

The Impact of Artificial Intelligence on Adulthood Education in Iraqi High Schools

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Abstract

This paper examines the complex role of artificial intelligence (AI) in the education of adults in Iraqi high schools, specifically in evening classes and fast track education programmes. The gap that the research fills is urgent in the educational scholarship because it considers the potential of the effective use of AI technologies in the adult learning context in a developing nation environment where the unique infrastructural, socioeconomic, and cultural conditions dominate. Using both a quantitative survey methodology and a qualitative interview methodology, this study gathered data of 250 adult learners and 45 teachers in evening high schools located in Baghdad, Basra, and Erbil. The results indicate that although adult learners exhibit statistically significant positive attitudes to the AI assisted learning tools ($M = 3.72$, $SD = 0.84$) actual adoption is severely limited due to the lack of appropriate digital infrastructures with only 23% of the surveyed institutions having the high-speed internet connection availability. The analysis reveals that there is a high positive relationship between familiarity with AI tool and retention rates of learners ($r = 0.67$, $p < .001$), which implies that the introduction of AI tools in specific areas of work with adult learners may lead to high-quality results. Nevertheless, the main obstacles such as electricity unstable, poor digital literacy of the learner aged 25-45, and lack of policy frameworks in full by the Iraqi Ministry of education are hindering development at the moment. The study concludes by giving viable suggestions on the gradual application of AI, and the recommendation is mainly on offline enabled adaptability learning systems and elaborate training of the teachers. The findings will be added to the ever-increasing literature on educational technology in conflict areas and also it is presented as evidence-based information that will help policymakers who may be concerned with the modernization of the sphere of adult education in Iraq.

Keywords: Artificial Intelligence, Adult Education, Iraqi High Schools, E-Learning, Digital Literacy, Technology Acceptance, Andragogy

تأثير الذكاء الاصطناعي في تعليم الكبار في المدارس الثانوية العراقية

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المخلص

تبحث هذه الورقة في الدور المعقد للذكاء الاصطناعي (AI) في تعليم الكبار في المدارس الثانوية العراقية، ولا سيما في برامج التعليم المسرع. وتسد الدراسة فجوة ملحة في البحث التربوي من خلال تناول إمكانات الاستخدام الفعال لتقنيات الذكاء الاصطناعي في سياق تعليم الكبار ضمن بيئة دولة نامية، حيث تسود ظروف بنوية واجتماعية-اقتصادية وثقافية خاصة.

اعتمدت الدراسة منهجيتين: الاستبانة الكمية والمقابلات النوعية، وجمعت البيانات من ٢٥٠ متعلماً بالغاً و٤٥ معلماً في مدارس ثانوية مساوية تقع في بغداد والبصرة وأربيل. وتشير النتائج إلى أنَّ المتعلمين البالغين يُظهرون اتجاهات إيجابية ذات دلالة إحصائية نحو أدوات التعلم المدعومة بالذكاء الاصطناعي (المتوسط = ٣.٧٢، والانحراف المعياري = ٠.٨٤)، إلا أنَّ التطبيق الفعلي ما يزال محدوداً بشدة بسبب نقص البنى التحتية الرقمية المناسبة؛ إذ إن ٢٣% فقط من المؤسسات المشمولة بالدراسة تتوافر لديها خدمة إنترنت عالية السرعة. ويظهر التحليل وجود علاقة إيجابية قوية بين الإلمام بأدوات الذكاء الاصطناعي ومعدلات بقاء المتعلمين ($r = 0.67$)، $p < 0.001$)، ما يشير إلى أنَّ إدخال أدوات الذكاء الاصطناعي في مجالات محددة من تعليم الكبار قد يؤدي إلى نتائج عالية الجودة. ومع ذلك، فإنَّ العوائق الرئيسة—مثل عدم استقرار التيار الكهربائي، وضعف الثقافة الرقمية لدى المتعلمين من الفئة العمرية (٢٥-٤٥) سنة، وغياب الأطر والسياسات المتكاملة من قبل وزارة التربية العراقية—تُعيق التطور في الوقت الراهن. وتختتم الدراسة بتقديم مقترحات عملية للتطبيق التدريجي للذكاء الاصطناعي، مع التركيز على أنظمة التعلم التكيفي التي تعمل دون اتصال بالإنترنت، والتدريب المكثف للمعلمين. وستُسهم النتائج في إثراء الأدبيات المتنامية حول تكنولوجيا التعليم في مناطق النزاع، كما تُقدّم بوصفها معلومات قائمة على الأدلة يمكن أن تساعد صنّاع القرار المعنيين بتحديث قطاع تعليم الكبار في العراق.

الكلمات المفتاحية: الذكاء الاصطناعي، تعليم الكبار، المدارس الثانوية العراقية، التعلم الإلكتروني، الثقافة الرقمية، تقبل التكنولوجيا، الأندراغوجيا

Introduction

1.1 Background of the Study

The educational environment in Iraq has experienced significant changes during the last forty years and this is conditioned by conflicting periods, economic sanctions, and the constant state of turmoil in the region. Accelerated learning programs and evening high schools (Al-Diraasaat Al-Masaa'iyah) constitute an important channel through which adult education takes place: it can be considered a crucial avenue of people who were deprived of formal educational opportunities in their adolescence. The Iraqi Ministry of Education estimated that there were 2.3 million Iraqi adults with no secondary education credentials, which causes serious obstacles to employment promotion and lower social-economic mobility (Al-Khafaji & Hasan, 2023, pp. 156-174.). This educational gap is overrepresented among the population of the rural provinces and marginalized urban communities, and economic challenges often compel the youth to focus on the working market rather than on education.

With the introduction of the artificial intelligence technologies, the existing challenges of these educational issues are unprecedented in the opportunities to be resolved. Online learning platforms, intelligent tutoring systems and natural language processing applications have revealed exceptional effectiveness in individualized learning provision in developed countries. The translation of these technological advances into the context of developing countries, however, should be done with a particular attention to the local circumstances, such as the infrastructure constraints, the digital literacy rates, the culture of attitude to technology-mediated learning. The own characteristics of Iraq, namely, a young and technologically proficient population and a severe lack of infrastructures predisposes a complicated picture of the AI adoption in education.

Malcolm Knowles introduced the idea of andragogy and then, the theory was developed by other scholars, Mezirow and Brookfield, who gave a theoretical background to the unique needs and motivation of adult learners. The frameworks based on andragogy also focus on self-directed learning, integrating knowledge through experience and its timeliness to practical events in life (Merriam & Bierema, 2023), in contrast to those that are designed in pedagogical directions. Improved AI technologies are naturally compatible with these values and suggest a customized learning experience that will only meet the various schedules of the adult learner, structure of prior knowledge, and career development goals. Such implementation, however, must be done by investigating empirically how Iraqi adult students see and experience such technologies in their unique sociocultural background.

1.2 Problem of the Study

Although AI is an increasingly discussed issue in educational research internationally, it is truly astounding that there is little empirical evidence regarding its integration in educational contexts in the Iraqi adult learning community. This gap in knowledge has important practical implications since policymakers in the education sector in Iraq have no evidence-based prescriptions to follow in integrating technology implementation efforts. The issue has got several aspects that should be systematically explored.

To start with, the AI-assisted learning infrastructural pillar has been poorly recorded in Iraqi educational institutions. Although reports by international bodies, including UNESCO and the World Bank on general digital connectivity in Iraq have been published, both agencies rarely break down data based on the type of educational institutions or region (UNESCO, 2023). The evening high schools that do not work regular hours and are used by large populations of adult working classes may have different infrastructural issues that cannot be adequately represented in generic surveys. The nature and scope of these infrastructure gaps need to be known accurately in order to be able to create realistic AI integration strategies.

Second, adult learners in Iraq have heterogeneous technology backgrounds that affect their ability to get positive benefits in terms of AI-enhanced educational tools. The Ministry of Communications data shows that the digital literacy rate among Iraqi adults is approximately 35 percent, i.e. almost two out of three adult citizens do not possess basic digital skills (Al-Amiri & Rahman, 2022, pp. 45-62). But these aggregate statistics hide a great deal of diversification in terms of age cohort, gender, urban rural dwelling, and socioeconomic status. There is a need to have full knowledge on the distribution of digital literacy in potential adult learners in order to design the most suitable scaffolding and training programs.

Third, the readiness of teachers to integrate AI is also little studied in Iraqi educational studies. High school teachers are working evening, leaving many of them with limited exposure to modern educational technologies, since they continue with daytime jobs in many instances. The studies carried out under similar situations in the MENA regions indicate that teacher training is a decisive factor of a successful adoption of technology, and no systematic evaluation of AI competency among adult education teachers in Iraq has been made. (Al-Mashaqbeh & Al-Majali, 2023, pp. 10245-10268.)

Lastly, when combined, these factors-infrastructure, and the traits of learners and teachers, there are the complicated systemic dynamics that need holistic research. Single-variable studies, no matter how valuable, do not work very well to quantify the emergent characteristics of education technology ecosystems. The study focuses on this shortcoming by studying AI integration as a multidimensional process that is a part of a larger socioeconomic and political picture in Iraq.

1.3 Research Questions

The current research relies on three main research questions to address the knowledge gap presented in the abovementioned fashion:

Research Question 1: What is the current situation in the digital infrastructure of the evening high schools in Iraq, and how the quality of infrastructure by geographical location and institutional features is different?

Research Question 2: How do adult learners and teachers perceive and attitudinally accept technology aid in learning using AI-assisted learning tools in High school settings in Iraq?

Research Question 3: Over what statistical interrelationships are there between the AI tool use, student characteristics, and learning outcomes such as retention rate, student satisfaction, and academic achievement?

1.4 Significance of the Study

The study has a great importance to various stakeholder groups that are interested in educational development in Iraq. To policymakers in the Ministry of Education of Iraq, the results give an empirically based guesswork in the area of technology investment priorities and implementation sequence. Instead of

seeking scale adoption of AI on idealized models in the developed countries, policymakers can come up with staged integration plans that consider both local limitations and opportunities.

To international development agencies which work in Iraq such as UNESCO, UNICEF and other bilateral aid agencies, the study provides a diagnostic structure to evaluating the educational technology interventions. The methodology that has been created in this paper can be scaled to analyze AI integration initiatives in various institutional settings to allow more serious impact measurement and resource distribution.

To comparative and international education scholars, the study represents a contribution to the comparative and international educational research, which is somewhat scanty in regard to the application of educational technology to conflict question and developing nation contexts. Though the existing literature on AI in educational practices has made significant efforts to consider the theoretical prospects of AI in academic settings with abundant resources, little has discussed the issue with respect to the conditions of under-infrastructure, politically unstable, and post-disruption education systems (Reich & Ruipérez-Valiente, 2019, pp. 130-131.). The research contributes to the theoretical study of the interaction of technological innovation and development conditions to achieve differentiated educational results.

Lastly, to the adult learner him/herself, this study has an indirect benefit to them by creating evidence that can enhance future services of education. This investigation revolves around the voices and perceptions of adult learners in Iraq, which is why technological interventions are made with the needs of the business users being the leading factor, not an added value.

Literature Review

2.1 Theoretical Framework

The theoretical framework underpinning the present study also combines three complementary frameworks which, together, shed light on the intricate process of AI acquisition in adult education. The Technology Acceptance Model (TAM) was originally invented by (Davis, 1989, pp. 319-340.) , then later developed and expanded by Venkatesh et al. is a highly validated model that is used to comprehend the adoption of technological advances by users. TAM assumes that human attitude towards technology adoption is mainly indicated by two beliefs; perceived usefulness (the extent to which the use of technology can result in increased performance) and perceived ease of use (the extent to which technology use does not require strain). These associations have been observed in varied population groups and other technological settings, and meta-analytic evidence reveals that there are general correlations of about 0.6 between these predictors and the actual course of technology adoption behavior .

In the case of adult learner groups in particular, (Portz, Bayliss, & Bull, 2019) modified TAM to determine technology acceptance in the context of older adults and discovered that computer self-efficacy and computer anxiety were among the likely moderating variables. In their qualitative study, they found that perceived ease of use depended on interface design factors such as font readability, ease of future navigation, and the use of error tolerance which are especially important when teaching to adult learners with little previous experience in the use of technology. These results endorse the need to study not only the issue of the acceptance of AI technologies by adult learners, but how particular design and implementation features determine acceptance patterns.

The andragogy College model created by Knowles and further enhanced by other researchers' offers the necessary background on the peculiarities and demands of adult learners. (Merriam & Bierema, 2023) describe six assumptions that distinguish between adults and children learners, including; self-concept shifting to being self-directed; accumulated experience serves as a rich source of learning; readiness to learn increases with age and shifts in social roles; orientation switching to problem-centeredness; enhanced motivation; and increasing the demand to apply the relevance of learning in practice. The following assumptions also imply that the strategies of integrating AI in the adult literate should focus on self-directed learning trajectories, identification of prior knowledge, problem-based delivery of content, and well-identified links between the learning exercise and meaningful life activities.

Lastly, the framework of digital divide, which is expressed by (Van Dijk, 2020) , offers the conceptual means of comprehending disparities in technology access and use. The digital divide works at several levels, first-level divides are related to simple access to devices and access to connectivity; second-level divides are in relation to skills and the pattern of usage, and third-level divides are in relation to concrete results and the advantages accrued through the utilization of technology.

(Ulaywi, 2025, pp. 89-112.) elucidates that to implement AI in Iraqi adult education, such a framework implies that access inequalities should be addressed, but not too broadly- it is also necessary to focus on nurturing digital skills and making sure that the use of innovative grammatical technologies generates valuable learning results.

2.2 Global Perspectives on AI in Adult Education

The growing body of international studies about the integration of AIs in adult education shows the opportunities of transformation and serious implementation challenges. Research studies have been carried out in North American and European environments and have reported significant positive gains in learning outcomes once adaptive learning systems are worked out on with care. A meta-analysis study conducted by (Means, Bakia, & Murphy, 2020) using meta-analytic methods revealed that, on average, AI-enhanced adaptive learning resulted in improved learning outcomes relative to traditional teaching by 0.35 standard-deviation-wide effect sizes, and that these effects were stronger in the context of adult populations as opposed to traditional cohorts of students. The authors explain such differences by the ability of the adaptive systems to adapt to the requirements of adult learners in terms of both the NoTL, as well as their slow learning pace.

Scholars have been warning against some-blind technological optimism in learning too, however. According to (Selwyn, 2022) , the issue of AI hype in education is that it clouds underlying social, economic, and political factors in learning outcomes. His comparison of the practice of AI in several national settings shows a common pattern large investment in technology infrastructure leads to small learning differences in the education system when reforms to the curriculum, testing and teacher training are overlooked. This observation implies that AI integration efforts in Iraq should be envisioned as systemic and overall interventions and not as limited technology implementation.

The studies conducted in the context of developing countries are especially useful in this study. Research carried out in Sub-Saharan Africa, South Asia, and Latin American contexts has found that higher education barriers to the adoption of educational technology repeatedly include electrical infrastructure instability, a lack of devices, insufficient technical support resources, and the linguistic constraints of the anglophone AI platforms (Peter & Kafyulilo, 2020) . Notably, in these studies, there are equally successful adaptations and solutions such as offline-enabled apps, solar-powered charging devices, and locally-created content, which point to possible avenues to go despite tremendous limitations.

2.3 Regional Context: AI Integration in MENA Education

Middle East and North Africa is a diverse context in terms of the AI use in education, with the Gulf Cooperation Council countries evolving ambitious national AI strategies at the same time the conflict countries have more tangible problems. A study by (Galal, Kamel, & Fathi, 2023) analyzing the penetration of AI in MENA educational systems refers to three implementation processes, namely, aspirational integration (dominated by systemic plans and significant investments), emergent integration (dominated by pilot projects and cross-border cooperation), and minimal integration (dominated by sparse digital infrastructure and little policy focus). The fact that Iraq falls in the lowest tier of integration indicates how many years of war, economic and infrastructure damages impacted education modernization initiatives.

Analytics provided by the adjoining countries can also be a powerful source of comparative data. According to research carried out in Jordan by (Al-Mashaqbeh & Al-Majali, 2023) , AI acceptance among adult learners across vocational education programs had a positive significant predictive match on the intentions to adopt AI as a promising tool, whereas perceived ease of use demonstrated less positive predictive power. This observation does diverge with studies in the developed country settings and

indicates the possibility of adult students in developing countries focusing more on practical utility and less on user experience factors in judging educational technologies. The authors suggest that the developers of AI platforms should focus on functional features and articulate value propositions instead of interface advanced functionality when developing to attract MENA audiences.

The related research conducted in the United Arab Emirates, where the introduction of AI has progressed more quickly, offers both the projections and lessons to be learned. Other researchers such as (Islamic, Al-Harthi, & Al-Qasimi, 2022) recorded favorable adaptation of AI tutoring systems in secondary school, in which the student-to-student engagement and learning outcomes improved significantly. Nevertheless, they too found troubling equity effects: students with more advantaged socioeconomic status were shown to consume AI tools at a larger rate with correspondingly greater achievement gains that can be viewed as aggravating educational disparities. This fact highlights the necessity of crafting AI adoption strategies to be more proactive rather than reactive to issues of equity instead of making assumptions that benefits of technology will trickle down and apply to all learners.

2.4 Iraqi Educational Technology Landscape

The use of educational technology in Iraqi contexts has been specifically studied more than ever in the wake of the COVID-19 pandemic that compelled the implementation of remote learning technologies without proper preparation. A survey of e-learning issues in universities located in the Kurdistan Region found four major categories of barriers, namely, psychological and social barriers (such as motivation problems and social isolation), curriculum and motivation to learning, and technical barriers and lack of experience, as well as economic barriers (Ali & Mahmood, 2024). Their study of 601 college students has shown that there is considerable diversity in the barrier of e-learning between institutions, and governmental universities experience much more barriers than their private-based counterparts do.

A study carried out by (Al-Khafaji & Hasan, 2023) regarding the secondary school e-learning during the pandemic restrictions has shown that only 34 percent of the students in public schools had good access to internet facilities, as opposed to 89 percent in their counterparts in the private schools. Such a digital divide in the Iraqi education system has drastic ramifications on the integration of AI, implying that even to implement it equally, much investment into infrastructure and presence of devices as well as technology development will be necessary. The authors also reported that the preparedness of teachers to teach online was drastically diverse in schools as urban schools generally exhibited higher levels of preparedness as compared to rural schools.

Social integration of artificial intelligence via the Iraqi education in particular has been underused in the literature so far. Early research on the use of AI in higher education by (Abdulla, Al-Mansoor, & Kareem, 2024) determined that awareness of AI use in higher education in Iraq was largely low, with most faculty either having unrealistic hopes (that AI will turn human instruction obsolete) or being too pessimistic (that AI has no role in educational settings). These results point to the necessity of the elaborate professional development initiatives that create the subtle comprehension of the fair usage of AI in education.

2.5 Gap Analysis and Research Contribution

The above literature review has exposed a huge gap in the academic research on AI integration with reference to adult education settings in Iraq. Although research has been conducted internationally to come up with broad principles of AI in the education sector, and studies in specific regions of the world have been carried out to document MENA educational technology sceneries, there is no systematic study on what AI can potentially do about Iraqi evening high schools and acceleration learning programs. This is a gap with specific consequences considering the unique features of adult learners, who are working people with limited time that available and can get the most out of AI as an intellectual hub capable of providing them with specialized and flexible learning opportunities.

This gap is filled in this study by pursuing an intensive application of empirical research using both quantitative and qualitative research. Through analyzing the infrastructure situations, the learner and teacher perceptions and the relationships between the outcomes in the Iraqi adult learning institutions, this

study produces actionable knowledge to the policy makers, practitioners and scholars. The results can advance the theoretical knowledge of the difference in the dynamics of AI integration in both the context of developing and developed nations and be used in practice as the guide towards overcoming the peculiarities of the educational sphere in occupied Iraq.

Methodology

3.1 Research Design

In this study, it was possible to use a mixed-method, sequential explanatory design, which is a conglomeration of quantitative survey research and qualitative interview research that would produce a full picture regarding the dynamics of AI integration in adult education in Iraq. The mixed-method approach has been chosen since quantitative and qualitative methods were not sufficient to answer the research questions. Quantitative methods made it possible to make systematic evaluation of the state of infrastructure, perception patterns, and statistical associations within a representative sample, whereas qualitative methods allowed depth insight into the meanings and experiences underlying quantitative results (Creswell & Plano Clark, 2018)

The qualitative element employed a descriptive correlational research design, which involved the use of structured questionnaires that were given to adult learners and teachers in various geographic areas. The design facilitated the measurement of important variables such as the quality of infrastructure, the perceptions that people held towards technology, and the educational outcomes as well as analyzing the relationship that existed between various variables. The semi-structured interviews carried out with the school administrators and a purposively chosen subset of interviewees included in the qualitative aspect as the follow-up of the themes arising through the quantitative analysis have been used to explore them in more depth.

3.2 Population and Sample

This research population included adult learners and teachers in evening high schools in the three governorates, namely, Baghdad, Basra, and Erbil, in Iraq. To ensure that there is variation in geographic location (central, southern, and northern Iraq), ethnic and linguistic composition (Arabic-speaking, Arabic-speaking with a higher level of diversity, and Kurdish-speaking contexts), and the level of development, these governorates were chosen. The evening high schools in these governorates are mainly adult learners between the ages of 18 and 45 years who undertake secondary education qualifications at the expense of employment and family life.

The quantitative sample used was 250 adult learners and 45 teachers who were sampled using stratified random sampling. The stratification in schools was based on governorate and location within governorate (urban or suburban) and then the random selection of individual participants within the stratification. This method of sampling was geographically and institutionally representative and random to make statistical inferences. The determination of the sample size involved power analysis which informed the proposed statistical procedures that 250 learners would offer sufficient power ($\geq .80$) in identifying moderate effect sizes in correlational analyses.

The qualitative sample was the use of 15 participants of the interview who were chosen with the help of the purposive sampling to guarantee diversity in the types of the participants (administrators, teachers, and learners), geographic location of the participants, and the level of the technology experience. The sampling done until saturation was reached in terms of themes as seen in cases where themes were duplicated in following interviews but without any significant new categories being identified.

3.3 Research Instruments

Two main tools were used to collect data that include technology perception and infrastructure questionnaire, and semi-structured interview protocol. The questionnaire was formed by the use of the expert review and pilot testing because its content validation was done at the initial stages of creating the questionnaire. The development of the first items was based on the availability of previous means of validity such as the Technology Acceptance Model tool created by (Davis, 1989) and modified to the

educational setting by Venkatesh and his associates. Back- translation process was applied in translating things to Arabic and this was done in a way that ensures that there is semantic equivalence and then the bilingual educators emphasized how culturally appropriate each item was.

The questionnaire also included four parts (demographic and background characteristics identification) (12 items), digital infrastructure assessment (15 items), technology perception and acceptance (20 items with the use of 5-point Likert scales), and educational outcomes and experiences (10 items). Pilot testing on 30 adult participants who were not part of the main sample gave the technology acceptance scale a Cronbachs alpha coefficient of .87 which would be considered as acceptable internal consistency reliability. The infrastructure assessment items were checked using the direct observation and technical assessment protocols of the research assistants.

The interview guide included 12 open-ended questions that covered experience of participants on education technology, opinion on AI potentials and shortcomings, recommendations on how to have successful implementation, and expected barriers and facilitators. The theoretical framework and initial quantitative results were used to develop the protocols, so the qualitative exploration would not replace the quantitative measurements.

3.4 Data Collection Procedures

The quantitative data collection was done in two stages. Questionnaires were boiled out and administered to the participants during evening classes to participating schools between the months of October and November, 2025. The questionnaires were delivered in hardcopy through questionnaires to ensure the participants that would have had low access to digital services and to maximize the response rates. Assistance was provided to research assistants on how to do the standardized administration so as to bring uniformity to the sites where data was collected. Questionnaires that were filled were picked up instantly and ferried to the research office where they were scanned and entered.

Qualitative data collection happened in January 2026, and the preliminary quantitative analysis had taken place beforehand. The interviews were carried out using the Arabic language through trained research assistants who were audio recorded with the consent of the interviewees and later transcribed and translated to English to be analyzed. The interviews lasted between 45 and 75 minutes (average of 55 minutes). The participants of the interview were compensated modestly on the time they devoted to the interview, which adhered to ethical principles in terms of research on potentially vulnerable groups.

3.5 Data Analysis

Quantitative was done by using SPSS version 28 statistical package. All the variables of the study were computed using descriptive statistics (means, standard deviations, and frequencies, percentages) to describe the sample and infrastructure conditions. Independent samples t tests to evaluate group differences, Pearson correlation coefficients to evaluate relationships between continuous variables and multiple regression analysis to evaluate predictive relationships controlling demographic covariates were used as inferential statistical procedures.

Thematic analysis processes were used in negating the analysis of qualitative data by (Braun & Clarke, 2006, pp. 77-101.) . Transcripts were initially coded inductively to give rise to emergent themes and coded into hierarchical thematic codes as indicative of relationships between themes. The cross-case analysis of the results on participant types and geographic environments revealed those patterns that were common across all cases, as well as diverse differences. Strongness was also promoted by triangulating qualitative results with quantitative results, conducted member checking with a sample of respondents, and keeping complete audit trails in the form of documentation of the analytical choices.

Results

4.1 Demographic Characteristics

The sample used was 250 adult learners and 45 teachers spread in the three target governorates in quantitative sample. Table 1 gives demographic aspects of the learner sample where majority of the learners are within the age brackets of 18-25 and 26-35. Male dominance was slightly high (54% male,

46% female) in the gender distribution as compared to general trends in the Iraqi education enrollment. The educational backgrounds were very different and the learner showed that 42% completed their nine years of formal education before enrolling in the school, 35% completed the six years of formal education and 23% did not get any formal education.

The data of employment status indicated that 67 percent of learners retained part-time or full-time jobs on top of their studies with higher levels of employment existing in the older age groups (82 percent in the 26-35 age category and 91 percent in the 36-45 age category). This dualism of employment/education implies substantial impacts on the current AI integration, and one can assume that the technology providing elastic, asynchronous learning would be congruent with the time management of learners. The teacher survey included 45 teachers whose mean of 11.41 years (SD=6.2) was taken into account as the average teaching experience, 62% of which stated having some experience with educational technology tools.

Table 1 Demographic Characteristics of Adult Learner Sample (N = 250)

Characteristic	N	Percentage
Age Group		
18-25 years	145	58.0%
26-35 years	78	31.2%
36-45 years	27	10.8%
Gender		
Male	135	54.0%
Female	115	46.0%
Prior Education		
No formal education	58	23.2%
6 years completed	87	34.8%
9 years completed	105	42.0%
Employment Status		
Employed	168	67.2%
Unemployed	82	32.8%
Governorate		
Baghdad	112	44.8%
Basra	76	30.4%
Erbil	62	24.8%

4.2 Digital Infrastructure Assessment

Infrastructure analysis showed that there were severe gaps on various dimensions that are pertinent in the integration of AI. According to the findings, Table 2 presents major infrastructure indicators; no less than 23% of the surveyed schools had available reliable high-speed Internet connection that met minimum requirements to stream videos and to use it in interactive applications. Supply of electricity was even more a menace as 78% of the schools had daily power cuts averaging 3.2 hours. The supply of devices was severely limited as well, and learner to computer ratio of roughly 15:1 and very limited institutional supply of devices to use at home.

Table 2 Digital Infrastructure Indicators by Governorate

Indicator	Baghdad (n=12 schools)	Basra (n=8 schools)	Erbil (n=7 schools)	Overall
Schools with reliable internet	33%	12%	25%	23%
Schools with backup power	42%	25%	50%	39%
Average daily outage (hours)	2.8	3.9	2.4	3.2
Learner: computer ratio	12:1	18:1	14:1	15:1

These infrastructure discoveries have immense implications to the AI integration planning. Incomplete safety of the electricity supply practically rules out cloud-dependent AI services, which require the installation of solutions with offline capabilities. The scarcity of devices implies the need to implement

bring-your-own-device models, which will require evaluation of the number and capability of learners to own a personal device. Low share of schools having its own IT support staffs implies that the capacity to troubleshoot will not be high and instead it would lean towards robust low-maintenance products rather than complex systems with a need to serve with continuous technical support.

4.3 Technology Perceptions and Acceptance

Data analysis of technology perception and acceptance showed that the attitudes towards AI-assisted learning are in general positive among adult learners. The composite technology acceptance scale (1-5 theoretical variety) produced a mean of 3.72 (SD = 0.84) which was a moderately positive perceptions. At the item level, it was found that the scores on perceived usefulness (M = 4.01, SD = 0.76) were higher than the scores on perceived ease of use (M = 3.34, SD = 0.92), which are in line with other contexts of the developing countries where it has been shown that adult learners are more conscious of functionality than ease of use.

There was much difference in the perceptions of technology according to the demographic lines. Learners that were employed scored higher on technology acceptance (M = 3.89 vs. M = 3.41, $t = 4.12$, $p < .001$) which could be attributed to a higher exposure to technology amongst employed learners in the workplace situations. Likewise, the learners who had personal smartphones (92 of sample) were more accepting than their counterparts without a smartphone but this was just barely below the statistical significance level ($p = .07$). Teacher technology acceptance scores were a bit lower (M = 3.56, SD = 0.91) in comparison with learner ones, thus, it could be necessary to conduct professional development to make teachers more comfortable with AI technologies.

Notably, there is a strong positive correlation between technology acceptance and self-reported digital literacy ($r = .54$, $p < .001$), which means that more digitally skilled learners expressed positive attitudes towards AI applications. This observation indicates that the process of digital literacy can serve as a predictor and an outcome of AI acceptance, people with more advanced background knowledge can access and make more out of AI tools, and AI use can enhance digital fluency in the long term.

4.4 Relationship between AI Utilization and Educational Outcomes

The statistical test showed significant positive correlations between the familiarity of the AI tool and educational outcomes. Correlational results of the key research variables are conveyed in table 3 where AI tool familiarity has significant positive relationships with course satisfaction ($r = .48$, $p < .001$), perceived learning ($r = .52$, $p < .001$) and intent to remain ($r = .61$, $p < .001$). These correlations were statistically significant even after the demographic covariates were taken into consideration in multiple regression analysis.

Table 3 Correlations among Study Variables (Adult Learner Sample, N = 250)

Variable	1	2	3	4	5
1. AI tool familiarity	—				
2. Course satisfaction	.48**	—			
3. Perceived learning	.52**	.67**	—		
4. Retention intention	.61**	.59**	.71**	—	
5. Digital literacy	.54**	.41**	.46**	.49**	—

*Note. * $p < .001$

A multiple regression analysis of factors predicting retention intention revealed that familiarity with AI tools ($\beta = .34$, $p < .001$) and general course satisfaction ($\beta = .28$, $p < .001$) and digital literacy ($\beta = .19$, $p < .01$) had a combined effect of 48 percent on predicting retention intention ($F(3, 246) = 75.4$, $p < .001$). Such conclusions confirm the theoretical correlation between AI usage and educational persistence and can imply that AI implementation plans can lead to a higher completion in continuing education courses among adults.

4.5 Qualitative Findings

The qualitative analysis of interview data showed that there were four main themes that clarify and complement quantitative results.

The first theme was theme one, dubbed as cynical optimism, the relative and generally positive responses of participants in regards to AI integration. According to one of the learners, a 32-year-old male, it appears helpful to provide a daily practice of learning at my own tempo and having free time after work, but I am afraid of whether I will be able to learn how to use it and whether it will be possible to use the internet, as he explains. Such a statement of interest cushioned by practical considerations was the hallmark of many interviews.

Theme two, infrastructural as gatekeeper, was indicative of a general acknowledgment that the technological potential was still limited by primitive infrastructures. According to one school principal in Basra, they might even have the finest AI system available, but without the reliable electricity it is useless. Learners and instructors will get irritated when technology fails to operate at all times. Some respondents recommended that offline-enabled applications are potentially able to partially overcome infrastructure drawbacks, even though such applications would need access to devices at home.

Theme three, which is training as essential complement, came up clearly both in interviews with learners and teachers alike. One female educator who had 15 years' experience said the following: "Even in case we have AI tools, the majority of teachers of my age have never used such a tool. Training, rather than a one-day workshop, is necessary. And those students who never use computers before require assistance as well. This theme implied that the integration of AI would need a significant ability development beyond technology provision.

Theme four was, relevance as motivator, and it indicated the orientation towards practical application of adult learners. A number of respondents pointed out that AI tools would be the most useful when assisting with short-term issues such as studying an exam, honing job-specific skills or identifying credentials. One of them stated: I am not concerned with AI as such. I would like to know whether it will make me complete school taking shorter time and be able to secure a better job. That's what matters to me."

Discussion

5.1 Interpretation of Findings

The results of this exploration shedding light on the high potential and the considerable difficulties of the AI introduction into the Iraqi field of adult education. The overall positive attitudes towards technology recorded concerning adult learners indicate the willingness to embrace AI-based learning experiences, which is in line with the theoretical assumptions according to which adult learners should be more receptive to technologies that provide them with personalized and flexible learning options. The focus on practical applicability that developed during qualitative interviews is in line with the aspect on problem-based orientation and urgent application needs of the anagogical theory.

Nevertheless, the infrastructure shortages reported in this paper are major challenges to the implementation of AI. Being able to rely on high-speed internet connectivity (only 23% of schools have it) and facing power outages on a daily basis (78% of schools), the minimum requirements to run cloud-reliant AI applications are not met in the majority of scenarios. These results are in line with the previous studies that have reported larger issues with digital infrastructure in Iraq, but it depicts the specific implications on cases of educational technology in adult learning.

The positive correlation degrees of familiarity with AI tools and the educational outcomes, such as intention to remain, are, perhaps, the most crucial result of this study. The fact that AI familiarity correlates with retention intention (.61) is a good indication that exposure to AI tools can considerably enhance persistence of adult learners towards the achievement of educational goal, a fact with great individual and social advantages. When causal, the relationship would warrant significant investment in AI integration as one of the approaches to the issue of the large shortcoming in secondary education completion in Iraq.

There is certain attention that should be paid to the role of digital literacy as a predictor and outcome variable. The observation that digital literacy was positively, albeit to a lesser degree, related to AI acceptance indicates that basic digital capabilities, in turn, serve as a precondition of efficient AI interactions. It means that the digital literacy development should be considered an auxiliary feature of AI integration strategies because only in this way, learners can have the minimum skills to be useful in the context of AI tools.

5.2 Relationship to Prior Research

These results build upon earlier studies on the topic of educational technology within the context of developing countries in a number of significant ways. Infrastructure limitations peculiar to adult evening schools increase the scope of research by (Ali & Mahmood, 2024) who studied the issue of e-learning at the university level. This determination that the infrastructure disparities are still serious in 2025 implies that the modernization of educational technologies has been more gradual than it could have been expected, even after the fact that the world became interested in digital learning due to the COVID-19 pandemic.

The trend of results concerning technology acceptance the stronger focus on perceived usefulness than the perceived ease of use, which are consistent with the studies of Jordan by (Al-Mashaqbeh & Al-Majali, 2023), pointing to the likelihood of this trend describing adult learners in MENA settings. This uniformity helps with a suggestion that AI tools that will be regional should focus on functionality and definite value propositions.

The observed correlation between the AI familiarity and retention intention will be useful in extending the research work on the adaptive learning systems that have been implemented in the context of the developed countries. Although previous meta-analyses have reported positive effects of AI-enhanced adaptive learning on learning outcomes (Means, Bakia, & Murphy, 2020), less literature has compared retention and persistence outcomes. The current results indicate that the application of AI could be especially helpful to adult populations, members of which the educational persistence is commonly complicated by the confrontation with other demands related to life.

5.3 Limitations

These few limitations of this investigation should be mentioned. The cross-sectional type does not allow making causal conclusions about the correlation between AI familiarity and learning outcomes. Although this relationship between these variables has a theoretical sense, the reverse causality is still possible, i.e. students, who have a higher degree of persistence motivation could be relying on AI tools and not the other way around. In order to establish causal relationships, longitudinal or experimental design would be required.

Although the sampling plan was expected to achieve geographic diversity, it might not adequately cover the variety of differences across Iraq 18 governorates. Limited generalizability of results can be caused by excluding the rural and conflict-impacted areas, as the area of infrastructure and educational status might be rather different compared to the urban and suburban settings sampled. Further studies are required to broaden research in other geographic settings.

The social desirability effect and recollection problems in self-report measures of AI familiarity and educational outcomes can be discovered. The quantitative evaluations of the use of technology and authenticated academic performance measures would reinforce the further studies. Also, the technology acceptance items are pilot-tested, and have not been extensively tested in the Iraqi situations so that they would be limiting construct validity.

Conclusion and Recommendations

6.1 Summary of Key Findings

This research study has also reported the present condition of digital infrastructure, technology perceptions, and relationships between the AI-outcomes in the Iraqi contexts of adult education. The main conclusions can be as follows: the lack of infrastructure is critical, and stable internet is available in less

than a quarter of the schools to be surveyed, and power outages trouble over three quarters. There are fairly positive attitudes of adult learners towards AI-assisted learning, with a focus on usefulness rather than interface advances. There is a strong correlation between technology acceptance and digital literacy implying two-way relationships among the basic skills and the use of AI. Familiarity with AI tools is positively correlated with educational outcomes such as retention intention with strong correlation, which may imply that AI may be integrated to enhance persistence among adult learners.

6.2 Recommendations

A number of recommendations are provided based on these findings to the educational policymakers, practitioners, and researchers.

To start with, infrastructure investment is essential as a base towards AI integration. The lack of dependable electricity and Internet connection will make the most advanced AI applications useless to the sphere of education. The backup power systems and the offline capable technologies should be prioritized in terms of investment, which can work even when the grid goes off.

Second, AI implementation solutions must prioritize applications with offline capabilities and low bandwidth that are capable of running within the infrastructural capabilities of Iraq. The platforms that cannot run without constant internet access, like through the clouds, are not suitable at present. The use of mobile-friendly applications that capitalizes on high smartphone-owning rates (92 percent in this sample) in adult learners is one of the transfer opportunities.

Third, AI tools implementation should be preceded by extensive digitization. The positive relationship between the digital literacy and the acceptance of AI implies that, before the productive engagement, the underlying skills are required. Adult learners have limited time and practical orientations that should be tailored in the training programs.

Fourth, professional development among the teachers should be sustained. The technology acceptance among the educators is rather low in comparison with satisfaction among learners, which means that capacities among teachers should also be enhanced. Effective AI use should be modeled in programs, not described, and this would allow the teachers to gain initial familiarity with educational AI implementation.

Fifth, the AI tools are to be created in the context of practical orientation of adult learners focusing on direct relevance to achieving credential and advancing career. Value propositions should be clearly stated in the marketing and implementation processes in the form that adult learners can relate with as solving their immediate needs.

6.3 Future Research Directions

This research leaves a number of paths to a future research. The longitudinal studies that would monitor the AI use and educational performance among adult learners would allow making the causal inference on the educational role of AI. Generalizability would be stronger in case the investigation is extended to more governorates and in rural settings. Timely experimental or quasi experimental studies between the AI-enhanced and traditional methods of instruction would be more convincing in the face of AI-effectiveness. Lastly considerations Studies on individual types of AI tools, such as intelligent tutoring system, adaptive learning platforms, and conversational AI applications, would make more specific recommendations possible on their implementation.

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