Spring 6-21-2023

Assessing Artificial Intelligence Readiness of Faculty in Higher Education: Comparative Case Study of Egypt

Ayatallah Ali
ayaali@aucegypt.edu

The American University in Cairo

School of Global Affairs and Public Policy

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A Thesis Submitted to the

Public Policy and Administration Department

in partial fulfillment of the requirements for the degree of
Master of Public Administration

By

Ayatallah Mohamed Ali

Spring 2023

ACKNOWLEDGEMENTS

I would like to extend my deepest gratitude to Dr. Shahjahan Bhuiyan for being the supervisor to my thesis and a mentor in my journey. I would like to thank him for his valuable time and for always being understanding. I would also like to extend my gratitude to Dr. Ghada Barsoum and Dr. Noura Wahby for their time and willingness to be my committee advisors. Special thanks and appreciation to Dr. Noura Wahby for being one of my dearest professors throughout my journey. I am truly thankful that I started and ended my journey with her.

My greatest appreciation goes to my parents, for allowing me to complete this journey at AUC and for supporting me during my hardest times. Thank you for always believing in me and pushing me to my limits, believing that I can always do better. I could have not undertaken this journey without the encouragement, love, and support of my sister, Dr. Heba Mamdouh. Thank you for being a wonderful, loving sister, and an amazing mentor. I would also like to extend my appreciation to my brother-in-law, Yasser Nabil, for his tremendous efforts and support throughout my journey.

Last but not least, my journey would have not been complete without the support of my second family, Lamis Mohsen, and Mahmoud Ayoub. Thank you for always being by my side, throughout it all, and for truly opening my eyes to what I am capable of achieving. Without your love and support, I would have not achieved this success.

ABSTRACT

The field of Artificial Intelligence (AI) has been gaining considerable attention from many countries worldwide due to its rapid development and its potential benefits in different sectors. One of the leading global sectors that are currently considering the adoption of AI is the education sector. As a developing country, Egypt is gradually realizing the importance of AI and has begun considering the integration of AI in numerous sectors. Despite the importance of the field, there is a lack of published research on the integration of AI in education in Egypt or on the readiness levels of any stakeholders in the education sector, especially in the area of Higher Education (HE). For this reason, this study seeks to assess the AI readiness levels of faculty from three different types of universities (public/private/non-profit) to offer valuable insights for ministries and policymakers on whether the HE sector is ready for this integration. The research also focuses on other critical dimensions of AI readiness, including technological literacy, demographics, and other factors that may impact AI readiness. Additionally, the research analyzes the current challenges in the HE sector based on primary and secondary research and evaluates whether the adoption of AI will resolve such challenges. The research adopts a mixed-method approach, using in-depth interviews with 46 faculty members from 10 different universities to gather the primary data for this research. The findings indicate that the AI readiness of faculty in HE in Egypt is relatively high, as 87% of the participants demonstrated high levels of AI readiness, and was not correlated with the type of university they belong to. Additionally, the research suggests that technological literacy plays a significant role in AI readiness, while demographics were unrelated to AI readiness. Further research is recommended on other sector stakeholders, including students, administrators, and institutions, especially in Egypt, in order to build a solid basis on which policymakers can utilize if AI will be adopted in HE.

Keywords: Artificial Intelligence (AI), Higher Education (HE), Artificial Intelligence in Education (AIED), and Technological Literacy

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1 CHAPTER ONE: INTRODUCTION

From the earliest moments of the invention of technology, it was anticipated that it would be revolutionary within a wide range of industries and sectors across the world. The ongoing process of global development has been a foundation for technological progress over the years. Artificial Intelligence (AI), a new level of technical development, has emerged in recent years as a result of the considerable advancement of technology. In today's technologically advanced world, AI has grown significantly in numerous sectors. According to Popenici & Kerr (2017, p. 5), AI is currently "enhancing tools and instruments used day by day in cities and campuses around the world. From Internet search engines, smartphone features, and apps, to public transport and household appliances".

The definition of AI has been changing depending on the context, the timing, and the level of development of the technology. However, most scholars and experts have agreed that AI is an intelligent machine capable of learning and performing tasks that typically require human intelligence. Some scholars and experts have also agreed that AI can be considered "systems that will perform better on tasks that humans currently do better" (Grewal, 2004, p.11). Despite its potential benefits, there remains to be a large segment of people who fear the rise of AI, worrying that it will replace humans in the long term, leading to unsolvable crises such as unemployment.

AI applications are considered critical in educational institutions, schools, and universities, as they are currently required "to keep pace with technological development through the creation of new methods of education and teaching" (Aldosari, 2020, p.145). Artificial Intelligence in Education (AIED) is one of the popular trends currently being applied and evaluated worldwide, as it will lead to a completely different learning experience in the upcoming years. AIED refers to integrating AI technologies in education to benefit faculty, students, or the institution (Chen et al., 2020). Similar to any novel invention, AIED has its own potential and threats. The majority of the potentials and threats remain unknown due to the lack of implementation, whilst other potentials and threats are being discovered nowadays. For instance, in November 2022, a new AI machine learning chatbot known as ChatGPT has been released to the public, and shortly, many educators are already complaining that they are unable to distinguish whether the submitted work of students is original or AI-generated. However, this is not the only threat ChatGPT is posing to education, as other issues will likely arise in the near future.

Despite its importance in the sector, the application of AIED is limited due to various factors, including low investments and financial strains, technological illiteracy, and the inability to adapt or shift to new systems or applications (Dhawan & Batra, 2021). One of the significant problems developing countries face in achieving AIED is the country's readiness as a whole, with a particular focus on the readiness of the involved stakeholders to shift.

Egypt is one of the developing countries currently seeking to integrate AI in development sectors, as the country is aware of the importance of this shift in keeping pace with the changing global trends (Economist Impact, 2022). Applying AIED is crucial, especially in Higher Education (HE). Hence, it is required to understand further one of the significant challenges and gaps, which is the readiness of the faculty to accept such change. The topic must be more represented and is currently rarely researched in Egypt, as AI must still be integrated into HE. However, it was essential to investigate this topic and assess the readiness of faculty in different types of universities to determine if faculty were ready for such a transformative phase of learning.

This research offers valuable insights to different ministries on the levels of AI readiness in HE, allowing them to decide whether investments should be made in AIED and how AIED can be implemented in Egypt in the upcoming years.

1.1 Problem Statement

One of the measures determining a country’s development level is its technology adoption. For countries to succeed or develop, they need to keep pace with the technological developments that are taking place in all fields. The educational sector is considered one of the most critical sectors into which AI needs to be integrated, as it is the basis of development in any country. Furthermore, poor education with no intention of development could possibly lead to a decrease in the employment rate and an increase in poverty and illiteracy rates, which will consequently impact the economy of the nation (The World Bank, 2023).

At the moment, the adoption of AI in education is more prominent within countries with higher AI readiness levels such as China and the United States (Zawacki-Richter et al., 2019). Other countries may be looking forward to such a transformation but fear the unknown risks of such an adoption. However, countries are aware that this change is required, and will take place eventually. Hence, they are exerting more efforts towards researching the field in advance of

implementing it, in an attempt to reduce the potential risks that may arise. In Egypt, AI is relatively limited in the field of education (Economist Impact, 2022). While planning a strong vision for the nation's digital transformation, Egypt created and accelerated its AI strategies and goals over the past three years despite the setbacks (Economist Impact, 2022). Strategic planning is considered to be a major step, however, there remains to be other factors that need to be investigated in advance of the implementation of such plans, one of which is the assessment of the readiness of the education sector. Despite the importance of the topic, there is a lack of published scholarship reflecting on assessing AI readiness in the HE sector in Egypt. It is expected that this study would support policymakers in assessing how the faculty of HE responds to AI systems if they were to be implemented. In addition, policymakers will also be able to assess, which AI systems will be helpful in HE and will comprehend the perception of faculty on adopting AIED, which is one of the main pillars of this study.

1.2 Research Objectives

This study aims to examine and investigate various unanswered questions and gaps in the HE sector in Egypt. Firstly, the research seeks to compare three different types of universities to understand how they differ depending on their category (for example, public/private/non-profit). Secondly, the study further examines whether there was a relationship between AI readiness levels and other factors, such as the type of university, technological literacy levels, or demographic characteristics. Understanding the role of technological literacy in AI readiness is crucial to assess the extent to which they are ready to accept the introduction of AI in the education system. Thirdly, it seeks to discuss the current challenges within the HE sector, whether in the learning process, the grading process, or the curriculums. Identifying such challenges will offer insights into how integrating AIED can aid in abolishing such challenges. Lastly, the research examines the anticipated threats to AI's integration into education. Since the published literature has not yet adequately covered this topic in Egypt, it is necessary to capture all the possible benefits and challenges that may arise if AI applications were to be implemented in the HE sector.

1.3 Research Questions

The main research question is, ***"How ready are faculty of higher education in Egypt to integrate artificial intelligence systems in their educational system and curriculum?"***. There are

additional sub-questions that would be taken into consideration and answered in order to grasp a complete understanding of AI Readiness within the faculty of HE in Egypt. The sub-questions below will be examined in all types of universities under investigation.

1. *Is there a relationship between the technological literacy of faculty, their demographics, their type of institution, and their AI readiness?*
2. *What are the different factors that impact the AI readiness levels of faculty?*
3. *How can integrating AI tools and systems resolve the current challenges in the HE sector?*
4. *What are the anticipated challenges of AI adoption in the HE sector in Egypt?*

1.4 Structure of the Research

This thesis consists of seven chapters covering the main aspects of the research.

I. Chapter One: This chapter introduces the topic of research, the problem statement, the significance of the research, the research objectives, and the research questions.

II. Chapter Two: This chapter discusses the HE background in Egypt, including the challenges faced in the sector. It also introduces and defines AI, analyzes the field of AI in the context of the MENA region and Egypt, and discusses the potential threats and benefits of AI. The author also introduces and defines AIED, analyzes the field of AIED in terms of previous applications and research on the field, and concludes with the previous implementations of AIED.

III. Chapter Three: This chapter includes previous models or conceptual frameworks that have been used in assessing the readiness of technology or AI and concludes with the novel conceptual framework that has been developed for this research to aid in assessing the AI readiness levels of faculty in HE in Egypt.

IV. Chapter Four: This chapter reviews the research design, including the sample selection, structure, and procedure.

V. Chapter Five: This chapter analyzes the research findings and offers in-depth results for the qualitative research conducted, covering main topics such as the role of technological literacy in AI readiness levels, challenges in HE, utilization of AIED, perception of the usefulness of AIED, potential anticipated challenges in AIED, and the factors impacting AI readiness.

VI. Chapter Six: This chapter presents the discussion, and analyzes the findings in relation to previous studies that have been conducted.

VII. Chapter Seven: This chapter presents the conclusion, limitations, and recommendations for this research.

2 CHAPTER TWO: LITERATURE REVIEW

2.1 Education in Egypt

In recent years, many developing countries, including Egypt, have been prioritizing education development, whether primary, secondary, or higher levels. To reach a higher level of development, Egypt has been planning to allocate higher budgets for education. Despite the actual increase in the budget over the past decade, the allocated budgets remain to be low and have not significantly increased, as the Egyptian pound has been devaluating. In 2014, the total budget for HE was 25 billion Egyptian Pounds (Higher Education in Egypt, 2021). This budget increased by 160% between 2014 and 2021, reaching 65 billion Egyptian Pounds in 2021 (Higher Education in Egypt, 2021). Despite the government's plans to invest more in the upcoming years to tackle the challenges faced in HE, they still need to be made aware that a higher budget is not the solution for all of the challenges faced in the HE sector. Furthermore, a higher budget would partially aid in abolishing challenges such as poor facilities or low resources, but would not be able to abolish other challenges in the sector. Nonetheless, some of these challenges have existed for decades and need more than an increased budget to be fixed, as they require new solutions that still need to be implemented.

2.1.1 History of Higher Education in Egypt

Despite Egypt's prestigious reputation within the MENA region, its education system has been highly impacted by its political developments, whether positive or negative (Loveluck, 2012). This impact began as early as the 1950s when President Gamal Abdel Nasser began to comprehend the importance of education and its development in Egypt as he was concerned about the country's national development and social equality (Folmar, 2020). During his presidency, education was considered a central part of his "modernizing project"; thus, tremendous efforts were exerted in the educational sector (Folmar, 2020).

Following the 1952 revolution, President Nasser implemented many policies to improve Egypt's economic, social, and educational development (Abdelkhalek & Langsten, 2019). One of President Nasser's initial promises was to offer free education to all primary levels of education, allowing the younger generations higher chances of education and equality; to allow them to be equal to other privileged children whose families could easily afford primary education (Folmar,

2020). Later on, in 1962, President Nasser made other promises which led to consequences in the educational sector that exist until today, as he promised "a universal secondary school leaving examination for admission to higher education; elimination of all direct tuition fees for higher education; and a government job for all higher education graduates" (Abdelkhalek & Langsten, 2019, p.47). Furthermore, in 1962, all levels of education were free and accessible to all levels of society. The rationale behind these decisions was to increase the demand for HE, which took place immediately after he announced his current policies. Undoubtedly, President Nasser intended to solely improve the country's state, whether in education, employment, or overall development. However, in the long term, these decisions led to drastic changes and consequences in the educational sector in Egypt.

Shortly after President Nasser's decisions, two significant changes occurred in the education and employment sectors. Firstly, an excessive demand for HE took place due to President Nasser's promise of free higher education, which surpassed the level of supply and the available state resources, eventually leading to a deterioration in the quality of education provided (El-Shaarawi, 2015). At the time, the rapid growth in demand for education required massive hiring, which eventually led to the employment of unqualified teachers and instructors to satisfy the demand levels (Loveluck, 2012). Secondly, as President Nasser promised to guarantee government jobs for all graduates, the demand for education and government jobs was immense. At some point, the number of graduates was much higher than the government positions available, leading to the policy's abandonment in the late 1980s (Abdelkhalek & Langsten, 2019). However, there were expected to be limited positions available at some point. Thus, this policy did not entail drastic consequences as much as the "free education" policy.

In attempting to eliminate the "social divide," Egypt cannot impose high fees or tuition for public schools or universities, as this would put countless generations at a disadvantage (Abdelkhalek & Langsten, 2019). Therefore, the country is forced to offer public education at low tuition and fees while maintaining the highest possible quality of education and working on the challenges within the sector. Realistically, it is impossible to offer good quality education when the sector has deteriorated. For this reason, solutions to this phenomenon include higher budget allocations to public education, higher incentives for instructors or teachers, or an attempt to work on every single challenge that has led to the deterioration of the sector.

2.1.2 Challenges of Higher Education in Egypt

According to the World Bank (2010), "Egypt's higher education system has been described as not serving the country's needs well". The challenges faced by the HE system in Egypt are similar to those experienced in the primary and secondary educational system, including limited funding, infrastructure, and a politically constrained institutional environment.

The mismatch between the demands of the job market and the actual ability of graduates was one of the primary issues and difficulties emphasized by Barsoum (2014). Hundreds of thousands of students graduate each year, yet, only a few hundred can find suitable and stable jobs that pay sufficient wages. This takes place due to three main reasons. Firstly, The Ministry of Higher Education controls all the curricula of public universities, making them outdated and purely theoretical. As a result, when faced with real-world situations, graduates need help implementing what they have studied. Secondly, as confirmed by Ghazal (2012), the students were only familiar with their topics of choice, with limited exposure to any other discipline or topics outside their field of study. This was also due to the Ministry of Higher Education being outdated, not including interdisciplinary programs nor allowing universities to follow a liberal arts education approach. This makes graduates less qualified, as their knowledge is limited to their major. Thirdly, and most importantly, public university students need numerous sources of information, as their only source of knowledge is their instructor. Indeed, this only applies to those who solely rely on their universities, excluding those who hire private tutors.

Furthermore, Ghazal (2012, p. 20) emphasized the importance of having other sources of knowledge other than the professor since classes "typically take the form of lectures that do not allow for class discussions and do not encourage critical thinking or student reflections". As university students rely on their instructors, they must take an end-of-semester exam representing 100% of their final grade. They are expected to reproduce the same material that their instructors taught. In order to pass these exams, students must rely on their memorization skills, with no need to comprehend or learn the content, which in most cases is purely theoretical. Consequently, students graduate with minimal knowledge of the only field they have learned, with minimal skills that would categorize them as qualified for the labor market needs (Ghazal, 2012). For such reasons, the labor market needs can rarely be satisfied by graduates of public universities, as the unemployment rate is also prone to increase.

Another challenge highlighted by Ghazal (2012) is the emphasis of public universities on physical resources and none on digital, human, or social resources. Moreover, computer stations or open-access computer labs are nonexistent in public universities (Ghazal, 2012). Even if libraries do exist in public universities, they are in a deteriorated state. Such limited academic resources may indicate the decreasing standards and quality of instruction and education in most Egyptian public universities (Ghazal, 2012).

Lastly, Barsoum (2014) highlighted other issues in the system, including the need for more feedback on the instructors and learning experience and a nonexistent relationship with alums. Furthermore, any institution must gain students' insights concerning their learning experience and how it can be improved. Such feedback is necessary, as it is part of the quality assurance procedures of the institution (Barsoum, 2014). Additionally, it allows the university to improve since they will have sufficient information concerning the challenges faced and how they can be avoided. In addition to receiving feedback, universities must maintain a connection with alums since they could include potential future donors (Barsoum, 2014).

Overall, it can be concluded that the main challenges of the HE sector in Egypt include skill mismatch, outdated curricula, limited exposure to different sources of information and different areas other than the major being studied, lack of practicality, lack of resources or facilities, and lack of feedback. Such challenges in the HE sector need to be addressed and tackled through other means besides a simple higher budget allocation. A higher budget allocation might assist in eradicating such challenges if it was invested in tools that aid in ending these challenges, such as artificial intelligence.

2.2 Artificial Intelligence (AI)

The field of AI was initially created and developed to align with the primary objective of serving humanity, despite the potential unexpected threats that may arise in its adoption (Nadikattu, 2016). Over the past decade, AI has gained huge global recognition due to the formation of tools and applications that may offer significant potential benefits to countries, governments, institutions, and the private sector. Such benefits are expected to bring enormous economic growth and transform labor, education, transportation, healthcare, and possibly any services related to the public sector. In this sense, the reason behind the desire for AI adoption and

digital transformation within most countries is the benefits AI promises to deliver, including an increase in their overall growth (Boucher, 2020). Undoubtedly, investments in AI will lead to billions of dollars in economic value (Economist Impact, 2022).

Since the creation of AI, it has been developing rapidly, especially within this decade, where technology dominates our daily lives in some form or another. Recently, AI has been utilized to create new dimensions and realities (for example, Virtual Reality), which are highly likely to impact all forms of sectors. Hundreds of governments and institutions plan to utilize such applications to generate higher growth levels for their benefit instead of lagging in a highly competitive world. Moreover, global investments in AI have surged from US$0.8bn to US$78bn in 2021 to reach higher levels of digitization through AI (Economist Impact, 2022). As of now, there are yet to be any limits and expectations as to what AI can reach or do in the upcoming future as new applications of AI are being discovered.

Due to the complexity of the field and its constant development, there is no widely accepted definition of AI (Wang, 2019). However, essential components are widely prominent in any definition of AI, mainly including the machines' replication of human intelligence. Regardless, it is critical to discover one definition that can be used at a global scale, as it is extremely "difficult for policymakers to assess what AI systems will be able to do soon and how the field may get there" if there is no framework or definition that may indicate which AI tools will be desirable or will be of high beneficence (Bhatnagar et al., 2018; Wang, 2019, p.2).

2.2.1 Defining AI

The term AI was introduced in 1955 by the scientist John McCarthy at Stanford University, defined it as "the science and engineering of making intelligent machines" (Manning, 2020, p.1). McCarthy emphasized that the abilities of AI primarily focus on completing tasks that require human intelligence. In 1965, a Nobel laureate American political scientist, Herbert Simon, was able to create one of the earliest AI pioneers (a general problem solver) through AI programming, and that led him to another conclusion; one day, machines will be able to complete any work a human can do (Economist Impact, 2022). As decades passed, the development of the definitions has constantly changed. However, one main factor is consistent between all definitions: AI's "imitation of intelligent human behavior" (Kok et al., 2002, p.2).

There are countless definitions of AI; thus, for this research, the definition by Boucher (2020) will be used as it incorporates all of the significant aspects of AI. According to the information presented earlier, most existing definitions of AI incorporate the following features: think like humans, act like humans, reason, and act rationally (Kok et al., 2002). Hence, AI can be defined as "systems that display intelligent behavior by analyzing their environment and taking action – with some degree of autonomy – to achieve specific goals" (Boucher, 2020, p.3).

2.2.2 Potentials and Threats of AI

Undoubtedly, adopting AI in any sector will lead to enormous significant benefits, including the advancement of the sector in its technological adoption, efficiency, and effectiveness. Accordingly, numerous benefits are forecasted to occur with AI adoption, including high productivity, mobility, decision-making, growth, and higher efficiency levels (Boucher, 2020). With such potential, other challenges are forecasted to take place as well. Some fear that the threats of AI adoption will surpass its potential benefits. Regardless, many countries, governments, sectors, and institutions are taking the risk of AI adoption while considering the forecasted challenges and planning solutions ahead of time.

AI's potential to significantly impact daily activities or experiences increases alongside the field's investment and innovation (Economist Impact, 2022). For this reason, countries have begun investing in the field and its innovation, eager to implement this type of technology and witness the immense transformation that is forecasted to occur. Accordingly, several sectors, including "healthcare, retail, finance, transportation, manufacturing, and government services, are set to experience change due to AI adoption and applications" (Economist Impact, 2022, p.11). The integration of AI is highly expected to transform the efficiency of the workplace in all sectors, as it will augment the work done manually by humans (Nadikattu, 2016). In almost every sector, mandatory repetitive and time-consuming tasks take up all the time and energy of humans, which offers them less time and energy to be more creative, productive, or engage with others. Adopting AI in such tasks is highly likely to allow the workforce to be more productive as they will be occupied with other tasks involving empathy, teamwork, or creativity (Nadikattu, 2016). With this change, individuals are more likely to become satisfied with their jobs, offering higher productivity, efficiency, and effectiveness. This change will impact micro-scale institutions and the country as a whole.

Similar to any other introduction of a newly-developed innovation, there are also possible threats that are anticipated to occur with the adoption of AI. Such threats include "the possibility of biased and unexplainable outcomes, ethically challenging applications, privacy concerns, and intentional misuse of AI. These problems can have painful implications at the individual level, such as discriminatory algorithms excluding minority groups" (Economist Impact, 2022, p.11). Most investors and members of society as a whole are concerned about other significant issues, such as the infrastructure of AI, the scarcity of specialists in the field, its cost, the acceptability of the technology as a whole, and the technological literacy levels of its potential users (Boucher, 2020). However, one of the most critically feared threats is the significant job losses it may lead to since the adoption of AI is frequently correlated with unemployment (Economist Impact, 2022). According to a study by PwC, it was claimed that "30% of jobs could be automated by the mid-2030s", which poses enormous fears to governments and institutions that it may lead to unemployment (Economic Impact, 2022, p.11).

In order to implement AI within the different sectors with the least possible consequences, governments should start developing the right policies to accommodate such implementation (Economist Impact, 2022). Such policies could include "effective governance to guide the development and use of AI or developing initiatives to rectify any negative impacts of AI" (Economist Impact, 2022, p.11).

2.2.3 Artificial Intelligence in MENA Region

Throughout the past couple of years, the MENA Region has exerted tremendous efforts in planning the adoption of AI within its different sectors. More specifically, "one of the current defining characteristics of the region is the central and active role of the government in forging progress in AI" (Economist Impact, 2022, p.16). Though numerous developing countries in the MENA region are lagging in technological advancements and AI adoption, it seems that the pandemic of COVID-19 had a role in fostering the foundation of AI within the region (Economist Impact, 2022). According to Fadi Salem, the Director of Research and Advisory at the Mohammed bin Rashid School of Government, adopting digital technologies during the pandemic became necessary. It forced many to become literate and knowledgeable of the capabilities of technologies and how they can utilize them to their benefit after the pandemic (Economist Impact, 2022).

Additionally, before the pandemic, many governments in the MENA region feared digital transformation as they could not anticipate its possible impacts. However, as they witnessed the pandemic and how normally schools and institutions proceeded in their activities using digital tools, they were reassured that it is currently safe to invest in adopting AI technologies for the benefit of society (Economist Impact, 2022).

The report "Pushing Forward: The Future of AI in the Middle East and North Africa" published by the Economist Impact in 2022 and sponsored by Google, offers precious insights concerning the impact of AI on the growth of the region as a whole. According to the report, the potential economic impact of AI tools on the MENA region's economic growth is beyond enormous, as it is predicted that "the MENA region is estimated to accrue US$320bn by 2030 from value added by AI" (Economist Impact, 2022, p.5). This number is predicted to be obtained from costs that will be saved through the automation processes of AI, as well as the improvement of products and services in the MENA region (Economist Impact, 2022). In one of the studies mentioned in the report, it is forecasted that the benefits generated by adopting AI could support governments' budgets in the MENA region by up to US$7bn annually (Economist Impact, 2022).

In addition, "the annual growth in the economic contribution of AI is expected to reach 20-34% per year across the region, with the fastest growth in the UAE and Saudi Arabia" (Economist Impact, 2022, p.20). A country like Saudi Arabia is highly committed to adopting AI, as it set itself a key performance indicator to reach a 40% AI literacy rate for its workforce data by integrating AI into the educational curriculum, whether public or private (Economist Impact, 2022). The key sectors highly likely to contribute to such growth include retail, public, health and education, transport and logistics, technology, media, telecommunications, and financial services (Economist Impact, 2022). Furthermore, forecasts by PwC indicate that AI's contribution to the public sector in the MENA region "could be US$59bn in 2030", which accounts for approximately 18.6% of the regional GDP (Economist Impact, 2022, p.20).

Despite the anticipated growth, it is critical to mention that none of the countries in the MENA region has published any policies concerning AI ethics or an AI framework, which are crucial in the process of AI adoption as they support protecting against the threats of AI (Economist

Impact, 2022). It is recommended that governments start working on their policies, specifically on AI ethics, to obtain the most benefits from AI adoption with no fear of anticipated threats.

2.2.3 AI in Egypt

As a country, Egypt is considered a substantial case in comparison to other MENA regions since it has experienced consistent interruptions due to high political and economic instability throughout the past decade (Economist Impact, 2022). Despite the interruptions, Egypt developed and accelerated its AI strategies and plans in the past three years as it plans a bold vision for the country's digital transformation (Economist Impact, 2022). Accordingly, the adoption of AI in Egypt is forecasted to grant US$42.7bn to Egypt's economy (equivalent to approximately 7.7$ of its GDP) by 2030 (Economist Impact, 2022).

By the end of 2019, the Egyptian government created a National Council for Artificial Intelligence (NCAI) to develop its AI strategies and plans while conciliating with government institutions, academics, practitioners, and leading businesses in AI (Economist Impact, 2022). The council aims to cooperate to establish Egypt's AI strategy, published in 2019. The strategy that was established focused on the implementation of AI technologies, allowing Egypt to reach its sustainable development goals (SDGs) and become a "regional hub" for AI talent in order to benefit from the massive number of the youth population in Egypt (Radwan, 2021). In addition, the strategy also proposes an establishment of technical and vocational training to support the talented youth who seek to focus their studies, research, or work on AI.

According to the strategy's objectives, the mission statement is to "effectively create an AI industry in Egypt, with everything an industry requires" (Radwan, 2021, p.2). In other words, Egypt seeks to establish an AI industry while working on every aspect of the society and the country, whether it is the infrastructure of AI technologies, the literacy, and acceptance of the society, or the policies that ensure that the society is protected against the threats of AI. A framework was also created to focus on the four pillars and enablers: "AI for government, AI for development, capacity building, and international relations" (Radwan, 2021, p.2). Four enablers can support these pillars: governance, data, ecosystem, and infrastructure (Radwan, 2021).

In order to successfully adopt AI technologies in Egypt, the focus must not only be on the infrastructure, the government, or the policies but on the society as well. The general public is

required to become more educated in the field and have a general understanding and awareness of the capabilities of AI and how to utilize it. Focusing on the public's knowledge can be the key to fostering highly skilled experts Egypt requires to adopt and implement AI technologies (Radwan, 2021). One of the ways Egypt is attempting to focus on its youth is through university programs that include technical and non-technical majors in AI. Technical majors focus on AI as a core subject or a full degree. In contrast, non-technical majors can learn about AI during or after obtaining a degree (Radwan, 2021). Egypt's efforts in the integration and introduction of AI in university curriculums or majors are expected to raise a new generation of domain experts who can highly benefit the country when it comes to the implementation of AI technologies (Radwan, 2021).

As a country, Egypt's Global AI Index is at 68.7, which is higher than Brazil and Israel, which are considered pioneers and AI leaders (Economist Impact, 2022). Hence, Egypt's near future is promising when it comes to AI. Most importantly, and according to Golestan Radwan, an AI Adviser to the Egyptian Ministry of Communications and Information Technology, Egypt's interest in AI lies within "how AI can add value to Egypt and the Egyptians—either economic value or better quality of life," and not in simply competing with the rest of the regions in avoidance of falling behind (Economist Impact, 2022, p.16). Thus, the country's progress and intentions are highly optimistic as they seek to serve the greater good.

2.3 Artificial Intelligence in Education (AIED)

The current mission of universities is to exceed their traditional role of teaching and learning, as they are obligated to keep pace with the technological advancements taking place by introducing new methods of education (Aldosari, 2020). Hence, the future of education is highly linked and dependent on the developments of recent technologies (AI, for example) and their integration within their educational system. Though integrating AI in education may seem futuristic, several countries have already adopted AI technologies within education, with China and the United States of America being the most dominant. For example, nowadays, 65% of universities in the USA support AI-assisted learning (Kuleto et al., 2021). Developing countries are aware of the significance of such integration yet, are still investigating possible drawbacks to this advancement.

As of now, there has been and remains to be consistent evidence that AI technologies will massively transform the teaching and learning process in the educational sector. However, it is essential to comprehend that such technologies are still limited, with no possibility of replacing teachers or instructors but a slight chance to augment them (Popenici & Kerr, 2017). In addition, education is considered a human-centric endeavor rather than a technology-centric solution (Popenici & Kerr, 2017). Hence, the anticipated opportunities of AI technologies in education will only extend human capabilities and introduce up-to-date teaching, learning, and research methods, offering teachers and students a completely different educational experience.

Due to the significance of the potential transformation in the education sector, a new field named Artificial Intelligence in Education (AIED) was developed and has been the subject of research for approximately 30 years (Zawacki-Richter et al., 2019). Accordingly, in this section (2.3.1), the field of AIED will be examined, covering the different forms of AIED, previous institutions that have applied AIED, and the potential benefits and threats of AIED.

2.3.1 Types of AIED

In the field of AIED, there are countless applications that can be utilized for the benefit of students, instructors, administrators, and the institution as a whole. Uses of AIED include but are not limited to, automation of the grading process, evaluating students based on past performance, monitoring students in the classroom with facial recognition softwares, and developing individualized learning programs (Economist Impact, 2022). When it comes to instruction, AI can help by enabling instruction outside of the classroom, personalizing a teaching strategy for each student based on their data, performance, and learning preferences, analyzing the course material to suggest tailored content, and predicting a student's likelihood of academic success (Chen et al., 2020). Seven main forms of AIED are discussed below, including Intelligent Tutoring Systems (ITS), Profiling and Prediction, Assessment and Evaluation, Adaptive Systems and Personalization, Teacherbots, Virtual Reality, and Interactive Learning Environments (ILEs).

1. Intelligent Tutoring Systems (ITS)

Intelligent Tutoring Systems (ITS) are by far one of the most crucial forms of AIED, as they offer a wide range of functions that are highly beneficial to both students and faculty. ITS assists with teaching the course content, analyzing the strengths and weaknesses of each student

and offering automated and timely grades and feedback, facilitating collaboration, and creating each student's learning path based on their data (Zawacki-Richter et al., 2019). ITS are the closest alternative to human instructors, as they can simulate one-to-one tutoring with each student (Zawacki-Richter et al., 2019). ITS provides accurate decisions on each student's learning path, including the content they will learn and how they will learn it (Zawacki-Richter et al., 2019). ITS have a huge potential, especially in large distance learning institutions that run courses with thousands of students and cannot provide one-on-one instruction (Zawacki-Richter et al., 2019).

2. Profiling and Prediction

One of the other forms of AIED is a technology that focuses on profiling and prediction. For prediction systems to function, certain data needs to be gathered by the systems, so they can use such data to predict accurately. This process of data gathering is known as "profiling," which can be defined as gathering certain data on the users to execute accurate predictions (Zawacki-Richter et al., 2019). Such forms of technologies operate through machine learning algorithms in order to constantly improve their predictions based on the data that is gathered. In the field of education, they are mainly used to predict the likelihood of students dropping out from a certain course or university, the likelihood of students to fail an assignment, or the likelihood of acceptance into a certain program (Zawacki-Richter et al., 2019). Such technologies are important as they can be programmed to include timely warning systems that inform the instructors or the administrators of the situation so they can intervene. These systems can also be used for admissions decisions, the scheduling of courses, student models, student engagement, and the evaluation of academic performance (Zawacki-Richter et al., 2019).

3. Assessment and Evaluation

Assessment and evaluation technologies involve the automation process of grading, providing timely and accurate feedback, evaluation of a student's performance and comprehension of the content, engagement, academic integrity, and an evaluation of the teaching quality (Zawacki-Richter et al., 2019). Such benefits are highly critical in the higher education sector, as it attempts to solve major challenges that are currently threatening the quality of education being offered. Firstly, such technologies would be highly beneficial in large institutions that enroll thousands of students, as they automate the grading process with high accuracy, thus saving the

time and effort of instructors. Secondly, plagiarism is a global challenge in all educational institutions, especially larger ones, as one instructor cannot read hundreds of students' papers and detect cases of plagiarism (Chen et al., 2020). With such technologies, cases of plagiarism will be easily and more accurately detected. Lastly, such technologies focus on both the quality of learning and the quality of teaching, benefiting both students and faculty.

4. Adaptive Systems and Personalization

Adaptive systems and personalization technologies offer additional support in "teaching the course content, supporting teachers and learning design, using academic data to monitor and guide students, and representation of knowledge in concept maps" (Zawacki-Richter et al., 2019, p.11). They aid in creating recommendations for students depending on their abilities and context. For example, they can be used to offer assistance and recommendations to students on which courses they should register depending on their performance and target (Chen et al., 2020). This type of AIED can also assist adaptive group formation based on learner models, enable real-time group interaction, or summarize discussions that can be used by a human tutor to direct students toward the course's goals and objectives (Zawacki-Richter et al., 2019).

5. Teacherbots

Teacherbots can be defined as any computer-based software or hardware that manages student learning within the online learning environment and fills the position that is typically filled by a teaching assistant in organizing information and delivering quick responses to a wide range of topics (Popenici & Kerr, 2017). Teacherbots can be used to provide personalized learning at all levels of instruction, whether face-to-face, hybrid, or fully online courses (Popenici & Kerr, 2017). With a focus on material distribution, basic and administrative feedback, and monitoring, teacherbots provide computing solutions for the administrative side of education (Popenici & Kerr, 2017). As of today, teacherbots are emerging as a replacement for conventional teaching assistants (Popenici & Kerr, 2017).

6. Virtual Reality (VR)

One of the most prominent AI trends nowadays is VR. VR is a form of AI technology that generates a simulated environment that is highly similar to the real world, immersing the user in

the experience so that users can interact with the surroundings in this reality. In the field of education, VR applications can be used to generate simulations relevant to the subject being studied, allowing students to engage and live the full experience before being released to the real world. VR applications also include game-based learning environments, in which students can experience simulations that are relevant to their field in the form of a "game" (Zawacki-Richter et al., 2019). Additionally, in virtual or remote labs, virtual agents can take on the roles of teachers, facilitators, or students (Zawacki-Richter et al., 2019). One of the main fields that is currently ranked highest in VR adoption is the medical field, which educates medical students on their education's practical components through immersing them in a full VR experience that include learning about procedures, operations, and human anatomy (Chen et al., 2020).

VR technologies are perceived to have one of the highest potentials in the field of education, as it can generate realistic simulations depending on the field of study, hence contributing to the closure of the skills mismatch gap that exists between the educational system and the labor market through preparing students at the highest level of accuracy and realism.

7. Interactive Learning Environments (ILEs)

One of the most basic forms of AIED is ILEs. It is also one of the most basic and prominent forms of AIED that are currently being implemented worldwide. Such type of systems provides a user-friendly platform that can be used for teacher-student interactions, allowing them to communicate, receive feedback, and manage their performance and learning all through one platform (Chen et al., 2020).

2.3.2 Previous Implementation of AIED

Until recently, many educational institutions have already implemented AI systems within their institution in numerous ways. According to Kuleto et al. (2021), AI algorithms are currently being utilized to "market prospective students, estimate class size, plan curriculum, and allocate resources, like financial aid and facilities" (Kuleto et al., 2021, p.7). Other AI applications have also been used to track or monitor the behavior of students and their progress within their educational pathway in order to offer immediate and effective support to students who are at a high risk of abandoning their studies (Chen et al., 2020). Some useful examples of AIED include Jill Watson, IBM's Supercomputer Watson, and Martha.

2.3.2.1 Jill Watson

Jill Watson, an AI virtual teaching assistant (VTA), was introduced by Professor Ashok Goel in the School of Interactive Computing at Georgia Institute of Technology (Dhawan & Batra, 2021). The Chronicle of Higher Education ranked Jill Watson and further similar projects as one of the most revolutionary educational technologies to emerge in the past 50 years (Dhawan & Batra, 2021). Professor Goel introduced Jill Watson to the students at the beginning of the semester as a normal human teaching assistant, experimenting if they will be able to distinguish whether she is a real person or not. By the end of the course, students still believed that Jill was a human TA, and were later informed that she was a virtual TA based on IBM's Watson platform (Maderer, 2016; Popenici & Kerr, 2017). Jill was highly valued and appreciated by the students, to an extent that they wanted to nominate her for the outstanding TA award as she met the highest expectations of students (Popenici & Kerr, 2017). After the success of Jill Watson's experiment, other projects under IBM's Watson platform were developed.

2.3.2.2 IBM's Supercomputer Watson

IBM's Watson supercomputer is an early example of artificial intelligence that is already in use at universities. At any time of day, 365 days a year, this solution offers student advice for Deakin University in Australia (Popenici & Kerr, 2017). The potential impact of AI on the administrative personnel profile in higher education can be seen in Watson's utilization. The program can be used to respond to students' inquiries. Another university that also utilized the same program is the University of Derby, which implemented a system that monitors students' data to forecast when students are likely to drop out to alert the faculty and instructors so that they can make timely interventions (Kuleto et al., 2021).

2.3.2.3 Martha

Another example of an AI system supported by IBM's Watson AI platform is Martha, an AI agent created by George Washington University to help students and faculty with timely solutions (Kuleto et al., 2021). Martha is programmed to comprehend users' inquiries in their own words and store their inquiries or data to improve itself over time using machine learning tools. In other words, the more questions Martha receives, the more it learns from the data and improves its efficiency and accuracy. Martha is able to create or submit service requests, check and inform the

user of the status of a request, offer step-by-step instructions, and answer FAQs (Kuleto et al., 2021).

2.3.3 Potential Benefits of AIED

1. Automation, Efficiency, and Accuracy

Currently, thousands of universities face numerous challenges in their administrative and teaching tasks. Such challenges include the hassles in enrollment, curriculum planning, teaching students through personalized lessons, and fighting the phenomenon of high dropout rates (Kuleto et al., 2021). Since these tasks are done manually by human labor, they may be overwhelming and time-consuming due to their repetitive nature. According to research, utilizing AI applications within the education sector is a desirable solution to combat these challenges, as the number of students increases alongside the staffing costs, class sizes, and finances of the entire institution (Kuleto et al., 2021).

The attractiveness of AI applications in the education sector is mainly due to their automation and the higher efficiency and accuracy it offers compared to humans. There are hundreds of essential tasks that can be automated through AI applications in the field of education, including but not limited to the grading process, the monitoring of attendance and examinations, the instant online services that answer the queries of students, and the availability of virtual assistants that can offer quicker, personalized, cost-effective, and efficient solutions (Dhawan & Batra, 2021). Additionally, AI applications in education may be programmed to predict student performance, potentially identifying those who are at risk of dropping out and allowing instructors to intervene and support such students (Dhawan & Batra, 2021). Such predictions are critical to higher education institutions as they allow them to make better decisions and provide better long-term educational services (Zawacki-Richter et al., 2019). Altogether, such tools may provide higher-level accuracy, efficiency, and productivity over the long term, allowing the educational sector to be completely transformed.

2. Reduction of Paperwork and Workload

One of the most expressed burdens and challenges that instructors face nowadays in any education is the massive number of tasks correlated with workload and paperwork. Such tasks

include grading, providing feedback, and reviewing evaluations. In a study conducted in 2017 by McKinsey, it was found that "teachers work an average of 50 hours per week and spend less than half of that time interacting directly with students" (Kuleto et al., 2021, p.5). Other studies have found that approximately 20%-40% of such time spent on paperwork and related tasks can be easily automated through AI technologies, equating to an estimated 13 hours per week (Kuleto et al., 2021). If those hours were spent by teachers focusing on promoting students' learning, satisfaction, and knowledge retention, the educational process would significantly transform for both students and faculty. Besides the paperwork, it was also found by Kuleto et al. (2021) that teachers spend approximately 11 hours per week preparing for their lectures, while the utilization of AI technologies may prepare lectures for them in six hours or less, providing better lesson plans and teaching approaches that motivate student learning. The utilization of AI applications may also decrease the workload on instructors by being programmed to answer repetitive questions by students, allowing instructors to have more time to "improve the overall education quality, reduce per-student cost, or engage more students" (Kuleto et al., 2021, p.6).

Due to a large number of enrolled students globally, reducing paperwork and workload through AI technologies is an attractive potential solution for significantly higher education institutions. Furthermore, it may also be beneficial for instructors as these technologies can provide flexible learning opportunities that are interactive and personalized, for instance, by relieving teachers of burdens such as grading hundreds or even thousands of assignments so that they can concentrate on their primary responsibility: empathic human teaching (Zawacki-Richter et al., 2019).

3. Customization of Educational Pathway

Since all students are unique and distinct from each other, each student has specific preferences regarding the learning method and pace. Traditional teaching methods, especially in large institutions, can only offer a personalized educational experience for each student through more than one instructor. Using AI technologies may significantly transform each student's educational experience, as AI systems can create educational programs tailored to each student's needs (Aldosari, 2020). AI applications can be programmed to determine if a particular student needs subject-specific information or a different type of learning material, such as video versus audio-based instruction (Economist Impact, 2022). In this regard, it was found in previous research

that the utilization of AI applications and chatbots may enhance the learning experiences of students as such machines use machine learning algorithms to deliver personalized course content to students based on their capabilities and learning needs (Chen et al., 2020). Additionally, students can personalize their educational pathways using adaptive learning technology. Many educational institutions believe that AI has the ability to support adaptive learning and significantly increase student achievement (Kuleto et al., 2021).

4. Collaborative Learning

AI systems may alter how individuals acquire information and interact with it (Aldosari, 2020). Future students may have significantly different experiences searching for and discovering facts than current students due to the existence of newer, more integrated technology (Aldosari, 2020). For instance, programs that rely on AI technologies allow students and teachers to share their experiences and offer helpful, timely feedback on the same platform, leading to a new learning experience (Aldosari, 2020).

In this regard, AI systems can be helpful for independent tutoring and other forms of study support. Currently, numerous institutions have tried to assist students with their questions through AI chatbots or AI assistants (Dhawan & Batra, 2021). AI can also provide customized experiences whenever a learner requests it, offering everyone access to a classroom-like learning environment. For example, the free PowerPoint add-in Presentation Translator generates accurate and timely subtitles for the speaker's words (Dhawan & Batra, 2021). This tool or similar tools can be beneficial to those who speak different languages, have visual or auditory problems, or need assistance with a particular subject that is not offered in their institution (Dhawan & Batra, 2021).

5. Timely Instruction and Feedback

In the case of large higher education institutions, it is impossible that instructors can offer timely instruction or feedback to their students, noting a large number of students each instructor is responsible for. Accordingly, students may need help to learn from their mistakes or comprehend certain concepts or theories, as the instructor may never be able to offer personalized assistance to every single student. With AI technologies, specifically intelligent tutoring systems (ITS), such challenges can be easily combated, as they can be programmed to offer timely and personalized instruction and feedback (Chen et al., 2020). AI systems can be programmed to advise students on

the areas they need to improve and how they can avoid making the same mistakes in the future, allowing them to comprehend the content more effectively without simply memorizing to pass a specific test (Aldosari, 2020). Furthermore, with AIED, students are no longer required to wait for their instructor to review their work, explain the concepts, and offer constructive feedback (Aldosari, 2020). Additionally, instructors could receive timely summarized feedback on the student's learning progress, providing enough details on which content they should stress in upcoming lectures and which has been successfully digested by all students (Aldosari, 2020).

6. Reducing Fear of Learning

Many students globally fear the process of learning, especially in larger institutions, as they fear obtaining low grades or making mistakes. Very few universities foster a rule-free environment, allowing students to make mistakes and learn from them. Accordingly, AI systems can minimize the anxiety associated with learning through trial and error. Since AI teachers can offer suggestions for improvement, AI systems can allow students to learn in a setting with little to no rules (Aldosari, 2020). As AI systems frequently learn by making mistakes, they are the perfect platform for this kind of learning (Aldosari, 2020).

7. Distant Learning and Accessibility

The recent introduction of technology in the educational sector provides several potential benefits: increased accessibility and distance learning. Integrating AI technologies in the educational sector will provide further opportunities to extend learning outside of the classroom, enabling students to learn, unlearn, and relearn at their own pace and in their desired location (Hafez, 2013). The implementation of distance learning or the utilization of web-based learning platforms would "allow students and teachers to grasp the opportunity to choose the proper places for learning and enhance their educational abilities," providing them an opportunity to learn from home, work, library, or even coffee shops (Aldosari, 2020, p.148). Not only do AI systems change the students' learning location, but it also alters who teaches them the material and how it is being taught (Aldosari, 2020). Furthermore, other aspects of AI technologies may bring further benefits in accessibility, such as language translation tools, providing students an opportunity to "learn best within the context of their abilities" (Chen et al., 2020, p.75270).

2.3.4 Potential Harms of AIED

1. High Reliance on Technology

One of the main threats of AIED is humans' high reliance on technology. Throughout the past decade, it has been clear that humans favor and depend on technologies that make their lives easier. Most AI critics fear the dominance of virtual and augmented reality for this reason, worrying that humans may disconnect from reality due to their reliance on such technologies. The main reason behind the introduction of AIED is to facilitate and automate tasks to decrease the workload on instructors and provide a unique educational experience to students. For this reason, many researchers, experts, and policymakers fear the integration of AI in education, worrying that humans may highly rely on it, which may lead to a dangerous path and threats rather than benefits.

2. Increase in Screen Time

Many parents across the world are suffering due to their children being addicted to technology and the virtual world (Dhawan & Batra, 2021). There is no doubt that with the introduction of AIED, students will have to spend more time online than they do in the real world for many reasons, whether for intelligent tutoring systems, online simulations, or hybrid learning (Dhawan & Batra, 2021). Though such inventions may aid the student learning process, high exposure to technologies or screens is dangerous and may severely impact individuals' development.

3. Biased Input

There are several forms of AI machines; yet, they all function based on the same fundamental step, which is programming and the insertion of algorithms and codes (Boucher, 2020). Some AI machines cannot update or develop new information unless a human programmer intervenes and inserts new algorithms. Such machines are known as ‘symbolic AI’ (Boucher, 2020). Other advanced AI machines are known as ‘generalized AI’ operate using machine learning and can update and develop themselves through their communication with other human beings without human intervention (Boucher, 2020). Unfortunately, potential threats can take place in both forms of AI.

With AI machines that require regular programming, there is no way to guarantee that the programmer's bias is not transmitted to the machine (Popenici & Kerr, 2017). In other words, programmers may subconsciously transmit their own biases or agendas into the AI machine they are programming, with no awareness that this has been done (Popenici & Kerr, 2017). Other AI machines that operate with no human intervention and rely on machine learning are no less biased, as it may be critically dangerous depending on what kind of information that machine is exposed to. In other words, if AI machines operating through machine learning are exposed to aggressive, racist, or biased information, they will add such information to their knowledge and act upon it since they cannot distinguish right and wrong behavior (Boucher, 2020).

4. Security and Privacy Concerns

For AI machines to function correctly, primarily when they operate through machine learning, they require enormous amounts of data to develop themselves. Such data will certainly include confidential information concerning students and faculty if it were applied in the educational sector (Chen et al., 2020). This may lead to drastic consequences for several reasons. Firstly, many students may want to keep such confidential information (ex: their learning styles or capabilities) private, whether to machines or others (Zawacki-Richter et al., 2019). Secondly, students may be concerned about discrimination from their instructors after such confidential information is discovered and released to their faculty by AI machines (Zawacki-Richter et al., 2019). For instance, some students may worry that their instructors may subconsciously discriminate against them if they have special needs or learning styles, perceiving them as less intelligent than their peers. Thirdly, the personal data obtained by AI machines can be protected to a certain limit. Hence, the data obtained may be breached if such machines are hacked or malfunction. Lastly, according to Education Cybersecurity Report (2018), the educational sector was ranked last in cybersecurity performance and protection compared to all other significant sectors (Dhawan & Batra, 2021). Therefore, this potential threat deserves additional attention from experts in the field, programmers, and researchers, as it needs to be resolved before any implementation in the educational sector.

5. High Cost of Technology

Undoubtedly, AI technologies are the most expensive due to their ability to outperform humans in specific fields and tasks. It is essential to mention that the costs of AI technologies differ based on several factors, including their abilities, the complexity of their algorithms, whether they utilize machine learning, and the level of expertise of the programmers available to handle the machine (Dhawan & Batra, 2021). Not only are they expensive technologies, but they require a lot of time in order to be developed. Both factors, the cost and the time, are not affordable by most public educational institutions worldwide (Zawacki-Richter et al., 2019).

6. Technological Illiteracy

The decision to use AI technology, particularly in education, is significantly influenced by technological illiteracy (Dhawan & Batra, 2021). Users who are unable to make use of the machines to their advantage may result in the failure of the entire process due to a lack of technological literacy or a refusal to adapt to new technology. Since researchers are still figuring out how professors and students will respond to AI technology, the majority of educational institutions are reluctant to invest in them (Dhawan & Batra, 2021). Regardless, this threat needs to be handled as students, and faculty will eventually face a reality in which they will have to use these technologies, whether in the same institution or another workplace (Dhawan & Batra, 2021).

7. Lack of Experts

As the field of AI remains developing and is relatively new, the number of experts in the field or programmers that can work with AI machines is low. Furthermore, inserting massive amounts of data so that AI machines can become more accurate and precise requires enormous financial and human resources, which, again, many educational institutions need help to afford (Dhawan & Batra, 2021). This threat is highly relevant to the educational field, as institutions are required to keep their students equipped with up-to-date knowledge and skills that include the ability to function with AI machines so that they can find employment or create employment opportunities in the labor market (Ma et al., 2018) (Dhawan & Batra, 2021). Jobs requiring AI expertise are more premium than equivalent positions requiring no AI expertise. This is primarily due to a need for more knowledge in the job market (Dhawan & Batra, 2021). This cycle will continue as long as AI is not taught or implemented in educational institutions. Hence, the cycle

needs to be broken through the slow adoption of AIED and the introduction of AI specializations to higher education students in order for them to find decent opportunities in the labor market.

Though the threats may seem alarming, current researchers are already finding solutions. In a study by Aldosari (2020) concerning the future of HE in light of the AI transformations, it was recommended that higher education institutions need to "increase the awareness among specialists of the requirements of applying artificial intelligence in education" as well as "creating community cooperation with specialized companies in AI field" (Aldosari, 2020, p.150). Other studies also recommended that academic researchers need to conduct further studies on the field of AIED, with a focus on institutions that have already adopted AIED, taking into consideration the current potential opportunities and challenges as they are constantly changing alongside the development of AI applications in the education sector (Dhawan & Batra, 2021).

8. Fear of Originality

With the higher dependency of students on AI technologies, due to their ease of use, convenience, and accuracy, it is no doubt that the educational process may become flawed due to dependency of students on AI to complete their work (Dhawan & Batra, 2021). Furthermore, AI is feared to reshape how students behave or think, as students are highly likely to depend on such technologies that have the capacity to complete their work. With this in consideration, the dependence on such precise and convenient technologies may easily lead to further issues concerning security, integrity, originality, and fairness, involving further ethical dilemmas in the educational process (Dhawan & Batra, 2021). Unfortunately, if this challenge takes place, the only way to limit it or track it would be through using further AI technologies to detect whether the work has been submitted by the student or was AI-generated.

2.4 Addressing the Gap

As covered in the literature review, both the potentials and the challenges of AI implementation are high, however, the potential of AI could completely transform any kind of sector, especially the education sector. Nonetheless, AI is rarely adopted in the field of education for a variety of reasons, one of which is AI readiness. Though the topic is critical to be examined as the world is constantly evolving; the topic of AI readiness concerning education has been rarely researched worldwide and has never been researched in Egypt. For this reason, this research seeks

to fill in this gap through extensive primary and secondary research on the topic, with a special focus on examining AI readiness among faculty of three different types of universities in Egypt.

3 CHAPTER THREE: CONCEPTUAL FRAMEWORK

3.1 Readiness

Prior to examining and defining readiness, it is necessary to understand the pillars or factors representing readiness as a concept. Since the idea of readiness is complex and may consist of numerous variables or elements, it will be examined through two perspectives (a macro perspective and a micro perspective) for this research. Both views contribute to the creation of the conceptual framework of this study, as it primarily relies on the elements of which readiness may consist. The macro perspective measures readiness at a global or regional level, while the micro view focuses on institutional and organizational levels.

3.2 Readiness from a Macro Perspective

As technology advances, countries have begun to realize the importance of its integration within societies, governments, and institutions. In advance of such integration, countries need to be able to assess several factors, including how and why AI technologies would benefit society and institutions, as well as their capacity to adopt such complex technologies. To do that, countries must use unified benchmarking tools that examine their AI readiness or preparedness before introducing such technologies to governments or institutions. Such devices include but are not limited to Tortoise's Global AI Index and Oxford Insights' Government AI Readiness Index (Economist Impact, 2022).

Tortoise's Global AI Index was one of the first benchmarks to measure a country's innovation, investment, implementation, and capacity to adopt AI technologies. The Government AI Readiness Index focuses more on governments instead of countries as a whole. It assesses whether governments are prepared and ready to adopt AI technologies in their delivery of public services (Economist Impact, 2022). This assessment examines three pillars: government, the technology sector, and data and infrastructure (Economist Impact, 2022). The first pillar, the government, focuses on the government's vision and capacity for AI adoption. The second pillar, the technology sector, focuses on the availability or supply of human capital and the tools required to implement AI technologies. The third pillar, the data, and infrastructure, focuses on the inputs needed for this implementation. Though both benchmarks may seem to assess different aspects or contexts, they share the same goal: to understand a country's capacity to adopt AI based on the

raw capabilities and the institutions responsible for supporting such implementation (Economist Impact, 2022). The raw capabilities of a country include its "infrastructure, talent, and data—the crucial inputs that determine success in AI development" (Economist Impact, 2022, p.12). The institutions required to support such implementation are those needed to support the adoption through their investments, such as governments, policymakers, the private sector, and academia (Economist Impact, 2022).

3.3 Readiness from A Micro Perspective

In the past decade, numerous studies have assessed technological or AI readiness in particular institutions and organizations (Holmstrom, 2021). These studies have either readjusted commonly used models or created their own models to match their research purposes. It is essential to examine both readjusted commonly used models and novel models in order to develop a new model for this research that captures all dimensions and elements of AI readiness.

1. Commonly Used Models

Over the years, researchers have consistently attempted to comprehend the reasons behind users' refusal or acceptance of specific technologies and find ways to measure their extent of acceptance or refusal, which eventually led to the creation of numerous models that assess readiness (Khamis, 2023). One of the most popular models of acceptance, the Technology Acceptance Model (TAM), was used in a study by Khamis (2023) to evaluate how Egyptian citizens felt about accepting e-government services. This study used the TAM model to obtain a further understanding of the variables that could influence citizens' views on adopting e-government (Khamis, 2023). Though the TAM model does not explicitly measure AI readiness, it offers valuable insights into the dimensions of readiness that can apply to measuring it.

The TAM model was developed by Fred Davis in 1989, focusing on the external social factors that may impact the perceptions of users on accepting or refusing to adopt new technologies (Khamis, 2023). It incorporates four elements: the perceived usefulness of the technology, the perceived ease of use, attitude, and behavioral intention (Khamis, 2023). The model proposes that perceived usefulness and ease of use are independent variables, while attitude and behavioral intention are dependent variables. Furthermore, the model proposes that "the attitude towards the acceptance and usage of technology as well as perceived usefulness is a fundamental factor that

influences the behavioral intention determining whether to adopt a certain technology or not" (Khamis, 2023, p.23). As a result, perceived usefulness and perceived ease of use can influence attitude. The perceived usefulness and accessibility may be impacted by additional elements, such as demographics, trust, and social influence (Khamis, 2023). Such presumptions suggest that users will be more inclined to make use of a given technology if they believe it to be a simple and valuable tool. The modified TAM model developed by Khamis (2023), illustrated the relationship between external variables, elements of the TAM model, and the adoption of e-government services.

The modified model incorporates some critical elements that measure readiness. However, the TAM model has certain limitations that other scholars have sought to modify. Firstly, the model assumes a positive correlation exists between perceived usefulness, ease of use, and willingness to adopt the technology. However, certain users perceive certain technologies as valuable and easy to use but may not be willing to adopt them for various reasons. Hence, this assumption weakens the model to some extent. Secondly, the model needs to shed more light on technological literacy when in reality, it is as important as the other factors mentioned above. Al-adaileh (2009) also suggested that people with low levels of technology literacy were unable to recognize new technologies as valuable tools and might only use them because of their convenience (Khamis, 2023). In this situation, a completely new correlation may be created between technological literacy and the actual adoption of the technology. For such reasons, the TAM model cannot be used for this research, yet, it may inspire the creation of a novel framework for this research, with the integration of technological literacy and other elements to capture all necessary dimensions of readiness.

2. Re-adjusted Models

In a study by Holmstrom in 2021, a framework of his creation was introduced to aid in assessing organizational AI readiness through four dimensions; technologies, activities, boundaries, and goals (Holmstrom, 2021). Accordingly, Holmstrom (2021) defined AI readiness as "an organization's abilities to deploy and use AI in ways that add value to the organization" (Holmstrom, 2021, p.330). The researcher's goal was to provide a framework that offers a fuller theorization of the roles of AI in an organization's digital transformation. Holmstrom (2021) created this innovative framework as a result of his knowledge that the deployment of AI

technologies heavily depends on the assessment of AI readiness. Hence, it was crucial to "develop an understanding of organizations' abilities to meet these challenges (i.e., of their AI readiness)" (Holmstrom, 2021, p.330). According to Holmstrom's (2021) framework below, four elements play significant roles in digital transformation and aid in assessing AI readiness.

Figure 1: Scorecard for the AI Readiness Framework

Source: Constructed by Holmstrom (2021, p.334)

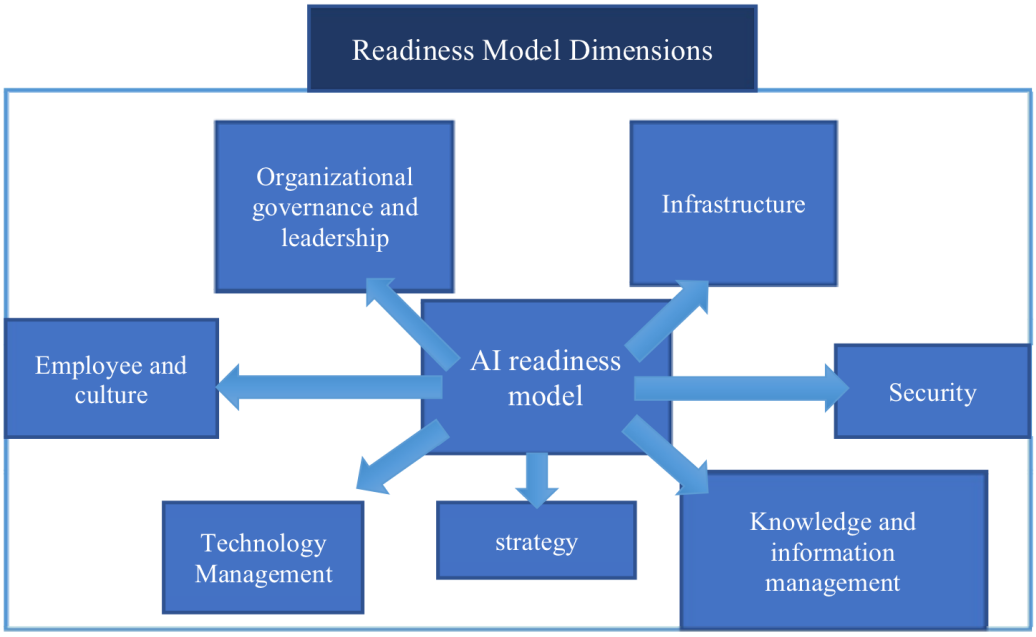
The first element used to assess AI readiness is technology, which refers to the changes in the existing technologies that are currently being utilized and will be utilized in the future to aid the organization. The second element used is activities, which refers to the extent to which routine activities in the organizations will change with the implementation of AI technologies (ex: handling of money transfers or sensor-based technologies) (Holmstrom, 2021). The third element is boundaries, which refer to any changes that may occur, including expansion, contraction, or disappearance of certain boundaries (ex: remote working). Lastly, the fourth element is goals, which refers to the extent to which the goals or objectives of the organization may change with the integration of AI technologies.

Holmstrom's (2021) framework provides valuable insights that many have failed to address when assessing AI readiness. However, it lacks several crucial points that fail to address actual readiness levels. Holmstrom's model successfully incorporates significant elements, such as boundaries and goals, which are dismissed within other models. However, it does not assess other factors, such as the perceptions of AI technologies (ex: their usefulness or willingness to adopt

them). Nonetheless, another AI readiness model was developed by Nortje & Grobbelaar (2020) to identify a wide range of dimensions and elements associated with adopting AI technologies that may not have been mentioned in Holmstrom's (2021) framework.

Nortje and Grobbelaar's (2020)'s AI readiness model can be described as highly descriptive and rich as they successfully covered all aspects of readiness, including the perceptions of usefulness and willingness to accept such technologies. They designed their model to "assist in the implementation of AI into a business' structures," seeking to simplify the readiness model in a narrative form (Nortje & Grobbelaar, 2020, p.1). According to their readiness model below, seven main dimensions should be considered within an AI readiness model, including organizational governance and leadership, employee and culture, technology management, strategy, knowledge and information management, security, and infrastructure (Nortje & Grobbelaar, 2020).

Figure 2: Readiness Model Dimensions



Source: Constructed by Nortje & Grobbelaar (2020, p.3)

Through this simplified model, Nortje and Grobbelaar (2020) attempted to integrate all of the main dimensions of readiness. However, further on in their research, they explain that each dimension has several elements, and each element has its variable. Moreover, they successfully demonstrate each dimension in-depth, covering all of the possibilities that assess the readiness for AI adoption. For this research and in developing a framework based on previous models, the most significant contribution from Nortje and Grobbelaar (2020) would be the dimension of employee and culture. Furthermore, this dimension seeks to assess "the different perspectives of employees with regard to AI" (Nortje & Grobbelaar, 2020, p.3). The dimension focuses on perceived usefulness, benefits, trust, ease of use of AI technologies, the employees' skills and expertise, perception of job security, and, most importantly, their willingness to adopt such technologies (Nortje & Grobbelaar, 2020). Below is a table that illustrates the most significant highlights of the readiness dimension of employee and culture (Nortje & Grobbelaar, 2020).

Figure 3: Readiness Dimensions and Elements

Readiness dimension (d)	Readiness element	Readiness variables
Employee and Culture	Job security	Employees' perception on job security with regards to AI
	Perceived usefulness	Employees' perception on the usefulness of AI
	Perceived ease of use	Employees' perception with regards to ease of use of AI
	Compatibility with existing values and practices	Compatibility of AI with business values and practices
	Benefits	Employees' perception on the benefits regarding AI
	Business Acceptance	Perceived business acceptance of AI
	Skills and expertise	Perceived current skills and expertise capability to implement and manage AI
	Collaboration	Willingness of employee collaboration with regards to AI
	Certainty	Willingness of employee collaboration with regards to AI

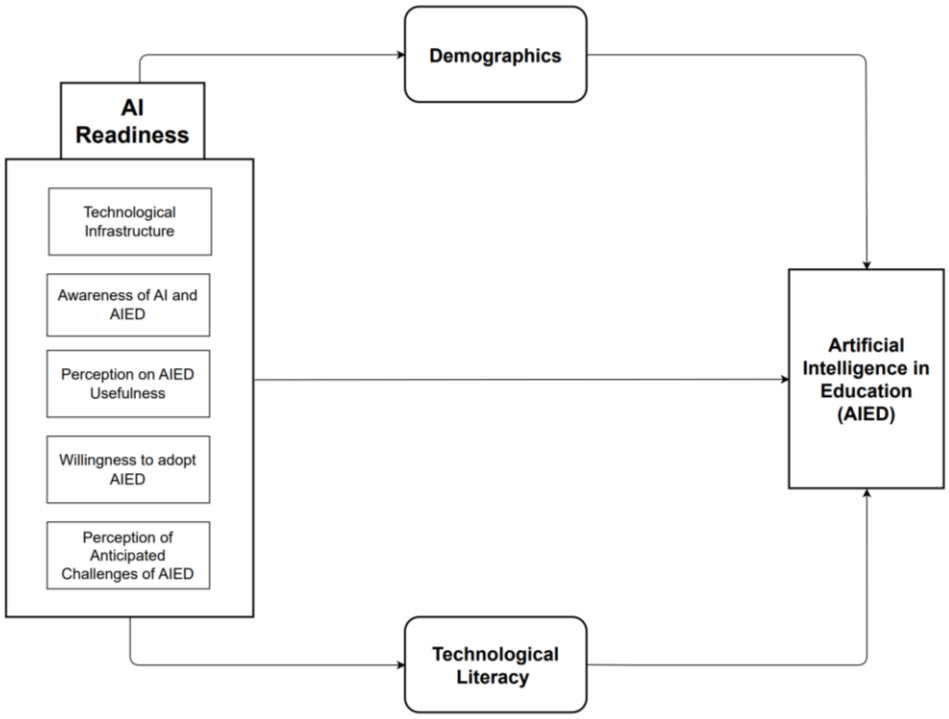
Source: Constructed by Nortje & Grobbelaar (2020, p.6)

3. Conceptual Framework of this Research

To study the topic of research, a novel conceptual framework for AI readiness was formulated, focusing on the main variables and factors of the research. Firstly, the focus of this research is on AI readiness. Under AI readiness, there are five main pillars that are considered essential in impacting AI readiness, based on previous conceptual frameworks that assess readiness and previous literature. These pillars are technological infrastructure, awareness of AI and AIED, perception of AIED usefulness, willingness to adopt AIED, and the perceived anticipated

challenges of AIED. These pillars will be considered a criterion on which the interview will be structured. Secondly, the main goal of this research is to understand the factors that impact AI readiness. According to Khamis (2023), technological literacy and demographics are significant factors that may impact technology or AI readiness. For this reason, technological literacy and demographics are added to the conceptual framework as separate elements. Thirdly, the main purpose of this research is to assess AI readiness and understand the relationship between AI readiness and other factors in an attempt to achieve AIED, which makes AIED the final goal or factor in the framework. In order to comprehend or assess AI readiness, the research will need to examine the following factors to gain insight as to how ready the faculty of HE are to accept AIED. This framework was inspired by Nortje & Grobbelaar's Readiness Model (2020), yet, it was modified to fit in the context of this research.

Figure 4: AIED Readiness Conceptual Framework



Source: Constructed by the researcher

4 CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1 Research Design

This research adopts a mixed-method research approach. Structured in-depth interviews were used in order to gather the primary data for this study. A qualitative method was used to gather the primary data since it is important to focus on meanings and contexts that need to be interpreted and investigated. A qualitative methodology is the best option for data gathering in this type of research, as it offers more in-depth insights into the challenges, and different contexts, and answers all the why and how questions that are included in the research (Marshall et al., 2021). In order to fully capture the meanings and the areas in which higher education is deteriorating as well as the readiness levels of different faculty depending on the type of university, it is necessary to conduct in-depth interviews and analyze them comprehensively. In-depth interviews were chosen as the most suitable research tool for a variety of reasons. Firstly, in-depth interviews offer the most comprehensive, in-depth, and detailed responses in comparison to other qualitative tools such as surveys or focus groups (Marshall et al., 2021). Secondly, in-depth interviews offer the respondents the privacy and confidentiality they need in order to answer freely with no fear of interruption or judgment (Marshall et al., 2021). Thirdly, the researcher can be more focused on only one interviewee in order to monitor the changes in the word choice or tone to obtain better insights and comprehension of their opinions.

Since this is a comparative research, the structured in-depth interviews will be held with faculty members from three different types of universities and institutions; public, private, and non-profit. The study was designed to be comparative in order to be able to establish whether there is a relationship between the type of the institution and the AI readiness level of its faculty. Additionally, highlighting this relationship will offer higher external validity to this research, allowing it to be generalizable.

4.2 Sample Selection

The sample of participants of this research consisted of faculty members that teach in any of the three types of universities or institutions, namely private, public, or non-profit. The criteria for the sample selection included the following: the availability and willingness of the interviewee to participate, the ethnicity and nationality of the participant, and their educational level. For the

purposes of this research, only PhD holders were chosen to be participants for two reasons. Firstly, some universities require all of their faculty to be PhD holders. In order to include the largest number of possible universities in this research, it is important to require all of them to be PhD holders. Secondly, PhD holders were chosen in order to unify the educational level of all participants through one main dimension. Moreover, all participants had to be available and willing Egyptians with a PhD that teach in one of the aforementioned types of universities. A total of 64 faculty members were emailed to take part in this research. They were reached either through the personal connections of the researcher or through recommendations of other faculty members that were already interviewed. A total of 52 faculty members agreed to participate in this research. However, the researcher stopped the data collection process after 46 faculty members have been interviewed as the responses were becoming redundant and there was no need to continue the data collection procedure. The 46 participants were faculty members from a variety of universities, including The American University in Cairo, Ain Shams University, Cairo University, Canadian International College, The British University in Egypt, Egyptian Russian University, Mansoura University, University of Hertfordshire, Ahram Canadian University, and The Arab Academy for Science, Technology, and Maritime Transport. The titles of the faculty members that were interviewed included assistant professors, associate professors, and professors. Additionally, they were from different departments, including Mass Communication and Journalism, Business Administration, Economics, Political Science, Economics, Pharmacy, Engineering, and Geology. Their age range was ranged between 32-64 years. A total of 21 males and 25 females were interviewed. In total, 18 faculty members from private universities, 13 faculty members from public universities, and 15 faculty members from non-profit universities were interviewed. Accordingly, Table 1 (below) illustrates the type of institution each university belongs to, and how many of faculty members were interviewed from each university, and their reference in the data analysis.

Type of Institution	Number of Faculty Members Interviewed	Reference in Data Analysis
Public	13	R2, R9, R10, R12, R16, R18, R26, R33, R35, R38, R39, R40, R45
Private	18	R1, R5, R6, R8, R11, R14, R21, R24, R25, R27, R31, R32, R34, R37, R41, R42, R44, R46
Non-Profit	15	R3, R4, R7, R13, R15, R17, R19, R20, R22, R23, R28, R29, R30, R36, R43

4.3 Interview Structure

The interview questions were developed and structured based on two areas; the research questions and the conceptual framework. Both areas sought to examine similar determinants, including but not limited to the levels of the technological literacy of the participants, the perceived challenges in higher education institutions, their perceptions on AI systems, and the factors that may impact their AI readiness. Accordingly, each question was created to explore a particular area from the aforementioned topics. All of the questions in the interview were structured, with the majority being open-ended. The other type of questions that were included in the interview were rating questions (for example, on a scale of 0-10 [0 being the lowest and 10 being the highest], how would you rate your technical knowledge). The interview questions can be found on Appendix 1.

4.4 Interview Procedure

The interviews took place from mid-January 2023 until early March 2023. The interviews lasted from 30-50 minutes, depending on the details provided by each interviewee in each question. All interviews were held online, on the platform "Zoom" in order to fit the schedules of the faculty members without causing any inconvenience or altering their willingness to participate. Furthermore, online interviews offered them more flexibility when scheduling the time and the date of the interview. Prior to starting all interviews and upon the agreement of the participants to be part of the research, the informed consent was emailed to each of the potential participants to

be signed in advance of the actual interview. Those who did not reply to the email with signed informed consent were excluded from the research. As soon as the interview began, the participants were reminded of the purpose of this research, that their identity is entirely confidential, and that the interviews were audio-recorded. The interviews were conducted in Native Arabic and later transcribed and translated to use some of the insights and quotes in the data analysis and findings of the research. After the interviews ended, the participants were thanked for their efforts and participation and were informed that the researcher may contact them again if any further information is required. Upon the completion of the data collection process, the researcher used thematic analysis in order to analyze the data that was gathered as well as a quantitative approach in order to quantify the results into percentages.

4.5 Limitations

There are certain limitations to this research that may hinder the ability to generalize the overall results to the general higher education population. Firstly, as mentioned previously, the topic is highly under researched in Egypt. Hence, there are no previous studies that can be used as a reference or a basis to support the findings of this research. Secondly, the number of participants for this research is considered unrepresentative of the entire higher education faculty in Egypt. Thirdly, the number of universities involved in this research is also relatively limited as many universities were not considered in this research. Fourthly, this research focuses on assessing AI readiness for only one aspect of higher education, which is the faculty; excluding students, administrators, staff, and the institution as a whole. Fifthly, this research was completed before the rise of ChatGPT, the latest release of an AI social chatbot that is currently being over-used in education by both, faculty and students. ChatGPT can be considered a significant case study as it can provide major insights that may impact the AI readiness of faculty. However, it was not stressed upon in this research as it was released after the research was conducted. Lastly, according to the findings of this research, the AI readiness levels is dependent on the individual rather than the institution as a whole, hence, it is difficult to assess whether certain types of universities have lower or higher AI readiness levels. With this into consideration, it will be harder for governments or policymakers to decide which types of universities they should begin with when adding AI technologies to the institution or its system. Further research can be conducted on specific types of universities through focusing on all aspects of the university (ex: faculty, students,

administrators, staff) in order to offer in-depth insights that can also be generalized. Despite the limitations, this research offers significant insights on the AI readiness levels of faculty in higher education, which are considered as a main pillar in the education system. In other words, the faculty's readiness will shape other aspects and will be the main determinant on whether such technologies are utilized within the system or curriculum or not.

5 CHAPTER FIVE: FINDINGS AND DATA ANALYSIS

The interview questions were structured into six different sections in order to answer the research and sub-research questions of this study. They were also sectioned based on the different elements of AI readiness and on the conceptual framework of this study. The main purpose of the interviews was to assess the AI readiness levels of faculty from three different types of universities for two further goals. Firstly, assessing the AI readiness levels of different faculty from the higher education sector will offer insights as to how "ready" faculty are to adopt AI technologies within their educational system or curriculum. Hence, offering insights as to how far higher education institutions are from such a transformation. Secondly, comparing the AI readiness levels of faculty from different types of universities will allow the researcher to establish whether there is a relationship between the AI readiness levels and the type of university being investigated or not, hence, offering further insights into the types of universities that may be more "ready" for this change, and on the universities that may be behind when it comes to this transformation.

The first part of the interview examined the technological literacy levels of the faculty, depending on the technologies they own, their own ratings of their technological literacy levels, and their willingness to adopt, learn, or shift to utilizing new technologies. The second part of the interview investigated their perceptions of the existing challenges in the higher education sector, from a macro and a micro perspective. The third part of the interview focused on their previous knowledge concerning AI and AIED. Furthermore, this section was also concerned with their knowledge concerning existing AIED tools that may be used in their current institution, as well as how AI can be further integrated into their current institutions. The fourth part of the interview assessed the faculty's perceptions of the usefulness of AI tools in education, as well as their willingness to adopt such technologies in their institutions. The fifth part of the interview explored the potential anticipated challenges that may occur if AI systems were integrated or applied in their institution or university. The sixth and final part of the interview analyzed the faculty's perceptions concerning the AI readiness levels of the country as well as their institution in terms of the adoption of AIED. Moreover, they were also questioned about the factors that may impact their AI readiness levels, besides their demographics and their technological literacy levels. Lastly, the interview ended by questioning the respondents about their demographics (for example, gender, age, and income level) as well as their years of experience as faculty members.

5.1 Role of Technological Literacy in AI Readiness Levels

5.1.1 Utilization of Technology

There were common technologies that were utilized by all respondents on a daily basis such as Smart Phones, Laptops, PCs, AirPods, and Smart TVs. A total of 24 of the 46 respondents used other different and unique technologies on a daily basis such as Cameras, VR Headsets, iPads, Smart Boards, and Smart Watches. It is important to note that the 24 respondents that used other different technologies were from private or non-profit universities, whilst faculty from public universities used common technologies only. As quoted by the respondents working in different universities, the following are examples of the most unique responses received for this question.

- Public Universities: *R16 "I can't survive without my phone, my entire personal and professional work is on there".*
- Private Universities: *R21 "These are the technologies I remember, but I'm sure that I've used or been exposed to much more devices throughout my entire life".*
- Non-Profit Universities: *R3 "My family bought me a Smartwatch as a gift for my birthday, and I kept it in the drawer for months because I didn't think it was useful, not until recently. I can't take it off my arm now".*

Based on the quotes above, it is clear that there is a high dependency on different technologies between different faculty from different types of institutions. With higher dependency, comes higher technological literacy and awareness; since the more an individual depends on a technology, the more likely they will be exposed to it on a daily basis and hence know more about its different features and on how to utilize it. This will eventually lead them to accept using further technologies in the future. All of the insights concerning the utilization of technology between the different types of universities indicate that all faculty have a proper basis of technological literacy, with minor variations on the complexity of the technologies used.

5.1.2 Rating Technological Literacy Levels

This question aimed to rate each respondent's technological literacy level through their own self-rating or self-assessment. Accordingly, they were asked to rate their technological

literacy level on a scale from 0-10 (0 being the lowest and 10 being the highest). As an overall, all respondents ranked their technological literacy levels as 5 or higher. The average technological literacy ranking was 7 for public faculty, 8 for private faculty, and 6 for non-profit faculty. The most common rating was 8 and 6 with the public faculty, 7 in the private faculty, and 5 and 7 in the non-profit faculty.

5.1.3 Willingness to Shift Between Technologies

This question aimed to rate each respondent's willingness to shift to utilizing new technologies or utilize new technologies if they had to. The respondents were asked to rate their ability and willingness to shift to new technologies on a scale from 0-10 (0 being the lowest and 10 being the highest). Surprisingly, all ranks were given for this question, including 0 and 10. Furthermore, only one respondent ranked her ability and willingness as 0 out of 10, elaborating that she despises technology and has serious concerns about it. On the other hand, 7 respondents ranked their willingness and ability as 10 out of 10. The average and most common willingness and ability ranking was 7 for public faculty, 8 for private faculty, and 6 for non-profit faculty.

5.1.4 Summary of the Role of Technological Literacy in AI Readiness Levels

To summarize, faculty members from the private and the nonprofit sector utilize more advanced technologies in comparison to faculty from the public universities. Moreover, they have higher technological literacy levels than faculty from the public sector. Faculty from the private sector ranked themselves highest in terms of technological literacy, whilst the non-profit sector ranked themselves lowest in technological literacy. Lastly, faculty members from the private sector ranked themselves highest in terms of their willingness and ability to shift to new technologies, whilst faculty from the non-profit sector ranked themselves as the lowest. Overall, the insights for this section indicate that faculty members from private universities may have the highest levels of technological literacy, awareness, and abilities, whilst faculty from the non-profit sector are slightly behind, with the faculty of the public sector being in between the private and the non-profit sector.

5.2 Challenges in Higher Education

5.2.1 Perceptions of Challenges in Higher Education in Egypt

The aim of this question was to assess the responses of faculty concerning their perceptions on the existing challenges in the higher education sector in Egypt. The respondents were asked to address the existing challenges in the higher education sector from their own point of view. The most common challenges that were identified and agreed upon between the three types of sectors included the weak infrastructure, lack of resources or facilities, lack of practicality leading to skill mismatch after graduation, the unwillingness of students to learn, outdated teaching methods and curriculum, and high levels of plagiarism and cheating. Other less common challenges that were identified included the hiring of unqualified faculty, nepotism, high workload on faculty members and students, and the existence of a language barrier. Challenges that were addressed by less than 5% of the respondents included the lack of job security in private and non-profit universities, the carelessness of students during the educational process due to free education or lack of passion, lack of digital skills and literacy, weak trial and error process, grading inflation, and the existence of several grading systems that are not generalized. As quoted by the respondents working in different universities, the following are examples of the most unique responses received for this question.

- Public Universities: *R35 "The biggest problem is that in public universities we hire faculty not based on their qualifications or knowledge, but based on the fact that they were top of their class, meaning that faculty may not be fully qualified. They sometimes even inherit the position from their family. I am pro that we need to choose based on qualifications without nepotism".*

- Private Universities: *R11 "Academia is purely theoretical, when life is purely practical. This is why internships are of rising importance nowadays because they need to face both aspects. Not just that, but the teaching methods are still traditional and classical which kills the motivation part for both faculty and students".*

- Non-Profit Universities: *R23 "There is no evolution or improvement in the educational system and curriculum, we are stuck where we are and very outdated. We stick to the same curriculum and same teaching methods with no respect for the changes taking place*

whether in technology or teaching methods or even the curriculum being taught. We are very traditional, resisting any changes in anything whatsoever as long as it works".

According to the quotes above, it may be indicated that one of the biggest perceived challenges in HE is the outdated curriculum as well as the outdated teaching methods. This leads to several serious consequences, whether it is the lack of motivation of faculty and students or the skill mismatch that takes place shortly after graduation. In addition, it seems that the hiring of faculty within public universities is based on personal connections rather than actual qualifications, which may lead to potential deteriorations during the learning process. However, these were not the only perceived challenges, as there were others that were mentioned earlier as well. Yet, these may be considered as the most critical challenges in the sector.

5.2.2 Perceptions of Challenges in Own Institution

The aim of this question was to assess the challenges that exist in each respondent's own institution or university, whether faced by them or by students. The respondents were asked to address the existing challenges in their institution from their own point of view. For this question, the answers were categorized based on the type of institution as different types of institutions face different challenges based on their system. Despite their differences, there were only two common challenges that were addressed in all three types of sectors, which were the skill mismatch and the unwillingness of students to learn due to a lack of passion and motivation. Skill mismatch refers to the inability of students to cope with the labor market needs after their graduation, due to their education and knowledge being purely theoretical. Another common challenge that was prominent between the private and the non-profit sector included poor communication between faculty and students. In the public institutions and universities, the main challenges that were identified were skill mismatch, the unwillingness of students to learn, a large number of students in classes, plagiarism, and cheating, low wages for faculty, lack of resources for faculty and students, low motivation of faculty and students, problems in faculty promotion, and the guarantee of job security that leads to the lack of improvement. In private institutions and universities, the main challenges that were identified were skill mismatch, lack of support for students, the high workload on students and faculty, inability to alter the curriculum, language barrier, poor communication between faculty and students, and lack of passion and motivation from students. In the non-profit institutions and universities, the main challenges that were identified were the short attention span

of students, low linguistic and digital literacy levels, increasing number of students in classes, high tuition, lack of job security, grade inflation, resistance of students to accept constructive feedback, low criteria for accepting students into the institution, and low job satisfaction due to low promotions and lack of recognition. As quoted by the respondents working in different universities, the following are examples of the most unique responses received for this question.

- Public Universities: *R38 "Education in public universities has become a one-way channel, just as if the student is listening to a lecture in an online session".*

- Private Universities: *R1 "Professors enter the class waiting for students to make mistakes to punish them, with no appreciation to their mental health or progress. Another problem is requiring so much of the student in terms of knowledge, when it won't really benefit them in the future. We're simply using the same curriculum, with no respect to deep learning and what will actually benefit the students".*

- Non-Profit Universities: *R15 "The very short attention span of students that has been caused by all the new technologies and the short videos and reels. This has changed the way we process information. So as an instructor, I have difficulties changing their mentality and attitude and making them actually want to learn. It takes a lot of time to convince them that the information being taught is essential and that they need to be more engaged and motivated to learn instead of simply attending for grades and passing the course".*

Based on the quotes above, it seems that the main challenges that exist in the different types of universities nowadays are concerned with student motivation and lack of communication between faculty and students. The lack of communication between faculty and students is leading to a lack of student engagement and eagerness to learn, which in return leads to lower motivation, and education being a one-way channel. Furthermore, faculty are not offering a chance for students to learn and communicate properly, but are rather forcing them to memorize large bulks of material without listening to their concerns, simply because their mentalities have not been adjusted to match the new generation of students, nor have the curriculums been updated by the necessary stakeholders.

5.2.3 Summary of Challenges in Higher Education

To summarize, the most common and agreed upon perceived challenges that exist in the higher education sector in Egypt were the weak infrastructure, lack of resources or facilities, lack of practicality leading to skill mismatch after graduation, the unwillingness of students to learn, outdated teaching methods and curriculum, and high levels of plagiarism and cheating. In terms of the existing challenges in each respondent's institution or university, all three sectors addressed two common challenges which were the skill mismatch and the unwillingness of students to learn due to a lack of passion and motivation. Overall, all respondents agreed that there are serious challenges with the higher education sector in Egypt that are impacting the quality of education being offered. If such issues were not resolved or tackled in any way, it may be anticipated that the quality of education will continue to deteriorate over the upcoming years.

5.3 Utilization of Artificial Intelligence in Education (AIED)

5.3.1 Defining Artificial Intelligence (AI)

The aim of this question was to determine the pre-existing knowledge of the respondents regarding AI and what it means. The respondents were asked to define AI in their own terms. Despite all respondents claiming to know what AI means, only 67% of the respondents knew what AI truly was. The most common answer to this question was that AI are machines that have the ability to perform tasks that typically require human intelligence. Those who did not know what AI was discussed how AI was widespread and is integrated into all parts of society nowadays. The highest accuracy rate in defining the term belonged to the faculty from the private universities. The lowest accuracy rate in defining the term belonged to the faculty from the non-profit sector. As quoted by the respondents working in different universities, the following are examples of the most unique responses received for this question.

- Public Universities: *R33 "AI is a new technology that is becoming integrated in everything around us, even in social media, shopping, working life, and even driving. It's the ability of machines to complete human tasks with no human intervention. Not everyone knows that this is AI, some people think it's regular technology".*

- Private Universities: *R5 "AI means I have a machine than can process equations and answer requests without me giving them too many details. I can simply give keywords and they create the rest. They're basically machines that operate on their own based on some algorithms that were previously programmed into the machine. It's a computer that has its own mind".*

- Non-Profit Universities: *R22 "AI is something that I look at positively, in a way that it is going to facilitate my world. It helps you facilitate getting information faster and more accurately. When we talk about AI today we're really talking about the unknown".*

According to the quotes above, it can be said that the general attitude toward AI is somewhat positive. Additionally, faculty from different universities recognize the importance of AI and are able to distinguish the difference between regular technology and AI, which indicates higher levels of technological literacy and awareness.

5.3.2 Defining Artificial Intelligence in Education (AIED)

The aim of this question was to assess the previous knowledge of the respondents concerning the field of Artificial Intelligence in Education (AIED), since it is the main aspect of this research. The respondents were asked whether they have heard about it before or not, and what they knew about the field. Interestingly, a total of 29 out of the 46 respondents (a total of 63%) recognized the field and knew what it was. The highest recognition rate was for the private sector, and the least recognition rate was for the non-profit sector. Furthermore, a total of 9 out of 13 (69%) faculty members from the public sector recognized the term, whilst a total of 14 out of 18 (78%) of the faculty members from the private sector recognized the term. Oddly, only 6 out of the 15 (40%) of the faculty members from the non-profit sector recognized the term. The most common definition that was attributed to the term was that AIED is the integration of AI technologies into the education system to benefit the students, faculty, or the institution as a whole through increasing the efficiency and effectiveness of all stakeholders. As quoted by the respondents, the following are examples of the most unique responses received for this question.

- Public Universities: *R12 "I briefly heard about it. AIED is using some technologies for research or to study or teach remotely, maybe even it does not require human instructor".*

- *Private Universities: R42 "Yes I've heard about it, it is the integration of AI machines into the educational tasks or curriculum to support faculty and students, so, for example, it's the utilization of automatic grading machines to save time and effort on instructors and provide higher accuracy for students".*

- Non-Profit Universities: *R13 "I have not read about the field but I know that right now it has become a very hot topic in university settings".*

Based on the quotes above, faculty from different universities have brief knowledge of the field of AIED, and recognize that it is becoming a field of interest in the educational sector due to its potential in transforming the educational process. Once again, this may indicate higher levels of technological literacy and awareness, as well as high levels of readiness as well.

5.3.3 Utilization of AIED in Existing University

The aim of this question was to assess which universities use or do not use AIED within their educational system or curriculum. The respondents were asked whether they use any AI programs in the educational system or curriculum and whether they perceive it as beneficial or not. Surprisingly, 40 out of the 46 respondents (87%) use some form of AI technology within their educational system or curriculum. Interestingly, 30 out of the 46 respondents (65%) utilize automatic grading systems (bubblesheets or multiple choice questions) in their educational system. Furthermore, automatic grading systems were the most prominent form of AIED being utilized in the higher education sector in Egypt. The second most prominent form of AIED being utilized in the higher education system in Egypt are centralized systems for the entire institution on a micro and a macro scale. Other limited AI technologies that were utilized were simulations, proctoring programs, automated testbanks, chatbots, and robots to perform repetitive tasks. Concerning the different types of universities, all faculty members from the public and non-profit sector utilize AI technologies within their educational system and curriculum. On the other hand, only 72% of the faculty from the private universities utilize AI technologies within their institutions. Lastly, it was agreed upon between all the respondents that utilize some form of AIED in their institution that it is highly beneficial for them and for the students, offering several benefits including saving time and effort, higher accuracy levels, and beneficial predictions and feedback. As quoted by the respondents, the following are examples of the most unique responses received for this question.

- Public Universities: *R33 "There is a system we use in collaboration with the computer science department. Ever since we started using this system, nothing is submitted with papers anymore. Each student has their own barcode and uses it to know everything on this system. Professors can also teach and interact with students online (we use Microsoft Academic for that). We also have machines that grade the examinations (both essays and MCQ)".*

- *Private Universities: R24 "We use bubblesheet grading and automated testbanks. We are highly benefiting from them because suddenly the number of students per class increased so the bubblesheet is saving a lot of time on us in grading. The automated testbanks helped us a lot during the pandemic as well, since they generate new randomized questions that we can use each exam without the fear of them being shared with other students since we were online".*

- *Non-Profit Univerities: R19 "I personally use an application called Zipgrade for automatic bubblesheet grading. This is not sponsored by the university, I purely use this out of my own knowledge and experience. We also have a system - Moodle, that our communication with students is based on. The system offers feedback and statistics concerning the students' progress (for example, which questions were difficult and which were easiest, the estimated time for each question). Our registration system also offers a personalized registration experience for each student depending on their goals".*

In reference to the quotes above, the findings are truly encouraging and promising for a future of AI in education. The majority of the different types of universities are utilizing some form of AI in their educational process in order to facilitate the communication or grading process. Such results also indicate that faculty are somewhat aware of the potential of AI and the extent to which it eases different processes in the educational experience.

5.3.4 Perception on AI Adoption in Existing University

The aim of this question was to explore whether the respondents perceived the adoption of AI in their own institution as beneficial or not, and in case it is beneficial, how would it benefit them or other stakeholders. Interestingly, all of the respondents agreed that the adoption of AI in their institution or other institutions would be highly beneficial to them and other stakeholders (for

example, students and the institution as a whole). 89% of the total respondents confirmed that the adoption of AI in their university would significantly save time and effort for them, allowing them to concentrate more on other aspects of their job responsibility. Sixty percent of the total respondents also mentioned that the adoption of AI would decrease the probability of human error, hence offering more accurate predictions or results. Additionally, 17% of the respondents explained that technology has its dangers and potential drawbacks, such as privacy or the possibility of errors or bias, however, they still agreed that the potential advantages exceed the disadvantages; hence, the adoption of AI in higher education would still be significantly useful and helpful. As quoted by the respondents, the following are examples of the most unique responses received for this question.

- Public Universities: *R16 "There is no doubt that technology is beneficial but it still has its problems, but that shouldn't stop us from adopting all kinds of technology in avoidance of staying behind. We need to take it step-by-step in consideration with its benefits and threats. This requires a mentality that can adapt with technology and is willing to try new technologies. It takes time but after its adoption it is truly useful and helpful".*

- *Private Universities: R6 "Sure it will be beneficial, mainly because each student needs a specific learning method and specific attention, so yes AI machines will highly benefit the system. It will also open the horizon of students to see other work outside of the box and will encourage creativity. Until now, I don't have a TA, so virtual TAs will highly support as well. This will also give faculty member more time to take a break and be able to focus more on the students instead of being buried in work.*

- *Non-Profit Univerities: R17 "Besides saving time, it will also improve the entire educational system as it allows higher chances of innovation and creativity, leaving behind the traditional methods. Students will no longer have to memorize in order to pass and will be forced to be engaged, motivated, and actually learn".*

According to the quotes above, it is promising that all faculty answered that the integration of AI tools would be highly beneficial whether to them or to the students. This indicates that faculty are aware of the benefits of this integration, and hence, have higher AI readiness levels than expected. More importantly, it is beyond significant that the faculty are not only aware of the

technologies but are more aware of the potential benefits it will offer. In fact, their eagerness towards implementing such technologies is considered more promising than their actual awareness, as willingness is one of the major pillars of AI readiness (in the context of this research).

5.3.5 Summary of Utilization of AIED

To summarize, the majority of the respondents had accurate previous knowledge concerning the definition of AI, which is considered insightful for this research. In terms of the field of AIED, a total of 63% recognized the field and knew what it was. According to such results, the private faculty members seem to be more knowledgeable concerning the field of AI, whilst the non-profit faculty members seem to be a bit behind. In terms of whether the respondents used AI tools within their educational system or curriculum, it was found that a total of 87% used some form of AI technology. The main AI technologies being used in the higher education system in Egypt are automatic grading systems, and centralized web systems for the entire institution. All of the respondents agreed that the adoption of AI in their institution or other institutions would be highly beneficial to them and other stakeholders (for example, students and the institution as a whole). The main reasons why AIED was perceived as beneficial was due to saving time and effort, decreasing the probability of human error, and that the overall advantages exceed the potential disadvantages.

5.4 Perception of Usefulness of AI Tools in Education

5.4.1 Beneficial AI Tools in Education

The aim of this question was to assess which AI tools or technologies would be most beneficial to Egypt's higher education depending on the choices made by the respondents. For this question, the respondents briefed with each type of AI technology that was listed in order to ensure that they understood the purpose of each tool. They were asked to choose the most 3 beneficial AI tools that would highly benefit them in education. The list they were choosing from consisted of 10 different AI applications, which were automatic grading machines, artificially intelligent teaching assistants, online chatbots, integrity detectors, simulations, automated testbanks, transcription of lectures, intelligent tutoring systems, prediction AI technologies, and ChatGPT. In total, 82% of the total number of respondents chose automatic grading machines as the most

beneficial AI tool in education. 64% of the total number of respondents chose integrity detectors as the second most beneficial AI tool in education. 43% of the total number of respondents chose prediction AI technologies as the third most beneficial AI tool in education. The least AI tools that received any votes were online chatbots, intelligent tutoring systems, and ChatGPT (or GPT4). As quoted by the respondents, the following are examples of the most unique responses received for this question.

- *Public Universities: R12 "I believe the first option would be AI prediction tools to offer insights on whether a certain student can fit in a certain major or whether a certain TA is fit for the role. My second choice would be automatic grading machines. Though we already use them, they are still limited and need higher expansion as we can only use them for MCQs at the moment. Using automatic grading machines for essays would be highly beneficial and efficient. My third option would be the usage simulations to offer the practical experience for the students so they're not in shock after they graduate".*

- *Private Universities: R25 "I know this will sound weird, but all of them. It's really impossible to choose between any of them because a mixture of all would offer maximum productivity for all sides, because each one of them has its own benefits".*

- *Non-Profit Univerities: R3 "Of course my top choices would be automatic grading machines and integrity detectors because of the amount of effort we spend as faculty in this area"*

According to the quotes above, automatic grading machines seem to be the most significant tool which many faculty are hoping to utilize within their universities in the near future, due to its potential benefits including higher accuracy and lower workload on faculty. Other AI tools such as prediction systems, integrity systems, and simulations are also perceived as highly beneficial, but faculty are aware that they may not be implemented as early as automatic grading machines.

5.4.2 Ranking Willingness to Adopt AIED

The aim of this question was to assess the willingness of each respondent in adopting AIED based on their own self-rankings. The respondents were asked to rank themselves on a scale from 0-10 (0 being the lowest and 10 being the highest) on how willing they are to adopt further AI

technologies in education. Surprisingly, none of the respondents ranked themselves less than 7 out of 10. Additionally, a total of 54% of the respondents ranked their willingness as 10 out of 10. The average willingness ranking was 9 for public faculty, 8 for private faculty, and 9 for non-profit faculty. The most common rating was 10 with the public faculty, 7 and 10 in the private faculty, and 9 in the non-profit faculty.

5.4.3 Summary of Perceptions of Usefulness of AIED

To summarize, the majority of the respondents (82%) chose automatic grading machines as the most beneficial AI tool in education. 64% of the total number of respondents chose integrity detectors as the second most beneficial AI tool in education. 43% of the total number of respondents chose prediction AI technologies as the third most beneficial AI tool in education. The least AI tools that received any votes were online chatbots, intelligent tutoring systems, and ChatGPT. When ranking their willingness to adopt further AI technologies in education, none of the respondents ranked themselves less than 7 out of 10. Additionally, a total of 54% of the respondents ranked their willingness as 10 out of 10. The average willingness ranking was 9 for public faculty, 8 for private faculty, and 9 for non-profit faculty.

5.5 Potential Anticipated Challenges in AIED

5.5.1 Main Challenges of AIED

The aim of this question was to explore the responses of faculty concerning their anticipated potential challenges that they may face due to the adoption of AI in higher education. The respondents were asked to address their anticipated potential challenges that may arise or they may face due to such integration from their own point of view. The most common challenge that was addressed by 63% of the respondents was the low technological literacy levels that the faculty may have, hence the inability to adopt further advanced technologies if they do not have the basic knowledge on how to utilize basic technologies. The second most common challenge that was addressed by 48% of the respondents was the fear that AI may ruin the educational process due to higher dependency on technologies or utilization of AI (example, ChatGPT). Other common challenges that were addressed included the unwillingness of faculty to adapt to such transformation, resistance, weak infrastructure, poor connectivity, lack of basic resources to operate such advanced technologies, fear of dependency or utilization of AI tools, and the

deterioration of the communication process between faculty and students. There were other minor challenges that were addressed by less than 5% of the respondents, including that there will be no challenges since such technologies will facilitate all of the tasks or that the answer to this question remains to be unknown since it is hypothetical. Lastly, only 3 respondents mentioned that technology is still prone to errors or may be misguiding, which can lead to further challenges if AIED was fully implemented in higher education. As quoted by the respondents, the following are examples of the most unique responses received for this question.

- *Public Universities: R35 "By far, the bubblesheet automatic grading is extremely successful, and this may offer insights that other AI machines would also be as successful if implemented and used properly. But the main challenge that we might face is the availability of the main or basic resources of operation the machines, so for example the infrastructure or internet connectivity".*

- *Private Universities: R8 "The biggest problem would be communication or the orientation, so how to normalize the utilization of AI in education. Faculty are already refusing or resisting change, so the first thing to work on would be communication and very high awareness so they are not surprised or do not act by resistance. The only problem that may face faculty is adopting new technologies and leaving the traditional and classical methods behind, so they need to be willing to adapt to AIED. But anything that decreases effort, increases fairness, and decreases mistakes will be easily used".*

- *Non-Profit Universities: R4 "My biggest concern with AI in education is the dominance AI will have on the field. ChatGPT is seriously one of our biggest worries today, because we'll never know whether a student is submitting their original work or work done by AI. ChatGPT and similar programs have the capacity to ruin the educational process if we can't control them or forbid students from using programs as such".*

Based on the quotes above, it can be said that there are different perceived challenges associated with the adoption of AI in education, varying from infrastructure, resistance, willingness, and the dominance of the newly introduced technology. All of these challenges correlate with the previously found challenges from other scholars and literature. However, the

awareness portrayed through this question indicate that faculty are somewhat prepared for what is coming in the future, indicating that this transformative phase may be handled with minimal losses.

5.5.2 Summary of Potential Anticipated Challenges in AIED

The most common anticipated challenge that was addressed by 63% of the respondents was the low technological literacy levels that the faculty may have, hence the inability to adopt further advanced technologies if they do not have the basic knowledge on how to utilize basic technologies. The second most common challenge that was addressed by 48% of the respondents was the fear that AI may ruin the educational process due to higher dependency on technologies or utilization of AI (ex: ChatGPT) in unethical methods. Other common challenges that were addressed included the unwillingness of faculty to adapt to such transformation, resistance, weak infrastructure, poor connectivity, lack of basic resources to operate such advanced technologies, fear of dependency or utilization of AI tools, and the deterioration of the communication process between faculty and students.

5.6 Factors Impacting AIED Readiness

5.6.1 Egypt's AIED Readiness

The aim of this question was to examine the perceptions of the respondents on how ready Egypt is to adopt AI in higher education. The respondents were asked to whether Egypt is ready or not for such a transformation, and why it is or it is not. Interestingly, approximately 60% of the total number of respondents explained that Egypt is not ready for this transformation for various reasons, with the main reason being poor funding and infrastructure. Those who mentioned that Egypt is ready clarified that the human factor is ready and that the only problem remains within the mentalities that may resist such a transformation. Moreover, 90% of the faculty from the public sector agreed that Egypt was ready, whilst only 20% of the faculty from the private sector agreed that Egypt was ready. As quoted by the respondents, the following are examples of the most unique responses received for this question.

- *Public Universities: R16 "Yes, Egypt is ready, because many of our faculty are up to date and are ready for this transformation. The human factor is ready".*

- *Private Universities: R37 "No, Egypt is far from ready. It is not on the agenda of Egypt in the moment. We are now working towards digital literacy, but that's about it. Private universities are ready for this change but public universities do not even have the basis of normal technology. It is utopia to imagine Egypt integrating AI in universities in Egypt"*

- *Non-Profit Universities: R7 "I don't really have the answer to this. When the smartphones came out, I recall that in the US people didn't have smartphones. It took them longer in the US to adapt to smartphones. There may be something similar here, so we are far behind in technology, so we may either jump into the wagon and adopt it or still stay behind. The economy is not doing too well, so this should be taken into consideration in this question"*

According to the quotes above, this was one of the few questions that the answers significantly differed upon. Some perceived Egypt to be ready, whilst others perceived Egypt to be far from ready. However, it can be said that the majority of the overall faculty believed that Egypt was not ready for valid reasons, including digital illiteracy, lack of technological infrastructure to support this transformation, and lack of funds.

5.6.2 Universities' AIED Readiness

The aim of this question was to examine the perceptions of the respondents on how ready their universities are to fully adopt AI in their educational system and curriculum. The respondents were asked whether their university is ready or not for such a transformation, and why it is or it is not. Strangely, 82% of the total respondents did not offer a solid yes or no answer to this question, as their answers were more lenient towards some extent. Furthermore, there were several reasons why they believed they were not fully ready to adopt AI in their institutions. The main reasons that were identified behind their hesitation were the lack of funding, the fact that it is not their university's decision to adopt such technology, the inability of certain departments to adapt as easily as other departments, the complexity of certain AI programs, and the anticipated resistance from the students. However, faculty from the private and the non-profit sector seem to believe that their universities are more ready in comparison to the public sector.

5.6.3 Factors Impacting AIED Readiness

The aim of this question was to examine all the factors that may impact the readiness of faculty to adopt AI in their institutions or universities. The respondents were asked on the determinants or factors that may have an impact on a faculty's readiness in adopting AI in education. A total of 93% of the respondents ranked technological literacy as the main factor that may impact a faculty's readiness, whilst 85% ranked age as the second factor, and 74% ranked income level as the third factor. Respondents explained that technological literacy is beyond critical when it comes to readiness, as faculty with little to no technological literacy will not have the basic knowledge of technology and will hence refuse to utilize advanced technology such as AI. They also agreed that age plays a major role in readiness since the older the faculty are in age, the less likely they will be ready to adapt to AIED. Lastly, the respondents clarified that with low-income levels, the faculty will most likely not be able to utilize the basic technology in their own personal life, which leads to lower technological literacy levels and hence lower readiness levels. Other common factors included gender, educational level, years of experience of the faculty, willingness or mentality, and whether the utilization of technology in education is mandatory or not. There were other minor challenges that were addressed by less than 5% of the respondents, including the nature of the major or course being taught, the social class, the ease of use of new technologies, the job satisfaction of the individual, and the nationality or culture of the individual. As quoted by the respondents, the following are examples of the most unique responses received for this question.

- *Public Universities: R39 "I think that willingness and technological literacy shape readiness. I know a colleague of mine who is also teaching at the same department that fought with me for years because he refused to utilize technologies in repetitive tasks such as attendance and grading, and when he used it in the end, their life was completely transformed, this is also because he has a very low awareness level of technology. Purely psychological, because after they tried AI, the were unable to return to their traditional methods again".*

- *Private Universities: R44 "I think gender plays a major role here. As a female and based on my other connections with female faculty, we're not that interested in changing our traditional methods even if we know the benefits. I think males are more accepting to AI*

than females. For instance, in our AI major in our university, 90% are males and only 10% are females".

- *Non-Profit Universities: R28 "Anyone working in any environment, the more they have job satisfaction they more likely they will be ready and willing because they are already satisfied. So the main factor here is job satisfaction in terms of income satisfaction and facilities satisfaction".*

Based on the quotes above, it can be said that there are different perceived factors that may impact AI readiness, whether it is technological literacy, mentality, gender, or job satisfaction. However, despite the perceived factors, not all of them were found to be impactful for the sample of participants. For example, gender was not found to be a significant factor that impacted AI readiness, whilst technological literacy was a primary factor that impacted AI readiness. Regardless, the awareness of faculty on the factors that may impact AI readiness offers a promising result if AI was adopted in HE, as they would be aware of the factors that may determine whether they utilize such technologies or not. Hence, they would be able to alter their own readiness depending on the factors that may be limiting them.

5.6.4 Summary of Factors Impacting AIED Readiness

To summarize, approximately 60% of the total number of respondents explained that Egypt is not ready for AI adoption in higher education for various reasons, with the main reason being poor funding and infrastructure. Those who mentioned that Egypt is ready clarified that the human factor is ready, and that the only problem remains within the mentalities that may resist to such a transformation. In terms of the universities' readiness, there were several reasons why the respondents believed they were not fully ready to adopt AI in their institutions. The main reasons behind their hesitation were the lack of funding, the fact that it is not their university's decision to adopt such technology, the inability of certain departments to adapt as easily as other departments, the complexity of certain AI programs, and the anticipated resistance from the students. However, faculty from the private and the non-profit sector seem to believe that their universities are more ready in comparison to the public sector. Lastly, in terms of the main factors that may impact the readiness of faculty when it comes to AIED, a total of 93% of the respondents ranked technological literacy as the main factor, whilst 85% ranked age as the second factor, and 74% ranked income

level as the third factor. Other common factors included gender, educational level, years of experience, willingness or mentality, and whether the utilization of technology in education is mandatory or not.

6 CHAPTER SIX: DISCUSSION AND ANALYSIS

The purpose of this research was to assess the AI readiness levels of faculty from different types of universities or institutions in order to examine the extent to which they are ready to adopt AI in education. It is no doubt that AI is impacting the economies of countries based on its integration within different sectors. Unfortunately, certain countries suffer in adopting AI due to a variety of reasons, one of which is their readiness levels depending on the sector being discussed. Egypt is moving towards the adoption of AI in several sectors, one of which is the education sector. However, there is a lack of supporting literature to indicate whether the higher education sector is ready for such a transformation. Accordingly, it is necessary to assess whether the higher education sector in Egypt is ready for such a transformation, in order to offer insights as to why or why not they may be ready and how to increase their readiness levels. In addition to assessing the AI readiness levels of faculty based on the conceptual framework of this research, the primary research conducted examines other sub-questions that are necessary in exploring other important factors that support the main research question.

Overall, the results of the primary research that was conducted offer positive insights into the adoption of AI in the HE sector in Egypt. However, each criterion needs to be discussed and evaluated thoroughly in advance of reaching this conclusion.

6.1 Assessing AI Readiness in Faculty from Higher Education

Based on Holmstrom (2021), AI readiness was defined as “an organization’s abilities to deploy and use AI in ways that add value to the organization”. Holmstrom (2021) developed this framework due to his awareness that the assessment of AI readiness plays a significant role in deploying AI technologies, as it is one of the main challenges thousands of organizations face nowadays. Furthermore, Holmstrom (2021) recognized the significance of AI technologies and their ability to transform organizations. Hence, it was crucial to “develop an understanding of organizations’ abilities to meet these challenges (i.e., of their AI readiness)” (Holmstrom, 2021, p.330).

There are numerous measurements that were designed to assess AI readiness, depending on the sector and size of the organization being studied. According to the conceptual framework of this research, the AI readiness levels were determined based on the main components in the

framework, which were technological infrastructure, awareness of AI and AIED, perception of AIED, perception of usefulness of AIED, willingness to adopt AIED, and perceived anticipated challenges of AIED. Based on the findings and to answer the main research question of this study, the majority of the participants (87%) had high AI readiness levels, which indicates that the higher education sector may not struggle in the implementation of AI in education. At this point, it was critical to understand what this means or why it may be significant. Such results indicate a variety of meanings, one of which is that the majority of the faculty of higher education in Egypt are ready to utilize AI within their system or curriculum. In other words, the concept of AI integration in education was not rejected nor feared by the faculty of higher education. Hence, the introduction of AI in education will be smooth and will not lead to potential threats or further challenges. As mentioned, readiness is one of the primary determinants that offers insights as to whether a certain sector or organization will be able to adapt to the utilization of AI or will suffer from it. Low readiness levels indicate that the organization or the sector is not ready for the transformation, and would suffer from the integration rather than benefit from it. Taking this into consideration, it is extremely fortunate that the readiness levels are high in the higher education sector, as the integration of AI into the systems or curriculums has the capacity to resolve major challenges the sector is currently facing.

6.2 Technological Literacy and AI Readiness

Technological literacy plays a significant role in decision-making regarding adopting AI technologies, especially in education (Dhawan & Batra, 2021). The lack of technological literacy or the refusal to adapt to new technologies may lead to the failure of the entire process, as users will not be able to utilize the machines for their benefit. Research has shown that there are key challenges that are feared by the majority of investors, including the infrastructure of AI, the lack of experts in the field, its cost, the acceptability of the technology itself, and the technological literacy levels of its potential users (Boucher, 2020). Due of the uncertainty surrounding how faculty and students will respond to AI technologies, the majority of educational institutions are reluctant to invest in them (Dhawan & Batra, 2021). Nonetheless, with the proper amount of research concerning the readiness of the faculty and the students to accept and adopt AI technologies, the issue would be abolished. Al-adaileh (2009) proposed that users with low technological literacy may not value or perceive new technologies as valuable tools and may only

utilize them due to their ease-of-use element (Khamis, 2023). For this reason, examining whether there was a relationship between technological literacy and AI readiness in the context of this research was essential. Fortunately, the findings of this research confirm the results of other studies concerning the significance of technological literacy in AI readiness.

In the context of this research, technological literacy was assessed based on three main determinants, with respect to the overall AI readiness level of the participant: Firstly, it was assessed through the amount, type, and complexity of technological devices the faculty utilized in comparison to the AI readiness level. Secondly, it was assessed through the faculties' self-rating of their technological literacy level in comparison to the AI readiness level. Thirdly, it was assessed through their previous knowledge of technology, AI, and AIED and their AI readiness level. According to the results of this research, it can be established that there is a significant positive relationship between technological literacy and the AI readiness levels of faculty from different universities.

This relationship was established through numerous factors. Firstly, faculty that utilized more advanced technological devices ranked themselves higher in their AI readiness levels than those who utilized basic technology. Secondly, faculty that ranked themselves higher in technological literacy levels also ranked themselves higher in their AI readiness levels. Thirdly, the more knowledge a faculty had on technology, AI, or AIED, the more curious and accepting they were in adopting AI in their educational system or curriculum, as they had the basic knowledge of technology and were fully aware of the benefits of such an integration. Lastly, when faculty were asked on the factors that may impact the AI readiness levels for them or others, a large number of faculty agreed that technological literacy was the primary determinant that AI readiness was based upon. Though technological literacy can be hardly assessed, the research findings offer high and significant insights that illustrate a very strong positive relationship between technological literacy and AI readiness. In other words, it can be established that the higher the technological literacy level (based on the complexity of technology being utilized by the user, their self-rating, and previous knowledge or exposure to technology), the higher their AI readiness levels were, with respect to other variables of AI readiness.

6.3 Relationship between Demographics and AI Readiness

Over the years, several studies in a variety of sectors have examined the relationship between demographics and technological acceptance. According to Khamis (2023), demographics may play a significant role in the AI readiness levels of individuals. Gender and age were found to be the most important factors in determining the AI readiness levels of individuals (Khamis, 2023). The results of previous studies differed based on their context, timing, and area of research; yet, the majority of previous research has indicated that there may be a negative relationship between age and technological acceptance. Furthermore, the younger the age, the more likely they will accept new technologies (Chimento-Díaz et al., 2022). In addition, gender also plays a role in the acceptance of technology. According to Khamis (2023), males were more likely to adopt AI technologies than females. This was also suggested in another research by Hu et al., (2013), as it was found that "gender moderates the effect of subjective norms on intentions and the influence of perceived usefulness on attitude, more prominently among male than female workers". However, such previous studies examined the relationship between demographics and regular technology acceptance, and not between demographics and AI readiness. For this reason, it was important to assess whether demographic factors play any role in AI readiness levels in the context of this research. However, the insights of this research were not similar to previous studies, as there were no differences found between the AI readiness levels and the demographics of the participants.

The relationship between the demographics and the AI readiness levels of faculty was assessed based upon their overall AI readiness levels and their demographics. It was interesting to note that 96% of the participants believed that there is a significant negative relationship between age and AI readiness. Moreover, the participants believed that the older the faculty, the less ready they will be to adopt AI in education due to their preference to stick to traditional teaching methods as long as it serves the purpose of education, whilst younger faculty may be more flexible, leaning towards integrating technology in education. Despite their agreement, and according to the findings, this relationship is purely hypothetical, and was not found with any of the participants, as older faculty had equal levels of AI readiness in comparison to younger faculty. However, it is important to note that this research is also hypothetical, as AI has not been integrated into higher education yet. Therefore, this relationship can only be confirmed through an actual implementation

of AI in education. Yet, this research only seeks to examine AI readiness before the adoption of AI in education, and not after. Besides age, other factors such as gender, income level, and educational level were also thought to impact AI readiness levels. However, all of these factors did not have any impact on the AI readiness levels of the participants of this research.

6.4 AI Readiness and Type of Institution

In terms of the different types of universities, faculty from the private sector had the overall highest levels of AI readiness, followed by the public sector. It was unexpected that faculty from the non-profit sector would have the lowest levels of AI readiness, however, there may be an alternative interpretation as to why this may have taken place. The sample of participants consists of 46 participants, which are not indicative of the entire higher education faculty in Egypt. Hence, it may be that the chosen participants from the non-profit sector were generally against AI in education or had lower technological literacy and awareness levels. The same concept can be applied with the faculty of the public sector, as it was also unexpected that the public sector would be ready at all due to the poor infrastructure and technological literacy and awareness levels. Similarly, it may be that the chosen faculty from the public sector were highly interested in the field of AIED and had previous knowledge about it and enough willingness to adopt it.

Overall, there was no major difference found between the three types of universities, as it cannot be concluded that certain types of universities have higher or lower AI readiness levels. In other words, it depended on the individual being interviewed and their own readiness level. For instance, not all of the non-profit sector faculty had low levels of AI readiness. Similarly, not all of the private sector faculty had high levels of AI readiness. Hence, there is no relationship between the type of university and the AI readiness levels, as it depends on the individualistic characteristics and behavior of the faculty. This finding is not considered as a drawback or a limitation to the study, but is rather a positive finding indicating that AI readiness is solely dependent on the faculty as an individual instead of representing the entire institution. The finding would have not been the same if lower or higher AI readiness levels were found in certain types of institutions. For example, if the results indicated that 90% or more of the faculty interviewed from the private sector had high AI readiness levels, whilst 90% or more of the faculty from the non-profit sector had low AI readiness levels, it could be said that the type of institution is a determinant in AI readiness levels, allowing further comparative research opportunities on AI readiness levels and the types of

universities involved. Regardless, the most significant finding is that the higher education sector as a whole is relatively ready for the adoption of AI within their institutions or universities.

6.5 Elements Impacting AI Readiness

The measurement of readiness is known to be complex due to the countless factors that may have an impact on such measurement. In the context of AI readiness, technological literacy is known to be a major factor that can impact readiness levels. However, there are other factors that have been found to impact readiness. In a study by Khamis (2023), one of the most dominant models of acceptance and readiness, known as the Technology Acceptance Model (TAM), was slightly modified and utilized to assess citizens' perceptions of adopting e-government services in Egypt. This study aimed to gain further insights into the factors that may impact the citizens' attitudes toward adopting e-government through using the TAM model (Khamis, 2023). The model proposes that "the attitude towards the acceptance and usage of technology as well as perceived usefulness is a fundamental factor that influences the behavioral intention determining whether to adopt a certain technology or not" (Khamis, 2023, p.23). Accordingly, attitude can be shaped through perceived usefulness and perceived ease of use. However, other factors such as demographics, trust, and social influence may act as external variables that impact the perceived usefulness and ease of use (Khamis, 2023). According to such assumptions, it was predicted that the more the users perceive a particular technology as an easy and valuable tool, the more likely they would utilize it. Hence, it can be established that attitude, usage of technology, perceived usefulness, perceived ease of use, demographics, trust, and social influence may impact AI readiness. However, this is not specifically the case in education, as other variables may impact the AI readiness of faculty or instructors in education.

In another study by Hafez (2013), the factors that impact elementary teachers' decisions to adopt ICT in education have been investigated to use the findings and results to improve the adoption of ICT in education. Though the study may not be concerned with HE or AI, it provides relevant insights into the factors hindering instructors' acceptance of specific technologies in an educational context. Hafez (2013) focused her research on instructors instead of students, as the success of any kind of educational transformation highly depends on instructors as "they are responsible for deciding the medium and the tools through which the educational materials are passed on to students" (Watson, 2001; Hafez, 2013, p.13). According to Hafez's (2013) findings,

all teachers that participated in the study emphasized the significance of ICT integration within the teaching and learning process. Subsequently, the factors that hindered the ICT integration were not individual but institutional-level factors. Furthermore, such factors were related to the lack of technical support within the institution, access to technology resources, and the low quality of the ICT sessions that the teachers attended (Hafez, 2013). The only individual-level factors that were found to be impacting the ICT integration process were related to the competency and skills of the teachers in utilizing technology (Hafez, 2013). Other factors, such as the instructors' awareness of the impact of ICT on students' learning process, their willingness to accept change, and their confidence in their capabilities and competencies, were also prominent in their responses (Hafez, 2013).

Fortunately, there is a very high similarity between the elements identified in previous literature and the elements found through the interviews conducted for this research. However, other factors were also identified, including job satisfaction and the obligation of utilizing AI in education. Yet, technological literacy and awareness remained as common primary element that has the capacity to influence or shape AI readiness, especially in the context of education.

6.6 Current Challenges in Higher Education Sector

According to Barsoum (2014) and Ghazal (2012), there were numerous challenges in the higher education sector, ranging from poor infrastructure, low funding, skill mismatch, and outdated curriculums. Furthermore, Barsoum (2014) elaborated that in order for Egypt to cope with the growing demand for higher education, higher levels of funding need to be allocated for the sector and the abolishment of politically constrained institutional environments (Barsoum, 2014). Similar to primary and secondary education, the Ministry of Higher Education controls higher education, whether in its curricula or the institution's composition as a whole. This is leading to unsolvable crises such as unemployment due to a mismatch between labor market needs and the capabilities of graduates (Barsoum, 2014). Another concern and challenge highlighted by Barsoum (2014) was the mismatch between labor market needs and the actual capabilities of graduates from public or private universities. This is due to the curriculums of almost all public universities being outdated and purely theoretical, as the Ministry of Higher Education also controls them. Hence, graduates cannot apply what they learned to the real-world experiences they face. This was also supported by Ghazal (2012), as it was found that there are three main issues

that are currently impacting the quality of higher education in Egypt, which are inadequate academic resources, constrained curricula, and limited academic freedom. Such challenges were also found to be existent according to the interviews conducted in this research.

Interestingly, there were many other issues addressed by the respondents in this research concerning the challenges faced in the higher education sector. Some of these challenges were not addressed in previous studies or literature, including the unwillingness of students to learn, the high levels of plagiarism or cheating, the hiring of unqualified faculty, and the high workload on faculty and students. It is important to note that addressing such challenges is beyond critical for the purposes of this research, as it is critical to assess whether AI will offer any potential in resolving such challenges or will simply add more challenges to the sector. Fortunately, and according to the respondents and the evaluation of the challenges, the integration of AI in the higher education sector has the potential to resolve the majority of the challenges that currently exist.

6.7 Capacity and Benefits of AI in Resolving Challenges in Higher Education Sector

As an invention, AI has gained massive attention and recognition due to the significant potential benefits that it may offer to all kinds of sectors. AI is highly beneficial in the education sector as it will offer a unique, personalized, and highly effective teaching-learning experience for both faculty and students. Accordingly, thirteen potential benefits of AIED have been identified according to previous studies and literature, including but not limited to the role of technology in education, automation, efficiency and accuracy, reduction of paperwork and workload, customization of educational pathway, collaborative learning, timely instruction and feedback, reducing fear of learning, distant learning and accessibility, a personalized teaching-learning experience, skill development, and AI in research. The findings of the interview of this research have also suggested similar benefits from the perspective of the faculty that were interviewed. This suggests that faculty of higher education are now aware of the potential benefits of AI and expect AI to be a potential solution for all the challenges they are currently facing.

Applications of AI in the educational field include but are not limited to the automation of the grading process, evaluations based on past student performance data, utilizing facial recognition software to monitor students in the classroom, and the creation of individualized

learning plans (Economist Impact, 2022). Such technologies operate through data mining and machine learning algorithms. Data mining can be simplified as the detection of patterns and usage of predictive modeling through the gathering of the data (Chen et al., 2020). In instruction, AI can offer support in allowing instruction beyond the classroom, personalize a teaching method for each student based on their data, performance, and learning style, analyze the course content to propose customized content, and predict the likelihood of student's academic success (Chen et al., 2020). With the integration of such technologies in education, AI has a massive potential to resolve the existing challenges in the higher education sector, whilst offering numerous benefits in the process to all stakeholders involved.

One of the primary challenges of the higher education sector is the outdated curriculum and teaching methods. With the introduction of AI in education, the assessments may be altered to become more practical or require creativity or critical thinking instead of solely relying on memorization. Hence, the curriculum may remain the same, yet requiring different tasks from students that increase their motivation or interest in learning. Another challenge in higher education is the high workload on faculty and students. With the introduction of automatic grading machines, the workload on faculty will be significantly decreased as they will have more time to spend with their students or on improving their performance as instructors. Lastly, the challenge of skill mismatch that exists due to the lack of practicality in many higher education institutions can be eliminated through the introduction of AI simulations that offer a real-life simulation of the situations they will encounter after their graduation. In short, there is no doubt that AI has the full potential to eliminate many, if not all, of the challenges being currently faced in the higher education sector.

6.8 Anticipated Threats of AI Adoption in Higher Education

Despite the potential benefits of AI adoption in education, previous studies and literature have found that there may be threats associated with this integration. One of the primary threats identified by Popenici and Kerr (2017) and about 48% of the respondents of this research was the high dependency or reliance on technology, leading to the deterioration of the education process. Whilst many perceive the integration of AI as a positive addition to education, there was no doubt that students would highly depend on AI on performing their assessments and tasks. The primary fear nowadays is due to the rise of an AI Chatbot named ChatGPT which was released in

November 2022. Only a limited amount of research has been conducted concerning this specific program as it was launched recently. The program has many capabilities, yet, the most important capability is writing full academic essays with 0% plagiarism depending on the topic of choice. With the capabilities of this program, the educational sector is at high risk of deteriorating due to the anticipated dependency of the students on this or similar AI technologies.

There are other anticipated threats of AI adoption in education, including but not limited to an increase in screen time, biased input, security and privacy concerns, high cost of technology, technological illiteracy, lack of experts, and implementation issues (Dhawan & Batra, 2021; Zawacki-Richter et al., 2019). However, the respondents of this research mentioned completely different threats that may not be directly related to AI, but rather the reactions of the users. The only common threats between the previous literature and the actual responses were the technological illiteracy of the users as well as the high dependency or reliance on the technology. Other issues stated by the respondents included the unwillingness of faculty to adapt to such transformation, resistance, weak infrastructure, poor connectivity, lack of basic resources to operate such advanced technologies, fear of dependency or utilization of AI tools, and the deterioration of the communication process between faculty and students, and the programs being prone to errors or misguiding. It is important to comprehend the extent to which respondents of this research are aware of the potential challenges or threats as awareness is one of the primary determinants of readiness. If the respondents were unaware of the potential threats AI could bring to the educational sector, their readiness would automatically decrease, taking into consideration that they do not have enough knowledge on the technology and its possible threats.

Despite the fact that the respondents still mentioned potential threats, it is important to note that the threats they mentioned were somewhat irrelevant to AI and more relevant to the individual users or the institution as a whole. Accordingly, it seems that the serious threats of AI are not yet fully comprehended by the respondents of this research, which may be considered a drawback as they do not comprehend the dangers of fully utilizing or adopting this technology.

6.9 Summary of Discussion and Analysis

This study sought to determine how ready faculty are from various types of universities or institutions for the use of AI in educational settings by rating their levels of AI readiness. Overall,

the primary research's findings provided encouraging information on how AI will be applied in Egypt's HE sector. Furthermore, according to the analysis of the findings of this research, the majority of participants (87%) showed high levels of AI readiness, suggesting that the higher education sector may not have trouble implementing AI in education.

Based on prior research and the conceptual framework of this study, the primary variables that may directly affect AI readiness were technological literacy and demographics. It was determined that there is a considerable positive association between technological literacy and the degree of AI readiness among faculty from various universities. This correlation suggests that the more technologically literate they are, the more AI-ready. In terms of demographics, there were no differences between the demographics of the participants and the levels of AI readiness, hence this research's conclusions were distinct from those of other studies.

It was also found that faculty from the private sector had the highest levels of AI readiness, followed by those from the public sector and non-profit sector. Based on the findings, no relationship was established between the type of institution and the AI readiness levels. In other words, it depended on the faculty and their individual level of readiness instead of the readiness of the institution as a whole.

In terms of the variables that may impact readiness, technological literacy and awareness continued to be the most prevalent primary factors. This study also revealed other factors that may have an impact on readiness, mentioned by other researchers as well as the participants, such as perceived usefulness, attitude, perceived ease of use, accessibility of technological resources, willingness, demographics, trust, and social impact.

The difficulties in HE discovered by earlier research and the difficulties discovered by this research were related. However, novel challenges were raised in this study, including students' resistance to learning, academic integrity, the hiring of unqualified professors, and the heavy workload placed on both faculty and students. Higher comprehension of current challenges in the sector suggests that professors may find AI more beneficial as they can understand the advantages that AI will offer in an effort to address these difficulties.

Lastly, in terms of the potential risks associated with the adoption of AI in education, technological illiteracy and a greater reliance on technology were the only issues that could be

shared by earlier research and the primary research for this study. Through this research, novel issues have been addressed, such as faculty resistance to change, a lack of infrastructure and connectivity, a lack of basic technological resources to support this change, and a decline in communication between faculty and students. Having higher awareness of possible threats indicates higher AI readiness levels as they are fully aware of the potential challenges that may arise during the transition.

7 CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

To answer the main research question of this study, the primary research's findings indicate that the majority of faculty members (87%) from different types of universities have shown high levels of AI readiness, and hence, are ready for this transformative phase. This suggests that the HE sector may have little to no trouble implementing AI in education, whether in the curriculum or the system. This conclusion was reached based on numerous factors, including the assessment of the demographics, technological literacy and infrastructure, awareness of AI and AIED, perception on AIED usefulness, willingness to adopt AIED, and perceived challenges of AIED of the interviewed faculty. This conclusion was also reached based upon the sub-questions of this research.

Firstly, based on prior research and the conceptual framework of this study, the primary variables that were taken into consideration in impacting AI readiness were technological literacy and demographics. It was found that there is a positive relationship between technological literacy and the degree of AI readiness among faculty from various universities. This correlation suggests that the more technologically literate they are, the more AI-ready. In terms of demographics, there was no established relationship between the demographics of the participants and the levels of AI readiness.

Second, it was established that faculty from the private sector, as opposed to those from the public and non-profit sectors, had the highest levels of AI readiness. There was minimal difference between the three types of universities in this research since it is impossible to say whether educational institutions are more or less AI-ready. In other words, rather than the institution as a whole being ready, it depends on the faculty and their level of readiness.

Thirdly, when it came to the aspects that could affect readiness, technological literacy and awareness have remained the most important fundamental elements. This study also revealed additional elements that may impact readiness such as perceived usefulness, attitude, perceived ease of use, accessibility of technology resources, willingness, demographics, trust, and societal impact that were noted by other researchers as well as the participants. However, this study also found other characteristics, such as the obligation to use AI and job satisfaction.

Fourthly, there was a connection between the challenges in HE identified by past studies and the challenges identified through this research. Nonetheless, other issues were also mentioned in this study, such as students' reluctance to learn, academic integrity, the selection of professors who are underqualified, and the substantial workload that is put on students as well as faculty.

Lastly, the sole challenges that may be shared by earlier research and this research in terms of the potential risks connected with the implementation of AI in education were a growing dependency on technology and technical illiteracy. Novel challenges have been addressed through this research, including the reduction in communication between faculty and students, resistance to change, a lack of infrastructure and connectivity, and a lack of basic technology tools to facilitate this transition. As they are completely aware of the potential difficulties that may occur during the transition, having a better awareness of potential dangers indicates higher AI readiness levels.

Future research on AI readiness or the adoption of AIED may be conducted on a larger sample of faculty members or may incorporate students into the research to offer higher validity and generalizability. Despite the low adoption of AI in education, the topic deserves further attention from scholars and researchers as developing countries including Egypt are striving to move towards a phase that requires a solid basis of research in advance of any implementation.

7.2 Recommendations

As mentioned, it is important that this field is further investigated by other scholars and researchers in order to reach generalizable conclusions with information concerning all stakeholders of higher education. This research only serves as a beginning, as it offers initial significant insights on the AI readiness levels of faculty of higher education. According to the findings, there are major recommendations that can be offered based on the results and the data that was obtained through this research.

1. Universities should plan to add the integration of AI in their systems or curriculum as a main pillar on their agenda, as it is the key to solving the majority of the existing challenges in education.

2. Further research needs to be conducted on the readiness level of the universities (ex: whether an institution has enough technological infrastructure to adopt AI) and on the students (ex: their AI readiness levels).

3. Ministries and governments should allocate more funds and exert more effort on increasing the awareness of faculty on the importance of AI in education, preparing them for the integration of AI in education.

4. AI systems or machines should be slowly introduced to HE institutions in the nearest time possible. The primary keyword of this recommendation is the speed of introduction. Universities should begin by introducing the most basic and simple forms of AI systems or machines (ex: automatic grading machines) and move to more complex forms of AI in the future.

5. Universities should allocate more funds on hiring AI experts that will lead the transformation.

6. Universities should exert more effort in readjusting the curriculums. Additionally, Ministries should exert more effort on allowing higher flexibility in the alteration of curriculums by faculty.

7. Ministries, governments, or universities should seek to collaborate with other universities or schools (whether in Egypt or outside of Egypt) that integrated AI into their systems in order to learn from their experiences with this integration.

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APPENDIX 1

Interview Questions (English)

The interview will begin by explaining the purpose of this research and this interview and how the contribution of the participant will assist in developing this research. The participant will also be informed that the interview will be audio recorded in order to assist the researcher during the transcription phase. In case the participant refuses that the interview is audio recorded, the participant will be assured that no methods of recording will be used throughout the interview. The participant will be informed with the consent either orally or hand-written depending on whether the interview is held on Zoom or Face-to-Face. Lastly, the participant will be asked whether their answers would like to be confidential or not. Therefore, the first question will be whether they have any questions or concerns about the study or the informed consent.

1. Do you have any questions about the research or the informed consent before we begin?

2. What are the types of electronic devices do you use?

3. On a scale of 0-10 (0 being the lowest and 10 being the highest) how would you rate your technological literacy level (in other words, how aware are you about technology and how well can you utilize it?)

4. On a scale of 0-10 (0 being the lowest and 10 being the highest), how would you rate your ability/willingness to shift to utilizing new technology?

5. What do you think are the main challenges faced in the higher education system as a whole?

6. What do you think are the main challenges faced at your own institution?

7. What do you know about Artifical Intelligence?

8. Have you ever heard about Artificial Intelligence in Education? If yes, please give examples on how AIED was applied (whether in Egypt or any other country).

9. Now that you are familiar with AIED, does your university utilize any AIED? If yes what are they and how do you benefit from them?

10. Do you think AIED will support the current education system that you are in? If yes, how will it do so, and if no, why not?

11. From the AI options below, which do you think would be the top 3 beneficial AI machines in education:

- Automatic grading machines (Ex: bubblesheet)
- Artificial Intelligence Teaching Assistants
- Online chatbots
- Prediction systems
- Integrity systems (Ex: Artificial Intelligence operating cameras that detect cheating in exam halls)
- Artificial Intelligence Simulations customized for each course
- Artificial Intelligence Chapter Guides and Automated Testbanks (Ex: Cram101)
- Artificial Intelligence Transcription in Classroom

12. On a scale of 0-10 (0 being the lowest and 10 being the highest), how willing are you to adopt or adapt to AIED if it were applied in the current university system you are in?

13. What do you think are the main challenges that faculty may face if AI was integrated in your current university or in the curriculum?

14. Do you think Egypt as a country is ready to integrate AI in education? Why or why not?

15. Do you think universities (including yours) are ready to integrate AI in education? Why or why not?

16. Do you think demographics may play a role in the acceptance of AIED?

17. Do you think technological literacy may play a role in the adoption of AIED?

18. What are the main factors that you think impact the readiness of a faculty member to adopt AI other than demographics and technological literacy?

19. Please introduce yourself (name, age, education level [university name is needed], income level).