

## PAPER

# Digital Library and Adult Education: Assessing Acceptance, Utilization, and Adaptability Challenges in AI-Driven and Mobile-Enabled Library Services

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## ABSTRACT

In the advanced artificial intelligence (AI) era, prompt responses from educational foundations are imperative. Academic libraries serve as central learning resources within the global education sector, playing a critical role in this context. With the increasing incorporation of interactive mobile technologies, AI-driven library services have become more accessible, which promotes students' engagement and meets the diverse students' needs. This exploratory paper investigates the experiences of Arab adult learners using AI technologies and mobile platforms as assistive tools for adult education and lifelong learning, focusing on the challenges of adapting to AI in library services and mobile technologies. A sample of 456 Arab adult students from a private institution in the United Arab Emirates (UAE) participated in this study. A cross-sectional approach was incorporated to achieve the study's objectives. The descriptive analysis and responses to open-ended questions revealed that Arab adult students found AI tools, mainly when accessed through interactive mobile technologies, to be effortless and useful, and they expressed their intention to continue using them in library services. However, the study also uncovered that the incorporation of AI technologies in academic libraries is currently insufficient. Arab adult students highlighted several adaptability challenges to using AI and mobile technologies for library services, including language proficiency, digital literacy, and a lack of guidance and training. The study recommends offering workshops to enhance students' digital and language proficiency to ensure effective use of AI applications and mobile technologies in library services.

## KEYWORDS

artificial intelligence (AI), interactive mobile technologies, academic library, adult education

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## 1 INTRODUCTION

Libraries are fundamental learning resources in the education sector, especially in adult and higher education. Library services assist learners and users in acquiring new knowledge, developing advanced skills, and fostering the qualities needed for learning and personal development. These resources and services are instrumental in preparing individuals for their future careers. Worldwide, interactive mobile technology is recognized by its portability and accessibility, which shape the structure of educational systems [1–2]. Today, artificial intelligence (AI) is promptly transforming several sectors, and library services are not excluded. Integrating AI tools in libraries, particularly through mobile technologies, introduces enormous potential for enhancing adult education and lifelong learning, which is crucial in recent, ever-evolving scholastic settings. The function of libraries is enhanced by rapid advances in interactive mobile technologies today, leading to an increasing incorporation of AI tools in library services, which encourages adult education and lifelong learning aspects. AI technologies are rapidly evolving computing functions in libraries. AI technologies are about advancing computing devices that can be engaged in processing human thoughts, such as reasoning, learning, and self-reflection. Numerous professionals are drawn to AI, an innovative technological tool that simplifies work in public and academic libraries [2–16]. Adult education is a lifelong learning dynamic process that requires learners to access libraries and interactive mobile technologies, seeking knowledge, information, and materials needed for achieving their educational goals. Therefore, AI tools may offer great help to adult learners in searching for and completing learning outcomes. Research has shown that modern libraries are adapting to leverage the intellectual computing capabilities of AI, aiming to reach the full potential of using AI as a supplementary tool to enhance their functionality [3]. Massis [4] suggested that the disruptive dynamics of new technological aspects like AI could pose a threat to educational institutions, including libraries, from the perspective of adopting them. However, with ultimate acceptance and integration, AI and interactive mobile technologies are expected to bring many potential positive improvements to library services. Incorporating AI in library services has become prevalent and encouraging for scientific research because it provides expert systems that facilitate reference services, book-reading, and article summaries [5]. The most prospective application of AI in libraries is found in its power to transform library services by offering enhanced information retrieval and virtual assistance [6]. Although the great advantages of incorporating AI in libraries, some challenges, including adaptability and acceptance of AI, need to be addressed. It was found that AI applications have been perceived positively as helpful tools, however, difficulties in implementation hinder the adoption of AI [7]. Embracing AI technologies in higher education learning activities is positively correlated with student engagement, which promotes the learning process [8]. Nonetheless, adult learners who pursue lifelong learning showed discomfort towards AI, which hinders the pursuit of learning and growth [9]. Despite its importance, the literacy of AI in adult and higher education is receiving insufficient attention. Researchers and educators need to prioritize this topic [10]. The current paper attempts to study the enhancement of adult education through AI library services by examining the following: (1) the acceptance and utilization of AI in library services when integrated with mobile technologies (2) AI's most incorporated applications, and (3) the challenges of adaptability to AI library services encountered by adult learners in the UAE and Gulf region. The United Arab Emirates (UAE) is a fast-developing country that makes

significant efforts to improve the education sector and higher education, notably to increase the productivity of graduate human cadres. The UAE's strategic plan is focused on offering lifelong and continuous learning to equip graduates to adjust to the evolving landscape of a promising future [11]. To achieve these strategic goals, research studies are needed to address the insufficient research on adopting AI in libraries and to support scientific research in the UAE.

## 2 BACKGROUND AND LITERATURE

The literature review informed us that AI is not a newborn technology. It emerged a long time ago at the beginning of the 1940s. Despite the many decades passed, reaching an exact definition of the term "AI" is a confusing matter. Kok [12] introduced a group of meaningful definitions for AI, including (1) a field of research and study of computer science specialization. (2) The idea of developing machines to perform tasks stereotypically connected with human intelligence, like self-reflection, generating concepts, learning, improving content, etc. (3) AI describes an extended human intelligence and intellect that computer devices can perform effectively. (4) applying systematic methods to make computers run more efficiently by embracing improved programming techniques. Given the growing number of AI applications, people will have more opportunities to interact with these technologies, integrating AI as a central component of daily life aspects. This integration is evident in smart devices such as phones, smart home machines, virtual assistants like computer games, and Siri [13]. AI is a promptly progressing technology that develops intelligence qualified for performing tasks normally requiring human intelligence, such as perception of natural language, pattern recognition, and composing data-informed decisions. AI is recognized as an assistive technology with a wide range of applications to enhance daily life. It is used in early detection in healthcare [14], personalized assistants in customer service [15], and individualized teaching in education [16].

Since the emergence of AI, the dynamic of library services has been extended greatly. However, librarians have developed numerous skills to manage the information and facilitate its accessibility wherever, it is recommended that libraries adopt assistive tools that meet the advancement of knowledge, which work beyond the well-known Google search that has been established for promoting academic aims to promote lifelong learning [17]. The advanced applications of AI provide libraries with alternative navigation of the information, which promotes the focus and attention of students when using the library services [18]. Hence, AI applications can be incorporated with library services to better benefit learners and users. There are several ways in which AI is incorporated into library services, notably data analysis, remote access, and using Big Data to activate the library's role in supporting research. Pence [19] revealed that AI tools have the potential to implement the repetitive tasks that humans do for library users, which will minimize the role of librarians and activate the users' role, which promotes lifelong learning. The following section summarizes the paper [20].

**Expert System:** It is defined as a computerized knowledge-based tool that works as an entrance to the database to obtain relevant information. The Expert System includes everything from simple data to very extensive data and cohesive development that requires a long time to be developed. The Expert System is a computer structure that offers professional advice to make decisions and suggest resolutions to specific cases, "Wikipedia/expert system, 2014."

Natural language processing (NLP): It refers to one of the most important targets of the field of computer science, aiming at teaching computer devices to learn the language of today. NLP is the most advanced feature of computer language. AI researchers created a natural language to connect with limited terminology and language rules; hence, the computer can recognize key language terms related to an inquiry or question and answer them using the NLP. The NLP aims to develop a computer that analyzes, comprehends, and produces natural language. Aspects like machine translation, speech synthesis, linguistic methods, data recovery, and information extraction are proposed to be the main components of NLP [21].

Libby is a virtual assistant that enables users to find and borrow eBooks, digital audiobooks, and magazines from the library. Through this application, users can search titles online or download them for offline use and read them anytime, anywhere. Users need only a library card to get started.

MARCEdit is an assistant tool that uses AI to facilitate the editing and management of MARC (Machine-Readable Cataloging) records, which means a machine, such as a computer, can read and explain data in the cataloging record.

BiblioCommons is a software development company that adopts the concept of an “online public access catalog” and employs AI to find personalized book suggestions based on user preferences and borrowing history details. It processes search results accurately and provides easier borrowing.

Encore Discovery Solution: It is an AI-driven system that is used to make recommendations about materials such as articles, books, documents, and other library materials.

Clarabridge: It describes an AI tool that assists in content analysis and generating abstracts, which supports students’ learning and achievement.

Google Translate: It is one of the AI tools that operates by advanced technologies, including machine learning and neural networks, to provide translation services in multilingual, which assists non-native language speakers.

Adaptability to technology is defined as an individual’s ability to incorporate and employ new technological advancements effectively. This implies individuals’ intention to adopt new tools and be open to learning new methods offered by technology transformation [22]. Adaptability to technology is an essential factor in promoting adult education and lifelong learning, as it maintains efficiency and competitiveness in a promptly evolving digital era. Adaptability embraces skills such as continuous learning, adopting problem-solving principles, a positive perception of modern technology, and flexibility in applying them. A remarkable focus was given to adult learners’ adaptability to modern technology and online learning. Moussa [23] examined the adaptability of adult learners to the advanced technology of Web 2.0 in pursuing lifelong learning and uncovered that adult learners are adapting effectively to advanced technologies and intend to continue using them for their lifelong learning. Today, with the advancement of AI in education, it was found that adult learners are mostly excited about learning and using AI tools; however, some challenges, such as insufficient learning opportunities and some worries about privacy and the ability to decide [24]. As adult learners aim to obtain a more personalized method of learning and recalling large amounts of information, new technologies of AI, such as chatbots, recommendation systems, data analytics, and natural language processing (NLP) algorithms, are offering effective options to this challenge. According to Story [25], AI has been rapidly embraced in adult education to support lifelong learning by providing tailored learning practices relying on Large Language Models, Machine Learning, and Virtual Reality technologies. Laupichler [10] showed the need to focus on AI literacy in higher and adult education. Osmanoglu [26] aimed to

address the challenges of the adoption of adaptive learning by investigating the relationship and the interaction between humans and AI. The findings suggested that the main difficulties are linked to ethical considerations, including privacy, trust, risks, and data security associated with data management. Additionally, some cultural concerns are related to the organizational implementation of adaptive learning and AI interaction. Lin [27] conducted a research study to explore ChatGPT's potential tutoring ability to facilitate the self-directed learning approach among adult students in a virtual learning program. The outcomes revealed that incorporating the powerful AI tool, ChatGPT, helps set learning goals, design personalized academic plans, and identify available resources, besides observing performance among adult learners. Alternatively, the findings uncovered some challenges, such as demanding instructors provide clear guidance to better use ChatGPT effectively. In addition, adult learners may develop a reliance on ChatGPT, the lack of information accuracy presented by ChatGPT, and the reduction of the interaction between adult learners and human instructors.

### 3 RESEARCH METHODS

#### 3.1 Study design

The study design suggests applying a cross-sectional research design to explore the perceptions of using AI technologies through mobile technologies in library services among Arab adult learners in a private higher education institution in Dubai, UAE. The study suggests that when Arab adult students perceive AI applications in library services as useful tools and easy to apply, they will continue using them when seeking library services, as shown in Figure 1. Moreover, the study explores the most incorporated AI technologies in the academic library and the challenges of adaptability that Arab adult learners encounter when adapting to incorporating AI tools in library services.

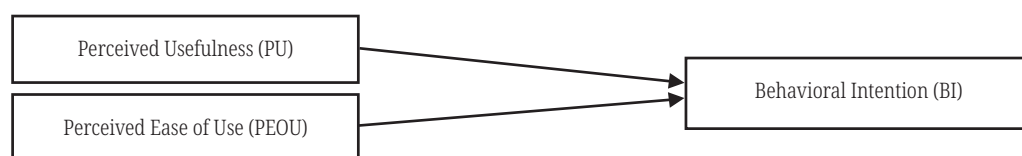


Fig. 1. Study design as described by the technology acceptance model (TAM)

#### 3.2 Research questions

This study explores students' perceptions of AI applications in library services, the most incorporated tools, and the difficulties in adaptability; hence, it is driven by the following research questions.

- What is the perception of Arab adult students of using AI tools in library services?
- What is the behavioral intention of Arab adult students to use AI tools in library services?
- What AI tools are incorporated in library services?
- What difficulties do Arab adult learners face in adapting to AI tools in library services?

### 3.3 Instrument validity and reliability

The research design utilizes the technology acceptance model (TAM) [28] to complete this study. TAM was adapted to assess how participants perceive AI technologies in library services. The model's purpose is to evaluate users' acceptance and implementation of a technology system, in this case, AI applications for library services. TAM focuses on two key variables: perceived ease of use (PEOU) and perceived usefulness (PU) of the new technology. A third variable is behavioral intentions (BI) toward a technology, too, which is predicted by the other two variables. According to Davis [28], the higher the perception of a technology's usefulness and ease of implementation, the more likely individuals are to use it, referring to (behavioral intention – BI).

For this study, TAM was adapted to assess the acceptance of AI applications among Arab adult learners. The TAM questionnaire comprises 17 items distributed across three main subscales, each measuring one of the variables: PU, PEOU, and BI. The psychometric properties of TAM use a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Since the early 1990s, extensive testing has demonstrated the strong reliability and validity of the TAM questionnaire [29]. Besides TAM, demographic questions and two open-ended questions to inquire about the most incorporated AI tools and the adaptability challenges were included.

According to Adams [30], the reliability of TAM showed Cronbach's  $\alpha$  of 0.94 for PU and 0.88 for PEOU. For this study, internal consistency was computed to measure the reliability of the measurement scale. The Cronbach's  $\alpha$  shows internal consistency, supporting the scale's reliability (refer to Table 1).

**Table 1.** TAM's reliability

Scale	Cronbach's $\alpha$	No. of Items
PEOU	.870	6
PU	.850	6
BI	.838	5
Total	.893	17

Note: N = 456.

### 3.4 Participants

A valid response was obtained from 456 Arab adult learners enrolled in various adult and continuing education programs conducted in English. The participants are over the age of 30 and have an education gap between earning their high school diploma and pursuing a bachelor's degree at a private institution in the UAE. This diverse sample included individuals from several Arabic nationalities, comprising 196 males (43%) and 260 females (57%). Participants' ages ranged from 30 to 60 years, averaging 47 years.

### 3.5 Data collection

The TAM survey was utilized to obtain data and answer the first two research questions. Data needed for answering the second two questions came from

answering two open-ended questions to inquire about the most incorporated AI tools in academic library services and the challenges of adapting to AI tools. The TAM questionnaire was modeled on Google Forms, besides the open-ended and demographic questions. All questions and responses are presented in English. The Institutional Review Board (IRB) was obtained, and the consent forms and a full description of the study were attached to the study link. Participants received the study link via their student portal, which was posted by their professors. Data was collected over four weeks at the start of the semester, fall of 2024. Participants could only take part in this study if they were 30 years or older. All data was kept anonymous and uploaded to SPSS 26.0 for analysis and conclusion.

#### 4 DATA ANALYSIS AND FINDINGS

Before starting the analysis, the researcher addressed all issues related to statistical analysis, such as missing values, independence, etc. For Research Questions 1 and 2, the mean and standard deviation of the three TAM subscales will be analyzed. Data analysis showed that Arab adult students developed a positive perception of using AI applications in library services. Across the three scales of TAM, students perceived AI applications as easy to use and useful, and they also showed a highly positive intention to continue using AI in library services, as displayed in Table 2. For more confirmation of the association between adult students’ perception of AI tools and the intention to utilize them, a Pearson Correlation Coefficient *r* was performed. Given *r* values of .647, .451, and .448, with *p* < .001, which is statistically significant for the three scales of TAM, thus, there is a positive, remarkable correlation between students’ perception of AI technologies as easy and useful tools and incorporating them when using library services, as shown in Table 3.

**Table 2.** Outline of the descriptive data of TAM measurements

Variable	M	SD
Perceived Ease of Use (PEOU)	4.12	.621
Perceived Usefulness (PU)	4.01	.556
Behavioral Intention (BI)	4.02	.614

Note: N = 456.

**Table 3.** The correlation between TAM subscales

		PEOU_Total	PU_Total	BI_Total
PEOU_Total	Pearson Correlation	1	.647**	.451**
	Sig. (2-tailed)		.000	.000
PU_Total	Pearson Correlation	.647**	1	.448**
	Sig. (2-tailed)	.000		.000
BI_Total	Pearson Correlation	.451**	.448**	1
	Sig. (2-tailed)	.000	.000	
	N	456	456	456

Note: \*\*Correlation is significant at the 0.01 level (2-tailed).

To answer research questions, 3 and 4 open-ended questions were presented to participants to provide data about the AI tools offered by academic library services and describe the challenges they face when adapting to AI tools in library services. Short responses were obtained to uncover the most incorporated AI tools in libraries, as acknowledged by students. Content analysis revealed that most of the available AI tools for adult learners to use are free applications that are accessible by everyone, such as Libby, Encore Discovery Solution, ChatGPT, Google Translate, QuillBot, Grammarly, ProWritingAid, and Duolingo. Generated data showed the insufficiency of AI tools in the academic library services. Students expressed their need for more real incorporation of AI tools to activate the academic library's role and improve their search skills. One of the significant responses was "AI tools save my time and help me finish my assignments quickly, reducing stress and anxiety that adult students may experience when working on an assignment or research project." In simple words, AI technologies make academic life easy and accentuate-free. However, the available AI tools in the academic library are limited and simple, so they are perceived as easy tools.

Regarding the challenges that adult learners encounter when they apply AI tools in library services, content analysis for the short responses revealed that the challenges are related to the students, not to the AI tools, because the AI tools they use are basic and simple, which developed a positive perception of them. Arab adult students reported that the difficulties they experience include the following: (1) English language proficiency; Some adult students struggle to understand instructions to use AI tools in library services. Moreover, the difficulty in perceiving the content generated by AI tools which necessitates finding a guide or using a translator tool. (2) Insufficient digital literacy may hinder adult learners' ability to use AI tools effectively, leading to frustration and decreased motivation. (3) Lack of guidance: adult learners need librarians' and professors' guidance and supervision to help them interpret the generated content when they use AI to personalize their learning objectives and experiences. (4) Lack of training: adult learners may feel unprepared to use AI's various tools for the first time. (5) Inappropriate incorporation: some adult learners need awareness of using AI tools properly to ensure their learning goals and the generated content are aligned, besides the proper use of AI content away from plagiarism. (6) Lack of support systems: the institution does not provide a sufficient support system; the burden of purchasing devices, software, or paying for high-speed internet can be a barrier for some adult learners, which makes it difficult for adult learners to invest time and effort into learning AI tools. (7) Data privacy and cybersecurity: Some adult learners feel worried about how AI collects, stores, and uses personal data, which may lead to reluctance to use these technologies. Furthermore, the possibility of cyberattacks and the security of online tools may dissuade adult learners from using them in library services.

## 5 DISCUSSION

The study discusses the crucial topic of acceptance, utilization, and adaptability challenges of incorporating AI tools when incorporated with mobile technologies in library services among Arab adult learners. Findings showed that Arab adult learners develop a positive perception of AI applications through mobile technologies in library services. They find it easy to use and useful, which encourages them to continue using AI tools in academic library services. Thus, these results could be explained in the context of the modern technology that has been spread in countless academic settings, including the academic library. The wide use of AI makes it easy

for individuals to use it in numerous fields and incorporate it into their everyday life tasks. Moreover, the perception of AI applications as an easy and helpful tool encourages students to plan to keep using them in the future, which emphasizes the significance of AI in libraries and its role in facilitating learning, research, and library use. The findings agree with Moussa [8], who showed a positive perception of integrating AI tools among higher college students in the UAE, and agree with Lund [31] and Ahmed [32], who discovered the multiple innovations of AI technologies, which encourage professionals to use it when accessing public and academic libraries and embrace AI aspects in their daily tasks. The outcomes specified that the Arab adult students' perceptions of ease of use and usefulness are positively correlated to continue using AI tools, which is an expected result. As new technologies have been perceived by individuals as easy to use and useful, the possibility of incorporating them increases. Great implications for these results can be achieved through more incorporation of AI tools in self-directed learning to help adult learners design their learning goals and objectives. Regarding the most incorporated AI tools in the academic library service, data analysis revealed the insufficient incorporation of AI tools in the academic library services within adult education settings. Arab adult students showed that the available AI tools in the academic library are simple and limited, like those AI tools available to any user, which explains the reason behind the perception of ease of use among participants. Thus, there is a need for professional assessment and evaluation of the facilities and equipment of academic libraries to expand the incorporation of AI tools to incorporate professional AI tools rather than availing simple applications. Regarding the challenges and difficulties that Arab adult learners experience when incorporating AI tools in the academic library, results showed unforgettable essential challenges related to English language proficiency, digital literacy, lack of guidance and training, inappropriate incorporation, lack of support systems, data privacy, and cybersecurity. These results can be explained as Arab adult learners having a gap of more than ten years needing more preparation in various perspectives, such as language and digital proficiency, and proper use of modern technologies to help them pursue their academic goals. These results agree with [24], [26], and [27], who demonstrated that predominant challenges are related to data privacy, trust issues, risks, and security of data management. Moreover, there is a demand for instructors to provide clear guidance and assistance in effectively using AI tools. Based on these results, higher education institutions in the UAE ought to implement a series of training programs and workshops for adult learners to improve their language and digital literacy abilities for better use of AI tools in library services. Study limitations can be found in the language proficiency; English is the second language of Arab adult learners, and the data collection was conducted in English, which may be a barrier for some respondents.

## 6 PRACTICAL RECOMMENDATIONS

The results of this study suggest the following for practical implementation. To activate the integration of AI in higher institutions' libraries, it is important for the higher academic sector to: Conduct continuous assessment and evaluation for the incorporation of advanced technology, namely, AI tools, in academic libraries, to ensure easy accessibility for adult learners. Offer workshops and training sessions for adult learners to improve their language and digital proficiency in using AI tools. Produce documentary media and tutorial videos to guide adult students to the proper use of AI tools. Provide continuous library guidance to adult learners.

## 7 CONCLUSION

This report summarizes a cross-sectional research study that explores Arab adult students' acceptance and utilization of AI technologies through mobile technologies in academic libraries in higher education institutions in the UAE and the related challenges to incorporating AI tools. The results uncovered the existence of a highly positive perception of easy and useful tools and the intention to use AI applications in library services among Arab adult learners. The report showed insufficient AI incorporation in the library services, limited to a few tools such as Libby, Encore Discovery Solution, ChatGPT, Google Translate, Grammarly, and Duolingo, which require stakeholders and decision-makers to assess the role of libraries in adult education. The study revealed the existence of various difficulties that limit the benefit of library services and hinder adult education progress, including language proficiency, digital literacy, lack of guidance and training, misuse of AI tools, and lack of support systems, besides the fear of data privacy and cybersecurity. The upcoming research project will focus on investigating the use of AI in personalized learning for Arab adult students and examining how this integration supports adult education.

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