars of student success, secure and connected campus, and academic research will be briefly discussed in this section, while teaching and learning will be discussed in the following section since more emphasis will be put on them as it is the core of the research.

Student success relates to student recruitment and retention and connecting with students through lifelong relationships (Papaspyridis, 2020). According to Pedró (2020), AI can provide projection tools for admission decisions and dropping-out scenarios. Tsai et al. (2020) were able to predict students with a high risk of dropping out and the reasons for dropping out to intervene and provide solutions. Another example is FLEXA, which was developed by MIP Politecnico di Milano Graduate School of Business and Microsoft and assisted students in identifying their

development areas in skills required between their career goal and their current state (Papaspyridis, 2020).

A secure and connected campus denotes the idea of managing the campus resources efficiently and effectively and providing a safe and smart campus life (Papaspyridis, 2020). AI would facilitate campus life and transform into a smart campus since managing and controlling campus facilities and human resources and finance tasks will be automated (Dhawan & Batra, 2021). Virtual assistants and chatbots can deliver "faster, personalized, cost-effective, and efficient solutions at the admin desk" (Dhawan & Batra, 2021, p 14). AI can also be used to facilitate human resource and finance tasks. For example, administrators can use Stellic for financial forecasting and planning. The tool helps them to determine the demand for any given course. Like cloud and other technology, shared resources can help bring down costs.

Academic research relates to allowing researchers to complete their research using an effective computing environment to eliminate any constraints and collaborate with researchers globally (Papaspyridis, 2020). Through the use of AI, data can be processed more easily. It can help researchers carry out their studies by creating and analyzing surveys or even conducting interviews and identifying fabricated data (Dhawan & Batra, 2021).

2.4 Artificial Intelligence Applications in Teaching and Learning

Teaching and learning in AI refer to building AI tools to empower academics and students to reach their full potential through collaborative learning, learning management, and learning spaces (Papaspyridis, 2020). Over the last 30 years, the development and adoption of new technologies in teaching and learning have grown (Popenici & Kerr, 2017). While earlier attempts to integrate AI in education considered using AI to replace the teacher, the direction currently being taken by institutions is that AI in teaching and learning is being used to aid

teachers rather than replace them (JISC, 2021). AI will never replace teachers. Teaching is a very complicated and comprehensive activity that requires not only the dissemination of information but also the development of social and emotional skills; thus, AI is unlikely to completely replace teachers and instructors (Kolchenko, 2018). Moreover, Chan and Tsi (2023) agree and stated that in their study on the "future role of educators in the face of advancing AI technologies," they concluded that the majority of participants contend that human instructors are irreplaceable because they have special abilities including critical thinking, creativity, and emotions, despite some participants' beliefs that AI would someday replace teachers. The study also emphasizes the value of social and emotional skills acquired via interactions with others, which AI systems cannot yet reproduce (Chan & Tsi, 2023). According to the research, instructors may successfully incorporate AI to improve teaching and learning without considering it to be a substitute, and in order to achieve this, instructors must cultivate AI literacy, comprehend how AI may effectively collaborate with teachers and students while avoiding possible pitfalls, and handle relevant problems like data protection, ethics, and privacy (Chan & Tsi, 2023). Among the uses of AI in teaching and learning is the use of chatbots and digital assistants, adaptive and personalized learning, feedback, automated grading, and emotional AI, which will be discussed below.

Chatbots and digital assistants

Chatbots and digital assistants are two closely related technologies used interchangeably (JISC, 2021). As evident from their name, chatbots, and digital assistants are virtual teaching assistants that can answer students' inquiries without any human intervention (Popenici & Kerr, 2017). Moreover, the increasing number of students, class sizes, expenses, and financial demands on institutions make the employment of chatbots a highly compelling solution

(Popenici & Kerr, 2017). Chatbots are used to give information, imitate learning, mentor, assist, encourage, scaffold, and assess learners (Southgate, 2020). However, chatbots can still be frustrating to students if it is not designed smart enough and thus do not lead the student in the direction they want. An example of a chatbot is the University of Edinburgh's TeacherBot or TwitterBot. In the University of Edinburgh, a TeacherBot was developed to interact with MOOC students through Twitter (Bayne, 2015). It was used to engage students with the course on twitter and take the MOOC a step further than the traditional MOOC experience. As an experimentation bot, it succeeded: TeacherBot replies played jokingly and quickly throughout the social conversations on Twitter, inspiring contemplation on course themes that were frequently fairly profound and led to generative misunderstandings (Bayne, 2015).

Another chatbot example that recently surfaced all around the world is ChatGPT. ChatGPT is a chatbot technology that allows people to have chats with a machine that is intuitive and human-like through language processing techniques. Users can communicate with a computer in a manner that mimics speaking to a real individual using ChatGPT (Halaweh, 2023). Students have been using ChatGPT to write them essays, generate codes, solve mathematical solutions, and many others (Halaweh, 2023). With the tool being free, it has made its way into higher education, and recently there has been a growing interest in best practices for using ChatGPT in higher education (Halaweh, 2023). Popenici and Kerr (2017) stated that digital assistants could provide an adaptive learning experience to students, which will be highlighted in the following paragraph. This shows the integration between two AI tools, chatbots and adaptive personalized learning, which would be very useful in online, independent learning.

Adaptive and Personalized Learning

Adaptive learning or intelligent tutoring systems (ITS) is a virtual learning environment that adjusts teaching and learning methodologies and resources to individual learners' skills and requirements (Luckin et al., 2016). To enable the system to make appropriate judgments about what learning content to deliver to the student, several current ITS incorporate machine learning techniques, self-training algorithms based on big data sets, and neural networks (Luckin et al., 2016) to adjust the rate, order, or amount of learning based on the student (JISC, 2021).

Adaptative learning offers a personalized learning experience to the student, identifying each student's proficiency level and providing them with activities and assessments relevant to them (Baker, 2021). Additionally, Calatayud et. al (2021) explained how teachers could combine a customized system that includes self-assessment for the disabled and non-disabled to self-assess themselves through adaptive learning AI systems and adjust the learning and materials accordingly. I think adaptive and personalized learning offers a major advantage to students and helps in creating equity since all students get to achieve the same learning objectives based on their own level and ability.

Examples showcasing the use of AI in teaching and learning are through adaptive learning systems, AI-assisted marking and feedback, chatbots, and virtual teaching assistants (JISC, 2021). For example, at Arizona State University, experts have started using CogBooks. This adaptive learning system replaces the traditional textbook and provides a personalized learning experience to the student (JISC, 2021). Students' passing rates improved by 24%, and the dropout rates were cut down by 90% (JISC, 2021). Other examples of adaptative learning systems include but are not limited to TSAL (Tseng et al., 2008) and WELSA (Popescu, 2010), which are adaptive learning systems designed to support different learning styles. These are

examples of systems that integrate several AI tools in one; adaptive learning, automated feedback and grading, and responses using chatbots.

An example of an intelligent tutoring system is Jill Watson. Watson is a virtual teaching assistant that aims to boost student achievement and engagement by combining AI technologies built on IBM's Watson platform with specialists from Pearson Education (JISC, 2021). Watson uses the chat to create an engaging conversation that mimics a skilled human instructor's questions and replies that are tailored to this student, which allows them to learn at their own pace (JISC, 2021). This is an example of using a chatbot to achieve a personalized and adaptive learning experience for students. These examples can serve as a gateway for students to have access to higher education learning that doesn't have to take place in a physical institution. It can be a replacement for traditional higher education, and more people can have access to it.

Automated Grading and Feedback

AI is being used to grade students automatically. August and Tsaima (2021) noted how the use of the autograder program is used to evaluate student work without human involvement. This tool assesses and marks writings in addition to scoring multiple-choice tests. In a study, the outcomes of auto-graders can range from binary (correct/incorrect) to generalized input (August & Tsaima, 2021). Haddawy et al. (2010) demonstrated in their research how an AI and virtual reality system was used for automatic grading. They described how the system evaluates dentistry students' proficiency based on their motions using a video monitor and haptic device, calculates their ratings in accordance, and classifies them as novices or specialists. (Haddawy et al., 2010).

Additionally, Gradescope, a tool that helps instructors save time and effort, is now being used by 500 higher education schools, according to Akgun and Greenhow (2021). If students

submit assignments on paper, Gradescope digitizes them, links each submission to the student's ID number on the learning management system, and then the teacher marks according to the question rather than the student. (Brennen, 2020). Gradescope uses artificial intelligence to assess each question and similar group answers. The teacher then constructs a rubric that assigns the complete mark to the correct group and partial or no credit to others (Brennen, 2020). However, I think this can limit students' creativity and ends up producing similar people in the end.

In Gardner et al. (2021), the automatic essay-scoring AI system was described. The use of automated essay marking has been prevalent in large-scale summative assessment programs like the SATs. (Gardner et al., 2021). Furthermore, automatic essay scoring AI tools are used to create a review, saving time and money, according to Braiki et al. (2020). The process begins with the instructor manually grading several practice essays. The system then learns from this grading, which is a type of machine learning. It then assesses the essays of the students based on the frequency of work, the vocabulary used, length, and grammar, translating this evaluation into a score. (Braiki et al., 2020). This is how edX, an online course provider, created its own automatic essay scoring system, the Enhanced AI Scoring Engine, to make machine grading more human-like because it resembles the marking of real teachers. The primary objective, according to the writers, is to develop an automatic lecturer who can remark on and provide feedback on many writings, leading to better initial assessments being done at a quicker rate. (Braiki et al., 2020). I believe that this could be effective with online learning that has a large number of students and no synchronous teacher presence; however, in a regular classroom, this would make the students answer according to a model and not according to what they want. Also, the model answer might not recognize an answer, even if it is correct, since it might not

include all data. Additionally, the empathy of the instructor in grading an assignment will be lost in the process.

Several studies provided insight into how AI supports feedback. When an instructor has a large number of students, AI can help them by automatically allowing them to provide continuous and quick input. (Calatayud et al., 2021). The use of AI could facilitate and support the ongoing feedback systems that are crucial to learning, Jain et al. (2014) added. Additionally, Gardner et al. (2021) noted that individualized formative assessment is the most beneficial form of learning feedback for students in any learning context, particularly in the context of MOOCs and other online learning environments where many students are enrolled at once.

Baker (2021) used his research to demonstrate the idea of using AI to give homework-based feedback. According to him, in the past, students would bring their homework to class, give it to the instructor, who would then mark it and give it back to the student, delaying the feedback process. However, statistics from homework tools are now available to instructors in real-time. This suggests that instructors may identify which students are struggling and which subjects students find challenging in general even before class even starts, allowing the teacher to modify the instruction and material in accordance (Baker, 2021), which I believe would be an effective way that would benefit the students academically.

Emotional AI

Emotional AI is being used by Education Technology businesses to measure social and emotional learning (McStay, 2019). Affective computing is a field of study that focuses on building systems and devices that can detect, recognize, and interpret human emotions (Pabba & Kumar, 2021). Affective computing is among the AI technologies that are utilized to construct

autonomous engagement monitoring systems that track and report student engagement levels by analyzing nonverbal signs without the need for human intervention (Pabba & Kumar, 2021).

In a study conducted by Sharma et al. (2019), the researchers created an AI system to detect student engagement through their eye and head movements and facial emotions using the laptop camera in an e-learning scenario. The results showed that the AI tool could correctly identify when the student was very engaged or when a student was not engaged (Sharma et al., 2019). However, in some rare instances when the students had their faces covered with their hands, the system couldn't detect the information (Sharma et al., 2019). Pabba and Kumar (2021) also conducted a study where they created a system to monitor student engagement both online and offline through their facial expressions and their affective states. The authors used six affective states in their study, which are "bored, confused, focused, frustrated, yawning, and sleepy" (Pabba & Kumar, 2021). Another study also confirmed how a teacher could recognize if a student is bored, frustrated, or facing difficulties and provides them with a personalized activity or assessment of their reported behavior (Baker, 2021), which combines emotion AI and adaptative and personalized learning.

The authors concluded that the results of the system were very promising and that the tool can be used to effectively track students' engagement and make the appropriate changes in the lesson to achieve the learning result and enhance engagement (Pabba & Kumar, 2021). However, while the results were promising, there are huge privacy concerns. Also, if students consented to its use, there are still cues that the tool might not detect, especially for students with a certain disability, such as ADHD, since there will always be a spectrum, and thus, the tool might not be able to detect a certain motion or expression.

2.5 Artificial Intelligence for Equity and Accessibility

Developing AI systems has been promised to improve equity in education and close the achievement disparities among diverse groups of students (Holstein & Doroudi, 2021). Moreover, Popenici and Kerr (2017) added that AI systems that use machine learning algorithms might serve individuals of all abilities, which moves higher education institutions into a new era. With Sustainable Development Goal 4, which seeks to provide all people with access to high-quality education and encourage lifelong learning opportunities, AI is being utilized to ensure that all students have equal access to education by giving marginalized people and communities, including the disabled, refugees, those who have dropped out of school, and those who live in isolated areas, with adequate learning opportunities (UNESCO, 2019). UNESCO (2019) also added that when it comes to establishing policies for AI in education, equity and inclusion should be top priorities. In doing so, governments should proactively create policy solutions that aim to narrow the digital divide in developing countries. For example, in Bangladesh, the government created digital centers that are no more than 4 kilometers from every citizen (Chowdhury, 2022). Moreover, in Uruguay, Plan Ceibal, an initiative created in order to provide "one laptop per student" and to provide internet access, was introduced as an educational initiative to digitize education but then became a social equity plan for the country (Pombo et al., 2018). This initiative came because, in Uruguay, only the elite and more privileged had access to devices and the internet (Pombo et al., 2018).

An example of using AI to achieve accessibility is IBM's Simpler Voice: Overcoming Illiteracy Project is an example of an AI tool that aids in accessibility in which adult learners who are illiterate or have limited reading abilities in navigating texts with more ease get help by having the text translated to them and by having the content provided to them through images or

simple spoken words, which assists people in overcoming severe challenges in their daily lives (UNESCO, 2019).

On the other hand, there is a wide range of challenges in using AI for equity and accessibility. Fairness, accountability, and transparency in AI systems have increased attention in high-stakes situations (Holstein & Doroudi, 2021). Holstein and Doroudi (2021) added that poorer areas usually have limited access to technologies than the rich, and even if they get access to it, the technology assumes that all students speak the same language and at the same proficiency level, which leaves the non-language speakers at a disadvantage. The majority of AI technologies used in education demand a certain level of technical proficiency and linguistic abilities. In light of this, AI may increase rather than ameliorate gaps in education for marginalized populations, between the affluent and poor, between able-bodied and disabled students, and between those who have access to dependable internet infrastructure and those who do not (Biggs et al., 2018). Moreover, since human intelligence is at the heart of some AI-powered technologies, particularly digital assistants, they answer to requests depending on the data they've been given, so if the data the algorithm was trained on is biased, then the outcome will be biased as well (Dhawan & Batra, 2021). As highlighted by Dhawan and Batra (2021), in 2016, Microsoft developed Tay, a Twitter chatbot that had to be pulled down within 24 hours of its launch owing to racist, sexist, and other offensive content. Tay was created to mimic a young American millennial female in order to do research on conversational understanding by casually conversing with millennial Twitter users; however, users started tweeting racial and offensive content, and as a result, Tay, also tweeted back with racist, sexist, and offensive content, causing Microsoft to shut It down within 24 hours (Suárez-Gonzalo et al., 2019). It is problematic to disregard differences when designing an AI tool or software, so collecting a representative

sample is essential to avoid algorithm bias (Baker & Hawn, 2021). However, this raises the issue of how much data is enough data? “Three core categories have received most of the attention from researchers in a study by Baker & Hawn (2021): race/ethnicity (but not indigenous learners), gender (but not non-binary or 22 transgendered students), and nationality (for a small number of nationalities; in terms of learners’ current locations)” (Baker & Hawn, 2021, p. 21-22).

The UNESCO (2021) report providing guidance for policymakers on AI in education, highlights the potential of AI to promote equity, inclusion, and accessibility in education. AI-based solutions can provide personalized learning experiences that cater to the unique needs and abilities of every student as well as help address educational barriers faced by marginalized and disadvantaged groups, such as language barriers, disabilities, and socioeconomic status (UNESCO, 2021). However, the report also highlights the potential risks of AI in reinforcing existing biases and inequalities. To ensure the responsible use of AI in education, the report emphasizes the need for ethical considerations and stakeholder engagement in the development and implementation of AI-based solutions (UNESCO, 2021). Policymakers and stakeholders must prioritize equity, inclusion, and accessibility to maximize the potential of AI in promoting equitable and inclusive education.

2.6 Artificial Intelligence in Education in Africa

According to an article that showcases a thorough assessment of empirical research on AI in education published between 1993 and 2020, no countries present in Africa participated in AI research (Zhang & Aslan, 2021). UNESCO (2019) highlighted two AI systems that are used in Africa; M-Shule in Kenya and Daptio in South Africa. M-Shule is a digital application that administers its courses via SMS to students based on the national curriculum standards and

adjusts the lesson to each student's skills and abilities using AI technology, then records and evaluates student achievement, providing insights and recommendations to parents and teachers (UNESCO, 2019). Similar to M-Shule is South Africa's Daptio. Daptio leverages AI to assist students, mentors, and teachers in determining each student's competence level and then matches the student with the appropriate content, giving them a personalized learning experience (UNESCO, 2019). While Africa is still on its way to implementing AI, I think that more initiatives and support are needed to encourage research and development of AI tools; since Africa mostly consists of developing and underdeveloped countries, so more support would be needed for them to catch up with the AI boom.

2.7 Artificial Intelligence in Egypt

In this section, AI is discussed based on its availability and awareness level in Egypt, not on AI's use in education in Egypt. In 2019, the Ministry of Communication and Information Technology in Egypt created the National Council for Artificial Intelligence (NCAI), partnering with governmental organizations, academics, and AI businesses to form Egypt's national AI strategy with the aim to utilize AI to accelerate the process of achieving Egypt's developmental goals, and especially the United Nations' Sustainable Development Goals (NCAI, n.d). Moreover, in tandem with Egypt's AI strategy, Dell Technologies, in collaboration with the Ministry of Communications and Information Technology, announced a new initiative to teach students from five higher education institutions (American University in Cairo, German University in Cairo, Cairo University, Ain Shams University, and the Arab Academy for Science and Technology) about AI and its applications (Alaa El-Din, 2022). In this program, Dell will offer data science and big data analytics workshops as well as solve a case study on AI and its applications (Alaa El-Din, 2022). This initiative will build capacity for AI educators, and Dell

will make use of it by implementing the 'Train the Trainers Program,' which will give training sessions for university professors on various technological areas related to AI, as well as a competition to choose the best three projects conducted by the students in this academic year (Alaa El-Din, 2022).

AUC has already started exploring the use of AI in teaching and learning. The Center for Learning and Teaching (CLT) at AUC, which is a service center for AUC faculty, has already published “Artificial Intelligence - Resources for AUC Faculty” in order to help faculty members understand and deal with AI tools, and especially ChatGPT which is impacting education (CLT, n.d). Moreover, the digital transformation team developed "Digi-Bot," which is a chatbot created to facilitate digital transformation within the university and provide students, faculty, and staff with a more streamlined and efficient way to access information and services (AUC, 2020).

With the increased appeal of artificial intelligence in the world and in Egypt and based on a systematic general to a specific approach to conducting the literature review using specific search strategies mentioned above, no to little literature exists regarding the application of AI in higher education institutions in Egypt and how this will transform the future of it.

2.8 AI and Ethical Considerations

AI use raises ethical concerns and challenges. According to Luckin (2017), a substantial amount of user data and information must be gathered in order to develop an assessment-focused AI application. Additionally, Akgun and Greenhow (2021) added four main ethical challenges when applying AI to education; “privacy, surveillance, autonomy, and bias and discrimination.” Privacy concerns are related to information that students, instructors, and other educators disclose online, which can then be used by businesses in ways the students are unaware of. Surveillance issues are raised because of the constant surveillance and observation of students'

actions which makes the students feel unsafe and prevent them from participating in class or taking ownership of their ideas. Concerns about autonomy are expressed because students are unable to make their own decisions; instead, the system decides what is best for the student. Finally, bias and discrimination concerns are made by the tool itself, such as gender bias when a term is translated from another language, and it becomes feminine or masculine or racial bias when a face recognition tool fails to identify a particular race. (Akgun & Greenhow, 2021).

2.9 Literature Review Conclusion

After a review of the literature on the use of AI in education, I think AI will continue to grow and make its way into the education system. Chatbots and digital assistants can save time and resources for both instructors and students in higher education; however, little was said about how it can also be time-consuming for students to use if it's not smart enough and keeps directing the students to irrelevant information. Moreover, providing an adaptive and personalized learning experience can allow the students to achieve the learning outcomes better and according to their own level and pace, which I see is the most advantageous and has little to no limitation to use, except its development. Automated grading and providing feedback can serve both the faculty members and the students by saving time and adjusting the lessons accordingly, yet there needs to be a lot of consideration on how automated grading and feedback can be used in questions that are open-ended since this can limit creativity. Lastly, emotional AI can provide faculty members with the necessary information to make the lesson engaging and provide the students with a better learning experience, yet a very problematic concern here is students' privacy and surveillance concerns.

The literature addressed different uses on how AI can be used in teaching and learning, but can these uses be applied to the Egyptian context, or would AI be used in higher education in

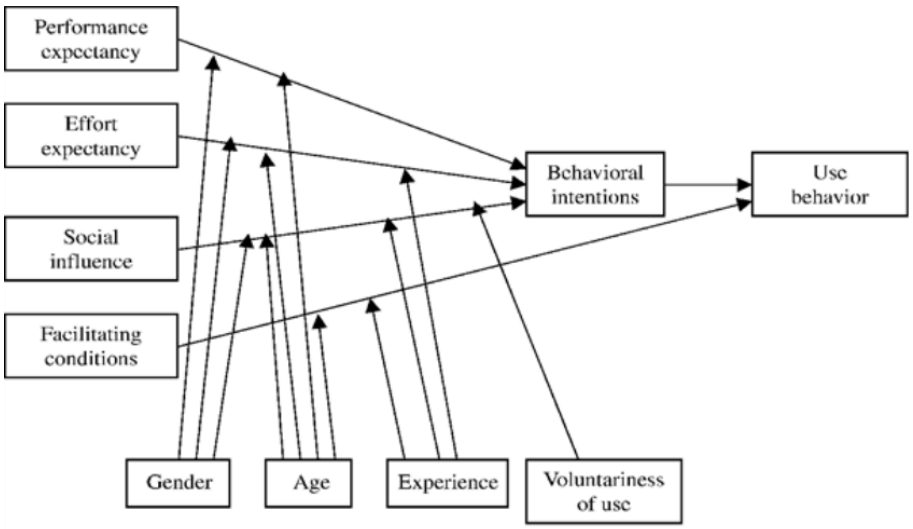
Egypt in a different way? Contextualizing the use of AI in higher education in Egypt is one of the knowledge and research gaps that this study aims to explore. Moreover, with the initiative from the Egyptian government in agreement with the five universities which aim to build capacity in AI, there is a gap in knowledge in how these policies are going to affect the higher education industry and how AI can be applied to teaching and learning. Moreover, regarding equity and accessibility, while ideally, equity and accessibility in higher education are needed, I think there are still many challenges to how this can be applied and implemented. Also, different contexts would respond differently to such concerns; a developed country cannot be compared to a developing country in this aspect since the conditions and resources are different.

3. Chapter Three: Theoretical Framework

Venkatesh, et al. (2003)'s Unified Theory of Acceptance and Use of Technology (UTAUT) model was chosen since its domains were more fitting than other technology adoption models. Some models lacked important domains, while others had extra unnecessary domains. The UTAUT model consists of four main domains, performance expectancy, effort expectancy, social influence, and facilitating conditions, which were applied in this research. These four domains serve as determinants for the individual's intention to adopt the technology. The model also has four variables that might have an impact on the four main domains; these variables are gender, age, experience, and voluntarism of use (Venkatesh et al., 2003). For example, age can affect whether a person adopts a technology or not. Moreover, experience can affect technology adoption since someone with a vast experience might be ready to adopt new technologies while those with little experience might be more hesitant. This model serves as a model that integrates the eight previous technology adoption models, so it is a built-on and improved version of previous models such as the Technology Acceptance Model (TAM) by Davies (1989, as well as TAM 2 and TAM3. This model serves as an aid to determine the likelihood that the individual will adopt a technology (Slepankova, 2021). The ability of UTAUT to explain technology acceptance and usage in a variety of contexts and settings is one of its strengths. It has been used with numerous platforms, such as cell phones, social media, e-commerce, and medical equipment, and it has also been applied in developed and developing countries (Venkatesh et al., 2003). The model can be seen in Figure 1 below:

Figure 1

The Unified Technology Acceptance and Use of Technology theory (UTAUT)



Note. The figure explains the UTAUT model with all its domains that lead to usage behavior. Adapted from "User Acceptance of Information Technology: Toward a Unified View," by V. Venkatesh, M. Morris, G. Davis, and F. Davis, 2003, *MIS Quarterly,* 27(3), p. 477.

Performance expectancy, which is the first domain in the UTAUT model (Venkatesh, et al., 2003), is the level to which users anticipate that the technology will assist them in achieving their objectives or enhancing their performance (Venkatesh et al., 2003). This is considered the strongest indicator of technology adoption (Venkatesh et al., 2003). For this research, this would refer to viewpoints listed by faculty members in relation to the use of AI in teaching and learning and how it can lead to a better performance as a faculty member in a higher education institution. This will shed light on the research question on faculty perspectives on the use of AI in higher education in Egypt in teaching and learning.

The second domain, effort expectancy, refers to the degree to which individuals anticipate the use of the technology will be simple and effortless, so the ease of use (Venkatesh, et al., 2003). This will be related to the faculty's viewpoints on the ease of use of AI in their

institution, this will also shed light on the research question on faculty perspectives on the use of AI in higher education in Egypt in teaching and learning.

Social influence, the third domain, is the extent to which a person believes that others should use the new system (Venkatesh et al., 2003). For this research, it will be related to how social influence leads to increased use of AI and how the use of AI can achieve equity and accessibility since it will refer to the faculty believing that those at a disadvantage will or will not benefit from the use of AI. While the aspect of equity and accessibility could have a domain on its own in future technology adoption models, this domain seemed the most fitting. This will highlight findings on the research question of how AI could be used in teaching and learning in higher education to achieve equity and accessibility in Egypt.

The fourth and final domain, facilitating conditions, is the degree to which users believe that the necessary resources and support are available to use the technology (Venkatesh et al., 2003). This domain has a direct influence on the willingness to use the technology; however, after it has been used, there is no influence, so as a result, the model indicates that facilitating conditions have variables affecting the willingness to use the technology (Venkatesh, et al., 2003). In the case of this research, it refers to the faculty viewpoints on higher education's readiness to adopt AI technology in their teaching and learning, and this refers to whether they have the resources and infrastructure for it.

For the aim of this research, perceived risk (Bauer, 1960) was borrowed and integrated into this model as a fifth domain. Bauer (1960) defined perceived risk as the level of uncertainty and potential negative consequences that a consumer associates with a particular purchase decision. While this is mainly used in marketing, it will be used in this study to refer to the risks and ethical considerations associated with the use of AI in higher education since this is a major

factor that can affect the adoption of AI. This relates to all research questions since it is an important challenge on adopting AI in higher education.

Overall, while the model is relevant to technology adoption and fits the use of this study, perceived risk has been added as a new domain. Moreover, equity and accessibility were put under social influence, but they could have added a new domain on their own. Thus, in the future, suggestions could be added to the model.

The domains created in the new proposed framework were used to code the data and put them into themes. Additionally, there were used to guide the findings and the discussion sections.

4. Chapter Four: Research Design and Methodology

4.1 Research Approach

This research followed a phenomenological approach, one of the qualitative research strategies of inquiry. This study technique was chosen because it would assist in giving more significant and in-depth insights into the artificial intelligence phenomenon and the faculty experiences and viewpoints on the use of AI. According to Plano and Creswell (2015), qualitative research aims to explore a specific phenomenon by examining a person's experience and point of view, which is why phenomenology has been selected since phenomenology seeks to understand the essence of a lived experience (Creswell & Poth, 2017). In this research, experience is defined based on John Dewey's definition, which is the development of organism-environment relationships (Acampado, 2019). He describes it as being socially focused, conversational, and unified (Acampado, 2019). Experience is constantly different because new interactions take place every time an organism interacts with its surroundings (Acampado, 2019). In the case of this research, this is contextualized as the faculty members in higher education institutions and their environment in AI uses and applications and their perspective on it. Moreover, in Acampado (2019), Dewey explained attributes of experience as "dynamic, unified, communicative, historic and socially oriented" (p.1). Experiences are different from one person to another and are always changeable depending on the new and fresh interactions between the person and the environment.

Building on this approach, this research studied the lived experience of stakeholders and their viewpoints of AI in their environment. The research was conducted via semi-structured interviews on their experience on the use of AI and whether and in what ways AI might be used

to create equity and accessibility in higher education. The stakeholders are from five Egyptian universities and are all faculty members.

The questions for the interviews are guided by the topics mentioned in the literature review about how AI is used in teaching and learning and how it can create equity and accessibility.

4.2 Data Collection Methods

One-on-one semi-structured recorded interviews were utilized in this research project. One-on-one interviews were used in order for the researcher to understand the point of view of the interviewee in-depth (Plano & Creswell, 2015). Open-ended questions were asked to the interviewees, and the interviewer built on the respondents' answers. The questions were guided by the topics of how AI is used in teaching and learning in higher education, which is mentioned in the literature review section. This type of data collection method allows the researcher to gain useful information in a study that cannot be observed (Plano & Creswell, 2015). Moreover, researchers have control over the information in interviews because they can ask specific questions to get the right information. The interviews were recorded, contingent upon the interviewee's approval, and the researcher also took notes. The interviews were all transcribed word by word.

Site

Depending on the interviewee's convenience, the interviews were either conducted on-site or via Zoom. Six interviews were conducted via Zoom, and nine interviews were conducted face-to-face. If time and resources allowed, the priority would have been to conduct all interviews face-to-face on the university's site. This approach would allow the researcher to study the body language of the interviewee and allow them to interact better with them; however,

the limitation of time and availability made this difficult. So alternatively, if time and resources were limited, the interviews were conducted via Zoom. This approach saved time, but, in this case, to me, it lost the essence of the human interaction between the interviewer and interviewee. The interviews lasted from half an hour to an hour. The more length, the deeper and richer data. Moreover, better rapport was built face-to-face than online since not all interviewees even had their cameras on while on zoom, which made the connection and dynamics among interviewee and interviewer more challenging.

The universities chosen to conduct the study are the American University in Cairo, German University in Cairo, Cairo University, Ain Shams University, and the Arab Academy for Science and Technology. These universities were chosen because they were all part of the agreement between the Ministry of Communications and Information Technology and Dell Technologies to build capacity in AI in Egypt (Alaa El-Din, 2022). The participants were all faculty members.

Participants

The sampling strategy used in this study is purposeful sampling. Purposeful sampling is when the researcher selects the participants on purpose as they see fit (Plano & Creswell, 2015). Hence, this sampling strategy is helpful since the researcher purposefully chose the professors whom the researcher sees fit. Moreover, the snowball strategy, which is a type of purposeful sampling strategy, was used. Snowball sampling is used when accessing participants with the desired traits is challenging (Naderifar et al., 2017). In this strategy, the researcher asked the first few interviewees if they knew anyone with similar ideas or circumstances who would be interested in participating in the study (Naderifar et al., 2017).

The snowball strategy is used since the individuals interviewed would lead the researcher and recommend other individuals who will be of use to the study. To begin with, the selection was based on the agreement between the Ministry of Communications and Information Technology and Dell Technologies. The researcher aimed to reach those who were part of the initiative from each university and take it from there through snowball sampling.

A range of 1-5 people from each university was selected, comprising 15 one-to-one semi-structured interviews. Five professors were chosen from AUC, three professors were selected from GUC, three professors were selected from AAST, three professors were selected from Ain Shams, and one professor was selected from Cairo University.

The participant's information is highlighted in the table below. For anonymity and confidentiality, their real names have been changed and are referred to as per the names in the table 1 below:

Table 1

Participants' Demographics

Participant	University Name	Position/Role
Faculty 1	American University in Cairo	Professor of Practice, teaches Digital Literacy in the core curriculum, and faculty member at the Center for Learning and Teaching.
Faculty 2	American University in Cairo	Associate Professor in the Mechanical Engineering department.
Faculty 3	American University in Cairo	Professor of Practice, Director of the Center for Learning and Teaching.

		Professor at the Electronics and Communications Engineering
Faculty 4	American University in Cairo	Department and Associate Dean for Graduate Studies and Research School of Sciences and Engineering.
Faculty 5	American University in Cairo	Adjunct Faculty at the Department of Educational Studies.
Faculty 6	Ain Shams University	Professor Emeritus of Computer Science and former Vice Dean of the Faculty of Computer and Information Sciences.
Faculty 7	Ain Shams University	Associate professor of Educational Planning and Future Studies at the Faculty of Education, former Director of the Center for Educational Excellence in faculty of education, former Director of the Quality Assurance and Accreditation Center, and former Vice Adviser of Strategic Planning and Administrative Planning at Ain Shams University.
Faculty 8	Ain Shams University	Assistant Professor of Curriculum and EFL instruction.
Faculty 9	Arab Academy for Science and Technology	Dean of College of Computing and Information Technology, Professor of Computer Science, Member of UNESCO AI

		Ethics Document, Member of Arab League of State AI Strategy team.
Faculty 10	Arab Academy for Science and Technology	Dean of College of Computing and Information Technology, Professor of Computer Science.
Faculty 11	Arab Academy for Science and Technology	Academic Head of Departments, College of Computing and Information Technology, Rapporteur of the National Committee for Communication and Information Technology, Member of Arab League of State AI Strategy team.
Faculty 12	German University in Cairo	Vice Dean for Academic Affairs . Faculty of Media Engineering and Technology, Assistant Professor, Faculty of Media Engineering and Technology.
Faculty 13	German University in Cairo	Vice Dean of Student Affairs, Associate Professor, Faculty of Media Engineering and Technology.
Faculty 14	German University in Cairo	Lecturer of Computer Science and Engineering.
Faculty 15	Cairo University	Founder and Head of the Egyptian Scientific Research Group (SRGE) and a Professor of Information Technology at the Faculty of Computer and Information.

4.3 Data Analysis

To begin with, the researcher transcribed the recordings and the notes taken. The notes were essential since it helped the interviewer organize the interview in a better way, yet transcription provided more accuracy to the findings. Transcription is the procedure of transcribing audio recordings or field notes into written text (Plano & Creswell, 2015). Verbatim transcription, which is word-for-word transcription, was used. The researcher also used automated transcription online software that converts recordings to text automatically for the recordings that were in English to speed-up and support the manual verbatim transcription; however, it was revised after to ensure accuracy. Moreover, the researcher translated and transcribed manually the interviews that were conducted in the Arabic language.

After that, the researcher scanned over the data to get a general overview of the findings. Then, data were coded in order to lead to the following step, which is coming up with themes. Coding is a method of identifying text segments, putting an emphasis on them, or highlighting them, and then assigning a code that specifies the meaning of the text segment (Plano & Creswell, 2015). Moreover, Saldaña (2013) added that coding is the process of identifying and labeling segments of meaning in your data with a code, which is defined as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 3). Deductive coding was used since the codes were deduced from the theoretical framework, which is the concepts of performance expectancy, effort expectancy, social influence, facilitating conditions, and perceived risks, and was then used as the themes.

4.4 Quality Parameters

Lincoln and Guba (1985) initially proposed four criteria to establish trustworthiness in qualitative research: credibility, dependability, transferability, and confirmability, which are discussed in detail in this section. For this research, the focus is on dependability, transferability, and confirmability.

The first criterion, dependability, refers to the consistency and reliability of the data and the interviewee's assessment and interpretation of the data (Korstjens & Moser, 2018). This was achieved by describing the research steps from the beginning of the research through the development and reporting of the findings in a clear and concise manner.

Transferability, the second criterion, is the extent to which the research findings may be applied to various contexts or settings with different respondents (Korstjens & Moser, 2018). The research achieved this criterion if the results have significance for those who aren't participating in the study and readers can connect the findings to their own experiences (Cope, 2014). This is demonstrated in this research by providing a thick description, which explains the context and the environment and improves the capacity to assess the applicability to one's own context (Lincoln & Guba, 1986).

The third and final criterion, confirmability, refers to neutrality, or the extent to which the findings are determined by the respondents rather than by any researcher bias (Korstjens & Moser, 2018). In this study, this was established by showing how conclusions and interpretations were reached and by demonstrating that the findings were drawn directly from the data by including direct quotes for each theme in the coding. Moreover, as an employee in a higher education institution, I did not have any direct relationship with the interviewees, except with

two of my colleagues at work, and was fully aware to report the data as is, without any bias, and ensure that the process remains professional and formal.

4.5 Ethical Considerations

Confidentiality, informed consent, and all necessary approvals were taken into consideration when conducting the research. First, the Institutional Review Board (IRB) approval and the Central Agency for Public Mobilization and Statistics (CAPMAS) approval were obtained since the study was conducted at several universities. This guaranteed that the techniques follow ethical guidelines for performing human-subject research. Moreover, permission to conduct the research at each university was obtained. The consent of the participants being interviewed was also obtained prior to starting the research. In this consent, the purpose of the research study was explained, and the interviewees' participation was voluntary. To ensure confidentiality and privacy, the participants' names were hidden and not disclosed. The researcher also asked permission to record the interviews beforehand and ensured that the recordings would be used for the sole purpose of the research and stored in a password-protected computer and deleted after 1 or 2 years. The transcription and coding of the data took place privately with headphones to ensure confidentiality, and the data was stored safely and securely.

All approvals and research questions are included in the appendices section at the end of the document.

5. Chapter Five: Research Findings

This section discusses the research results in relation to the research questions, literature review, and theoretical framework that guided the study. In light of this, the perspectives of faculty members of the five higher education institutions regarding the use of AI in higher education and how it can be used to achieve equity and accessibility are highlighted. Also, this section sheds light on the challenges of using AI in higher education in Egypt. To start, the role of AI at each institution is explained, which relates to the use of AI in each higher education institution, and then the findings are presented in tandem with the themes based on the theoretical framework, which are performance expectancy, effort expectancy, social influence, facilitating conditions, and perceived risk.

5.1 Role of AI in the Institutions

This section will highlight the role AI currently plays in each institution in order to give context to the study and to the findings below.

The American University in Cairo (AUC)

At AUC, all faculty interviewed stated that at AUC, AI is used through the usage of plagiarism checkers such as Turnitin, for grammar/spelling checkers, used in hackathons by students to design their projects, AUC library has a chatbot, and it is currently an area of interest and concern to the faculty members there. In addition, Faculty 4 stated that AUC is discussing having a School of AI. Moreover, Faculty 2 stated that he uses some AI tools to experiment with in his class. For example, he uses Raw Shorts, a tool that converts text to video, so he uses it to post announcements to students in animated form. Another thing he uses is ChatGPT, and he is considering experimenting with it with his students in class. He also uses a tool that belongs to McGraw Hill and which AUC has it integrated with Blackboard, the learning management

system, and what this tool does is they have a digitalized version of the textbook, and it offers a solution manual adaptively rather than just at the back of the book. In this case, the student is not looking at the solution immediately. They try, and if they get it wrong, they get parts of the answer to guide them. If they get that wrong, they can get a fuller explanation. If they still get it wrong, then they get the complete answer. Moreover, as it does that, it also connects the question to the relevant section in the textbook.

The German University in Cairo (GUC)

All interviewed faculty teach AI-related courses at GUC. Also, faculty 12 and 13 use AI for research, both for their personal interest and with their students in their research projects where students develop AI tools as part of their graduation projects. Faculty 13 stated that GUC is currently in the process of developing a chatbot for its mentorship program.

Ain Shams University

At Ain Shams University, Faculty 6 teaches AI and supervises the thesis where students develop AI tools, similar to Faculty 12 and 13 at GUC. Faculty 8 uses AI as a plagiarism checker, similar to AUC, and given that she is a professor of Curriculum and EFL instruction, she uses it with her language students to practice their language with robots. While Faculty 9, since she is a professor of Strategic Planning and future studies in Education informatics, they do not have AI in their department, but stated that AI is used in the School of Engineering and is used in the School of Medicine, where they perform operations using robots, and they have a school of AI where students create AI tools and apply AI.

Arab Academy for Science and Technology (AAST)

Faculty 9, 10, and 11 all teach AI courses, similar to Faculty 12, 13, 14, and 6. Also, like at the GUC and Ain Shams, the students develop and apply AI tools in their coursework and as part of their graduation projects. Faculty 10 stated that AAST uses AI as part of their decision support system, for example, on trends in certain subjects, students at risk, and so on. Moreover, he added that currently, students are developing a facial recognition AI tool for attendance.

Cairo University

At Cairo University, Faculty 15 teaches it, and they have a whole department specialized in AI. Recently, the name has changed from Faculty of Computers to Faculty of Computers and Artificial Intelligence.

5.2 Performance Expectancy

The following section will shed light on performance expectancy, which is the degree of whether the use of AI will lead to better job performance by the faculty and better learning opportunity for the students.

5.3.1 Chatbots and Digital Assistants

Most faculty members (Faculty 6, Faculty 9, Faculty 13, Faculty 14, and Faculty 15), mentioned that a significant advantage of using chatbots and digital assistants in higher education is that it is always available and offers quick response and guidance. Faculty 14 added to this by mentioning that faculty members are not always available to respond to students' needs. Faculty 6 also gave another example by mentioning that he might be away for a meeting and a student needs him, and he is not available. Another advantage mentioned by Faculty 3 is that it can free up time for them to do more important things. Similarly, Faculty 2 also shed light

on a similar point to Faculty 3, where he mentioned that using chatbots can help the students with basic tasks and then leave high-order tasks to the faculty member. He gave an example with Bloom's taxonomy, where he mentioned that the chatbot could achieve the lowest taxonomy level, then the faculty could work on the higher levels. Faculty 1 mentioned that it could free up time for teaching assistants and reduce the load on them if the questions are boring and repetitive. Faculty 7 shed light on how there is no aspect of education that a chatbot or a digital assistant will not be needed in. For example, she mentioned that she would feed the tool with every step in the higher education process, starting with enrollment and ending with employability. Faculty 9 added to this by saying,

> *Chatbots are available anywhere now, even in shopping. It is no longer a luxury, it's something there, and the students in this generation have already gotten used to it. They got used to not having to find a staff or an actual human to ask; they just use chatbots and virtual assistants (Faculty 9).*

Faculty 15 also added to this by stating that chatbots and digital assistants can serve as academic advisors and as tracking and decision-making tool in this aspect. Faculty 11 mentioned that an advantage to chatbots and digital assistants is that it engages with students in a human-like way and will solve their problems, which in turn will make them more engaged with the university. Faculty 12 also added to this by mentioning that it can be helpful for newcomers when everything is confusing to them and also mentioned that it can serve as a friendly companion to the students. Faculty 13 agreed to that by stating that students might feel more comfortable talking to a machine and revealing information to it because they will feel less judged.

On the other hand, five faculty members, Faculty 4, Faculty 6, Faculty 8, Faculty 9, and Faculty 13, highlighted the importance of human interaction aside from using chatbots and digital assistants. Faculty 8 mentioned that human interaction and connection are vital, and that faculty and students cannot rely on it solely. Faculty 9 also stressed this point by mentioning that a significant disadvantage is if the student becomes more connected to the machine rather than to humans. Faculty 4 additionally added that human interaction makes you empathize with students and understand them more, which is something that will only be recovered if they rely heavily on chatbots and digital assistants. Additionally, Faculty 14 mentioned that role of chatbots would help beyond the classroom, not inside the classroom. Faculty 1, Faculty 4, and Faculty 5 highlighted that a disadvantage to chatbots and digital assistants is that students can get frustrated if it keeps directing them to a solution that they do not want; however, it can be a step towards being moved to human interaction.

5.2.2. Adaptive and Personalized Learning

All faculty members agreed that an advantage this could have in teaching and learning in higher education is that the content is tailored to the student. Faculty 4 agreed to that by mentioning that this tool can work well in helping the faculty identify the student's strengths and weaknesses and adjust the material accordingly, and this is something an instructor cannot do on their own if they have a large number of students. Faculty 13 also confirmed this and added by giving an example that although she tries to do this on her own, it is hard because at the end of the day, she has a specific time and specific curriculum and objectives that she needs to achieve, so having a tool that automates this process would be a great help. This was confirmed by Faculty 2, who mentioned the same thing. Another faculty, Faculty 3, expressed that it needs to work for both the overachievers and those at risk; if this happens, then this is the future. She

mentioned that students do not want to be doing something they already know, so a tool like that will help in this, which Faculty 11 also agrees with. However, Faculty 5 mentioned that it for this to work, it needs to be accompanied by a needs assessment tool. Faculty 13 added that by using this, the students would feel like the system understands them and, thus, be more engaged in learning. Faculty 7 and Faculty 15 both shared the same view that, nowadays, education cannot have a "one size fits all" approach. Faculty 7 added more to that by highlighting that this tool can also help each student receive the reward and punishment they respond better to, and also, this tool will eliminate the idea of having a class for over-achievers and a class for struggling; instead, they will all be learning together, but at their own pace. On the other hand, Faculty 9 mentioned that this tool would eliminate the idea of students learning together and teamwork. This was also shed light on by Faculty 8, who mentioned that she is against individualized learning because, with the zone of proximal development, students can learn better and develop better. Faculty 7 and Faculty 2 mentioned that this tool could help them as faculty members identify which parts to focus on in their learning or repeat.

Building on the issues with using adaptive and personalized learning in higher education, Faculty 1 highlighted that adaptive and personalized learning could be useful only for young children who don't have the judgment to know what to do next; however, for university students, there is value in the faculty member and the students identifying what's next and informing them, so the teacher needs to have agency in deciding what to give or not give the students. She said,

> *"I think as long as the teacher has the majority of the agency over what's going to happen that's good. I think as people get older, it's important for the learner to have that agency so that nothing is hidden from the learner by the AI, that the learner could choose*

to see something different than what the AI is recommending, that's also important because you don't want the AI to limit what someone can see. And the other element is just to make sure that it doesn't produce identical people at the end, like doesn't keep converging everyone into the same box because they keep calling it personalized learning, but it's not really personalized" (Faculty 1).

Faculty *5* mentioned that not all courses should be done that way; it will work better only for self-paced online courses. Faculty 12 seemed to also have a concern about how this can be done in a traditional higher education setting since, as he mentioned, teaching is done in a traditional way, and you must ensure fairness, and he wasn't sure if a tool like that would be fair.

The viewpoints mentioned in this section shed light on how the use of adaptive and personalized learning, if used, may or may not assist the faculty members in making their job better, which is performance expectancy. As mentioned previously, this will be discussed further in the discussion section.

5.2.3 Automated Feedback and Automated Grading

Faculty 6 expressed that the automated feedback and grading process would save a lot of time. Faculty 2 would trust using an automated grading tool in his coursework. However, he mentions that as a human being, you can see the bigger picture of what the students want to say, so you can at least give them partial credit and such, but an AI tool that automates this won't be able to make this judgment and just grade the assignment as is, which was also mentioned by Faculty 9. Similarly, Faculty 10 also shed light on this by saying,

"Sometimes the professor can give the full mark, despite having some errors because it is logical, you feel like he understands, the mistakes he did are minor so the professor will

be empathetic with him, but with an AI automated system, this won't be available" (Faculty 10).

Faculty 8 agreed that human interaction in grading and feedback is important, but her reason was that students need to understand this feedback and understand why they got this grade; AI cannot explain the decision they made. Faculty 13 also agreed to this by adding that currently, AI doesn't provide an explanation as to why the students got this grade, so human interaction is important here. Thirteen out of the fifteen faculty members agreed that human intervention at some point is crucial, whether it is to give reasons or as a second look. However, the fourteenth faculty member, Faculty 15, highlighted that this process doesn't need human interference and would be very useful since depending on humans means that there is a high dependency on their mood. Moreover, the fifteenth faculty member, Faculty 4, mentioned that if there is an accurate tool that is available and does this, he will rely on it heavily since, as he mentioned, grading is the worst part of his job. On the other hand, Faculty 1 mentioned that if she needs a tool to grade the students because she doesn't like grading or she is bored, then it must be boring for the student to do the assignment in the first place, so in this case, she needs to reassess the assignment, instead of relying on a tool to grade. Faculty 1 and Faculty 5 also shed light and agreed on how a tool like this can limit the creativity of students and would result in producing identical people in the end.

On another point, while Faculty member 10 mentioned that AI is ready to give accurate automated feedback and grading, Faculty 12 and Faculty 14 mentioned that currently, AI is unable to do this and is not accurate, especially for essays and design-based questions. Faculty 3 mentioned that the tool would only be as good as the data you feed it.

In this section, the faculty members shed light on how automated feedback and grading can or cannot help them in their teaching and learning, which as a result, would either help or not in achieving their goals in their job performance, which is the performance expectancy.

5.2.4 Emotion AI

Thirteen out of the fifteen faculty members were against the use of emotion AI in the classroom for students. Faculty 5 mentioned that since her classrooms are designed properly using interactive activities, the use of emotion AI won't be needed for the students; it can, however, serve as a tool to inform and guide the professors on their own performance. Faculty 10 agreed and mentioned that this tool can serve as an evaluation tool of a professor's performance in class. Moreover, Faculty 1 highlighted that detecting students' emotions should be done by a faculty member, not by an AI tool. All Faculty except Faculty 7 and Faculty 11 agreed to this. Faculty 4 expressed that the students will not feel at ease if they know they are being watched and added that this is not fair for the students since students have every right to be bored at times. However, he mentioned that something like that could work in an exam because, during an exam, students should be watched anyway. Faculty 2 also agreed that students have a right to be bored sometimes and lose their concentration; he would rather they come up and tell him rather than have a tool that monitors that. He added that a good way to use this tool would be if it were completely anonymous, and it would produce a report maybe every two semesters about when the students felt more engaged and when they felt bored in order to adjust the course material accordingly. In addition, Faculty 3 added that by using this, it would interfere with the natural environment. Also, Faculty 8 mentioned that such a tool would make her lose connection with her students.

On another note, Faculty 14 mentioned that this could be useful if the class is online, where she is unable to see the students' faces. However, Faculty 9 stated that even in online classes, she could tell if the students were engaged or not by the class design and their tone of voice.

To add on, Faculty 13 highlighted that this could be useful with large classrooms since it would be difficult for the professor to be attentive to all students at the same time, but for it to work, the tool must respond back to the professor with a changing technique to do. Faculty 12 did not agree, though, and mentioned that it would work with small classrooms rather than large classrooms.

Faculty 7 and Faculty support the use of emotion AI in higher education. Faculty 7 mentioned that this tool could help her help the student who is bored or seems confused in class without him noticing and causing him embarrassment because, as an educator, she has to make sure the emotional and mental well-being of a student is important, which this tool will help her achieve. She said,

> *I don't know the background of the student and the environment and home he is coming from, so I don't know what he is thinking about, what his fears are, or what makes him anxious and panic, so if I have a monitoring and tracking tool for all that, he will not learn while feeling sad, he won't take in information when he is feeling mad or scared, so if AI can give me these emotional signs and the reasons behind his fears, then in the middle of the lecture I can help him overcome it without him noticing because as an educator (Faculty 7).*

Faculty 11 added on to that by highlighting that having this tool will keep the students more engaged, thus, gain more knowledge.

The use of emotion AI was highlighted, and it showed the different viewpoints of faculty members on how this tool can or cannot help them in their job performance.

5.3 Effort Expectancy

This section includes the effort needed by faculty members to adopt the use of AI. This helps in deciding whether the faculty are willing or not to adopt AI based on their experiences and effort.

A major challenge mentioned by Faculty 2 regarding the use of AI in teaching and learning is the huge amount of professional development needed for faculty. He also added that it depends on each faculty's background and how each background will require more or less effort to become acquainted with the tools. Faculty 5, Faculty 8, and Faculty 7 also agreed to this. Faculty 7 confirmed the importance of professional development and building capacity for all stakeholders, not just the faculty members, as a first initial step to integrating AI in higher education since the lack of awareness is a big challenge. Faculty 8 added that at her institution, faculty need to enhance their general digital skills, to begin with, since they lack it; thus, those groups of faculty members will require more effort to familiarize themselves with AI tools. She also added, similarly to Faculty 7, that changing the beliefs and mindsets of both the faculty and the learners would be a major challenge and would require a lot of effort. Faculty 7 added to this by clarifying that at her institution, the additional effort would be needed for the older generation who refuse the use of technology, as opposed to the younger generation or are open and willing to use technology. This was also confirmed by Faculty 5, who mentioned that the culture and mindsets of the instructors are very important when it comes to adopting AI; she mentioned that some faculty still see the value of the pen and paper for everything, so these faculty members would require more effort. On the other hand, Faculty 14 said,

> *"I don't think this will be hard in the area of higher education in particular because these are highly educated students and professors, so they will accept technologies more. You get more challenges with people who are not educated" (Faculty 14).*

Faculty 8 mentioned that if the faculty put the effort to learn the tools and their mindsets changed, it would save a lot of time for them, remove a burden, and benefit the learner, so the end goal is worth the effort; nevertheless, it is still more work and effort for faculty to try these new things, as mentioned by Faculty 3. Moreover, Faculty 4 highlighted that faculty at his institution has the flexibility to experiment and try these new AI tools. Faculty 3 said,

> *"Faculty are late to the game. The train has already left the station and that we need to really, first of all understand it as educators reeducate ourselves and educate ourselves to understand it and then think creatively on how we can actually embrace and leverage it for good, how we can educate ourselves first and then our students and be very creative in the kinds of to really question why are they here?" (Faculty 3).*

Faculty 9 also added that the technology has already evolved from a long time ago, and things are becoming simpler, so the effort needed to learn, use, or even develop an AI tool has become easier and requires less effort. Faculty 11 disagreed and mentioned that developing AI tools still require a lot of effort. Another challenge to the use of AI in higher education, according to Faculty 10 and Faculty 12, is that it would require a lot of effort from the instructor's side if the classroom were big. Also, it would require a lot of effort if the tool was complex, like the emotion AI, as mentioned by Faculty 12.

5.4 Social Influence

In the section below, the social influence, which is the degree to which others use AI and its popularity. Also, how AI may or may not achieve equity and accessibility will be discussed in this section.

Generally, AI is already there and available and being used by people from across different sectors.

"Artificial intelligence is a path to all sectors (Faculty 15)".

Faculty 5 mentioned that AI is going to affect internationalization and ranking and that now they are obliged to be part of the game; there is no other choice or else they will be left behind, so higher education institutions need to face it, work on it, and develop a plan for it. Faculty 10 agreed and said:

> *"It's the future. Don't stop in front of the train; either ride it or stand in front of it and let it pass you. AI is the train; will you stand in front of it, or will you ride the train? You need to ride the train, even if you took the last seat in the train but ride it" (Faculty 10).*

Faculty 3 also mentioned this analogy by saying,

> *"Students are already using it. Faculty are late to the game. The train has already left the station and that we need to really, first of all understand it as educators reeducate ourselves and educate ourselves to understand it and then think creatively on how we can actually embrace and leverage it for good, how we can educate ourselves first and then our students" (Faculty 3).*

Additionally, Faculty 7 agreed and mentioned that now, there isn't an aspect of life that doesn't include AI, and thus, higher education institutions need to act instantly and catch up before it is too late. Faculty 12 corresponded and mentioned that it is something that cannot be avoided

anymore, and that AI should be embraced wholeheartedly, especially on the level of the student due to the endless job opportunities in this field.

> *"It is pointless to actually resist embracing this technology that has such potential in so many different types of applications" (Faculty 12).*

This was also shed light on by Faculty 15, who mentioned the importance of AI in education since it is related to the future job market needs since now, skills and knowledge of AI are needed to be able to compete in the job market both locally and internationally. Faculty 11 also agreed to this by stating that AI is crucial for students to be able to have skills that match the job market.

Moreover, Faculty 14 highlighted the demand and willingness of students to explore AI by stating that there is an increase in enrollment for studying artificial intelligence, and even in computer science lectures, the first thing they ask is about when they will start covering AI. Also, Faculty 6, Faculty 10, Faculty 12, and Faculty 15 confirmed this and expressed how students are increasingly being interested in studying AI. Faculty 7 also agreed and mentioned that now, almost all universities have either a faculty or a department or a degree in AI, and this happened 3 years ago when the Ministry of Communications and Information Technology created its AI strategy. This takes us to what Faculty 4 mentioned about how AUC is considering having an AI degree. This shows the high demand and interest among students from different majors to study AI. Faculty 11 also highlighted that AI should be included in all departments and majors. Faculty 6, Faculty 10, and Faculty 15 also agreed and stressed on the use of AI across all disciplines. For example, as mentioned by Faculty 10 and Faculty 15, AI can be used in music to write symphonies, AI can be used in medicine for diagnosis and to perform surgeries using VR, AI can be used in law to make decisions based on the abundance of data on previous law cases, it

can also help business to predict stock market prices. Moreover, it can help in art and design to learn from previous styles and themes and produce a painting; accordingly, it can also be used in journalism and media to detect fake news and news credibility.

On another note, faculty members shed light on how AI can or cannot achieve equity and accessibility to higher education. Faculty 12 highlighted that AI could help autistic students adapt to their condition. Faculty 3 agreed and added that AI can be used to help people with autism understand body language and facial cues. She also added that AI could help in generating alternative text for visually impaired students to ensure that all students can see and experience the same thing; this was also mentioned by Faculty 12 and Faculty 9.

Another example mentioned by Faculty 2 is that,

> *"By 2050, there should be 30 million people in higher education," and with the number of institutions Egypt currently has, it won't be possible to fit 30 million people; thus, AI with MOOCs and micro-credentials can fill in this gap and provide access to education to the large number of Egyptians" (Faculty 2).*

Yet, Faculty 8 stated that this in itself creates a divide in that not all students get the same opportunity for education, but at least it is something, rather than not having anything at all. Faculty 14 added that the use of an adaptive classroom in rural areas for people who cannot physically come to a higher education institution would help with access. This was also mentioned by Faculty 13, who highlighted that AI could be used to help identify students in rural and disadvantaged areas who benefit most from specific programs. This was also confirmed by Faculty 15, who stated that AI could serve as an aid to the instructor to let them know how a certain disability affects the students' skills, and accordingly, the student can get the content in the way and pace that suits them. This was also highlighted by Faculty 1, Faculty 7, Faculty 10,

and Faculty 11, who shed light on how adaptive and personalized learning can be used to help students with a disability or from a marginalized area. Faculty 11 added that AI could help the instructor predict a problem a student might be facing, and then the instructor can act accordingly. Another example provided by Faculty 10 is to have an AI assistant with those disabled to help them decipher certain content based on their impairment, for example, to help with sign language communication between professor and student. Faculty 1 also shed light on how AI can help those disabled and who cannot draw; AI can help them express themselves better. Faculty 1 also mentioned that the goal of AI is to achieve access to knowledge in rural areas where there aren't enough teachers, so it is better than nothing; however, there is a differentiation between what is better than nothing and what is good enough. Faculty 2 added that, just like there are private tutoring centers, there could be centers for AI support where students can go learn and take take-home activities; this will help with access; however, whether it translates to equity or not, this depends on how policies are designed, but AI can help with access. On the other hand, Faculty 6 stated that AI could help in achieving equity and accessibility, but there will always be differences among students, no matter what. Faculty 1 said,

> *"What I worry about is always that education becomes, you know, two-tiered, you know, the people who can afford, and the people can't afford, and the ones who can't afford don't get access to a teacher, they just get access to these machine things" (Faculty 1).*

This highlights how the issues of accessibility and equity with AI can go both ways, yes, it can create opportunities, yet there will always be divisions and inequity in some way, shape, or form. Faculty 10 mentioned that in order to achieve accessibility, students will need internet and a

device, which takes us to the following section on facilitating conditions that affect the use of AI in higher education.

5.5 Facilitating Conditions

This section will report the findings on the facilitating conditions, which in other words, are the resources, infrastructure, and policy guides that either help or do not help in using AI in higher education.

All faculty members stated that currently, there is no policy text specifically for AI in their higher education institution. Faculty 1 stated that there is a general academic integrity policy but nothing specific for AI. Faculty 3 mentioned that it is up to each faculty to decide how they want to use AI in their classroom. Moreover, Faculty 9 highlighted that she was a member of the UNESCO AI ethics document, but this was a general document and not specific to her institution. She also added that a team was formed, which she was part of, who worked on an Arab Strategy for Artificial Intelligence as part of the Arab League of States, but again, it was general and not specific to their institution. Additionally, Faculty 10, who is from the same institution, stated that there is a general technology policy that has issues with privacy and ethics, but it is not specific to AI. Faculty 7 also added that institutions do not have a proper implementation strategy or policy document to abide by, which is a major challenge. She stated that her university has a general strategic plan that mentions the use of advanced technology to be used in teaching and learning but does not specifically mention AI. Faculty 14 added that it would be helpful if the ministry provided higher education institutions with a general code of what is acceptable or not in AI, which is something that has been discussed a lot in AI conferences. On the other hand, Faculty 5 sees that AI is a tool, not an end, so an entire strategy

or policy text on its own is unnecessary; it can be included in other things, such as the use of technology.

On another note, Faculty 7, Faculty 10, and Faculty 15 agreed that the readiness of institutions for AI is a major challenge due to the weak infrastructure, weak internet, and the unavailability of data, and the high cost of technology, which is what AI tools rely on. Faculty 2 added that with the internet, 5G is already coming to places like Cairo and Alexandria, and in upper Egypt, they are getting 4G internet, so using these resources and a mobile phone or an iPad, people can have access to vocational learning using AI. However, Faculty 1 and Faculty 8 stated that this limits access to those who have access to a device or the internet only, which is not everyone. Faculty 8 added that not having access to the internet is a major challenge in the use of AI in higher education. This was also confirmed by Faculty 5, who mentioned that based on her experience, the students from upper Egypt suffered a lot due to the poor quality of the internet and the high cost of it. Faculty 12 also highlighted the challenge of massive computing power needed for AI that costs a lot of money. On the other hand, Faculty 2 and Faculty 4 stated that AUC as an institution is ready with the infrastructure and system to support, develop, and integrate AI.

Moreover, Faculty 3 and Faculty 13 shed light on how a strong learning management system with a strong backend is needed to be able to manage the use of AI tools, especially with something like adaptive and personalized learning. Additionally, the use of Arabic in AI is still not fully supported, as highlighted by Faculty 15 and Faculty 10. Faculty 15 highlighted that in English, AI tools are fully supported and operational, yet in the Arabic language, there is still a problem with accuracy and such. This affects how institutions and specific departments can integrate AI into their teaching and learning. On the other hand, Faculty 4 and Faculty 14

mentioned that using chatbots would be the easiest to implement in terms of technology, data, and cost.

Another point mentioned by Faculty 7, Faculty 9, and Faculty 11 is that funds and financial support need to be allocated to academic research in order to encourage innovative ideas and tools regarding AI.

As concluding remarks, Faculty 6 said,

> *"I wish there was an institution for AI because, unfortunately, now everyone is using the term AI for propaganda and for fun, but there isn't anything practical being used and implemented and supported by policy guidelines. The country needs to follow up with higher education institutions to check on the research being published, check what is exactly being done, and so on. If there were an AI institution in Egypt, it would have been in charge of that" (Faculty 6).*

Faculty 11 also mentioned this idea and proposed that colleges of computing and AI become centers of excellence for other places, departments, and industries to benefit from them on the use of AI in their discipline, and it can be an initiative to give back to the community. On that same note, Faculty 7 and Faculty 14 highlighted that instructors from different departments would need someone from the department of AI to work together to build the AI tool or system. This confirms the idea of Faculty 11 to have a center that supports all AI initiatives from all departments and industries. Moreover, Faculty 15 added that although the future is promising, Egypt still doesn't have the technological infrastructure, strategy, or data to support AI, there are ambitious directions, but it is still in the initial phase, and governmental support is needed to be able to move forward. Faculty 10 also highlighted that it is important for Egypt as a country not to follow a pre-designed solution to use AI but instead design their own solution based on their

context and take it step by step by laying out the priorities and ways of implementation, monitoring, and evaluation. Faculty 7 also concluded by mentioning that the Ministry of Communication and Information Technology in Egypt is already exerting efforts to create an AI strategy and work on the digital transformation of the country, so now there is more talk and support for it. She said,

> *"I can see the future with the digital transformation going on, and with all ministries collaborating, I see that phase 2 will be expanding to AI. So, I see that all universities in Egypt are following clear and strong steps, and soon in the future, in higher education institutions, I will be optimistic and say 70-80% will rely on AI. There is no future in higher education institutions without AI" (Faculty 7).*

Another concluding remark mentioned by Faculty 5 is that AI can be used to manage the university's resources, which in return, will help in providing the resources and facilitating conditions needed for the institution to integrate AI. She gave an example of how AI can be used for facility management and working on the utilization rate of space, light, and other resources. This section sheds light on how the facilitating conditions, such as resources and infrastructure, affect the adoption of AI in institutions. Further explanation will be provided in the discussion section.

5.5 Perceived Risk

Perceived risk, which is the degree to which an individual perceives that the use of technology may result in negative consequences or harm, will be presented in this section in relation to AI.

All faculty members agreed that the major challenge with the use of AI is data protection, surveillance, bias, and privacy. Faculty 11 explained further that everything related to AI needs

data, and so privacy and confidentiality are major issues when using AI with students in education. Faculty 1 also added that face detection is an issue with AI because sometimes the data cannot identify a certain race or color. Faculty 15 agreed and added that discrimination is a major challenge when using AI. Faculty 1 gave the example of a game that uses AI and lets you draw something, and others guess it, in which she mentions that the words and drawings are Westernized and very culturally specific. She also gave an example of how when you Google "Professor," you are more likely to find an elderly white male. Faculty 1 said,

> *"The main issue with is the surveillance elements of just watching someone, and then letting an artificial intelligence decide if they're doing something wrong, rather than a human being. It's, it feels very big brother" (Faculty 1).*

This was also mentioned by Faculty 11, who agreed and stated that AI is only biased towards the data they receive, affecting what the students receive. In addition, Faculty 12 highlighted how using AI tools would result in privacy concerns and said,

> *"Anything that is related to AI must consider the privacy and implications of designing such an application because the smarter it gets, that means the more access it needs to personal information. That's how it actually becomes smarter. That's always the tradeoff" (Faculty 12).*

He added that students' consent and agreement need to be obtained before using anything related to AI with them.

On the other hand, Faculty 2 stated that the perceived risks would be short-lived and that developers would find tools and ways to overcome these issues. Faculty 15 also agreed and mentioned that even though people fear confidentiality and privacy concerns, however, as a professor specializing in AI, he doesn't like to look at the disadvantages because he believes that

they can be combated through many tools and applications. Another way Faculty 9 mentioned overcoming the perceived risks is to have each institution develop its own tools, not buy them from external developers, in order to avoid cybersecurity attacks.

A major aspect that perceived risk is high is the use of emotion AI, which was mentioned above. All faculty members highlighted this. Faculty 3 mentioned that she would not be comfortable using something that requires surveillance in the classroom as this would make the students uncomfortable. Faculty 1 also mentioned that with emotion AI, there are a lot of assumptions that it is okay for technology to track the students that way. She also added that surveillance and being watched make the students behave differently and that the default and normativity in it are based on the idea that all people are normal and the same and disregard those who might have a certain disability. Faculty 4 and Faculty 13 also agreed that using this will alter how students behave and project their emotions in the classroom.

Another issue mentioned by Faculty 14 is whether students will trust even to use the AI tools or not. Faculty 10 also added that students' psychological aspects might be affected if they got used to communicating and dealing with a lot of AI tools. To overcome this, Faculty 7 shed light on the idea that all stakeholders need to be involved in the process and that it should be communicated to the students that this is for them and will help solve a lot of their problems while ensuring that their privacy and confidentiality will be protected.

As concluding remarks, Faculty 1 mentioned that the learners need to have control and agency over how their data is used and grant permission to have their data used in that way. She also concluded that there will always be more data and new data that the tool is not fed, so there will always be bias. Faculty 12 mentioned that faculty members need to do a better job in teaching privacy problems and issues that can happen as a result of using AI. With that being

said, this section highlighted the perceived risks and trust of using AI in higher education. Despite almost all faculty members mentioning that using AI in higher education comes with privacy, confidentiality, bias, discrimination, surveillance, and data protection issues, nevertheless, some faculty members were still optimistic and provided solutions to overcome these challenges.

6. Chapter Six: Discussion and Conclusion

The following section includes a discussion of the findings in relation to the research questions, theoretical framework as well as literature. Moreover, the limitations and future areas of research are also discussed.

To begin with, it is worth noting that, as per the theoretical framework, the themes and components of the framework were intertwined, so one item can go under two of the five themes. For example, changing the mindset of the stakeholders could go under the social influence as well as under effort expectancy. Additionally, the perceived risk theme was adopted from other technology adoption models as a fifth element to use for the purpose of this research. Moreover, the equity and accessibility aspect were mentioned under the social influence, yet, it could have gone under a separately-established aspect that deals specifically with equity and accessibility in the use of technology. Overall, the findings were in tandem with the UTAUT model (Venkatesh, et al., 2003) since the research shed light on using AI in higher education, and the UTAUT (Venkatesh, et al., 2003) model is all about the willingness to adopt a new technology.

Based on the findings and the literature, supporting AI and its adoption can help in achieving the Sustainable Development Goals (SDGs) relating to quality education, innovation, infrastructure development, and poverty reduction. This is shown in how faculty described AI as transversal to all industries and sectors and how it will improve the skills the students gain as now, with the many AI tools available to help with low-order skills, faculty can help the students gain high-order skills. Moreover, the findings were used as a way to contextualize the use of AI in higher education in Egypt, and as per the results, the faculty members are ready and willing to embrace this new technology with various degrees. The findings are discussed in more detail below in relation to the research questions.

6.1 Research Question 1

What are the faculty experiences on the use of AI in higher education in Egypt in teaching and learning?

The first research question was consistent with the literature review as well as the theoretical framework, specifically the elements of performance expectancy and effort expectancy. The results mainly showed a positive relationship between the use of AI in teaching and learning and performance expectancy. The findings showed that all participants believe that they should adapt to the reality that AI should be integrated into their teaching and learning. Chatbots were seen as the tool that would be easier and quicker to implement and students and the institution would benefit from it as it would save time; this was also confirmed by the literature by Popenici and Kerr (2017). However, human interaction cannot be disregarded or replaced. Moreover, adaptative and personalized learning was seen as a tool that would benefit the students since they will learn based on their own pace and level, but still, teamwork and group learning is important. I think that if this were implemented, it would work very well with online learning since this would make the content adaptable to the learner and won't need human interaction. For automated grading and feedback, both the findings and the literature agreed that it saves time; however, the findings showed that a second look by a human would be important. I think that the issue of automated grading and feedback can fall into the pitfall of producing similar students and reducing creativity, as mentioned by some participants. Moving on to emotion AI, while the literature shed light on how it can be useful for student engagement (Pabba & Kumar, 2021), the findings showed that faculty wouldn't prefer using such a tool in a classroom since it would be an invasion of privacy and would alter the natural environment and behavior. I think that if used as a formative assessment tool for the faculty to monitor themselves

and their content, as a few participants mentioned, then it could yield positive results. Moreover, it was highlighted how AI could, in the end, lead to the students being able to compete in the job market both locally and internationally since they will have the skills needed relating to AI. Overall, the findings presented showed how the use of AI tools can be used in teaching and learning regarding the first aspect of the theoretical framework, which is performance expectancy. This was demonstrated by how the points mentioned showed whether the use of AI would either serve as an aid for the faculty members to attain gains in their job performances or not.

Regarding effort expectancy, findings showed the effort required to integrate AI into their teaching and learning. It highlighted that it would require major professional development, capacity building, and a change of mindset but that, in the end, the effort would be worth it. Moreover, it was evident that different backgrounds of faculty members would require more effort to adopt AI than others. For example, engineering and science backgrounds are more advanced and would require less effort than, for example, those from an education or arts background. This is why I think it is important, as mentioned also by a participant, that a place is offered where those more experienced can share resources and expertise with others. This is in line with what is mentioned in the literature about the efforts of the Center for Learning and Teaching at AUC, where they are already providing resources for faculty members on the use of AI and holding workshops related to AI. However, all the effort required to adopt AI would be worth it and have a high return since AI is there, and faculty and institutions need to adapt to it.

Regarding the facilitating conditions, the results of the interviews showed that none of the institutions currently have a policy text or strategy specifically for AI. Accordingly, with the increased interest and use of AI in higher education institutions, I think a policy text needs to be

developed in order to guide how AI can be used and ensure that students' ethical concerns are being taken into consideration and that the perceived risks mentioned above are being controlled. This can be guided by UNESCO's AI and education: guidance for policymakers (UNESCO, 2021), which one of the faculty members mentioned that she was already part of. This also confirms the literature that mentioned that the document takes into consideration developing and low socio-economic countries and includes them in decision-making. It can also be guided by Egypt's National Artificial Intelligence Strategy (NCIT. (n.d.). It is also consistent with what one of the faculty mentioned about the government creating a policy guide for institutions to let them know what is acceptable and what isn't. This policy text, though, would have to take the context of Egypt as a developing country when developing it. Moreover, all stakeholders should be included in the process, and faculty from different backgrounds as well as faculty who were less excited about AI than others, since those would also add a different perspective. Additionally, this policy text would need to take into consideration those less fortunate and guide how AI can be used to achieve equity and accessibility, as mentioned by UNESCO (2019).

While the willingness and excitement of faculty members are there, the readiness of the institutions regarding the infrastructure, data, and funds is still a major challenge, according to the interviews conducted. While most faculty members shared this viewpoint, this was conducted on a small sample, so it cannot be generalized. Moreover, UNESCO (2019) mentioned that AI would achieve equitable access to all using AI; however, some faculty members had concerns regarding this as they viewed AI as a possibility to widen the gap since, as mentioned, the students would need good internet and a device. While some faculty members believed that Egypt was ready for this, others still had their skepticism. Moreover, the findings were not in tandem with UNESCO (2019) mentioning that AI will achieve equitable access to all using AI;

then, as some faculty members mentioned, devices and the internet are needed for AI to be used, and currently, this might not be the case.

Overall, results show that there is still effort needed in the facilitating conditions in order to have a successful adoption of AI.

6.2 Research Question 2

How could AI be used in teaching and learning in higher education to achieve equity and accessibility in Egypt?

This question was highlighted under the social influence theme in the findings, which is in tandem with the social influence aspect in the theoretical framework. The results showed the social influence of using AI and the demand or willingness to use it, as well as whether using it can help in achieving equity and accessibility, which, if so, will result in more people adopting and using AI, leading to an increase in social influence. Additionally, if achieved, it will help in achieving SDG 4, as mentioned by the literature (Popenici & Kerr, 2017). Moreover, the literature and the results highlighted that there is a direct relationship between the use of AI and adapting to the disabled. Both the literature and the findings shed light on examples of different disabilities and how AI can help in overcoming them. Also, the findings and literature by Holstein and Doroudi (2021) were aligned in that AI can help those without access to education; however, it can also create a wider divide. The availability of the internet and devices is still a challenge faced by those in disadvantaged areas. While the literature mentioned how developing countries are creating initiatives to help in overcoming this obstacle, none of the findings shed light on initiatives being taken here in Egypt.

In addition, findings showed how higher education is now a growing market, and Egypt will need to adapt and create new ways to compete with this high demand in the future; thus, AI

can be used to achieve this access to higher education by creating AI-led learning opportunities. However, there would be a trade-off in whether something is better than nothing.

Accordingly, policy-makers should have inclusion and equity as a main priority in their planning in order to tackle the issue of accessibility. The findings highlighted several ways in which AI can be used to achieve equity and accessibility, and I think the government and policy-makers can make use of these suggestions when drafting a policy guide for the use of AI in higher education in Egypt while taking into account the UNESCO (2021) document mentioned above in the literature on AI in education: Guidance for Policymakers, which stated that AI-based solutions could help achieve equity and accessibility while highlighting ways to assure ethical considerations are being adhered to.

6.3 Implications of the Study

Based on the research and analysis of available literature, it is evident that there is a growing popularity of AI in higher education, and faculty members are keen to incorporate it into their teaching practices. It can be concluded that according to the UTAUT model (Venkatesh, et al., 2003) and the findings, faculty members have high levels of performance expectancy, effort expectancy, and social influence. However, there are still some areas that require attention, particularly facilitating conditions and perceived risks. As a result, the study has several implications for the effective integration of AI in higher education.

According to the results, while faculty members stated their experience and viewpoint on the use of AI in higher education, and while the viewpoints were generally positive and supported the usage of AI in teaching and learning, there were still concerns and challenges that they shared. This study showed that the government needs to create initiatives to help tighten the gap between social classes in order to achieve equity and accessibility by providing access to

good internet and devices. Moreover, policymakers need to develop a well-rounded policy for the Egyptian higher education context that takes into consideration the socio-economic challenges of the country. Also, this policy needs to include a section on inclusion as well as on the perceived risks and ethical considerations associated with using AI in an educational setting. This can be achieved by following UNESCO (2021)'s "AI and Education: guidance for Policy-makers" document, which takes into consideration the ethical, inclusive, and equitable use of AI in education. From this, individual institutions can then adopt this policy and create their own strategies to achieve the policy goals.

Another implication of this study is that it can serve as a lens for educators in higher education institutions to view how faculty members are responding to the use of AI in teaching and learning and can use this as a guide to start integrating AI in their institutions through the tools mentioned in the study. As mentioned by the participants, AI is there; it's the reality, and they gave the analogy of the train. The train is there, so you can either ride it or watch it as it passes you.

Moreover, AI can help in providing access to higher education since, in the future, the demand for higher education will exceed the supply; thus, decision-makers can study how they can create AI-led learning opportunities for students.

6.4 Conclusion

In conclusion, according to the UTAUT model (Venkatesh, et al., 2003), faculty members are generally willing to adopt using AI as they scored high on performance expectancy, effort expectancy, and social expectancy, yet there are still challenges when it comes to facilitating conditions and perceived risk. The use of AI in higher education institutions in Egypt has the potential to revolutionize the way students learn, professors teach, and institutions

operate. By leveraging the power of AI, universities can personalize learning experiences, reduce effort, save time, equip students with skills needed in the labor market, and provide more equitable and accessible solutions, depending on how AI is being used. However, the adoption of AI in higher education institutions in Egypt is still in its early stages, and there are several challenges that need to be addressed, such as data privacy concerns, lack of infrastructure, and the need for upskilling educators, and the availability of a policy text or strategy. Despite these challenges, the potential benefits of AI in higher education make it a technology that cannot be ignored. As such, universities in Egypt should continue to explore and experiment with AI to fully realize its potential in enhancing the quality and access to education.

6.5 Limitations

There were several limitations in this research study. Firstly, the intention was to interview a range of 2-4 people from each of the five institutions, leading to a range of 10-20 interviews, with an equal number of participants from each institution. However, there was an imbalance in the number of interviews from each institution, and only fifteen interviews were conducted. This was an issue in that each university did not have equal representation and an equal number of people from different departments and/or positions in the universities. For example, there were five interviews from AUC, three interviews from GUC, Ain Shams, and AAST, and only one interview from Cairo University, so there was much more representation from AUC than from Cairo University. There was also another limitation in the way each faculty member understood the tools and the terms, and this was evident in the way they responded. Moreover, another limitation is that the interviews were conducted over a large period, so by the time this research was written, there were already new AI tools available and being explored by institutions in Egypt. Also, this study cannot be generalized since the findings were gathered

from a small sample. Lastly, since this is a very timely topic, more resources, information, and data become available every day, which takes us to the recommendations for future research mentioned below.

6.6 Recommendations for Future Research

Future research can include studying the students' perspective when it comes to the use of AI in higher education since the main intention of adopting AI in higher education is to provide the students with a better learning experience, so their perspective on the matter would also add depth to the phenomena. Moreover, more viewpoints can be studied from other institutions in Egypt to be able to generalize the findings or even study one institution on its own in depth. Also, the study on the use of AI in K-12 education could be studied. Additionally, each AI tool used in teaching and learning can be researched independently. Also, how AI can be used to achieve equity and accessibility can be researched further in-depth in terms of the different types of disabilities as well as the different ways equity could be achieved. Another area of research could be how AI can be used in higher education for administrative purposes, not just in teaching and learning. As mentioned above, since this is a very timely topic, new AI tools and technologies emerge daily, so this research area is just in its beginning, and there will be more to come.

References

Acampado, A. (2019). Understanding experience: Dewey's philosophy. *International Journal of Educational Research and Studies*, *1*(1), 1–6.

Akgun, S., & Greenhow, C. (2021). Artificial Intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*. https://doi.org/10.1007/s43681-021-00096-7

Akinwalere, S. N., & Ivanov, V. (2022). Artificial intelligence in higher education: Challenges and opportunities. *Border Crossing*, *12*(1), 1–15. https://doi.org/10.33182/bc.v12i1.2015

Alaa El-Din, M. (2022). *Communications Ministry, Dell offer AI training to students of 5 universities*. Daily News Egypt. Retrieved April 15, 2022, from https://dailynewsegypt.com/2022/01/20/communications-ministry-dell-offer-ai-training-to-students-of-5-universities/

Aldosari, S. A. (2020). The future of higher education in the light of artificial intelligence Transformations. *International Journal of Higher Education,9*(3), 145-151. https://doi.org/10.5430/ijhe.v9n3p145

August, S. E., & Tsaima, A. (2021). Artificial intelligence and machine learning: An instructor's exoskeleton in the future of Education. *Innovative Learning Environments in STEM Higher Education*, 79–105. https://doi.org/10.1007/978-3-030-58948-6_5

Baker, R. (2021). Artificial intelligence in education: Bringing it all together. In *OECD Digital Education Outlook 2021: Pushing the Frontiers with artificial intelligence, Blockchain and Robots. essay,* OECD Publishing, Paris, https://doi.org/10.1787/589b283f-en

Baker, R. S., & Hawn, A. (2021). Algorithmic bias in Education. https://doi.org/10.35542/osf.io/pbmvz

Baker, T., & Smith, L. (2019). *Educ-ai-tion rebooted? exploring the future of artificial intelligence in schools and colleges.* Technical report, Nesta Foundation. Available online at: https://media.nesta.org.uk/documents/Future_of_AI_and_education_v5_WEB.pdf

Bartneck, C., Lütge, C., Wagner, A., & Welsh, S. (2020). What is AI? *An Introduction to Ethics in Robotics and AI*, 5–16. https://doi.org/10.1007/978-3-030-51110-4_2

Bauer, R. A. (1960). "Consumer behavior as risk raking," in *Proceedings of the 43rd Conference of the Dynamic Marketing for a Changing World*, ed. R. S. Hancock (Chicago, IL: American Marketing Association), 389–398.

Bayne, S. (2015). Teacherbot: Interventions in automated teaching. *Teaching in Higher Education*, *20*(4), 455–467. https://doi.org/10.1080/13562517.2015.1020783

Biggs, P., Cerwall, P., Gustafsson, G., Johnson, H., Forsberg, L., Henrikus, H., Airtel, B., Ilves, K., Lepczynski, S., Hemmerlein, C., Kirkpatrick, R., Luengo-Oroz, M., Romanoff, M., Dzouankeu, T., Vacarelu, F., Dawes, L., Exelby, B., Gillet, J., Pshenichnaya, N., ... Suleiman, J. (2018). The state of broadband 2018: Broadband catalyzing sustainable development. *Broadband Commission for Sustainable Development.* ITU, Geneva

Bliss, L. A. (2016). Phenomenological research. *International Journal of Adult Vocational Education and Technology*, *7*(3), 14–26. https://doi.org/10.4018/ijavet.2016070102

Braiki, B. A., Harous, S., Zaki, N., & Alnajjar, F. (2020). Artificial intelligence in education and assessment methods. *Bulletin of Electrical Engineering and Informatics*, 9(5), 1998–2007. https://doi.org/10.11591/eei.v9i5.1984

Brennen, E. (2020). *AI-powered grading software earns high marks*. UMass Lowell. Retrieved from https://www.uml.edu/news/stories/2020/gradescope-software.aspx#:~:text=Gradescope%20lets%20faculty%20scan%20the,online%20using%20AI%2Dpowered%20software.

Center for Learning and Teaching. The American University in Cairo. (n.d.). Retrieved March 2023, from https://www.aucegypt.edu/faculty/center-learning-and-teaching

Chan, C., & Tsi, L. (2023). The AI revolution in education: Will AI replace or assist teachers in higher education? *Computers and Society*. https://doi.org/https://doi.org/10.48550/arXiv.2305.01185

Chowdhury, A. (2022). *The 4th Industrial Revolution must close the digital divide*. 404. Retrieved April 15, 2022, from https://news.cgtn.com/news/2022-03-19/The-4th-Industrial-Revolution-must-close-the-digital-divide-18wD0lTuWfm/index.html

Cope, D. G. (2014). Methods and meanings: Credibility and trustworthiness of Qualitative Research. *Oncology Nursing Forum*, *41*(1), 89–91. https://doi.org/10.1188/14.onf.89-91

Creswell, J. W., & Poth, C. N. (2017). Qualitative inquiry and research design: Choosing among five approaches. *Sage*.

Dhawan, S., & Batra, G. (2021). Artificial intelligence in higher education: Promises, perils, and perspective. *OJAS,*11-21.

Digi-bot, the digital transformation chat-bot. The American University in Cairo. (2020, June 4). Retrieved from https://in.aucegypt.edu/announcements/digi-bot-digital-transformation-chat-bot

Gardner, J., O'Leary, M., & Yuan, L. (2021). Review for "artificial intelligence in educational assessment: 'breakthrough? or Buncombe and ballyhoo?'". *Journal of Computer Assisted Learning*, 37(5), 1207–1216. https://doi.org/10.1111/jcal.12577

González-Calatayud, V., Prendes-Espinosa, P., & Roig-Vila, R. (2021). Artificial intelligence for student assessment: A systematic review. *Applied Sciences*, 11(12), 5467. https://doi.org/10.3390/app11125467

Guba, E., & Lincoln, Y. (1994). Competing paradigms in qualitative research. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105–117). Thousand Oaks, CA: Sage.

Haddawy, P., Khanal, P., Suebnukarn, S., Dailey, M. N., & Rhienmora, P. (2010). A virtual reality simulator for teaching and evaluating dental procedures. *Methods of Information in Medicine*, *49*(04), 396–405. https://doi.org/10.3414/me9310

Halaweh, M. (2023). Chatgpt in education: Strategies for responsible implementation. *Contemporary Educational Technology*, *15*(2), 1–11. https://doi.org/10.30935/cedtech/13036

Holstein, K., & Doroudi, S. (2021). Equity and artificial intelligence in education: Will "AIEd" amplify or alleviate enequities in education? https://doi.org/10.48550/arXiv.2104.12920

Jain, G. P., Gurupur, V. P., Schroeder, J. L., & Faulkenberry, E. D. (2014). Artificial intelligence-based student learning evaluation: A concept map-based approach for analyzing a student's understanding of a topic. *IEEE Transactions on Learning Technologies*, 7(3), 267–279. https://doi.org/10.1109/tlt.2014.2330297

Jain, S., & Jain, R. (2019). Role of artificial intelligence in higher education- An empirical investigation. *IJRAR- International Journal of Research and Analytical Reviews,* 6(2), 144–150.

Janiesch, C., Zschech, P., & Heinrich, K. (2021). Machine learning and deep learning. *Electronic Markets*, *31*(3), 685–695. https://doi.org/10.1007/s12525-021-00475-2

JISC. (2021). *AI in tertiary education: A summary of the current state of play*(Rep.). https://repository.jisc.ac.uk/8360/1/ai-in-tertiary-education-report.pdf

Kolchenko, V. (2018). Can modern AI replace teachers? not so fast! artificial intelligence and adaptive learning: Personalized education in the AI age. *HAPS Educator*, *22*(3), 249–252. https://doi.org/10.21692/haps.2018.032

Korstjens, I., & Moser, A. (2018). Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice*, 24(1), 120-124.

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature*, *521*(7553), 436–444. https://doi.org/10.1038/nature14539

Lincoln, Y. S. & Guba, E. G. (1986). Judging interpretations: But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. In D. D. Williams (Ed.) Naturalistic evaluation. New directions for program evaluation, no. 30. San Francisco: Jossey-Bass.

Loveluck, L. (2012). Education in Egypt: Key Challenges. *Chatham House,* 1-16.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed. An argument for AI in Education. London: Pearson.

Luckin, R. (2017). Towards artificial intelligence-based assessment systems. *Nature Human Behaviour*, *1*(3). https://doi.org/10.1038/s41562-016-0028

McStay, A. (2019). Emotional AI and Edtech: Serving the public good? *Learning, Media and Technology*, *45*(3), 270–283. https://doi.org/10.1080/17439884.2020.1686016

Mhlanga, D. (2021). Artificial Intelligence in the industry 4.0, and its impact on poverty, innovation, infrastructure development, and the Sustainable Development Goals: Lessons from emerging economies? *Strides in Development of Medical Education*, *14*(3), 1–6. https://doi.org/10.3390/su13115788

Microsoft & Times Higher Education. (2019). *The THE-Microsoft survey on AI.*

Microsoft & Times Higher Education. (2020). AI in higher education survey. Retrieved from https://info.microsoft.com/ww-landing-AI-in-higher-education-survey.html

Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball sampling: A purposeful method of sampling in qualitative research. *Strides in Development of Medical Education*, *14*(3). https://doi.org/10.5812/sdme.67670

NCIT. (n.d.). Egypt National Artificial Intelligence Strategy. https://mcit.gov.eg/Upcont/Documents/Publications_672021000_Egypt-National-AI-Strategy-English.pdf

OECD. (2019). Education and AI: Preparing for the future. AI Attitudes and Values. Retrieved from https://www.oecd.org/education/2030/Education-and-AI-preparing-for-the-future-AI-Attitudes-and-Values.pdf

Pabba, C., & Kumar, P. (2021). An intelligent system for monitoring students' engagement in large classroom teaching through facial expression recognition. *Expert Systems*, *39*(1). https://doi.org/10.1111/exsy.12839

Papaspyridis, A. (2020). AI in higher education: Opportunities and considerations. Retrieved from https://news.microsoft.com/apac/2020/03/26/ai-in-higher-education-opportunities-and-considerations/

Parveen, I., & Awan, R. (2019). Equitable higher education: Students' perspective on access to resources, participation, and educational outcomes. *Bulletin of Education and Research*, *41*(1), 185–201.

Pedró, F. (2020). Applications of artificial intelligence to higher education: Possibilities, evidence, and challenges. *Open Journal of IUL University,1*(1), 61-76.

Plano, V. C., & Creswell, J. W. (2015). *Understanding research: A consumer's guide* (2nd ed.). Pearson Education, Inc.

Pombo, C., Gupta, R., & Stankovic, M. (2018). Social Services for Digital Citizens: Opportunities for Latin America and the Caribbean. Retrieved from http://dx.doi.org/10.18235/0001105.

Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, *12*(1). https://doi.org/10.1186/s41039-017-0062-8

Popescu, E. (2010). Adaptation provisioning with respect to learning styles in a web-based educational system: An experimental study. *Journal of Computer Assisted Learning*, *26*(4), 243–257. https://doi.org/10.1111/j.1365-2729.2010.00364.x

Ramlakhan, S., Saatchi, R., Sabir, L., Singh, Y., Hughes, R., Shobayo, O., & Ventour, D. (2022). Understanding and interpreting artificial intelligence, Machine Learning and deep learning in emergency medicine. *Emergency Medicine Journal*, *39*(5), 380–385. https://doi.org/10.1136/emermed-2021-212068

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). SAGE.

Sharma, P., Joshi, S., Gautam, S., Filipe, V., & Reis, M. C. (2019). Student engagement detection using emotion analysis, eye tracking and head movement with machine learning. https://doi.org/10.48550/arXiv.1909.12913

Slepankova, M. (2021). *Possibilities of artificial intelligence in education: An assessment of the role of Ai chatbots as a communication medium in higher education* (dissertation).

Slimi, Z. (2021). The impact of AI implementation in Higher Education on Educational Process Future: A systematic review. *Research Square*, 1–10. https://doi.org/10.21203/rs.3.rs-1081043/v1

Southgate, E. (2020). Artificial intelligence, ethics, equity and higher education: A 'beginning-of-the-discussion' paper. National Centre for Student Equity in Higher Education, Curtin University, and the University of Newcastle.

Suárez-Gonzalo, S., Mas-Manchón, L., & Guerrero-Solé, F. (2019). Tay is you. the attribution of responsibility in the algorithmic culture. *Observatorio (OBS*)*, *13*(2), 1–14. https://doi.org/10.15847/obsobs13220191432

Tomaševski, K. (2001). Human rights obligations: making education available, accessible, acceptable and adaptable. Lund, Sweden: Raoul Wallenberg Institute.

Tsai, S., Chen, C., Shiao, Y., Ciou, J., & Wu, T. (2020). Precision education with statistical learning and deep learning: A case study in Taiwan. *International Journal of Educational Technology in Higher Education,17*(1). https://doi.org/10.1186/s41239-020-00186-2

Tseng, J. C. R., Chu, H.-C., Hwang, G.-J., & Tsai, C.-C. (2008). Development of an adaptive learning system with two sources of personalization information. *Computers & Education*, *51*(2), 776–786. https://doi.org/10.1016/j.compedu.2007.08.002

UNESCO. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development.

UNESCO. (2020). AI in Education: Change at the Speed of Learning. UNESCO IITE Policy Brief.

UNESCO. (2020). *Towards universal access to higher education: international trends*. United Nations Educational, Scientific and Cultural Organization.

UNESCO. (2021). *Ai and education: guidance for policy-makers*. United Nations Educational, Scientific and Cultural Organization.

Venkatesh, Morris, Davis, & Davis. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540

Xing, B., & Marwala, T. (2018). Implications of the fourth industrial age on higher education. *Social Science Research Network,*(23). https://doi.org/10.25073/0866-773x/87

Yang, T.-C., Hwang, G.-J., & Yang, S. J.-H. (2013). Development of an Adaptive Learning System with Multiple Perspectives based on Students' Learning Styles and Cognitive Styles. *Educational Technology & Society*, *16*(4), 185–200.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on Artificial Intelligence Applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1). https://doi.org/10.1186/s41239-019-0171-0

Zhang, K., & Aslan, A. B. (2021). AI technologies for education: Recent research & future directions. *Computers and Education: Artificial Intelligence,2*. https://doi.org/10.1016/j.caeai.2021.100025

Appendices

Appendix A: Interview Questions

These questions are derived from the research questions and from the literature review conducted.

Please briefly introduce yourself and your role in the university.

1. What do you know about AI?
2. What is your experience with the use of AI in your university?
3. In your opinion, what role does AI play in your university?
    a. Is there a policy document or text for AI use?
4. How do you see AI being used in teaching and learning?
    a. From your experience, what are the pros and cons of using chatbots and digital assistants in higher education? If no experience, what do you expect or anticipate being the pros and cons of chatbots and digital assistants in higher education?
    b. From your experience, what are the pros and cons of using adaptive and personalized learning in higher education? If no experience, what do you expect or anticipate being the pros and cons of adaptive and personalized learning in higher education?
    c. From your experience, what are the pros and cons of using automated feedback in higher education? If no experience, what do you expect or anticipate being the pros and cons of automated feedback in higher education?

   d. From your experience, what are the pros and cons of using automated grading in higher education? If no experience, what do you expect or anticipate being the pros and cons of automated grading in higher education?
   e. From your experience, what are the pros and cons of using emotion AI in higher education? If no experience, what do you expect or anticipate being the pros and cons of emotion AI in higher education?
5. What do you think is the effect of AI on the future of higher education?
6. How do you see AI being used to achieve equity and accessibility in education?
7. From your experience and opinion, what are the challenges you or your institution are facing in relation to AI?
8. Is there anything else you would like to share on your experience or viewpoint on AI in higher education in Egypt?

Appendix B: Consent Form

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

Documentation of Informed Consent for Participation in Research Study

Project Title: Artificial Intelligence (AI) in Higher Education: A study on Egyptian Universities

Principal Investigator: Farah Sharawy- farahsharawy@aucegypt.edu

You are being asked to participate in a research study. The purpose of the research is to explore the use of artificial intelligence in higher education institutions and how this potentially creates equity in terms of availability accessibility, acceptability, and adaptability, in higher education in Egypt and the findings may be published and presented. The expected duration of your participation is a maximum of one hour. The procedures of the research will be as follows; you will be asked open-ended questions and follow-up questions will emerge from there.

There will not be certain risks or discomforts associated with this research.

There will be benefits to you from this research in which you will gain new knowledge on the use of artificial intelligence in higher education institutions.

The information you provide for purposes of this research is confidential. The data will be used for the sole purpose of the research and stored in a password-protected computer and deleted after 3 years. This interview will be recorded for transcription purposes. The transcription and coding of the data will take place privately with headphones to ensure confidentiality.

Questions about the research, my rights, or research-related injuries should be directed to Farah Sharawy at +201003066661 or farahsharawy@aucegypt.edu.

Participation in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or the loss of benefits to which you are otherwise entitled.

☐ I agree to have my name in the thesis
☐ I do not agree to mention my name in the thesis
☐ I agree to being recorded
☐ I do not agree to being recorded

Signature _____

Printed Name _____

Date _____

Appendix C: IRB Certificate

CITI PROGRAM

Completion Date 07-Feb-2021
Expiration Date 07-Feb-2024
Record ID 40710892

This is to certify that:

Farah Sharawy

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Social & Behavioral Research - Basic/Refresher
(Curriculum Group)
Social & Behavioral Research
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

The American University in Cairo

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w5f751142-3f16-4772-ab0b-6dfbe2f12497-40710892

Appendix D: IRB Approval

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

Case# 2021-2022-192

To: Farah Sharawy
Teklu Abate
Dena Riad

From: Heba Kotb Chair of the IRB
Date 28th July 2022

Re: IRB approval

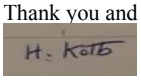
This is to inform you that I reviewed your revised research proposal entitled

"Artificial Intelligence (AI) in Higher Education: A study on Egyptian Universities"

It required consultation with the IRB under the "expedited" category. As you are aware, there were minor revisions to the original proposal, but your new version addresses these concerns successfully. Your proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participants in any published record. I believe you will also make adequate provision for obtaining informed consent of the participants.
This approval letter was issued under the assumption that you have not started data collection for your research project. Any data collected before receiving this letter could not be used since this is a violation of the IRB policy.

Please note that IRB approval does not automatically ensure approval by CAPMAS, an Egyptian government agency responsible for approving some types of off-campus research. CAPMAS issues are handled at AUC by the office of the University Counsellor. The IRB is not in a position to offer any opinion on CAPMAS issues, and takes no responsibility for obtaining CAPMAS approval.
This approval is valid for only one year. In case you have not finished data collection within a year, you need to apply for an extension.

Thank you and good luck.



Heba Kotb
IRB chair, The American University in Cairo
2078 HUSS Building
T: 02-26151857
Email: hebakotb@aucegypt.edu

Institutional Review Board
The American University in Cairo
AUC Avenue, P.O. Box 74
New Cairo 11835, Egypt.
tel 20.2.2615.1000
fax 20.2.27957565
Email: irb@aucegupt.edu

Appendix E: CAPMAS Approval

الجهاز المركزى للتعبئة العامة والإحصاء

الجهاز المركزى للتعبئة العامة والإحصاء
الإدارة العامة للأمن
صادر رقم ١١٠
تاريخ ١٤ / ١ / ٢٠٢٣م
مرفقات قرار+خطاب

القيـــد :.....
الموضوع :.....
التاريـــخ : / /
المرفقات : .....

السـيد الأستـاذ الدكتور / مستشار الجامعة الأمريكيـة بالقاهرة

تحيـة طيبـة وبعد ،،،

بالإشـارة لكتـاب سيادتكم الـوارد للجهـاز فـى ٢٠٢٢/٨/٩ ومرفقاتـه - بـشأن طـلب الموافقـة علـى قيام الباحثـة / فـرح شـريف محمد عـامر شـعراوى - المسـجلة لدرجـة الماجسـتير بقسـم التعلـيم الـدولى والمقـارن كليـة العلـوم الإنسـانية والإجتماعيـة / الجامعـة الأمريكيـة بالقـاهرة - بإجـراء دراسـة ميدانيـة بعـنوان: (الذكاء الإصطناعى فى التعليم العالى : دراسة عن الجامعات المصرية).

وذلك وفقا للإطار المعد لهذا الغرض.

يرجـى التكـرم بالإحاطـة بـأن الجهـاز المركـزي للتعبئـة العامـة والإحصـاء يوافـق علـى قيـام قيام الباحثـة / فرح شريف محمد عامر شعراوى - بإجراء الدراسة الميدانية المشـار إليها بعالية وفقا للقرار رقـم (٩٦٥) لسنة ٢٠٢٢ اللازم فى هـذا الشأن وعلى إن يوافى الجهـاز بنسخـة مـن النتائج النهائيـة كاملة فور الانتهاء من إعدادها طبقا للمادة رقم (٧) من القرار.

وتـفضـلوا بـقبـول فـائـق الاحـتـرام ،،،

محمد ممـدوح محمد