

Factors Influencing Students' Acceptance of AI-Based Virtual Tutors in Higher Education: Evidence from Morocco

Hind EL BANANE ¹

Karima SALAH-EDDINE ²

Soumia ZITI

¹ hind.elbanane@um5r.ac.ma

² IPSS, Intelligent Processing and Security of Systems, Faculty of Science, Mohammed
V university in Rabat, Rabat, Morocco

² SMSD, Moroccan Society of Digital Health, Rabat, Morocco

² LIAS, Artificial Intelligence and Systems Laboratory, Hassan II University in
Casablanca, Casablanca, Morocco

² s.ziti@um5r.ac.ma

*Correspondence: hind.elbanane@um5r.ac.ma

Abstract:

Artificial Intelligence (AI) is increasingly transforming higher education by offering innovative solutions to improve academic support and personalized learning. Among these technologies, AI-based virtual tutors have emerged as promising educational tools capable of providing immediate assistance, adaptive feedback, and continuous support to students. However, little empirical research has examined the factors influencing students' acceptance of these systems in developing countries such as Morocco.

This study aims to investigate university students' perceptions of AI-based virtual tutors and identify the factors influencing their intention to use these technologies for academic support, based on the Technology Acceptance Model (TAM).

A quantitative cross-sectional survey was conducted among 224 university students in Morocco using a structured questionnaire. The instrument collected data on demographic characteristics, familiarity with AI tools, academic support needs, perceived usefulness of AI-based virtual tutors, and intention to use. The data were analyzed using descriptive statistics, Cronbach's alpha, Pearson correlation, Chi-square tests, independent-samples t-tests, and one-way ANOVA.

The findings reveal that students generally hold positive perceptions of AI-based virtual tutors and recognize their value for facilitating access to educational resources, supporting exam preparation, providing rapid responses, and promoting self-paced learning. The perceived usefulness scale demonstrated excellent internal consistency (Cronbach's $\alpha = 0.904$). A strong positive correlation was found between perceived usefulness and intention to use AI-based virtual tutors ($r = 0.757$, $p < 0.001$), while familiarity with AI tools was also significantly associated with students' intention to use these systems. No significant differences were observed according to gender or level of study.

The study concludes that AI-based virtual tutors have strong potential to complement traditional academic support in Moroccan higher education. The findings provide empirical evidence supporting the applicability of the Technology Acceptance Model in explaining students' acceptance of AI-based virtual tutors and offer practical insights for universities seeking to integrate AI-powered educational technologies.

Keywords: Artificial Intelligence; Virtual Tutor; Technology Acceptance Model; Academic Support; Higher Education.

1. Introduction

Artificial Intelligence (AI) is increasingly transforming higher education by providing innovative solutions to support teaching and learning processes. Recent advances in generative AI, conversational agents, and intelligent tutoring technologies have expanded the possibilities for personalized learning and academic assistance. Studies have shown that AI-based systems can enhance learning experiences by providing adaptive feedback, facilitating access to educational resources, and supporting students beyond traditional classroom settings (Yan, 2025; Vieriu et al., 2025).

Despite these developments, many higher education institutions continue to face challenges in providing individualized academic support. Large class sizes, limited instructor availability, and diverse student learning needs often restrict opportunities for personalized assistance. Consequently, many students experience difficulties understanding course content and require additional support outside regular teaching hours.

In this context, AI-based virtual tutors have emerged as promising educational tools. Building upon Intelligent Tutoring Systems (ITS) and recent advances in Natural Language Processing, virtual tutors can provide personalized guidance, answer students' questions, recommend learning resources, and support self-paced learning. Previous studies have demonstrated the educational value of intelligent tutoring systems and educational chatbots in improving learner engagement and facilitating academic support (VanLehn, 2011; Graesser et al., 2005; Okonkwo & Ade-Ibijola, 2021).

At the same time, the growing adoption of AI tools such as ChatGPT, Gemini, and Copilot suggests that students are becoming increasingly familiar with AI-assisted learning environments. However, despite the growing adoption of AI tools in higher education, existing research has primarily focused on the technological effectiveness of intelligent tutoring systems and educational chatbots. Comparatively less attention has been devoted to understanding the factors that

influence students' acceptance of AI-based virtual tutors, particularly in developing countries such as Morocco. Furthermore, limited research has examined how students' academic support needs relate to their willingness to adopt AI-powered tutoring systems.

To address this gap, this study investigates university students' perceptions of AI-based virtual tutors and explores the factors that may influence their acceptance. The study is grounded in the Technology Acceptance Model (TAM), one of the most widely used theoretical frameworks for explaining technology adoption. According to TAM, users' intention to adopt a technology is influenced by their perceptions of its usefulness and ease of use. In the context of AI-based virtual tutors, students are more likely to adopt these systems if they perceive them as valuable tools for supporting learning and academic success.

This study contributes to the literature in three ways. First, it provides empirical evidence regarding students' acceptance of AI-based virtual tutors in the Moroccan higher education context, which remains underexplored. Second, it examines the relationship between familiarity with AI technologies and students' intention to use AI-based virtual tutors through the lens of technology acceptance theory. Third, it identifies students' academic support needs and discusses how AI-powered tutoring systems may complement traditional forms of pedagogical support.

Based on the Technology Acceptance Model and previous research on educational technology adoption, the following hypotheses were formulated:

H1: Students who perceive AI-based virtual tutors as useful educational tools are more likely to express an intention to use them.

H2: Students who are familiar with AI tools are more likely to express an intention to use AI-based virtual tutors.

2. Related work

2.1 AI-Based Virtual Tutors in Higher Education

Artificial Intelligence (AI) has significantly transformed higher education through the development of intelligent systems capable of supporting teaching and learning processes. Among these technologies, AI-based virtual tutors have emerged as promising tools that provide personalized guidance, adaptive feedback, and on-demand academic assistance. These systems build upon the foundations of Intelligent Tutoring Systems (ITS) and recent advances in Natural Language Processing and Generative Artificial Intelligence.

Previous studies have demonstrated the educational benefits of intelligent tutoring systems. VanLehn (2011) reported that ITS can achieve learning outcomes comparable to those obtained through human tutoring in specific educational contexts. Similarly, Graesser et al. (2005) showed that AutoTutor improved students' conceptual understanding through natural language interactions and personalized feedback.

More recently, conversational AI systems and educational chatbots have expanded the capabilities of virtual tutoring environments. Educational chatbots can provide immediate responses, facilitate access to learning resources, and support students outside regular classroom hours. These characteristics make AI-based virtual tutors particularly relevant in higher education contexts where individualized academic support is often limited.

2.2 Technology Acceptance Model (TAM)

Beyond their technological capabilities, the successful implementation of AI-based virtual tutors depends on students' willingness to adopt and use these systems. Technology acceptance has therefore become an important area of investigation in educational technology research.

One of the most influential frameworks for studying technology adoption is the Technology Acceptance Model (TAM) proposed by Davis (1989). According to

TAM, users' behavioral intention to adopt a technology is primarily determined by perceived usefulness and perceived ease of use. Numerous studies have applied TAM to explain the adoption of digital learning technologies, online learning platforms, and AI-powered educational systems.

Recent studies indicate that students generally perceive AI technologies positively and recognize their potential to support learning activities, improve access to educational resources, and facilitate academic tasks. However, technology acceptance may vary according to students' prior experience with AI tools, perceived benefits, and confidence in the reliability of AI-generated responses.

In the context of AI-based virtual tutors, understanding students' perceptions and acceptance intentions is essential for supporting successful implementation in higher education institutions.

3. Methodology

3.1 Research Design

This study adopted a quantitative cross-sectional survey design to investigate university students' perceptions of AI-based virtual tutors and their potential role in academic support.

3.2 Theoretical Framework

This study is grounded in the Technology Acceptance Model (TAM), which explains users' adoption of new technologies through their perceptions of usefulness and behavioral intention to use. In the context of AI-based virtual tutors, perceived usefulness refers to students' beliefs that virtual tutors can improve learning, facilitate access to educational resources, provide rapid assistance, and support academic success.

Based on this framework, the study examines the relationship between students' familiarity with AI technologies, their perceived usefulness of AI-based virtual tutors, and their intention to use such systems for academic support.

3.3 Participants

A total of 224 university students participated in the study. Participants were recruited using convenience sampling through online student networks and social media groups. Participation was voluntary and anonymous. The sample included students from different academic disciplines and study levels, although undergraduate students constituted the majority of respondents.

3.4 Instrument

The fourth section assessed students' perceptions of AI-based virtual tutors. Seven items measured perceived usefulness, including course understanding, access to educational resources, academic performance, exam preparation, learning motivation, self-paced learning, and rapid response capabilities. One additional item measured students' intention to use AI-based virtual tutors in their future academic activities. All perception items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

To assess the internal consistency of the perception scale, Cronbach's alpha coefficient was calculated. In addition, a composite Perceived Usefulness score was created by averaging the seven items related to the educational benefits of AI-based virtual tutors. Following the Technology Acceptance Model (TAM), the relationship between Perceived Usefulness and Intention to Use was examined using Pearson's correlation analysis.

3.5 Data Collection Procedure

The questionnaire was administered online using Google Forms. Data were collected during the academic year 2024–2025. Participants were informed about the purpose of the study and assured that their responses would remain confidential and be used exclusively for research purposes.

3.6 Data Analysis

The collected data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics, including frequencies, percentages, means, and

standard deviations, were used to summarize participants' demographic characteristics, AI usage patterns, academic support needs, and perceptions of AI-based virtual tutors.

To further investigate relationships between variables, Chi-square (χ^2) tests were conducted to examine associations between categorical variables such as familiarity with AI tools, learning difficulties, and students' intention to use AI-based virtual tutors. Independent-samples t-tests were used to compare perception scores across binary demographic groups, particularly gender. In addition, one-way Analysis of Variance (ANOVA) was performed to determine whether students' perceptions of AI-based virtual tutors differed significantly according to their level of study (bachelor's, master's, and doctoral levels). Statistical significance was assessed at the 0.05 level ($p < 0.05$).

The results were organized according to the research objectives in order to identify patterns related to students' use of AI tools, academic support needs, and perceptions of AI-based virtual tutors.

In addition, a composite perceived usefulness score was calculated by averaging the seven perception items related to the educational benefits of AI-based virtual tutors. This variable was used to examine its relationship with students' intention to use virtual tutors, in accordance with the Technology Acceptance Model. The inferential analyses were conducted to test the proposed hypotheses regarding AI familiarity, perceived usefulness, and behavioral intention to use AI-based virtual tutors.

4. Results

4.1 Participant Profile

Table 1. Participant profile

Variable	Category	Number	Percentage (%)
Gender	Female	186	83
	Male	38	17
Study Level	Bachelor's	219	97.8
	Master's	3	1.3
	Doctoral	2	0.9
Field of Study	Humanities	107	47.8
	Sciences	48	21.4

Table 1 presents the participant profile. The demographic analysis reveals a clear predominance of women (83%) compared to only 17% men. This distribution indicates that the sample is predominantly female and should be taken into account when interpreting the results, concerns the level of education. Most respondents are enrolled in bachelor's programs (97.8%), and very few are in master's or doctoral programs. This suggests that the results primarily reflect the perspective of students at the beginning of their studies, who generally require additional academic support.

Regarding academic disciplines, the majority of students are in the humanities (47.8%), followed by science students (21.4%). Other disciplines are less well represented. This distribution provides a better understanding of students' perspectives in different fields of study.

This result suggests that the adoption of AI-based virtual tutors may be influenced by students' familiarity with digital tools.

4.2 Use of Artificial Intelligence Tools

Figure 1. Familiarity with AI Tools in Learning **Figure 2.** Frequency of AI Tools Usage

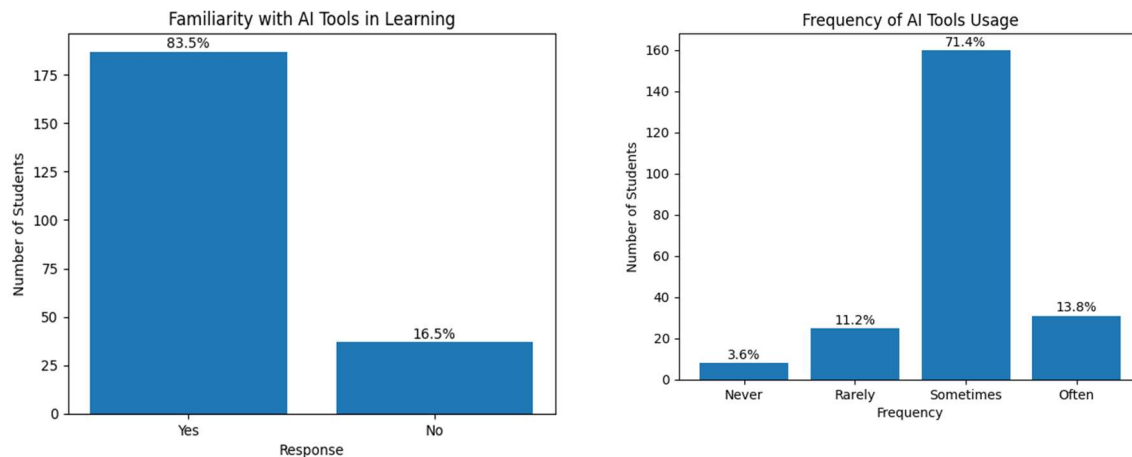


Figure 1 indicates that a large majority of students (83.5%) are familiar with the artificial intelligence tools used in learning environments, while only 16.5% report having no prior knowledge of them. This finding highlights student's high awareness of AI technologies, thus creating a favorable context for the integration of AI-based virtual tutors.

Regarding the frequency of use, Figure 2 shows that most students (71.4%) reported using AI tools occasionally, while a smaller proportion indicated using them often or rarely (13.8%). A minority of respondents stated that they never use these tools (3.6%). These results suggest that, despite the widespread availability of AI tools, their integration into daily learning practices remains limited.

Table 2. AI Tools Used by Students

AI Tool	Users (%)
ChatGPT	68.1
Gemini	48.6
Copilot	19.9

Furthermore, Table 2 illustrates the AI tools used by students. The analysis reveals a strong predominance of conversational AI systems, with ChatGPT being the most frequently used tool (68.1%), followed by Google Gemini (48.6%) and Microsoft Copilot (19.9%). This trend confirms that students are already familiar with AI systems that resemble virtual tutoring environments.

4.3 Students' Learning Difficulties and Need for Support

Figure 3. Difficulties understanding the lessons

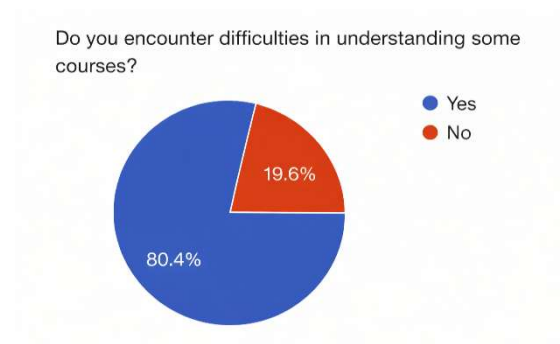


Figure 3 shows that the results reveal a significant proportion of students (80.4%) who have difficulty understanding the course content. This finding highlights a clear need for additional pedagogical support in higher education.

According to Figure 4, most students reported needing help occasionally (69.6%), while a smaller proportion indicated needing help frequently or rarely (13.8%). This suggests that, although the need for support is not constant, it is recurring and affects a large number of students.

Figure 4. Frequency of Need for Academic Assistance

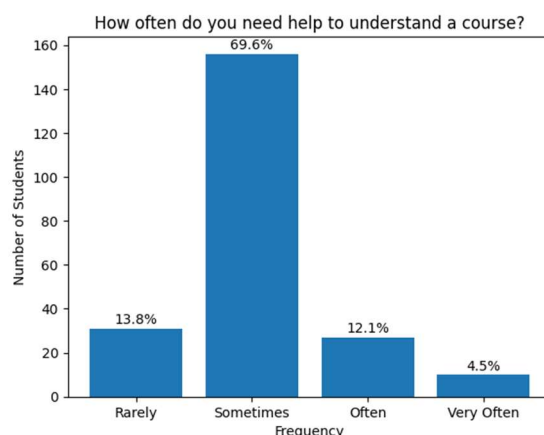


Table 3. Perceived Pedagogical Support from Instructors

Perceived Level of Pedagogical Support	Frequency (n)	Percentage (%)
Insufficient	16	7.1
Moderate	107	47.8
Sufficient	101	45.1

Table 3 presents the pedagogical support provided by teachers. The results show that most students consider it moderate (47.8%), followed by those who consider it sufficient (45.1%), and a small percentage (7.1%) who consider it insufficient.

Overall, these results confirm the existence of a lack of pedagogical support, thus justifying the integration of AI-based virtual tutors as complementary teaching tools.

4.4 Students' Perception of AI-Based Virtual Tutors

Analysis of student perceptions generally reveals a positive attitude towards the use of AI-based virtual tutors in higher education.

Table 4. Students' Perceptions of AI-Based Virtual Tutors (N = 224)

Statement		Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Improve course understanding		12.5	8.9	26.8	38.4	13.4
Provide quick answers		11.2	11.6	21.9	36.6	18.8
Support self-paced learning		9.4	12.9	22.8	38.8	16.1
Improve academic performance		11.2	15.6	26.8	34.8	11.6
Facilitate access to resources		9.4	10.7	21.0	40.2	18.8
Support exam preparation		12.9	6.2	21.0	41.1	18.8
Increase learning motivation		9.8	13.8	23.7	36.2	16.5
Intention to use an AI-based virtual tutor		15.6	11.2	20.5	35.7	17.0

Table 4 presents the distribution of students' responses regarding AI-based virtual tutors. Overall, the results indicate a generally positive perception of virtual tutors. For all statements, the combined percentages of “**Agree**” and “**Strongly Agree**” exceeded those of negative responses. The highest levels of agreement were observed for exam preparation (59.9%), facilitating access to educational resources (59.0%), and providing quick answers to students' questions (55.4%). Similarly, more than half of the respondents expressed a willingness to use an AI-based virtual tutor in their university studies (52.7%). These findings suggest that students perceive virtual tutors as useful tools for academic support, particularly for accessing learning resources, receiving immediate assistance, and supporting independent learning.

Table 5. Mean Scores and Standard Deviations of Students' Perceptions of AI-Based Virtual Tutors (N = 224)

Statement	Mean	SD
Improve course understanding	3.31	1.19
Provide quick answers	3.40	1.23
Support self-paced learning	3.39	1.18
Improve academic performance	3.19	1.17
Facilitate access to educational resources	3.48	1.19
Support exam preparation	3.46	1.24
Increase learning motivation	3.35	1.20
Intention to use an AI-based virtual tutor	3.26	1.30

Table 5 presents the mean scores and standard deviations for students' perceptions of AI-based virtual tutors. Overall, the results indicate a moderately positive perception, as all mean scores were above the neutral value of 3. The highest mean scores were observed for facilitating access to educational resources ($M = 3.48$, $SD = 1.19$), supporting exam preparation ($M = 3.46$, $SD = 1.24$), and providing quick answers to students' questions ($M = 3.40$, $SD = 1.23$). These findings suggest that students primarily perceive AI-based virtual tutors as useful tools for accessing learning materials, receiving immediate assistance, and supporting their academic preparation. In contrast, the perceived impact on academic performance obtained the lowest mean score ($M = 3.19$, $SD = 1.17$), indicating a more cautious evaluation of the direct influence of virtual tutors on learning outcomes.

Table 6. Overall Perception Score of AI-Based Virtual Tutors (N = 224)

Variable	Mean	SD
Overall perception score	3.36	0.97

To obtain an overall measure of students' attitudes toward AI-based virtual tutors, a composite perception score was calculated by averaging the eight perception items. As shown in Table 6, the overall mean score was 3.36 (SD = 0.97), indicating a moderately positive perception of AI-based virtual tutors among university students. This result suggests that students generally recognize the potential benefits of virtual tutors for supporting learning and academic assistance, although some reservations remain regarding their effectiveness in certain areas.

4.5 Inferential Statistical Analysis

4.5.1 Reliability Analysis

Table 7. Reliability Analysis of the Perceived Usefulness Scale

Scale	Number of Items	Cronbach's Alpha
Perceived Usefulness	7	0.904

The reliability of the perceived usefulness scale was assessed using Cronbach's alpha coefficient. The analysis yielded an alpha value of 0.904, indicating excellent internal consistency among the seven items. This result confirms that the items measure a common underlying construct and can therefore be combined into a composite perceived usefulness score.

4.5.2 Testing Hypothesis H1

Table 8. Correlation Between Perceived Usefulness and Intention to Use AI-Based Virtual Tutors

Variables	r	p-value
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Perceived Usefulness × Intention to Use	0.757	< 0.001
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To test Hypothesis H1, Pearson's correlation analysis was conducted between the perceived usefulness score and students' intention to use AI-based virtual tutors.

The results revealed a strong positive correlation ($r = 0.757$, $p < 0.001$), indicating that students who perceive AI-based virtual tutors as useful are significantly more likely to express willingness to use them in their academic activities.

Therefore, H1 was supported. This finding is consistent with the Technology Acceptance Model, which identifies perceived usefulness as a key determinant of technology adoption.4.5.2

4.5.3 Independent Samples t-Test

Table 9. Comparison of Overall Perception Scores by Gender

Gender	N	Mean	SD
Male	38	3.24	0.98
Female	186	3.39	0.96

Test	t	p-value
Independent Samples t-test	-0.816	0.418

An independent-samples t-test was conducted to examine whether students' perceptions of AI-based virtual tutors differed according to gender. As shown in Table 9, female students reported a slightly higher overall perception score ($M = 3.39$, $SD = 0.96$) than male students ($M = 3.24$, $SD = 0.98$). However, the difference was not statistically significant, $t(50.42) = -0.816$, $p = 0.418$. Therefore, students' perceptions of AI-based virtual tutors do not appear to be influenced by gender.

4.5.4 One-Way ANOVA

Table 10. Comparison of Overall Perception Scores by Study Level

Study Level	N	Mean
Bachelor's	219	3.36
Master's	4	3.06
Doctoral	1	4.25
Test	F	p-value
One-Way ANOVA	0.613	0.543

A one-way ANOVA was performed to explore whether students' perceptions of AI-based virtual tutors differed according to their level of study. Although doctoral students reported the highest mean perception score and master's students reported the lowest, the differences between groups were not statistically significant, $F(2, 221) = 0.613$, $p = 0.543$. These findings suggest that students' perceptions of AI-based virtual tutors are generally consistent across educational levels. However, the interpretation of these results should be made with caution due to the very small number of master's and doctoral students in the sample.

4.5.5 Chi-Square Test

Table 11. Association Between Familiarity with AI Tools and Intention to Use AI-Based Virtual Tutors

Variable	χ^2	p-value
Familiarity with AI Tools $\times$ Intention to Use a Virtual Tutor	18.72	< 0.001

To test Hypothesis H2, a Chi-square test of independence was performed to examine the relationship between familiarity with AI tools and intention to use AI-based virtual tutors. The analysis revealed a statistically significant association ($\chi^2 = 18.72$, $p < 0.001$). Students familiar with AI technologies were significantly more likely to express willingness to use AI-based virtual tutors.

Therefore, H2 was supported. This result suggests that prior experience with AI technologies may facilitate the acceptance and adoption of AI-powered educational systems.

5. Discussion

This study investigated university students' perceptions of AI-based virtual tutors and explored factors influencing their acceptance in higher education. The findings revealed that students are generally familiar with AI technologies and frequently use tools such as ChatGPT, Gemini, and Copilot in their learning activities. This result is consistent with recent studies reporting the increasing integration of AI tools into higher education environments (Yan, 2025; Vieriu et al., 2025).

The results also showed that a large proportion of students experience difficulties understanding course content and regularly require additional academic support. Although most participants considered the pedagogical support provided by instructors to be moderate or sufficient, many students still expressed recurring needs for assistance. These findings suggest that AI-based virtual tutors could serve as complementary support tools capable of providing immediate and accessible assistance beyond traditional classroom settings.

Students generally reported positive perceptions of AI-based virtual tutors, particularly regarding their ability to facilitate access to educational resources, support exam preparation, and provide rapid responses to academic questions. These findings are consistent with previous research on Intelligent Tutoring Systems and educational chatbots, which highlighted their potential to enhance learner support, engagement, and autonomous learning (VanLehn, 2011; Okonkwo & Ade-Ibijola, 2021).

More importantly, the study provides empirical support for the Technology Acceptance Model (TAM). The strong positive relationship between perceived usefulness and intention to use AI-based virtual tutors confirms that students are more likely to adopt these systems when they perceive them as beneficial for their learning activities. This finding supports Hypothesis H1 and is consistent with TAM, which identifies perceived usefulness as a major determinant of technology adoption.

Similarly, the significant association between familiarity with AI tools and intention to use virtual tutors supports Hypothesis H2. Students who already have experience with AI technologies appear more willing to adopt AI-based educational systems. This suggests that prior exposure to AI may reduce uncertainty and facilitate acceptance of emerging educational technologies.

No significant differences were found according to gender or study level. These results indicate that positive perceptions of AI-based virtual tutors are relatively consistent across different student groups, suggesting that such systems may have broad applicability within higher education.

This study contributes to the literature by extending research on AI acceptance in education to the Moroccan higher education context and by empirically validating key assumptions of the Technology Acceptance Model in the context of AI-based virtual tutors. The findings demonstrate that perceived usefulness is a strong predictor of students' intention to adopt AI-powered academic support systems.

Despite these contributions, the study has several limitations. The sample was predominantly composed of undergraduate students and relied on self-reported perceptions rather than actual interaction with a real AI-based virtual tutor. Another limitation is that intention to use was measured using a single-item indicator, which may not fully capture the multidimensional nature of technology acceptance. Future research should therefore focus on evaluating implemented virtual tutor systems, examining learning outcomes, and exploring additional TAM variables such as perceived ease of use, trust, and user satisfaction.

6. Conclusion

This study investigated university students' perceptions of AI-based virtual tutors and examined factors influencing their acceptance in higher education. The findings revealed that students are generally familiar with AI technologies, experience recurring academic support needs, and hold positive perceptions of AI-based virtual tutors. Participants particularly valued the ability of virtual tutors to facilitate access to educational resources, support exam preparation, provide rapid responses, and promote self-paced learning.

The study also provided empirical support for the Technology Acceptance Model (TAM). The results demonstrated a strong positive relationship between perceived usefulness and students' intention to use AI-based virtual tutors, confirming that perceived educational value is an important factor influencing technology acceptance. In addition, students familiar with AI technologies were significantly more likely to express willingness to adopt virtual tutors for academic support.

These findings suggest that AI-based virtual tutors can serve as valuable complementary tools for supporting students beyond traditional classroom instruction. By providing accessible, personalized, and immediate assistance, such systems may contribute to improving learning experiences and addressing unmet academic support needs in higher education.

This study contributes to the growing body of research on AI adoption in education by providing evidence from the Moroccan higher education context and by applying the Technology Acceptance Model to explain students' acceptance of AI-based virtual tutors.

Despite its contributions, the study is limited by its reliance on self-reported perceptions and the predominance of undergraduate students in the sample. Future research should focus on the implementation and evaluation of real AI-based virtual tutor systems, investigate their impact on learning outcomes and academic performance, and examine additional determinants of technology acceptance, such as perceived ease of use, trust, and user satisfaction.

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