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SECONDARY SCHOOL STUDENTS' ACCEPTANCE OF ARTIFICIAL INTELLIGENCE IN SCIENCE LEARNING

Abstract. Artificial Intelligence (AI) is increasingly transforming educational practices and offers promising opportunities to enhance science learning through personalized support, adaptive feedback, and access to diverse learning resources. Although Artificial Intelligence is increasingly being integrated into educational settings, empirical evidence regarding the factors influencing its acceptance among secondary school students, particularly in science learning, remains limited. This study investigates the predictive effects of the Unified Theory of Acceptance and Use of Technology (UTAUT) constructs on secondary school students' behavioral intention to use AI in science learning.

A cross-sectional quantitative survey was conducted among 207 secondary school students from public and private schools in Casablanca, Morocco. Data were collected using a structured questionnaire measuring the core UTAUT constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, and behavioral intention. The data were analyzed using descriptive statistics, Spearman correlation analysis, and multiple linear regression.

The results indicate that students generally hold positive perceptions of AI in science learning. Regression analysis revealed that performance expectancy was the only significant predictor of behavioral intention ($\beta = 0.366$, $p < 0.001$), whereas effort expectancy, social influence, and facilitating conditions showed no statistically significant effects. The proposed model explained 20.4% of the variance in students' behavioral intention ($R^2 = 0.204$).

These findings suggest that students' acceptance of AI depends primarily on their perception of its educational usefulness rather than on ease of use, social pressure, or facilitating conditions. The study extends current knowledge on AI acceptance in secondary science education by providing empirical evidence from the Moroccan context and offers practical implications for designing pedagogically meaningful AI-supported science learning environments.

Keywords: Artificial Intelligence; Science Learning; UTAUT; Technology Acceptance; Secondary School Students

1. INTRODUCTION

Artificial Intelligence (AI) is playing an increasingly important role in educational systems. Its rapid development has led to the emergence of new tools capable of personalizing learning experiences, automating instructional tasks, providing immediate feedback to learners, and simulating complex situations that are difficult to observe in classroom settings [1]-[3]. In the context of science learning, these opportunities have attracted particular attention due to their potential to support modeling, virtual experimentation, and the development of scientific inquiry skills [4].

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The Problem Statement: This evolution has been accompanied by the growing presence of AI tools in learners' daily lives. Numerous studies have highlighted the increasing interest in these technologies among both teachers and students [5]-[7]. However, mere access to such tools does not guarantee their actual use in learning activities. Their adoption largely depends on how learners perceive these technologies, the benefits they associate with them, and their willingness to integrate them into their academic practices [8]-[10].

In this context, understanding the factors that facilitate or hinder students' acceptance of Artificial Intelligence has become an important issue for supporting its integration into science learning. The central research question of this study can therefore be formulated as follows: What factors influence secondary school students' acceptance of Artificial Intelligence in science learning according to the dimensions of the UTAUT model?

Analysis of Recent Studies and Publications: Artificial Intelligence (AI) is experiencing rapid growth in education and is increasingly recognized as a promising technology for supporting teaching and learning processes. Owing to its ability to generate personalized content, provide adaptive feedback, facilitate access to information, and simulate complex phenomena, AI offers new opportunities to enrich educational practices, particularly in science learning [1], [2]. In this field, AI-based tools such as intelligent tutoring systems, conversational agents, and content generation platforms have demonstrated their potential to promote active learning, foster learner autonomy, and support scientific inquiry processes [3], [6].

Despite these educational opportunities, the successful integration of AI into learning environments depends not only on the technological capabilities of these tools but also on learners' willingness to adopt and use them. Consequently, understanding the factors that shape students' acceptance of AI has become an important research issue for promoting its meaningful and sustainable pedagogical integration. Several recent studies have therefore investigated AI adoption using technology acceptance models [11].

Ali et al. [3] conducted a meta-analysis to synthesize empirical evidence on the acceptance and use of Artificial Intelligence in educational settings. Their findings identified performance expectancy and perceived usefulness as the most influential determinants of learners' behavioral intention to adopt AI, while confirming the robustness of the UTAUT framework across diverse educational contexts. However, the reviewed studies were conducted predominantly in higher education, providing limited evidence on AI acceptance among secondary school students. This limitation highlights the need for further empirical research examining the determinants of AI acceptance among younger learners, particularly in science learning contexts.

Sharma and Singh [7] empirically examined the adoption of Artificial Intelligence in Indian universities using the UTAUT framework. Their findings confirmed that performance expectancy and social influence were the strongest predictors of students' intention to adopt AI, further supporting the explanatory power of the UTAUT model in educational contexts. However, the study was conducted exclusively in higher education within a specific national context, which limits the generalizability of its findings to secondary education and other educational systems. These limitations highlight the need to examine whether the determinants of AI acceptance remain consistent among secondary school students, particularly in science learning.

Alenazi [12] investigated students' acceptance of Artificial Intelligence in nursing education using a cross-sectional UTAUT-based approach. The study reported generally positive attitudes toward AI and identified performance expectancy and social influence as significant determinants of students' behavioral intention to use AI. Nevertheless, the research was limited to a single academic discipline within higher education, making it difficult to generalize the findings to other educational levels or subject areas. This suggests the importance

of extending AI acceptance research to secondary school students and to disciplines such as science education, where learning activities differ substantially from professional training contexts.

Batani and Mbunge [13] developed a modified UTAUT model to explain the behavioral intention to adopt generative Artificial Intelligence in higher education institutions. Their findings demonstrated that extending the original UTAUT framework with additional context-specific variables improved its explanatory power for AI adoption. However, the proposed model was validated exclusively in higher education and focused on generative AI, leaving unanswered questions regarding the applicability of these findings to younger learners and other educational contexts. This limitation reinforces the need for empirical studies investigating AI acceptance among secondary school students within discipline-specific learning environments such as science education.

Acosta-Enriquez et al. [14] proposed a conceptual analysis of Artificial Intelligence acceptance in higher education based on the UTAUT2 framework. Their work highlighted the relevance of additional constructs, such as hedonic motivation and habit, for explaining AI adoption in university settings and emphasized the need to extend traditional technology acceptance models to emerging AI applications. However, as a conceptual study, it did not include empirical data to validate the proposed relationships. Consequently, further quantitative research is required to examine the applicability of these theoretical assumptions in different educational contexts, including secondary science education.

Although these studies consistently support the explanatory value of the UTAUT framework, they differ in terms of educational level, disciplinary context, and the specific AI technologies investigated, making direct generalization of their findings difficult.

Collectively, these studies demonstrate the robustness and relevance of the UTAUT framework for explaining AI acceptance across diverse educational settings. Nevertheless, they also reveal that empirical evidence remains concentrated in higher education and that secondary school students, particularly in science learning contexts, remain insufficiently investigated. These observations justify the adoption of the UTAUT model as the analytical framework for the present study.

Despite the growing body of research on AI acceptance in education, three important gaps remain. First, most empirical studies have been conducted in higher education, while secondary school students remain largely underrepresented. Second, previous research has generally examined AI acceptance in broad educational settings rather than within specific disciplinary contexts such as science learning. Third, although the UTAUT framework has demonstrated strong explanatory power, its application to AI acceptance among secondary school students remains limited. Addressing these gaps is essential for advancing current knowledge and supporting the effective pedagogical integration of AI into secondary science education.

The Research Goal: Against this backdrop, the present study examines the predictive effects of the Unified Theory of Acceptance and Use of Technology (UTAUT) constructs on secondary school students' behavioral intention to use Artificial Intelligence in science learning. By applying the UTAUT framework, the study seeks to determine the extent to which performance expectancy, effort expectancy, social influence, and facilitating conditions explain students' intention to adopt AI as a learning support tool.

Conducted with secondary school students in Morocco, this study contributes to the growing body of empirical research on AI acceptance by providing evidence from a context that remains underrepresented in the existing literature.

2. THE THEORETICAL BACKGROUNDS

2.1. The UTAUT Model

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. [15], synthesizes eight earlier models, including the Technology Acceptance Model (TAM) [16], the Theory of Planned Behavior (TPB), and the Diffusion of Innovation Theory. It seeks to explain behavioral intention to adopt a technology and its actual use through four main determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions [17], [18].

Performance Expectancy: Performance expectancy refers to the belief that using a technology will improve an individual's performance, effectiveness, or achievement. In educational settings, this dimension corresponds to perceptions of the pedagogical usefulness of digital tools and is closely related to the concept of *perceived usefulness* in the TAM framework [16]. Several studies have shown that performance expectancy is one of the strongest predictors of the intention to use educational technologies, including AI [14], [19], [20].

Effort Expectancy: Effort expectancy refers to the perceived ease of using a technology, including its accessibility, usability, and simplicity of functionality. In educational environments, this dimension is often associated with users' digital competencies and the user-friendliness of technological tools [21]. However, recent studies suggest that among learners who are familiar with digital technologies, effort expectancy plays a less significant role than perceived usefulness [7].

Social Influence: Social influence refers to individuals' perceptions of the importance that significant others (teachers, peers, or institutions) place on the use of a particular technology. In school settings, several studies emphasize the key role of teachers and the pedagogical environment in the acceptance of educational technologies [21], [22]. In the case of AI, institutional support and pedagogical endorsement appear to be important mechanisms for legitimizing its use [5], [6].

Facilitating Conditions: Facilitating conditions encompass the technical, organizational, and pedagogical resources that enable the effective use of a technology, such as access to equipment, Internet connectivity, technical support, and training opportunities. Several studies indicate that this dimension is particularly critical in educational contexts characterized by infrastructure inequalities [1], [2]. However, its effect on usage intention may vary depending on the context and user characteristics [23].

An extension of the model, UTAUT2, was later proposed by Venkatesh et al., incorporating additional constructs such as hedonic motivation, price value, and habit. Several recent studies have confirmed the relevance of these extensions for analyzing AI adoption in educational contexts [14], [19], [24]. In the present study, the focus is placed primarily on the core dimensions of the UTAUT model, which are considered particularly relevant for analyzing AI acceptance among secondary school students.

2.2. Hypothesis development

Based on the UTAUT model and previous research on the acceptance of educational technologies, four research hypotheses were formulated to examine the factors likely to influence students' intention to use Artificial Intelligence in science learning.

H1: Performance expectancy (PE) positively influences the behavioral intention to use Artificial Intelligence in science learning.

H2: Effort expectancy (EE) positively influences the behavioral intention to use Artificial Intelligence in science learning.

H3: Social influence (SI) positively influences the behavioral intention to use Artificial Intelligence in science learning.

H4: Facilitating conditions (FC) positively influence the behavioral intention to use Artificial Intelligence in science learning.

3. METHODOLOGY

3.1. Research approach

The present study adopts a quantitative, descriptive, and explanatory research approach to identify the main factors influencing secondary school students' acceptance of Artificial Intelligence (AI) in science learning. This approach is based on the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh [15], a widely used framework for analyzing technology acceptance and adoption.

The objective is to examine the extent to which the different dimensions of the UTAUT model are associated with students' intention to use AI in their learning activities. This approach provides a comprehensive understanding of learners' perceptions and helps identify the factors that facilitate or hinder their intention to use these tools in educational settings.

3.2. Questionnaire developement

Data were collected using a questionnaire developed based on the UTAUT model. The questionnaire items were adapted to the context of science learning and to the use of Artificial Intelligence among secondary school students.

The questionnaire consisted of two main sections. The first section collected sociodemographic information related to age, gender, educational level, and type of school attended. The second section focused on the dimensions of the UTAUT model and included items measured using a five-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree").

The questionnaire was adapted from previously validated UTAUT measurement scales reported in the literature. Since the constructs had already been psychometrically validated, the expert review was not intended to re-establish content validity but to assess the relevance, clarity, and contextual appropriateness of the adapted items for the present study. For this purpose, the questionnaire was reviewed by two experts in education and educational technologies, whose feedback resulted in minor revisions to the wording of several items.

A pilot test was subsequently conducted with 20 secondary school students to verify the clarity and comprehensibility of the questionnaire. The observations collected led to minor wording refinements before the final version was administered.

3.3. Population and sample

The survey was administered to a sample of 207 students from four secondary schools under the ANFA Provincial Directorate (Casablanca). Participants were drawn from both public and private schools and represented different secondary education levels, allowing for the collection of diverse student profiles.

The selection of schools and participants was based on purposive sampling, targeting educational contexts with a minimum level of digital infrastructure and where teachers demonstrated an interest in educational technologies.

3.4. Data collection procedure

The questionnaire was administered online using Google Forms and distributed to students through their science teachers via digital communication channels commonly used in school settings, particularly WhatsApp.

Participation in the study was voluntary. Participants were informed about the objectives of the research as well as the anonymous and confidential nature of the data collected. No personally identifiable information was gathered.

3.5. Data processing and analysis

The data were processed and analyzed using RStudio software. First, descriptive statistics were computed to characterize the sample and provide an overview of students' perceptions regarding the different dimensions of the UTAUT model.

Second, the internal consistency of the various scales was assessed using Cronbach's alpha coefficient. Correlation analyses were then performed to examine the relationships among the model constructs.

Finally, a multiple linear regression analysis was conducted to identify the factors that could predict students' behavioral intention to use Artificial Intelligence in science learning. The statistical significance threshold for all analyses was set at $p < 0.05$. The absence of multicollinearity among the independent variables was also verified using the Variance Inflation Factor (VIF).

3.6. Ethical considerations

This study was conducted in accordance with ethical principles applicable to educational research. Participants were informed of the objectives of the study and participated freely and voluntarily.

The survey relied exclusively on the anonymous collection of opinions and perceptions. Data confidentiality, participant anonymity, and the right to withdraw from the study were guaranteed throughout the research process.

4. RESULTS:

This section presents the results of the data analysis conducted with students regarding the acceptance of Artificial Intelligence in science learning. The findings are organized according to the dimensions of the UTAUT model and include descriptive analyses, correlation analyses, and multiple linear regression.

4.1. Sociodemographic characteristics of the participants

Before examining students' perceptions of the use of Artificial Intelligence in science learning, it is useful to present the main characteristics of the study sample. Table 1 summarizes the distribution of participants according to age, gender, educational level, and type of school attended.

Table 1

Sociodemographic Characteristics of Participants (N = 207)

Variable	Category	n	%
Age	Under 15 years	28	13.5
	Between 15 and 17 years	160	77.3

	18 years and older	19	9.2
Gender	Female	122	59.2
	Male	84	40.8
Educational Level	Middle School	35	16.9
	High School	172	83.1
School Type	Public	105	50.7
	Private	102	49.3

As shown in Table 1, the majority of participants were between 15 and 17 years old (77.3%). Female students accounted for 59.2% of the sample, compared with 40.8% male students. High school students represented the largest proportion of respondents (83.1%), whereas middle school students accounted for 16.9% of the sample. Finally, the distribution according to school type was relatively balanced, with 50.7% of students attending public schools and 49.3% attending private schools.

4.2. Reliability and descriptive statistics of the constructs

To assess the quality of the measurement instruments used in this study, an internal consistency analysis was conducted for the different dimensions of the UTAUT model. Means and standard deviations were also calculated to describe students' perceptions of each construct. The results are presented in Table 2.

Table 2

Reliability and Descriptive Statistics of the Constructs

Construct	Number of Items	Cronbach's α	Mean	Standard Deviation
Performance Expectancy (PE)	3	0.74	3.25	1.13
Effort Expectancy (EE)	2	0.76	3.66	1.10
Social Influence (SI)	2	0.83	3.73	1.13
Facilitating Conditions (FC)	3	0.84	2.38	1.22
Behavioral Intention (BI)	2	0.90	3.85	1.22

The results presented in Table 2 indicate satisfactory levels of internal consistency for all the dimensions examined. Cronbach's alpha coefficients range from 0.74 to 0.90, exceeding the commonly recommended threshold of 0.70 for research in education. Regarding the descriptive statistics, behavioral intention ($M = 3.85$, $SD = 1.22$) and social influence ($M = 3.73$, $SD = 1.13$) obtained the highest mean scores. In contrast, facilitating conditions showed the lowest mean score ($M = 2.38$, $SD = 1.22$).

From a pedagogical perspective, these descriptive results suggest that students generally express a positive intention to use AI in science learning despite perceiving limited facilitating conditions. This indicates that students may already recognize the educational value of AI, even when institutional or technological support remains insufficient. Such findings highlight the importance of strengthening access to digital resources and providing appropriate educational support to facilitate the effective integration of AI into science learning.

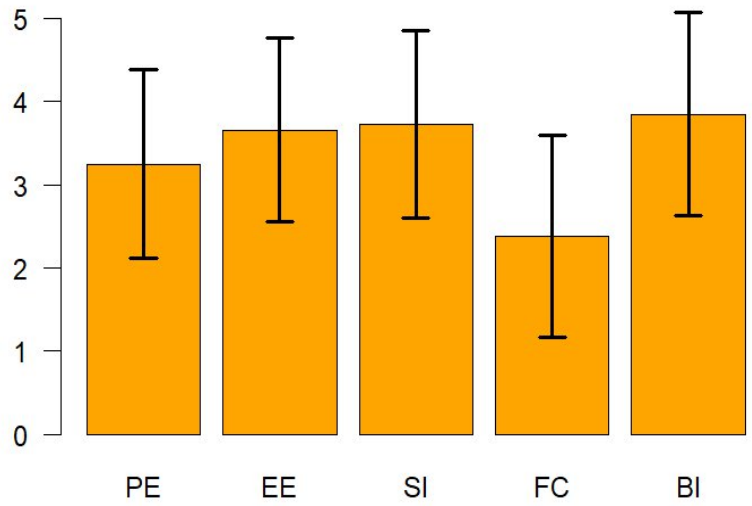

Figure 1. Descriptive Statistics of the UTAUT Model Dimensions (Mean ± Standard Deviation)

4.3. Correlations Among the UTAUT Model Dimensions

To explore the relationships among the different dimensions of the UTAUT model, a Spearman correlation analysis was conducted. This analysis makes it possible to assess both the strength and direction of the associations between the constructs under investigation. The results are presented in Table 3.

Table 3

Spearman Correlation Matrix of the Constructs

Variable	PE	EE	SI	FC	BI
PE	1.000				
EE	0.481	1.000			
SI	0.309	0.336	1.000		
FC	0.226	0.301	0.215	1.000	
BI	0.435	0.289	0.236	0.168	1.000

All correlation coefficients were positive, with observed values ranging from 0.168 to 0.481. The strongest correlation was found between performance expectancy (PE) and effort expectancy (EE) (r = 0.481). Regarding behavioral intention (BI), the correlation coefficients were 0.435 with performance expectancy (PE), 0.289 with effort expectancy (EE), 0.236 with social influence (SI), and 0.168 with facilitating conditions (FC).

From a pedagogical perspective, these correlations indicate that students who perceive AI as useful also tend to perceive it as easier to use and express a stronger intention to adopt it. This suggests that enhancing students' perceptions of the educational benefits of AI may simultaneously reinforce several determinants of technology acceptance, thereby facilitating its integration into science learning activities.

4.4. Effects of the UTAUT Model Dimensions on the Intention to Use AI

To examine the influence of the different dimensions of the UTAUT model on the behavioral intention to use Artificial Intelligence in science learning, a multiple linear regression analysis was conducted. Behavioral intention (BI) was considered the dependent variable, while performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) were included as explanatory variables. The results of the analysis are presented in Table 4.

Table 4

Results of the Multiple Linear Regression Analysis

Variable	B Coefficient	Standard Error	t	p
Constant	1.832	0.336	5.456	< 0.001
PE	0.366	0.080	4.564	< 0.001
EE	0.098	0.084	1.178	0.240
SI	0.074	0.073	1.027	0.306
FC	0.082	0.068	1.210	0.228

R^2 = 0.204; Adjusted R^2 = 0.189; F(4,202) = 12.96; p < 0.001

The results of the multiple linear regression analysis are presented in Table 4. The resulting model explains 20.4% of the variance in students' behavioral intention to use AI (R^2 = 0.204). The overall model is statistically significant ($F(4,202) = 12.96$; $p < 0.001$).

The coefficient associated with performance expectancy (PE) is positive and statistically significant ($B = 0.366$; $p < 0.001$). In contrast, the coefficients associated with effort expectancy (EE), social influence (SI), and facilitating conditions (FC) are not statistically significant at the 5% significance level.

From a pedagogical perspective, these findings indicate that students' intention to use AI is driven primarily by their perception of its educational usefulness rather than by its ease of use or external influences. This suggests that demonstrating the educational value of AI within science learning activities may play a key role in encouraging its acceptance among secondary school students.

Figure 2 provides a graphical summary of the final regression model and highlights the observed relationships between the different dimensions of the UTAUT model and behavioral intention.

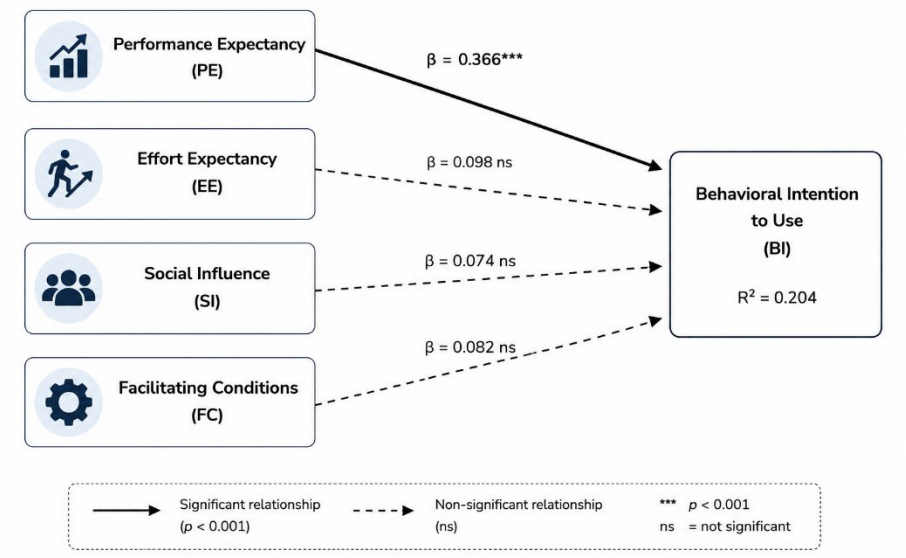

Figure 2. Final model predicting the intention to use Artificial Intelligence based on the UTAUT framework.

4.5. Assessment of Multicollinearity

To verify the absence of multicollinearity among the explanatory variables included in the regression model, Variance Inflation Factors (VIFs) were calculated. The results are presented in Table 5.

Table 5

Variance Inflation Factors (VIFs)

Variable	VIF
PE	1.40
EE	1.45
SI	1.14
FC	1.15

The observed VIF values range from 1.14 to 1.45. These results indicate low levels of collinearity among the explanatory variables included in the model. Consequently, multicollinearity does not appear to be a concern and is unlikely to affect the validity of the regression estimates.

The low multicollinearity observed among the explanatory variables also strengthens confidence in the interpretation of the regression results, suggesting that each UTAUT construct contributes independently to explaining students' behavioral intention.

5. Discussion of findings:

The findings of this study provide a better understanding of the factors influencing secondary school students' acceptance of Artificial Intelligence in science learning. Overall, the analyses indicate that students hold generally favorable attitudes toward these technologies. However, the different factors examined do not contribute equally to explaining their intention to use them.

The regression results allow for the examination of the hypotheses derived from the UTAUT model. Hypothesis H1, which proposed a positive effect of performance expectancy on the intention to use AI, is supported. In contrast, hypotheses H2, H3, and H4, relating respectively to the effects of effort expectancy, social influence, and facilitating conditions on behavioral intention, are not supported by the data.

One of the main findings of this study is the predominant role of performance expectancy. Among the dimensions of the UTAUT model, it is the only factor that exerts a significant influence on the intention to use AI. In other words, students are more willing to use these tools when they believe that they can genuinely help them better understand scientific concepts, complete academic tasks more effectively, or improve their academic performance. This finding is consistent with the seminal work of Venkatesh [15] and Davis [16], both of whom emphasized the importance of perceived usefulness in technology adoption. It also aligns with several recent studies on Artificial Intelligence in education, which indicate that learners are more likely to adopt these tools when they perceive clear benefits for their learning.

In the specific context of science learning, this result appears particularly relevant. AI tools currently offer numerous possibilities, including providing additional explanations, reformulating complex content, supporting problem-solving activities, and assisting students in their learning processes. When these contributions are perceived as useful, they naturally strengthen students' willingness to integrate such technologies into their academic work.

By contrast, effort expectancy does not appear to be a determining factor in the present study. Although students generally perceive AI tools as relatively easy to use, this perception does not seem to directly influence their intention to use them. One possible explanation lies in young people's growing familiarity with digital technologies. For many students, using digital applications and platforms has become part of everyday life. In this context, ease of use tends to be viewed as an expected characteristic rather than a decisive factor. Students therefore

appear to be more concerned with the benefits that a tool can provide than with the effort required to use it.

Social influence also does not have a significant effect on the intention to use AI. This finding may appear surprising, given that several studies have emphasized the role of teachers, peers, and the school environment in the adoption of educational technologies. However, it is possible that the use of Artificial Intelligence is now largely initiated by students themselves, outside formal educational settings. Many students discover these tools through social media, the Internet, or their own personal experiences. Under these circumstances, the decision to use AI may be driven more by individual initiative than by external social influence.

Facilitating conditions also represent an interesting finding. Although they exhibit the lowest mean score among the dimensions studied, they do not appear to directly influence usage intention. This suggests that students remain willing to use AI even when ideal technical conditions are not always available. Nevertheless, the relatively low mean score highlights certain limitations related to access to digital devices, Internet connectivity, and available technological resources. While these constraints do not necessarily reduce students' intention to use AI, they may hinder more frequent and in-depth use of these tools.

The findings provide several important insights for the integration of Artificial Intelligence into science learning. In particular, they demonstrate that students place considerable importance on the educational value of these technologies. Consequently, initiatives aimed at promoting AI in schools should place greater emphasis on its practical applications in learning situations. The goal should not merely be to familiarize students with these tools, but rather to demonstrate how they can support the understanding of scientific phenomena, foster learner autonomy, and enrich inquiry-based learning processes.

This study nevertheless presents certain limitations. The sample consists of students from a limited number of schools located within the same region, which calls for caution when generalizing the findings. In addition, the data are based on participants' self-reported perceptions and do not allow for the direct observation of their actual use of Artificial Intelligence. Future research could extend the investigation to other educational contexts, employ mixed-method approaches, or examine the actual impact of AI on science learning outcomes.

Overall, the findings suggest that students' acceptance of Artificial Intelligence depends primarily on their perceptions of its usefulness. The more learners believe that these tools can help them learn, understand, and succeed, the stronger their intention to use them becomes. This observation reinforces the importance of developing meaningful and contextually relevant pedagogical applications in order to support the sustainable integration of Artificial Intelligence into science learning.

6. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

Artificial Intelligence is becoming an increasingly important component of contemporary educational environments and offers significant opportunities to enrich science learning. Against this backdrop, this study examined the factors influencing secondary school students' behavioral intention to use AI in science learning through the Unified Theory of Acceptance and Use of Technology (UTAUT). By focusing on a population that remains relatively underrepresented in the literature, the study contributes to a better understanding of the mechanisms underlying AI acceptance at the secondary education level.

The findings indicate that students generally exhibit favorable attitudes toward the use of AI in science learning. More importantly, the results demonstrate that performance expectancy is the primary determinant of students' behavioral intention to adopt AI, whereas effort expectancy, social influence, and facilitating conditions do not significantly influence their

intention in the context investigated. These findings suggest that students are primarily motivated to use AI when they perceive it as capable of improving their learning, supporting their understanding of scientific concepts, and enhancing their academic performance.

From a theoretical perspective, this study extends previous UTAUT-based research by providing empirical evidence from secondary science education, a context that has received comparatively limited attention in studies on AI acceptance. The results confirm the continued relevance of the UTAUT framework for explaining students' behavioral intention while highlighting that the relative importance of its constructs may vary according to the educational level and disciplinary context. Beyond its empirical findings, this study contributes to the growing body of knowledge on AI acceptance by strengthening current understanding of the factors that shape students' willingness to adopt AI in science learning.

From a practical perspective, the findings emphasize that the successful integration of AI into science education depends less on the technological sophistication of AI tools than on students' perceptions of their educational value. Consequently, educational stakeholders should prioritize pedagogical approaches that explicitly demonstrate how AI can facilitate conceptual understanding, support inquiry-based learning, foster learner autonomy, and improve learning outcomes. These findings may assist teachers, curriculum designers, and educational decision-makers in developing AI-supported learning environments that respond more effectively to students' educational needs.

Despite these contributions, this study has several limitations. The findings are based on a relatively limited sample drawn from a specific educational context and rely on students' self-reported perceptions rather than observations of their actual use of AI. Consequently, the results should be interpreted with appropriate caution and cannot be generalized to all educational contexts.

Future research should extend this work by investigating more diverse educational settings and larger student populations. Comparative studies across educational levels, disciplines, and cultural contexts would provide a deeper understanding of the contextual factors influencing AI acceptance. Furthermore, future research should move beyond behavioral intention by examining students' actual use of AI and evaluating its impact on learning processes, scientific reasoning, and academic achievement. Such investigations would contribute to the development of evidence-based strategies for the pedagogically meaningful and sustainable integration of Artificial Intelligence into science education.

DECLARATION ON THE USE OF ARTIFICIAL INTELLIGENCE

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the preparation, submission, and publication of this article.

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ПРИЙНЯТТЯ УЧНЯМИ СЕРЕДНІХ ШКІЛ ШТУЧНОГО ІНТЕЛЕКТУ У ПРОЦЕСІ ВИВЧЕННЯ ПРИРОДНИЧИХ НАУК

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Анотація. Штучний інтелект (ШІ) дедалі більше трансформує освітні практики та відкриває перспективні можливості для покращення навчання природничих дисциплін завдяки персоналізованій підтримці, адаптивному зворотному зв’язку та доступу до різноманітних навчальних ресурсів. Хоча штучний інтелект дедалі ширше інтегрується в освітнє середовище, емпіричні дані щодо факторів, що впливають на його сприйняття серед учнів середніх шкіл, зокрема у процесі вивчення природничих дисциплін, залишаються обмеженими. У цьому дослідженні вивчаються прогностичні ефекти конструктів Об’єднаної теорії прийняття та використання технологій (UTAUT) на поведінкові наміри учнів середніх шкіл щодо використання ШІ у вивченні природничих наук.

Було проведено поперечне кількісне опитування серед 207 учнів середніх шкіл – як державних, так і приватних – у Касабланці, Марокко. Дані збирались за допомогою структурованого опитувальника, що вимірював основні конструкти моделі UTAUT: очікування ефективності, очікування зусиль, соціальний вплив, сприятливі умови та поведінковий намір. Аналіз даних здійснювався за допомогою описової статистики, кореляційного аналізу Спірмена та множинної лінійної регресії.

Результати свідчать про те, що учні загалом мають позитивне ставлення до штучного інтелекту (ШІ) у процесі вивчення природничих наук. Регресійний аналіз показав, що очікування щодо результатів було єдиним значущим предиктором поведінкового наміру ($\beta = 0{,}366$, $p < 0{,}001$), тоді як очікування щодо зусиль, соціальний вплив та сприятливі умови не продемонстрували статистично значущого впливу. Запропонована модель пояснювала 20,4 % дисперсії поведінкового наміру учнів ($R^2 = 0{,}204$).

Ці результати свідчать про те, що прийняття штучного інтелекту учнями залежить насамперед від їхнього сприйняття його освітньої корисності, а не від простоти використання, соціального тиску чи сприятливих умов. Дослідження розширює сучасні знання щодо прийняття штучного інтелекту в природничій освіті середньої школи, надаючи емпіричні дані з марокканського контексту, та пропонує практичні рекомендації щодо розробки педагогічно значущих середовищ навчання природничих дисциплін з використанням штучного інтелекту.

Ключові слова: штучний інтелект; навчання природничих дисциплін; UTAUT; прийняття технологій; учні середньої школи

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