Sakarya University Journal of Education

ISSN : 2146-7455
Publisher : Sakarya University

Vol. 14, No. Special Issue, 228-249, 2024
DOI: https://doi.org/10.19126/suje.1468866

Research Article

Exploring The Role of Digital Literacy in University Students' Engagement with AI through the Technology Acceptance Model

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Abstract: Through the last decades, Artificial Intelligence (AI) has revolutionized the field of education and transformed traditional teaching approaches. This study aimed to examine how university students adopt AI tools in their learning processes and the role of digital literacy (DL) in this process through the lens of the Technology Acceptance Model (TAM). In this context, this study measured the impact of DL on university students' acceptance of AI technologies and their intention to use such technologies in the future. The data was collected from university students (N = 154) at a university in Western Türkiye during the fall semester of 2023. Data collection was conducted using two separate online forms; the first form included items adapted from the Digital Literacy Scale developed by Bayrakçı and Narmanlıoğlu (2021) to measure digital literacy levels, while the second form included items adapted from the UTAUT study by Venkatesh et al. (2003). The hypothesis testing results showed that students with higher levels of DL perceived the usefulness and ease of use of AI tools more positively, which positively affected their intention to adopt AI-based tools. The study also found that perceived usefulness and ease of use were important in shaping students' attitudes and behavioural intentions towards AI. When students perceive AI as a valuable tool for learning and find it easy to interact with, they are more willing to use it. This study suggests that DL plays a significant role in the acceptance of AI-based tools among university students, and accordingly, the TAM is a practical and accurate model to explore students' potential engagement with AI in the learning process.

Keywords: Digital Literacy, Artificial Intelligence, Technology Acceptance Model, University Students

Received: 15.04.2024
Accepted: 22.07.2024
Available Online: 25.07.2024

1. Introduction

Artificial Intelligence (AI) has emerged as a groundbreaking technology in recent years, transforming traditional pedagogical approaches and learning environments. The integration of AI into education redefined and revolutionized the approaches adopted by educators in many forms, such as personalizing learning experiences, enhancing student engagement, and facilitating assessment and feedback mechanisms. This paradigm shift necessitates a digital literacy (DL) competency among university students since a certain level of DL competency is required to effectively integrate with AI technologies and maximize the use of these technologies. As Alakrash and Razak (2021) state, the recent increasing reliance on digital tools in education requires a profound understanding and acceptance of these tools among learners. Furthermore, DL competency offers proficiency in using technological tools and forms a ground to foster 21st-century skills such as flexibility, productivity, creativity, critical thinking, etc. In this context, The Technology Acceptance Model (TAM) offers a theoretical framework to examine this phenomenon, suggesting that the perceived ease of use (PEU) and perceived usefulness (PU) of technology can influence users' acceptance and engagement levels (Davis, 1989). Acceptance and effective use of AI-based tools can help students maximize learning outcomes, which makes TAM a relevant model in the AI-in-education context. Therefore, we argue that exploring DL's role in AI engagement through the lens of TAM can significantly contribute to how technology can be effectively adopted in educational settings.

Cite as (APA 7): Börekci, C., & Çelik Ö. (2024). Exploring the role of digital literacy in university students' engagement with ai through the technology acceptance model. *Sakarya University Journal of Education, 14*(Special Issue), 228-249. https://doi.org/10.19126/suje.1468866

Amidst this shifting educational paradigm, DL, which equips students with the necessary skills to navigate digital environments, has turned out to be a critical competence for university students. Furthermore, with the quick and intense integration of AI into education, the significance of DL has positioned from a mere familiarity to a deeper understanding and critical engagement with digital tools and environments. While the effective adoption and utilization of digital technologies are crucial in educational contexts (Aslan, 2021), it is evident that having a DL competency offers students a diverse set of skills, from critical thinking and problem-solving to communication and collaboration in digital environments (Bacalja et al., 2022; Bulganina et al., 2021). Recent developments in digital technologies show that DL is a supplementary skill that helps students step forward and is a foundational component in ever-evolving educational settings. Therefore, especially at the onset of the age of AI, it is essential to explore the intersection between DL and AI engagement to guide an informed decision-making process in any educational planning.

TAM has been used as a practical and seminal framework to understand how users accept and adopt technology. Introduced by Davis (1989), TAM posits that PU and PEU are significant determinants of individuals' intention to use a technology. This model has been used by researchers in educational contexts to reveal the nuances in student perceptions and behaviours in accepting new technologies (Jan & Contreras, 2011). It can be argued that TAM can be an instrumental tool in understanding the extent to which students interact or will possibly interact with the AI tools. It is also essential to explore this intersection with a particular focus on DL competence since it is a significant catalyst in the use of AI technologies (Wang et al., 2023). In this respect, TAM offers a powerful theoretical framework to fully understand the dynamics between DL competence and AI engagement of university students.

Although the use of AI technologies for educational purposes is becoming increasingly widespread, research on university students' acceptance and effective use of these technologies is limited. Especially within the framework of TAM, the acceptance of AI technologies and the role of DL in this process have not been adequately examined. In the current literature, there is a noticeable lack of an integrated model that considers these three important factors - TAM, AI interaction and DL. This gap is especially evident in the Turkish context. Considering all of the issues mentioned, it can be argued that studying the relationship between DL and AI engagement among university students can provide valuable insights for policymakers and practitioners. This is because the integration of AI into educational settings requires a fundamental level of DL. However, the degree to which DL influences the acceptance and use of AI among university students through the lens of TAM remains unexplored. Therefore, this study aims to address this gap in knowledge and provide valuable insights into the integration of AI into education, which is crucial for developing novel pedagogical approaches in higher education.

2. Related Literature

The integration of digital technologies into educational processes has led to a growing body of literature regarding the effectiveness of digital technologies in education, and TAM has been used as a convenient theoretical framework to explain this relationship. Therefore, literature can be categorized thematically under two themes as DL in education and TAM and user behavior.

DL in educational contexts has been a widely researched topic in literature. Researchers focused on exploring the role of DL from different perspectives, such as language teaching and learning (Aba Shaar et al., 2022; Alakrash & Razak, 2021; Liu, 2023), self-efficacy levels (Aslan, 2021; Gutierrez-Angel et al., 2022), challenges in implementing DL (Romero-Hall & Cherrez, 2023), factors that influence DL (Yoleri & Anadolu, 2022), student perceptions (Smith & Storrs, 2023), effects on global citizenship (Khlaisang & Yoshida, 2022) and active participation in society (Pegalajar Palomino & Rodriguez Torres, 2023), and higher order thinking capacities (Tian et al., 2023). The variety of topics studied indicates that DL has turned out to be one of the core concepts of education, influencing it from many different

perspectives. Most of these studies provide significant implications for the integration of DL into education and highlight the determining role of DL in increasing the quality of teaching and learning.

The implications of integrating DL into educational processes are multifaceted and transformative. The studies of Alakrash and Razak (2021) and Liu (2023) focus on the role of DL in language teaching and learning. Alakrash and Razak (2021) suggest the need for integrating digital technologies into the English language curriculum, emphasizing the shift towards technology-based teaching and learning paradigms, and they call for a transformation from traditional to digital modes of instruction to enhance language education's effectiveness and relevance in the digital age. Similarly, Liu's (2023) study underscores the importance of DL in language learning and emphasizes the role of DL in shaping the identities of language learners, which helps create inclusive learning environments. The studies of Aslan (2021) and Gutierrez-Angel et al. (2022) reveal the relationship between DL and self-efficacy of learners. They propose that higher education institutions should integrate comprehensive DL programs into their curricula to improve the self-efficacy of learners so that they can get ready for their future professional roles (Gutierrez-Angel et al., 2022) and targeted support and resources should be provided to students to enhance their DL self-efficacy (Aslan, 2021). The study of Tian et al. (2023) reveals the intersection between higher-order skills and DL, underscoring the role of educators in designing curricula that adapt teaching strategies based on students' digital experiences. The implementation of DL into education comes with several challenges. However, the study of Romero-Hall and Cherrez (2023) suggests that such challenges can be overcome with ongoing professional development and training and addressing DL challenges can enhance the effectiveness and resilience of faculty's digital pedagogy.

These studies emphasize the importance of integrating DL into education to foster a teaching and learning environment where digital tools are used as an aid. From facilitating the transition from traditional to digital instructional modes to fostering inclusivity and self-efficacy among learners, and finally, to empowering educators with strategies to overcome DL challenges, the evidence suggests a transformative potential of DL in education.

The Technology acceptance model has been used as a practical framework to explore users' level of interaction with emerging digital tools. Recently, TAM has been used in many studies to explore users engagement with AI in various fields such as agriculture (Mohr & Kuhl, 2021), construction (Na et al., 2023), commerce (Wang et al., 2023) and healthcare (Alhashmi et al., 2019). However, there have been very few attempts to explore the engagement level of learners with AI through the lens of TAM in educational settings. One of these studies conducted by Zou and Huang (2023) examined the acceptance of ChatGPT in second-language writing among graduate students using TAM and demonstrated that graduate students reported a high-level willingness to use ChatGPT in their writing process. Similarly, the study of Strzelecki (2023) also provides evidence for the acceptance of ChatGPT by university students. Another study by Li (2023) investigated the impact of AI-based systems on learning motivation through the lens of TAM and found that such systems positively influence student motivation, emphasizing the functionality of using TAM as a model to reveal student-AI engagement. The study of Zhang et al. (2023) utilizes TAM to discover pre-service teachers' engagement with AI with a special focus on determinant factors and gender-based differences. They suggest the encouragement of AI-powered in-service teacher education by addressing gender-specific aspects in AI acceptance. Lastly, Al Darayseh (2023) explored science teachers' perceptions to integrate AI applications into science education and highlighted that science teachers demonstrated a high-level of acceptance in the use of AI in their classrooms showing positive correlations with self-efficacy, attitudes, ease of use, intention to use and expected benefits. Although the studies conducted so far have been informative and insightful, there is still a need for more research to thoroughly investigate the level of engagement between students and AI across different educational environments.

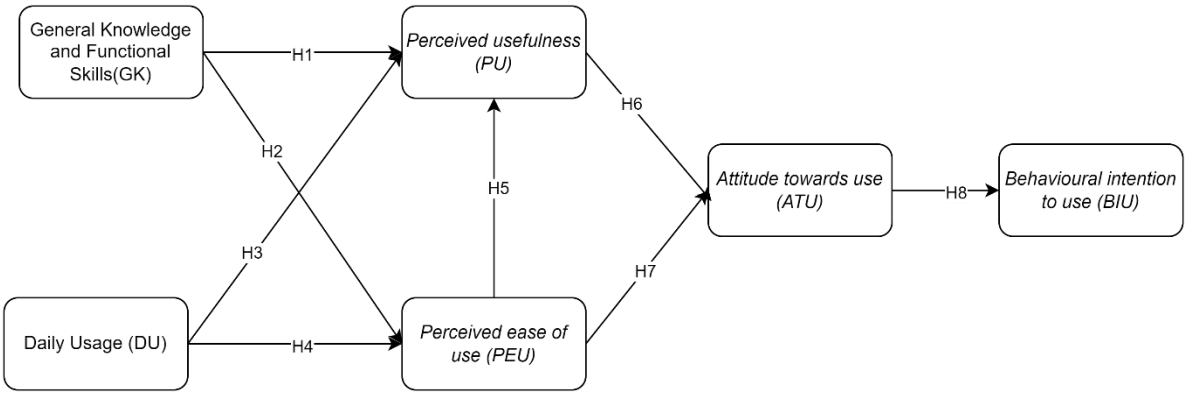
3. Methods

3.1. Proposed research model and hypotheses

In this study, we set out to investigate the impact of DL of university students (psychology and molecular biology and genetics students) on their acceptance of AI technologies and their intention to use these technologies by developing a model. Figure 1 shows the hypotheses of this study.

Figure 1

Research Model



3.2. Digital literacy (DL)

Koppel and Langer (2020) define DL as the essential technical skills needed for basic interactions with technology. DL encompasses a broad array of skills, such as media literacy, information literacy, and computer literacy. DL is based on the use of ICTs to search for, find, and utilize information (Mohammadyari & Singh, 2015). In this research, DL was modelled under two factors: (i) general knowledge and functional skills (GK) and (ii) daily usage (DU)

General knowledge and practical skills encompass a broad understanding of software, including information on software and hardware, digital technologies, licensed and pirated software, and malware. Additionally, technical proficiency is occasionally required for tasks such as formatting a computer, adjusting Proxy/DNS settings, and possessing both network and software expertise for more technical purposes. Today, the utilization of digital technologies is prevalent, involving aspects of e-citizenship, cloud technology, online streaming, reservations, online shopping, web browsing, and routine transactions. Below are the generated hypotheses indicating that higher DL level of students has a positive impact on the PU and PEU of AI technology:

- H1. GK positively affects PU.
- H2. GK positively affects PEU.
- H3. DU positively affects PU.
- H4. DU positively affects PEU.

3.3. Technology acceptance model (TAM)

TAM is a framework in the field of information systems that aims to explain how users adopt and utilize new technologies. Developed by Davis (1989), TAM posits that the success of a system depends on user acceptance, which is determined by three key factors: perceived usefulness (PU), perceived ease of use (PEU), and attitudes towards usage (ATU) of the system. The system is practically applied at the user level, where individuals interact with the technology. The decision to use technology is influenced by

behavioural intention (BIU), which is in turn, affected by attitude, representing the overall perception of the technology. The model suggests that if a system is not perceived as easy to use, it is unlikely to be considered useful. TAM elucidates that a user's perception of a system's usefulness and ease of use influences their intention to use or not use the system. Additionally, Davis (1989) emphasizes that practitioners use TAM to predict the acceptability of systems and diagnose the reasons for lack of acceptance, enabling them to take appropriate measures to enhance user acceptance.

The concept of PU pertains to an individual's belief in the extent to which the utilization of a specific technology will improve their performance or work results (Venkatesh & Bala, 2008). In essence, it revolves around the individual's assessment of whether employing the technology will enhance their proficiency in their tasks. The PEU pertains to an individual's perception of the extent to which utilizing a specific technology will require minimal effort, encompassing aspects of both learning and effectively using it (Venkatesh & Bala, 2008). PEU defines an individual's belief regarding the ease of comprehending and operating the technology. ATU pertains to an individual's comprehensive affective evaluation or sentiment regarding the utilization of a particular technology. This evaluation is influenced by their PEU and the PU of the technology (Davis, 1989). Behavioral intention to use (BIU) pertains to an individual's inclination to initiate and sustain the utilization of a particular technology (Davis, 1989). It can be understood as a forecast of their prospective actions derived from their present cognitive and affective states. Therefore, the following hypotheses will be tested with the data collected from the study group:

- H5: PEU positively affects PU.
- H6: PU positively affects ATU.
- H7: PEU positively affects ATU.
- H8: ATU positively affects BIU.

3.4. Instruction procedure

In this study, a vocational English course around the principles of task-based instruction (TBI) was designed to explore the engagement level of students with AI tools. TBI is a form of instruction where students are provided with real-world tasks and the assessment of task performance is made through task outcomes (Skehan, 1996). In this context, the tasks are designed to enable students to learn language structures through producing outputs using AI tools. In each task, a variety of AI tools were introduced to students to help them complete the tasks. At the beginning of the term, students were trained in the ethical and responsible use of AI tools in their tasks, and a guidelines document that frames how students can use AI tools in their work ethically was shared with the students (Appendix 1). The course content (Appendix 2) and a sample task description (Appendix 3) can be found in the appendices.

3.5. Data collection tools

We collected the data for this study using two distinct online forms. The first form includes demographic information about the students and items adapted from the Digital Literacy Scale (Bayrakci & Narmanlioğlu, 2021) to measure students' DL levels. The second form includes items adapted from the UTAUT study conducted by Venkatesh et al. (2003) (Appendix 4).

3.6. Data collection

The research target group is psychology (n = 77) and molecular biology and genetics (n = 77) students at a university in western Türkiye (N = 154). Data were collected in the fall semester of 2023 to identify participants' literacy levels, perceptions, and attitudes. The initial questionnaire gathered data on the

participants' demographic characteristics and DL levels. The subsequent questionnaire aimed to gauge the acceptance of technology for AI, utilizing a 5-point Likert-type scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). To assess reliability and comprehension, a small group of participants from a single institution underwent a pilot test. The first questionnaire was administered at the commencement of the fall semester, while the second was distributed at the end of the semester.

3.7. Data analysis

Questionnaires were distributed to over 250 students, yielding 214 responses. Following the exclusion of non-respondents and incomplete responses, data from 154 participants were deemed suitable for analysis. The proposed conceptual model underwent evaluation through structural equation modeling (SEM), with the analysis of the structural model conducted using Mplus (ver. 8.1) software. SEM is a robust statistical technique that is commonly used to study the relationship between observed and latent variables. Widely utilized across diverse scientific disciplines, SEM provides a comprehensive framework for testing and validating significant theories, particularly in assessing relationships between variables and constructing and evaluating structural models (Schumacker & Lomax, 1996).

3.8. Ethical principles

Ethics committee permission for this study was obtained from Balıkesir University Social Sciences and Humanities Ethics Committee with the decision dated 23.01.2024 and numbered E.344791.

4. Findings

4.1. Measurement model results

This study evaluated the proposed conceptual model by calculating the properties of reliability and validity of the constructs. Item reliability and internal consistency for each construct were assessed using metrics such as Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE). Hair et al. (1995) recommended that values of Cronbach's alpha (α), CR, and AVE should be at least 0.7, 0.7, and 0.5, respectively. Based on the findings presented in Table 1, constructs demonstrated high reliability and internal consistency as Cronbach's α exceeded 0.7 (Taber, 2018). A CR value above 0.7 indicated satisfactory internal consistency and reliability across all constructs. Convergent validity was confirmed by examining the factor loading of each construct, with AVE values exceeding 0.5 for all constructs (Bagozzi & Phillips, 1982; Hair et al., 1995).

Table 1

Descriptive Statistics, Internal Consistency, Convergent Validity and Reliability of Items.

Constructs	Item	Factor Loadings	Mean	Sd	Cronbach's α	CR	AVE
Daily Usage (DU)	DU1	.58	4.49	.78	.732	.72	.53
	DU2	.75	4.12	.89			
	DU3	.50	4.05	1.15			
	DU4	.51	3.40	1.37			
	DU5	.57	4.55	.65			
	DU6	.66	4.40	.90			
General knowledge and practical skills (GK)	GK1	.72	3.03	1.32	.889	.73	.61
	GK2	.72	3.09	1.15			
	GK3	.81	2.40	1.31			
	GK4	.75	2.91	1.39			
	GK5	.70	2.94	1.31			
	GK6	.68	2.32	1.42			
Perceived usefulness (PU)	PU1	.80	4.07	.88	.823	.69	.55
	PU2	.89	3.86	.89			
	PU3	.88	3.97	.88			
	PU4	.90	3.97	.93			
Perceived ease of use (PEU)	PEU1	.84	3.77	1.04	.958	.76	.87
	PEU2	.77	4.02	.93			
	PEU3	.74	3.74	1.03			
	PEU4	.83	3.57	1.02			
	PEU5	.90	3.71	1.04			
Attitudes towards usage (ATU)	ATU1	.91	2.86	1.23	.922	.74	.76
	ATU2	.96	3.35	1.19			
	ATU3	.94	3.77	1.04			
Behavioral intention to use (BIU)	BIU1	.61	4.00	1.01	.907	.72	.67
	BIU2	.76	4.06	1.01			
	BIU3	.95	4.11	.95			

In order to establish discriminant validity, it was observed that the square roots of the AVE values presented in Table 2 were greater than the correlations displayed below or to the left of them. This finding aligns with the criteria outlined by Hair et al. (1995) and confirms the discriminant validity of the measurement. The factors within the proposed model were identified to be correlated, as indicated in Table 2.

Table 2

Correlation Values for Each Factor

	DU	GK	PU	PEU	ATU	BIU
Daily Usage (DU)	(.72)					
General knowledge and practical skills (GK)	.502*	(.78)				
Perceived usefulness (PU)	.220*	.454*	(.74)			
Perceived ease of use (PEU)	.443*	.425*	.541*	(.93)		
Attitudes towards usage (ATU)	.259*	.460*	.728*	.606*	(.87)	
Behavioral intention to use (BIU)	.170*	.284	.642*	.586*	.729*	(.82)

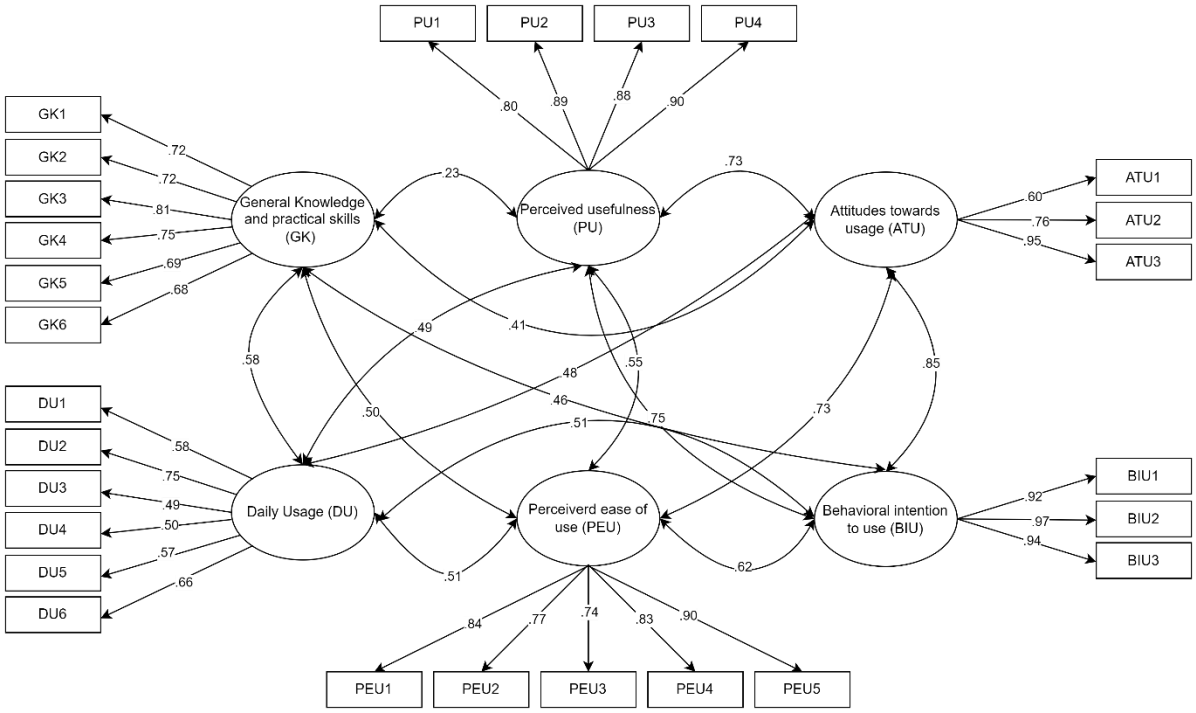
Note: * N= 154, p<.001

4.2. Validation of the measurement model

We employed confirmatory factor analysis (CFA) to evaluate the validity of the measurement by examining the extent to which a pre-established or constructed framework aligns with the gathered data. CFA, underpinned by theoretical foundations, is utilized to evaluate the consistency between the factors derived from multiple variables and the empirical data, as well as their alignment with the research sample. Consequently, CFA was applied to the measurement model depicted in Figure 2. The fit indices of the measurement are x2/df = 1.59, RMSEA = .067 with 95% CI [.057 ~.077], CFI = .925, and TLI= .915, respectively. Regarding parameter values, the fit measures were within acceptable limits (Hu & Bentler, 1998; Schumacker & Lomax, 1996).

Figure 2

Confirmatory Factor Analysis

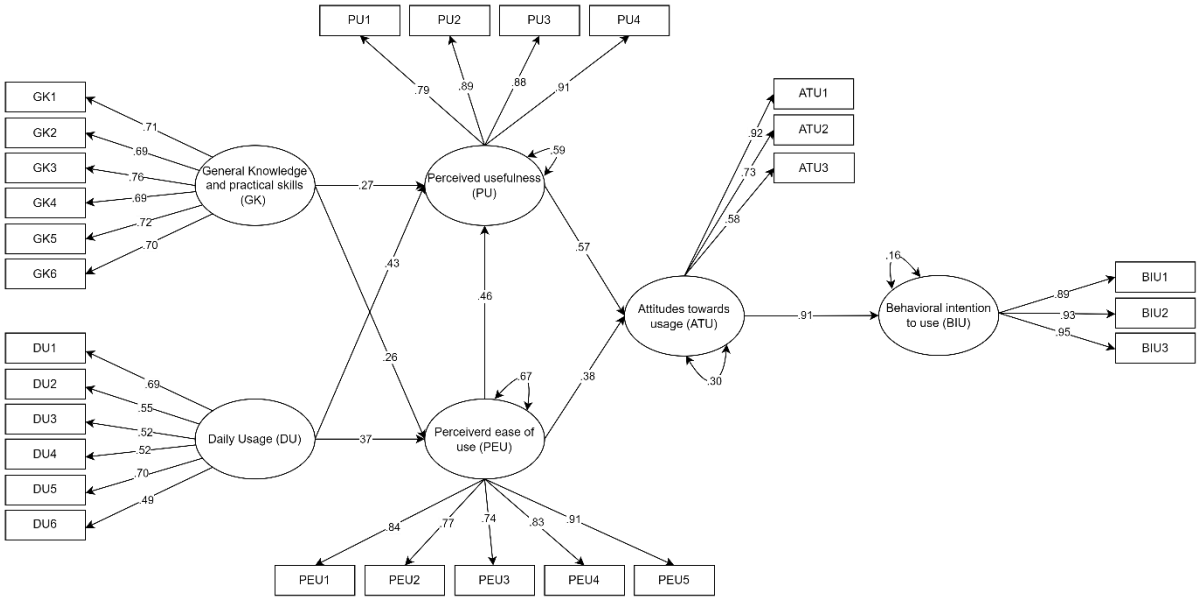


4.3. Structural model results

The research model's path coefficients were statistically analyzed and tested for significance using the SEM approach. The fit indices of the model x2/df = 1.52, RMSEA = .059 with 95% CI [.048 ~.069], CFI = .943, and TLI= .936 respectively. Regarding parameter values, the fit measures were within acceptable limits (Hu & Bentler, 1998; Schumacker & Lomax, 1996). When Figure 3 is examined, a 16% variance explains the behavioural intention to use AI tools. In addition, the PU, PEU and, ATU structures of the model are explained with 59%, %67, and 30% variances, respectively.

Figure 3

Structural Equation Modelling of the Hypotheses



4.4. Hypothesis testing

The data presented in Table 3 indicates a notable positive correlation among these variables. All proposed hypotheses were validated within the model.

Table 3

Hypothesis Test Results

Structural relations of the proposed model	β	t	p-value	Decision
H1. GK → PU	.27	2.27	.024	Accepted
H2. GK → PEU	.26	2.22	.027	Accepted
H3. DU → PU	.43	2.93	.003	Accepted
H4. DU → PEU	.37	2.70	.007	Accepted
H5: PEU →PU	.46	4.53	< .001	Accepted
H6: PU → ATU	.57	5.71	< .001	Accepted
H7: PEU → ATU	.38	4.58	< .001	Accepted
H8: ATU → BIU	.91	7.90	< .001	Accepted

5. Discussion

The DL level of individuals is an essential determiner for their acceptance and utilization of technology in both personal and professional settings. It is well-established that individuals' attitude towards technology is influenced by the extent to which they have DL skills (Mac Callum et al., 2014; Mailizar et al., 2022; Nikou & Aavakare, 2021). Accordingly, the acceptance of emerging technologies, such as AI-related tools, is directly related to individuals' DL levels. In this respect, this study hypothesized that DL levels of students, particularly General Knowledge and Practical Skills and Daily Usage domains, positively affect PU and PEU of AI tools in their learning process. The hypothesis testing results showed that General Knowledge and Practical Skills, and Daily Usage of digital tools significantly affect PU and PEU of AI tools. These results indicate that students who are more literate in digital technologies are likely to have a greater awareness of the capabilities of AI tools and, thus are more inclined to perceive AI as a useful tool for their learning process, which can lead to more favourable attitudes toward

adopting AI technologies because these students may be more aware of the specific benefits and applications of AI in their works (Li, 2023; Strzelecki, 2023; Zou & Huang, 2023). The positive relationships between GK/DU and both PU and PEU align with the foundational principles of the TAM because, according to TAM, both PU and PEU are primary predictors of the adoption of new technologies (Davis, 1989; Gie & Chung, 2019). In this respect, it can be suggested that improving DL can be a significant factor in encouraging university students to embrace the use of AI technologies in their learning process.

The hypothesis that the PU of AI positively influences ATU supports the idea that belief in the utility of a technology is a strong motivator for its acceptance (Davis, 1989; Kumar Kakar, 2017). The results of the analysis show positive path coefficients from PU to ATU. This result can be interpreted that when students recognize the practical benefits of AI in their learning process, they are likely to develop more positive attitudes towards its use (Ko & Leem, 2021). Similarly, the hypothesis about the relationship between PEU and attitudes toward use (ATU) suggests that the less effort required to use AI tools, the higher students' attitudes toward this technology may be. The results of the analysis show a positive relationship between PEU and ATU, which confirms this hypothesis. Ease of use can shape student attitudes by directly influencing the user's experience (Damerji & Salimi, 2021; Edmunds et al., 2012). If students find an AI tool intuitive, they are less likely to become frustrated or resist using it. As a result, they may evaluate AI technology more favourably and become more open to incorporating it into their learning process.

The last hypothesis tests that students' attitudes towards the use of AI tools (ATU) positively influence their behavioural intention to use AI (BIU) (Teo & Zhou, 2014). This hypothesis constitutes the most important link of the model because it explains the link between the affective components of technology acceptance and the behavioural components. The results of the analysis support this hypothesis with strong positive coefficients and show that students with positive attitudes towards AI are more likely to be willing to use it (Alzahrani, 2023; Gherheş & Obrad, 2018). Behavioural intention to use AI offers an important prediction of actual use. Positive attitudes can significantly support students' intentions to use AI tools, thus making ATU an important component of educational strategies aimed at promoting engagement with AI.

The results of the tested hypotheses confirmed the basic principles of the TAM and extended the coverage of these principles to the use of AI technology in education. The findings suggest that PU and ease of use directly influence students' attitudes towards AI and, consequently, significantly shape their intentions to use AI (Kashive et al., 2020; Ko & Leem, 2021). In light of these findings, the importance of a holistic approach to AI integration in education that addresses both cognitive and affective factors to encourage students' interactions with AI tools effectively comes to the fore. The findings of this study may help to draw important implications for the Turkish context. In Türkiye, the use of AI technologies in education is still in its early steps and the adaptation of university students to these technologies is a critical issue. This study found that Turkish university students' level of digital literacy significantly influences their tendency to accept and use AI technologies. This result provides evidence that higher education institutions in Turkey should develop policies in this direction.

In conclusion, the supported hypotheses revealed the importance of PU and ease of use in shaping students' attitudes towards AI tools. These attitudes are important in determining behavioural intentions towards AI. These implications can guide the development of educational policies that align with students' expectations, intentions, and uses of AI tools.

6. Conclusion

This study investigated the factors influencing university students' acceptance of AI tools in their learning process. The findings confirm the applicability of the TAM in the context of AI adoption for education. The study highlights the crucial role of DL, particularly general knowledge and daily usage, in fostering a positive perception of AI's usefulness and ease of use. Students with stronger DL are more likely to recognize the potential benefits of AI and find these tools user-friendly. This, in turn, leads to more favourable attitudes towards incorporating AI into their learning. Furthermore, the research emphasizes the importance of both PU and PEU in shaping students' behavioural intentions towards AI. When students perceive AI as a valuable tool for learning and find it easy to interact with, they are more likely to express a willingness to use it.

As the methodological implication of this study, it can be stated that The TAM provides a general framework for students' acceptance and adoption of new technologies. The model can also be used for testing various hypotheses. Although more studies are needed on the use of AI tools in educational settings, it is believed that positive outcomes can be achieved when students are guided on how to utilize these tools effectively. In particular, offering students a guide on AI ethics and how to utilize AI in the course content enhances the quality of student outcomes and their acceptance of this new technology.

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APPENDIX

[Blinded] University
2023 – 2024 Academic Year (Fall)
Molecular Biology and Genetics Department
Vocational English IV (English)
Guidelines for Responsible Use of AI in Student Works

Guidelines for Using AI Tools in Student Tasks

Artificial Intelligence (AI) offers an array of solutions designed to mimic human intelligence with the intent to alter the educational landscape. The AI-powered chatbots (i.e., OpenAI's ChatGPT, Google's Bard or Microsoft's Bing) known as Large Language Models are tailored to simulate human conversation and offer tailored academic assistance. Acting as a peer, these LLM chatbots can swiftly answer queries, clarify doubts and provide guidance on any given subject, assisting in the learning process. LLM chatbots can act as a peer for educational purposes in several ways.

What CAN you do with AI Tools?

1. **Brainstorming Ideas**: You can use AI tools to brainstorm ideas by giving them a topic or keyword and asking them to generate ideas. For example, a student could ask an AI chatbot to generate ideas for a research paper or a creative writing assignment.
2. **Researching Topics**: You can use AI tools to research topics by giving them a topic and asking them to find relevant information. For example, you can ask an AI chatbot to find information about the life cycle of a butterfly.
3. **Understanding Concepts**: You can use AI tools to understand concepts by giving them a concept and asking them to explain it in a clear and concise way. For example, you can ask an AI chatbot to explain the concept of Cell Division or Freud's Iceberg Theory.
4. **Practicing Skills**: You can use AI tools to practice skills by giving them problems to solve and feedback on their work. For example, you can ask an AI chatbot to generate math problems for you to solve or multiple-choice grammar tests.
5. **Getting Feedback**: You can use AI tools to get feedback on your work by giving them your work and asking them for feedback. For example, you can ask an AI chatbot to give them feedback on your essay or presentation.

Ethical issues about the use of responsible AI:

One of the biggest ethical concerns surrounding the use of AI tools in homework is the risk of plagiarism. Plagiarism is the act of copying someone else's work without giving them credit. This includes copying text, ideas, or code from an AI tool without properly citing it.

You should use AI tools as a tool to help you learn, not as a way to cheat. It is important to remember that AI tools are trained on massive datasets of text and code, and they may sometimes generate text that is similar to existing work. This does not mean that the AI tool has plagiarized, but it does mean that you need to be careful and cite the sources properly. Therefore, while LLM chatbots and similar AI tools have enormous potential to assist learning, it's crucially important that these resources are not misused to bypass original thought and work.

The following are key points we need to focus on:

1. **Originality**: The use of AI should be an enhancement of your work - not a substitute for your original thoughts, ideas, and expressions. Therefore, you are encouraged to use the AI system to help develop ideas but must ensure that the final submission is your independent work.
2. **Responsibility**: While AI tools can provide information or draft responses, you must take responsibility for the learning outcomes. This involves critically examining, modifying, and incorporating AI-driven content into your own.
3. **Co-creation**: AI tools like LLM chatbots should be viewed as collaborators in the learning process, not as a contract cheating service.
4. **Citing AI Assistance**: Even as AI becomes more prevalent in education, it's important that you properly cite the assistance you receive from such tools. Failing to do so can lead to unintentional plagiarism.
5. **Authorship Accountability**: Even with AI assistance, you should retain accountability for their assignments' content, acknowledging that you understand and can discuss your submitted work.

I encourage you to use AI tools responsibly and ethically in your homework. Remember that AI tools are a tool to help you learn, not a way to cheat. When you use AI tools in your assignment, make sure to write in detail at the bottom of each assignment which AI tools you used and how you used them. This will help you to be transparent about your use of AI tools and avoid plagiarism. If you have received any help from any AI tool in your assignments, I expect you to write a description at the bottom of your assignments, as in the example below.

***Template**: In this assignment, I used [name of AI tool] for [purpose] by issuing the following prompt ["the prompt"]. I collaborated with [name of AI tool] in the following way [collaboration detail]. I acknowledge that I have used AI as a collaborator in my assignment, that the assignment is my own, and that I take full responsibility for what I have written.*

***Example**: In this assignment, I used the ChatGPT tool for brainstorming by giving the prompt "Create an outline to give me a presentation on cell division". I collaborated with ChatGPT in the following way: ChatGPT gave me an outline of the steps I could take to explain cell division. Using this outline, I determined the flow of the presentation. I acknowledge that I have used AI as a supporter in my assignment, that the assignment is my own, and that I take full responsibility for what I have written.*

[Blinded] University
2023 – 2024 Academic Year (Fall)
Molecular Biology and Genetics Department
Vocational English IV (English)
Course Content (Grade 3)

Course Name	Vocational English IV
Instructor	[Blinded]
Duration	14 Weeks (2 Hours)
Credit	2
Attendance	Compulsory (%70 attendance required)
Aim	The main objective of this course is to equip students with the necessary vocabulary related to their fields of study and enable them to develop a vocational literacy that aligns with the B1 and B2 levels outlined in the Common European Framework of Reference for Languages. Additionally, the course aims to keep students updated on contemporary developments in their respective fields.
Course Materials	Task-book provided by the course instructor
Instruction type	Task-based instruction
Assessment	Assessment of the course will be based on the mid-term and end-of-semester exams as well as assignments. Evaluation will be divided as follows: **Mid-Term Evaluation**: %40 (Exam 25 pts – Tasks 75 pts) **End-of-Semester Evaluation**: %60 (Exam 40 pts, Tasks 60pts)

Scope and Sequence

Week	Topic	Task	Language Focus	Grammar
Week 1	Negotiating course content.			
Week 2	Songs	Writing a song about genetics and recording using AI tools	Creating Imagery and Mood	Comparatives and Superlatives
Week 3				
Week 4	Fun Facts Quiz	Creating a multiple-choice fun facts quiz about genetics	Creating options and alternatives	Wh- Questions
Week 5				
Week 6	Crossword Puzzle	Creating a crossword puzzle on concepts related to genetics	Defining and describing	Relative Clauses
Week 7				
Week 8	Mid-Term Week			
Week 9	AI	Playing a "Guess What" game with ChatGPT	Asking questions to elicit information	Interrogative Sentences
Week 10				
Week 11	Astrology	Fortune-telling a friend's future based on given data	Making predictions	Future Simple
Week 12				
Week 13	Fictional Character	Creating a fictional character based on pre-defined features	Describing	Adjectives and Adverbs
Week 14				

Week	Topic	Task	Language Function	Grammar
Week 9	AI	Playing a "Guess What" Game with ChatGPT	Asking questions to elicit information	Interrogative Sentences

Learning Objective	By the end of Week 9, students will be able to effectively use interrogative sentences to elicit information from ChatGPT about genetics-related topics. Students will practice formulating clear, concise, and relevant questions using ChatGPT voice chat.
Relevance and Context	This task leverages the interactive nature of ChatGPT to engage students in active learning. By crafting questions, students will not only explore using AI tools but also enhance their ability to communicate effectively and think critically about the responses they receive.
Instructions	**Step 1:** Prompt ChatGPT to play a GuessWhat game on genetics related topics. ChatGPT will think of a genetics-related thing and you will try to guess by asking questions. **Step 2:** You need to play three games and ask different types of questions in each game, including Yes/No, Wh- and Tag questions. **Step 3:** Using the voice chat of ChatGPT, play three games with ChatGPT. **Step 4:** Submit the share link of the chat as your homework.
Deliverables	A log of your questions and ChatGPT's responses.
Performance Criteria	Success in this task will be assessed based on the accuracy and creativity of the crossword design, the clarity and grammatical correctness of the clues, and the strategic implementation of relative clauses in the clues.

Evaluation Rubric

Criteria	Excellent (25 points)	Good (15 points)	Needs Improvement (5 point)
Use of Different Types of Interrogatives	Skillfully uses a variety of interrogative forms including Yes/No, WH-questions, and Tag questions, demonstrating a nuanced understanding of how different questions elicit different types of information.	Utilizes some variety in interrogative forms but may rely more heavily on one type, showing a moderate understanding of eliciting information.	Primarily uses one type of interrogative form, indicating a basic or limited approach to eliciting information.
Correct Prompting	Questions are formulated correctly and clearly, prompting detailed and relevant responses from ChatGPT. Demonstrates an adept ability to guide the conversation through questions.	Questions are generally well-formed but may occasionally lack clarity or precision, leading to responses from ChatGPT that are less detailed or slightly off-topic.	Questions often lack clarity or grammatical correctness, resulting in vague or irrelevant responses from ChatGPT.
Quality of the Conversation	The conversation flows logically, with each question building on the last response to delve deeper into AI topics. Reflections and follow-ups are thoughtful, showing high engagement.	The conversation shows some logical progression, but there may be missed opportunities for deeper exploration or reflection on the responses.	The conversation lacks coherence, with little to no reflection on responses or follow-up questions, indicating a superficial engagement with the topic.

Appendix 4

Digital Literacy Survey Items (Turkish)

	Beni hiç yansıtmıyor	Beni çok az yansıtıyor	Beni biraz yansıtıyor	Beni çoğunlukla ansıtıyor	Beni tamamen yansıtıyor
Bölüm 1					
Günlük hayatta olduğu gibi dijital ortamlarda da kişisel veya yasal haklarımın (mahremiyet, telif, konuşma özgürlüğü vb.) devam ettiğinin farkındayım.					
Çevrim içi ortamlarda kendimin ve başkalarının kişisel verilerini (fotoğraf, adres, aile bilgileri vb.) korumak için nasıl davranmam gerektiğini bilirim.					
Çevrim içi ortamlarda eriştiğim bilgilerin doğru olup olmadığını farklı kaynaklardan sorgulayabilirim.					
Çevrim içi ortamlarda siber zorbalık (aşağılama, küfür, nefret söylemi vb.) ve istismar gibi davranışların etik ve yasal sorumluluklarının farkındayım.					
Bilişsel ve ahlakî gelişime uygun olan dijital oyunları ve içerikleri ayırt edebilirim.					
Çevrim içi ortamlarda yaptığım her şeyin kaydedildiğinin farkındayım.					
Dijital ortamlarda telif haklarının ihlalinden doğabilecek etik ve yasal sorumlulukların farkındayım.					
Bölüm 2					
Lisanslı yazılım, demo yazılım, korsan yazılım, kötü amaçlı yazılım ve crack kavramlarının ne olduğunu bilirim.					
Donanım ve yazılım teknolojilerinin ne olduğunu bilirim					
Bilgisayarıma işletim sistemini kurabilirim/format atabilirim.					
Bilgisayarıma ya da diğer elektronik cihazlarıma yazılım veya program yükleyebilirim.					
Torent, İnternet, World Wide Web (WWW) ifadelerinin ne anlama geldiğini bilirim.					
Yasaklı İnternet sitelerine erişmek için cihazların proxy/dns ayarlarını değiştirebilirim.					
Bölüm 3					
e-Devlet uygulamalarını (MHRS, UYAP, vergi&ceza sorgulama vb.) etkin kullanabilirim.					
Bulut bilişim teknolojilerini (Google Drive, iCloud, Dropbox vb.) günlük hayatta etkin kullanabilirim.					
Mobil cihazlarda takvimi sadece tarihe bakmak için değil; aynı zamanda anımsatıcı, not alma, etkinlik oluşturma vb. işler için de kullanabilirim.					
Çevrim içi ortamlarda "video yüklemek/canlı yayın yapmak" gibi etkinliklerde bulunabilirim					
Rezervasyon, alışveriş, adres bulma vb. gündelik pratiklerde dijital teknolojileri etkin kullanabilirim.					
Kullandığım bir web sayfasını sık kullanılanlara veya yer imlerine ekleyebilirim.					
Bölüm 4					
Dijital teknolojilere dayalı yazılım/uygulama geliştirebilirim.					
Programlama dillerinden (Java, C, Visual Basic, PHP, vb.) en az birini kullanabilirim.					

Bölüm 5					
Uygulamaların kişisel bilgilerime (konum, rehber, kamera vb.) erişimini kısıtlamayı bilirim.					
İstenmeyen/spam epostaları ve oltalama mesajları tanıyıp engelleyebilirim.					
Sosyal ağlardaki paylaşımlarımda ve profilimdeki gizlilik/güvenlik ayarlarını değiştirebilirim.					
Nasıl güçlü bir şifre oluşturacağımın farkındayım.					
Bölüm 6					
Web tasarım sistemlerini (Weebly, Wordpress vb.) kullanarak İnternet sitesi tasarlayıp yayınlayabilirim.					
Kendi blog sayfamda veya farklı bloglarda yazı yazıp, paylaşabilirim.					
Dijital teknolojiler yardımıyla çeşitli imajları (fotoğraf, ses kaydı ve video vb.) değiştirip, yeni içerikler üretebilirim.					
Alanımla ilgili en az bir tane yazılımı (Photoshop, SPSS, Premiere, Office Word vb.) etkili bir şekilde kullanabilirim.					

Technology Acceptance Model Items (Turkish)

	Beni hiç yansıtmıyor	Beni çok az yansıtıyor	Beni biraz yansıtıyor	Beni çoğunlukla ansıtıyor	Beni tamamen yansıtıyor
Yapay zekâ araçlarını kullanmak, öğrenme görevlerimi daha hızlı tamamlamayı sağlıyor.					
Yapay zekâ araçlarını kullanmak öğrenme performansımı arttırıyor.					
Yapay zekâ araçlarını kullanmak öğrenme sürecimi daha verimli hale getiriyor.					
Yapay zekâ araçlarını kullanmak öğrenme sürecimi daha etkili hale getiriyor.					
Yapay zekâ araçlarını kullanmayı öğrenmek kolaydır.					
Yapay zekâ araçlarını kullanarak yapmak istediklerimi kolayca yapabiliyorum.					
Yapay zekâ araçlarını kullanırken çok fazla zorlanmıyorum.					
Yapay zekâ araçlarını kullanmada kolayca ustalaşabiliyorum.					
Yapay zekâ araçlarını kullanmayı kolay buluyorum.					
Yapay zekâ araçlarını kullanmaya başladığımda bırakamıyorum.					
Ödevlerimin yapay zekâ araçlarının kullanımını gerektiren yönleri olmasını sabırsızlıkla bekliyorum.					
Yapay zekâ araçları ile çalışmayı seviyorum.					
Bundan sonra, yapay zekâ araçlarını kullanmaya devam etmeyi planlıyorum.					
İleride, yapay zekâ araçlarını kullanmayı düşünüyorum.					
Gelecekte, yapay zekâ araçlarını kullanmayı planlıyorum.					

Article Information Form

Author(s) Notes: Authors would like to express their sincere thanks to the editor and the anonymous reviewers for their helpful comments and suggestions. GrammarlyGo was used to improve the readability and language of this paper. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Author(s) Contributions: All authors contributed equally to the writing of this paper. All authors read and approved the final manuscript.

Conflict of Interest Disclosure: No potential conflict of interest was declared by authors.

Supporting/Supporting Organizations: No grants were received from any public, private or non-profit organizations for this research.

Ethical Approval: The ethical approval for this study was obtained from the ethical board of the institution where the data were collected.

Plagiarism Statement: This article has been scanned by iThenticate.