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Employing Generative AI Applications in Learning: A Factor Analysis of Motivations and Effects among Moroccan University Students

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ABSTRACT

This study seeks to understand the nature of the use of generative artificial intelligence (GenAI) applications among Moroccan university students, by investigating the motivations for use and the effects of this use, by adopting the structural equation modeling technique using the partial least squares method (PLS-SEM) using the SmartPLS version 4 program, to analyze the study data

collected through a scale prepared for this study and applied to a random sample of (206) male and female students from different Moroccan universities. After verifying the reliability of the proposed model, the study reached a set of results: Study pressure is the main motivation for using generative artificial intelligence applications among students, while the effect of time pressure and the search for quality and rewards was less significant. In terms of effects, the study indicated that the use of applications contributes to improving academic performance, but it also leads to an increase in the tendency towards procrastination and poor ability to remember when used excessively. The study provides an explanatory model for the motivations and effects of using GenAI and recommendations to promote application users' responsible and ethical use of AI in higher education.

Keywords: Academic performance, Generative AI, Higher Education, memory impairment, procrastination, quality quest, reward quest, study pressure, time pressure.

INTRODUCTION

Recent years have witnessed significant developments in generative artificial intelligence (GenAI) applications, which have become a pivotal part of various aspects of life, especially in the educational field; applications such as ChatGPT have become the focus of researchers and academics due to their great potential in supporting education and learning (Dalalah & Dalalah, 2023; Khoumich & Nadif, 2026; Meyer et al., 2023). These applications are increasingly used as tools to improve self-learning and help students deal with academic pressures, but this increasing adoption raises questions about their effects on academic performance and learning behaviors (Yilmaz & Yilmaz, 2023).

This research falls within a specific context that focuses on the Moroccan university environment; which is witnessing increasing challenges in keeping pace with technological developments and dealing with growing academic pressures. With Morocco ranking second with 38% in the Visual Capitalist Network report (2024, August 18) on the use of ChatGPT, it should not be viewed with great optimism, especially since the features of this use are concentrated in younger age groups, and in the field of education and academic activities more, which raises the following question: Will this use, according to these features and in light of the decline in the evaluation of the educational system, and the decline in the values of integrity, honesty and truthfulness, have positive repercussions, or is the matter completely settled due to the hypothesis of unethical use leading to the destruction of the credibility of academic certificates and the growth of cheating and the decline in the principles of merit and equal opportunities in competitions and professional selection? If there are real dangers that are now becoming apparent,

and they are steadily growing, related to the destruction of all ethical standards and values in educational and university circles, and despite the increasing academic interest in analyzing the uses of generative artificial intelligence in education, there are clear gaps in the research conducted on this topic. On the one hand, we find a lack of experimental studies. Indeed, most of the studies conducted on the subject rely on descriptive or theoretical discussions with a significant absence of experimental studies that provide field evidence to support or refute these ideas, and most of the Arab research conducted on the subject focuses on the legal or ethical dimensions (Zemrani, 2024), and therefore the accurate understanding of students' motivations for using these applications and their effects on their academic or personal behavior is still limited. Hence, the importance of this research emerges in bridging the knowledge gap related to understanding the main motivations for students to use generative artificial intelligence applications and their positive and negative effects. This is done through a comprehensive analysis using the structural equation modeling methodology (PLS-SEM), with the aim of providing a scientific basis to guide the use of generative artificial intelligence techniques towards achieving positive and sustainable educational goals. Accordingly, the problem of the study is as follows: What are the motivations for university students to use generative artificial intelligence applications? What are the effects of that use?

LITERATURE REVIEW

Recent years have witnessed a significant increase in published studies on the use of generative artificial intelligence applications in education, reflecting researchers' interest in the motives and effects associated with this use. In this section, we review a group of studies that addressed this topic from different angles, focusing on the factors affecting the acceptance and use of these technologies, and their impact on students' learning and academic performance.

Faruk et al. (2023) conducted a study to analyze the psychological and technical factors that affect students' acceptance and use of ChatGPT. Using structural equation modeling (SEM), the study found that perceived usefulness and openness to new experiences positively affected the intention to use ChatGPT. In contrast, negative psychological factors such as neuroticism showed an opposite effect, indicating the importance of psychological readiness in adopting new technologies.

In a longitudinal study, Abbas, et al. (2024) explored the relationship between academic stress and motivation to use ChatGPT among university students. The results showed that students facing high time and academic pressures are more likely to use these applications to alleviate those pressures. However, the study indicated that such use may lead to increased procrastination and loss of comprehension, which negatively impacts academic performance.

Strzelecki and ElArabawy (2024) also presented a comparative analysis of the effect of gender and level of education on the acceptance and use of AI applications among higher education students in Poland and Egypt. Using a questionnaire as a data collection tool, the study found that there were significant differences in acceptance and use levels based on gender and level of education, and recommended the need to develop educational strategies that take these differences into account to promote effective adoption of technology. Saito (2024) also analyzed trends in the use of generative AI in Japanese technical universities, focusing on student characteristics and attributes. The study, which relied on a quantitative approach, showed that students widely use these technologies to personalize educational materials and enhance self-learning. However, participants expressed concerns about the reliability of information and ethical issues associated with their use.

Wecks et al. (2024) studied the relationship between the use of generative AI and students' academic performance. The quantitative analysis, showed that students who rely heavily on these applications scored lower than their peers who do not use them. The study indicated that over-reliance on technology may hinder the development of basic skills and deep knowledge.

In a similar vein, Masa'deh et al. (2024) studied the factors that influence Jordanian students' intention to use ChatGPT. Using a structural equation model, the study found that perceived usefulness, time pressure, and study pressure are the most prominent factors that drive students to adopt this technology. In contrast, perceived enjoyment had little effect on intention to use, suggesting that practical motivations outweigh recreational motivations.

These studies suggest that the use of generative AI applications in higher education has become an increasingly important reality, driven by practical motivations such as alleviating academic stress and increasing learning efficiency. However, this use is accompanied by challenges related to over-reliance on technology, ethical issues, and its potential impact on academic performance.

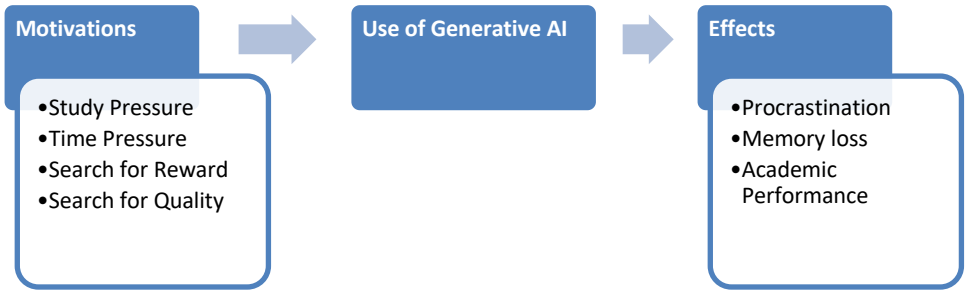
Previous studies also indicate that the main motivations for using generative AI applications among students include time pressure (Masa'deh et al., 2024; Amani et al., 2023), study pressure (Deric et al., 2024), the pursuit of recognition and reward (Abbas & Khan, 2024), and the search for quality and mastery in academic work (Chan & Hu, 2023; Nadif & Bidari, 2023; Rkiki et al., 2025; Wecks et al., 2024). These motivations reflect students' desire to improve academic performance and save time and effort in completing academic tasks.

On the other hand, these tools have raised concerns about their potential effects on academic behavior. Studies suggest that the use of generative AI can lead to procrastination (Abbas & Khan, 2024), poor recall (Wecks et al., 2024), and overall lower academic performance (Denkin, 2024). Furthermore, tools such as ChatGPT have raised concerns about issues of ethics and academic integrity, as they can contribute to increased cases of academic cheating (Smolansky et al.,

2023). These findings reflect a discrepancy in how professors and students accept these applications: while some professors see them as a promising educational tool, others express concerns about overreliance on these tools and their negative impact on students' critical thinking development (Styve et al., 2024). Based on previous studies on the use of generative artificial intelligence (GenAI) applications among students, a set of observations can be made: First, most previous studies, from a geographical perspective, included universities in regions such as Europe, North America, and Asia, indicating a lack of Arab studies.

Based on the review of previous studies, a theoretical framework for the study can be proposed, consisting of four possible motives for students to use generative artificial intelligence applications in university education, and three possible effects of this use. It is as follows:

Figure 1. The theoretical model of the study: Motives for using artificial intelligence applications and their effects



Accordingly, the main hypotheses of the study that we seek to verify about the real motives and effects of using generative artificial intelligence applications (GenAI) among Moroccan university students can be identified as follows:

Hypothesis 1: There is a positive relationship between time pressure and the use of artificial intelligence applications by students.
Hypothesis 2: There is a positive relationship between study pressure and the use of artificial intelligence applications.
Hypothesis 3: There is a positive relationship between the search for rewards and the use of artificial intelligence applications.
Hypothesis 4: There is a positive relationship between the search for quality and the use of artificial intelligence applications.
Hypothesis 5: The use of artificial intelligence applications leads to increased procrastination and stalling among students.
Hypothesis 6: Excessive use of AI applications leads to poor memory of students.

Hypothesis 7: There is a positive relationship between the use of AI applications and students' academic performance.

RESEARCH METHOD

In this study, we will use Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze the relationships between the use of generative AI applications and several behavioral and academic variables among Moroccan university students. Data were collected through a questionnaire designed to measure the extent to which students use these technologies, as well as their impact on academic performance, procrastination, poor memory, the search for quality and rewards, and levels of time and study pressure.

The questionnaire was developed based on previous literature and its validity was evaluated through a preliminary pilot test. After assessing validity and reliability, the questionnaire was distributed to Moroccan students pursuing their studies in one of the higher education branches, and 206 responses were collected through simple random sampling.

While the collected data were analyzed using SmartPLS 4, a specialized tool that provides accurate estimates for models containing multiple variables and complex paths. The obtained model was evaluated based on several criteria, including path coefficients, R^2 values, validity, and reliability, to ensure the accuracy and reliability of the results. The choice of structural equation modeling using the partial least squares method (PLS-SEM) instead of using the CB-SEM technique for this study is based on specific justifications that suit the nature of the data and the objectives of the study; since the PLS-SEM technique is used for the purpose of exploring a completely new topic or one that is under study, then because this approach is characterized by high flexibility in its application to small samples, and data that do not follow the normal distribution, which is completely appropriate for the case of the data obtained in this study, in addition to its ability to predict the dependent variables, and identify the most important and influential paths in the theoretical model (Hair et al., 2017).

Participants

Table 1. Distribution of study participants by gender and age group

		Repetition	Percentage
Gender	Male	87	42.2%
	Female	119	57.8%
Age Category	18-25	132	64.1%
	26-35	45	21.8%
	36-50	21	10.2%
	51-70	8	3.9%
	Total	206	100.0%

Table 1 shows the distribution of study participants by gender, as 206 male and female students from various Moroccan universities participated in the survey. Of these, (42.2%) were males, compared to 57.8% females. The table also shows the distribution of age groups among study participants, with most aged 18-25 (64.1% of the total sample), reflecting the study's focus on university students in the early stages of their academic careers. The next age group, ages 26 to 35, accounted for 21.8%, indicating significant participation among graduate students. The older age groups (36-50 and 51-70) showed less representation, at 10.2% and 3.9% respectively, which may indicate a decrease in interest or need to use artificial intelligence applications among these groups in the university context.

The study tool was prepared in the form of a questionnaire consisting of 31 paragraphs, measuring different levels of use of generative AI applications in education, in addition to influential factors such as time pressure, study pressure, search for rewards and quality, procrastination, poor memory, and academic performance. The preparation of the scale was based on a review of previous studies, and the selection of its paragraphs from variables that were tested and documented in those studies, in order to ensure validity and reliability in measuring variables related to the use of GenAI among students. The following table summarizes the study variables adopted to understand the use of artificial intelligence applications in the university space among students in the Moroccan environment, attached with the number of paragraphs allocated to it in the study tool.

Table 2. Study variables and description of each variable, number of items in the scale

Variable Type	Variable	Description	Items
Mediating Variable	Use of Generative AI (UGAI)	The extent to which students use generative AI applications, such as ChatGPT, in their academic activities	7
Independent Variables	Time Pressure (TP)	The pressure students feel to complete academic and study tasks within a limited time frame	4
	Study Pressure (SP)	The number of required assignments and coursework that students must complete	4
	Search for Reward (SR)	The extent to which students are interested in getting high grades or other academic rewards	3
	Search for Quality (SQ)	The extent to which students care about the quality and mastery of academic work	3
Dependent Variables	Procrastination (Pr)	Students procrastinating on completing academic assignments due to reliance on AI applications	4
	Memory loss (ML)	The effect of excessive use of GenAI on information retention and recall	3
	Academic Performance (AP)	Students' academic performance and getting good results in tests	3

The use of artificial intelligence among students is analyzed by examining a set of dependent, independent, and mediating variables that may contribute to understanding students' motivations and the effects of using artificial intelligence applications in their academic activities. By collecting and analyzing these variables, through functional paragraphs, the study seeks to provide an in-depth understanding of the factors that motivate students to use artificial intelligence, in addition to the effects that may result from this use, whether positive or negative.

RESULTS

After conducting the (PLS-SEM) test within the (SMART-PLS V4) program environment, the results obtained will be displayed based on the guidelines of (Hair & Ringle, 2019). By dividing the results into two main axes: The first axis; will be dedicated to displaying the standard model to ensure the homogeneity and stability of the tools used in measuring the variables, as well as evaluating the effectiveness of the variables in representing the concepts they were designed to measure, in addition to examining the model's ability to distinguish between different variables. The second axis; will be dedicated to displaying the structural model in order to test the hypotheses, analyze the paths between the independent, mediating, and dependent variables, in addition to analyzing the explanatory power of the model.

Table 3 shows the results of the stability and reliability of the original and modified models, by looking at the values of Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). The outer loadings were also evaluated for each item of the scale. At the GenAI application usage axis level, the Cronbach's alpha and composite reliability values of the original model were high (0.869 and 0.882, respectively), indicating good internal consistency. However, the average quoted variance was less than 0.6 (0.557), which means that the model may have problems distinguishing between variables. In the modified model, the AVE value improved to 0.609, which is a significant improvement. This indicates that the modifications have resulted in a model that is more reliable and discriminates between items. At the level of the study stress axis, the Cronbach's alpha and composite reliability values were very high in both models (above 0.88), indicating a high degree of internal consistency. The AVE value was also stable at 0.751, meaning that the variable retains a large portion of the total variance in the data.

As for the time pressure axis in the original model, the Cronbach's alpha value was 0.822 and the construct reliability was 0.869, with an AVE value of 0.653, indicating acceptable reliability. While the AVE value improved to 0.756 in the modified model, which enhances the distinctiveness of the variable, despite a slight decrease in the Cronbach's alpha value (0.838).

As for the reward-seeking axis, the Cronbach's alpha values and the composite reliability of the original and modified models showed very high results (above 0.91), with an AVE value of 0.853, indicating that the variable is robust and stable over time. As for the quality-seeking axis in both models, the Cronbach’s alpha and construct reliability values were relatively low compared to the other variables, but still acceptable (around 0.80), with an AVE value of 0.720, indicating moderate internal consistency.

Table 3. Comparison of measurement properties of the original model and the modified model using reliability and validity indices

Model Dimensions	Original Model					Modified Model				
	Cronbach's alpha	CR (rho_a)	AVE	Items	Outer loadings	Cronbach's alpha	CR (rho_a)	AVE	Items	Outer loadings
Applications use GenAI	0.869	0.882	0.557	UGAI1	0.769	0.840	0.854	0.609	UGAI1	0.763
				UGAI2	0.718				UGAI2	0.722
				UGAI3	0.674				UGAI3	–
				UGAI4	0.698				UGAI4	–
				UGAI5	0.759				UGAI5	0.745
				UGAI6	0.786				UGAI6	0.825
				UGAI7	0.785				UGAI7	0.840
Study pressure	0.888	0.898	0.751	SP1	0.841	0.888	0.895	0.751	SP1	0.839
				SP2	0.791				SP2	0.796
				SP3	0.914				SP3	0.913
				SP4	0.914				SP4	0.912
Time pressure	0.822	0.869	0.653	TP1	0.868	0.838	0.863	0.756	TP1	0.900
				TP2	0.904				TP2	0.924
				TP3	0.800				TP3	0.778
				TP4	0.634				TP4	–
Seeking Reward	0.914	0.925	0.853	SR1	0.915	0.914	0.920	0.853	SR1	0.915
				SR2	0.949				SR2	0.947
				SR3	0.906				SR3	0.908
Seeking Quality	0.805	0.806	0.720	SQ1	0.853	0.805	0.807	0.720	SQ1	0.859
				SQ2	0.871				SQ2	0.876
				SQ3	0.820				SQ3	0.810
Procrastination	0.884	0.901	0.740	Pr1	0.862	0.884	0.897	0.740	Pr1	0.853
				Pr2	0.835				Pr2	0.838
				Pr3	0.880				Pr3	0.884

				Pr4	0.862				Pr4	0.866
				ML1	0.861				ML1	0.868
Weak Memory	0.863	0.867	0.785	ML2	0.913	0.863	0.863	0.785	ML2	0.907
				ML3	0.884				ML3	0.883
				AP1	0.894				AP1	0.916
Academic achievement	0.734	0.801	0.650	AP2	0.665	0.751	0.772	0.799	AP2	–
				AP3	0.842				AP3	0.872

The results of the procrastination axis also showed high reliability in both models, with Cronbach's alpha and composite reliability values exceeding 0.88, and the AVE value fixed at 0.740, indicating good internal consistency and consistency.

The poor memory axis also achieved high reliability in both models, as Cronbach's alpha and reliability values recorded (above 0.86), with an AVE value of 0.785, which enhances the reliability of the variable and its ability to accurately measure the impact.

Finally, the academic performance axis in the original model recorded an average level of stability, as the Cronbach's alpha value was 0.734 and the AVE value was 0.650. As for the modified model, one of the items was excluded, which led to a slight improvement in the Cronbach's alpha value (0.751) and a significant increase in the AVE value (0.799), which enhances the model's ability to distinguish between items.

Based on the above, it can be said that the modifications made to the model have led to clear improvements in the stability and reliability of some variables, especially in the use of GenAI applications, time pressure, and academic performance. The model's ability to distinguish between variables has been improved, making it more effective in studying the relationship between the use of artificial intelligence among students and its impact on their behaviors and academic outcomes.

The results also show that all the variables latent in the model have good discriminant validity based on the Fornell and Larcker criterion, which enhances confidence in the model and indicates that the variables are independent of each other and are well distinguished. As for the results of the Multicollinearity Check, the results of the VIF analysis provide high confidence in the model, and indicate that it is free of multicollinearity problems, as all VIF values were less than 5, ranging between (1.00 and 2.11), which enhances the validity of the conclusion drawn from the structural equation modeling analysis. As for the reliability of the model or the explanatory power, the value of (R^2) indicates that about 21.4% of the variance in the use of artificial intelligence (GenAI) technologies can be explained by the independent variables included in the model, while the adjusted

value reflects that the useful explanation of this variance is very close to the initial value of 19.8%, indicating that the model has a reasonable effectiveness in explaining the use of GenAI. While the role of the effect size analysis (F2) appears important in assessing the strength of the relationships between the variables and their importance within the structural model, this analysis showed the impact of the use of generative artificial intelligence (GenAI) on academic performance and the rest of the study variables. The results show a moderate association between the use of GenAI and academic performance, with the effect size reaching 0.365, indicating a prominent role for this technology in improving academic performance. There is also a weak effect on the search for quality and the search for reward with an effect of 0.149 and 0.083 respectively, indicating slight effects on these variables, while the effects of other variables, such as academic pressure and time pressure, were absent, which recorded small effect sizes (0.050 and 0.012).

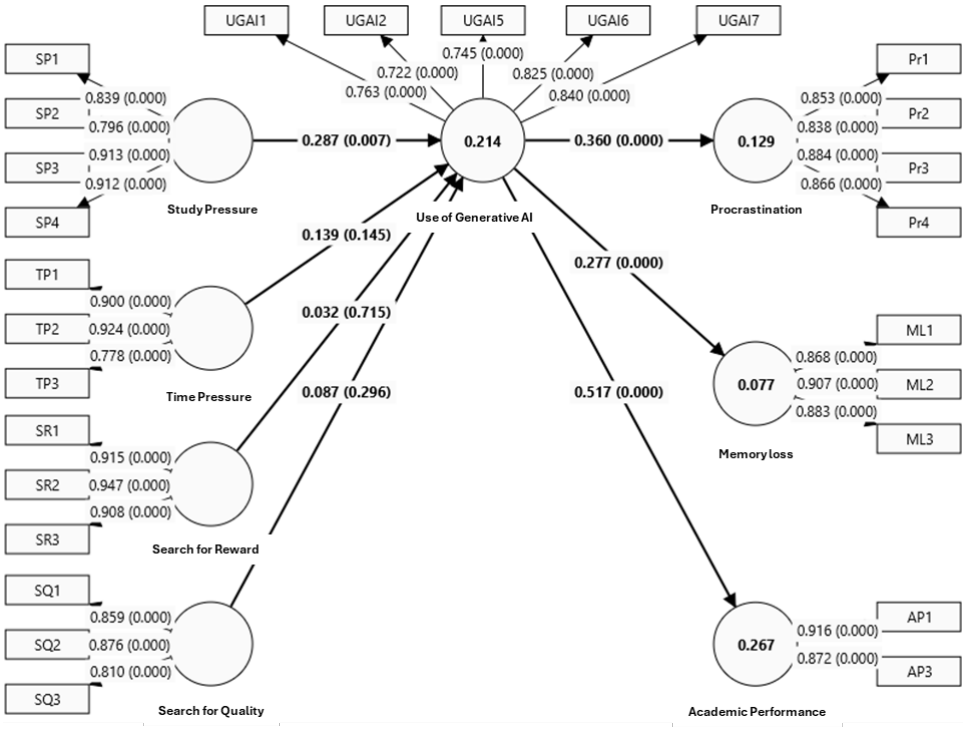
As for the results of the discriminant validity analysis using the ratio of the variance of the average of the interrelationships (HTMT), which aims to ensure that each dimension in the structural model measures a unique concept that does not overlap with the rest of the dimensions. HTMT values less than 0.85 are considered a good indicator of discriminant validity. All HTMT values for the study variables did not exceed (0.85), which enhances the discriminant validity of the proposed structural model according to (Henseler et al., 2015).

The variance inflation factor (VIF) is also an important test for determining multicollinearity between variables, and the results show that the VIF values for all study variables fall within the acceptable range (less than 5), indicating the absence of multicollinearity that would affect the reliability of the results. Based on the guidelines of Hair et al. (2019), it can be concluded that the model shows good stability in terms of multicollinearity, which allows moving on to analyzing other relationships in the model with greater confidence. Accordingly, the results presented indicate high reliability and validity of the tools used to measure the impact of using artificial intelligence applications on academic performance and other factors related to the educational process. Researchers can rely on these tools to conduct more detailed analyses of causal relationships and explore the profound effects of using artificial intelligence applications on students.

Structural Model

The study hypotheses for direct and indirect effects were tested using bootstrapping procedures on the study sample (206) using the SmartPLS program to display the structural model reached as shown in Figure 2.

Figure 2. The structural model of the relationship between the use of artificial intelligence applications and the rest of the variables



The figure above represents the structural model and shows the relationships between the use of GenAI and several dependent variables, such as academic performance, procrastination, poor memory, and study pressure. The model shows the path coefficients and R2 values for each dependent variable, and also shows the interpretive reliability values for each indicator (internal coefficients) in the circles.

Based on the guidelines of Hair et al. (2019), the figure reflects a strong explanatory model, as it shows that the use of generative AI as a factor has a positive and strong impact on academic performance, which is consistent with recent trends in research that emphasize the role of technology in supporting academic performance.

While the model records moderate relationships between the use of GenAI and both procrastination and poor memory, this indicates that there are some negative or side effects of using this technology among students. As a natural result of students' increased reliance on technology instead of personal abilities or the ability to concentrate, which affects the recall of information or leads to procrastination and delay in performing tasks and duties.

Table 4 Hypothesis testing results and path analysis results (Path Coefficients)

Hypotheses	Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Result
H1	**Time Pressure -> GenAI Use**	0.139	0.14	0.096	1.457	0.145	Disconfirmed
H2	**Study Pressure -> GenAI Use**	0.287	0.289	0.107	2.687	0.007	Confirmed
H3	**Seeking Reward-> GenAI Use**	0.032	0.03	0.088	0.365	0.715	Disconfirmed
H4	**Seeking Quality-> GenAI Use**	0.087	0.094	0.083	1.044	0.296	Disconfirmed
H5	**GenAI Use -> Procrastination**	0.360	0.367	0.071	5.097	0	Confirmed
H6	**GenAI Use -> Weak Memory**	0.277	0.286	0.072	3.851	0	Confirmed
H7	**GenAI Use -> Academic Achievement**	0.517	0.521	0.058	8.953	0	Confirmed

Table 4 shows the results of the hypothesis testing and the results of the resulting path analysis. Based on the evaluation criteria as explained by Hair et al. (2019), the results show significant implications for some hypotheses, while not supporting others. Below is an analysis of each hypothesis based on the results:
Hypothesis: This hypothesis assumes that there is a positive relationship between time pressure and the use of AI applications by students. The result showed a value of (β=0.139, t=1.457, p=0.145), which means that the relationship is not statistically significant, and therefore the hypothesis is not supported. This suggests that time pressure may not be a direct cause of students' increased use of AI applications.

Hypothesis: It predicts a positive relationship between study pressure and the use of AI applications. The result showed strong statistical significance (β=0.287, t=2.687, p=0.007), which supports the hypothesis. This means that students who face high study pressure tend to use AI applications more, perhaps to relieve their stress.

Hypothesis: It indicates that there is a positive relationship between reward seeking and the use of AI applications. The result (β=0.032, t=0.365, p=0.715) indicates that there is no statistically significant relationship, and therefore the hypothesis is not supported. This means that students who seek rewards may not have a strong motivation to use these applications.

Hypothesis: It assumes that there is a positive relationship between the search for quality and the use of AI applications. The result showed no support for this hypothesis as well (β=0.087, t=1.044, p=0.296), indicating that students who seek to achieve quality may not find AI applications an effective means for doing so.

Hypothesis: It indicates that the use of AI applications leads to increased procrastination and stalling among students. The result was statistically significant and strong (β=0.36, t=5.097, p<0.001), which supports the hypothesis. This suggests that students who use AI may develop a tendency to procrastinate and rely on these applications as a means to complete tasks more easily.
Hypothesis: It is assumed that excessive use of AI applications leads to a weakness in students' memory. The results significantly support the hypothesis (β=0.277, t=3.851, p<0.001), which means that frequent use of these applications may negatively affect students' ability to retain information.

Hypothesis: It indicates that there is a positive relationship between the use of AI applications and students' academic performance. The results showed strong statistical significance supporting this hypothesis (β=0.517, t=8.953, p<0.001). This indicates that students who rely on AI applications do not suffer from any deterioration in academic performance.

DISCUSSION AND CONCLUSION

The results of the study indicate that study pressure is a major factor influencing students' use of generative AI applications. This is consistent with previous research that students tend to seek technological solutions when they are under high academic pressure, in order to improve their efficiency and reduce the time and effort spent on completing tasks (Zhang & Livingston, 2018). Hair et al. (2019) explain that study pressure may lead students to rely more on external tools to complete their tasks, especially when they feel that the study requirements exceed their capabilities. Therefore, the use of generative AI can be attributed to the desire to save time and take advantage of the capabilities of these tools to complete tasks more efficiently.

Although the current study did not find a statistically significant relationship between time pressure and the use of AI, previous literature suggests that time pressure may have an indirect effect through other variables, such as feeling stressed or the need to reduce mental effort (Gonzalez & Wright, 2020). The lack of effect in this study may be due to contextual or cultural factors that influence how students respond to time pressure, as they rely on traditional strategies rather than relying on technology. The study also found that the use of AI applications is associated with an increase in procrastination among students, which supports the results of previous studies that indicated that the use of

technology may contribute to reducing personal interaction with educational content and increasing reliance on external tools, which leads to postponement of tasks. Wu et al. (2022) explained that reliance on AI may encourage students to postpone work under the pretext that AI will help them later, which leads to a deterioration in time management strategies and self-discipline. The results obtained in the study indicated that excessive use of AI applications is associated with poor memory. Similar studies have suggested that reliance on technology can lead to "machine-dependent thinking," which reduces an individual's ability to memorize and retrieve information. In this context, Storm and Stone (2015) found that reliance on technological tools to retrieve information reduces the brain's ability to retain information, as greater reliance on technology becomes a substitute for memory.

The results also showed that the excessive use of artificial intelligence is positively associated with academic performance, which makes them consistent with the study (Abbas & Khan, 2024) in terms of proving the existence of an impact of generative artificial intelligence applications on students' academic performance, and differ from it at the same time in terms of the direction of this relationship, as the current study reveals that it is a positive trend, while the study (Abbas & Khan, 2024) concluded that it is in the negative trend, as it confirms that students who relied heavily on ChatGPT in their academic tasks had poor academic performance rates (CGPA), which was also confirmed by the study by Wecks et al. (2024).

This difference in the researcher's estimate is due to the difference in the method of monitoring this variable, as both the study (Abbas & Khan, 2024.) and (Wecks et al., 2024) relied on the academic performance rate (cumulative average) as an indicator of this variable, while the current study relied on monitoring the student's personal tendency towards the impact of artificial intelligence applications on his academic performance.

This makes this result in need of review and scrutiny in future research and studies, given that many studies confirm that the adoption of technology has a profound impact on students' academic understanding, as some students rely on these applications to get quick answers without making the necessary effort to understand the content, and recall the skills and abilities that need training and practical practice to develop and refine them.

The claim that artificial intelligence applications have a negative impact on students' academic performance is consistent with what the current study proved when it confirmed the existence of a direct and positive impact of using generative artificial intelligence applications on the growth of procrastination and procrastination behavior among students, as well as the noticeable decline in the level of information retention and information recall.

To verify the results, it is recommended to conduct future studies with larger, more diverse samples from different educational institutions and

geographical areas, as well as to test the model in different contexts. Equally important, including new variables at the level of motivations such as peer influence, educational styles, confidence level in technology, ethical values, psychological stress, and self-confidence can be yield significant results. In addition to studying the impact of AI applications on other variables such as: critical thinking skills and creativity, academic integrity, research skills, self-efficacy, independence, and the ability to make critical decisions. These proposals are an opportunity for future studies aimed at improving and expanding the scope of the results to be more accurate and generalizable. These results highlight the need to develop educational policies that guide the appropriate use of AI within academic circles. The potential benefits of AI, such as increasing efficiency and saving time, must be coupled with sufficient awareness of potential risks, such as procrastination, poor memory, and declining academic performance. The study recommends increasing awareness on how to best use AI, and directing students to use it as an assistive tool rather than as a substitute for personal effort in learning.

IMPLICATIONS

The results of this study indicate that the use of generative artificial intelligence (GenAI) applications among Moroccan university students reflects a complex interaction between personal motivations, academic pressures, and educational outcomes. Based on the descriptive statistics, the following important conclusions can be drawn: Moroccan students rely heavily on artificial intelligence applications to improve their academic understanding and learn new concepts, indicating the need to provide access to this technology and train students to use it effectively. Additionally, students associate the use of artificial intelligence applications with improved academic outcomes, which supports investment in this technology as a tool to enhance learning. Importantly, the high level of anxiety among students about achieving good results underscores the need to develop psychological support and training strategies to help them cope with the academic pressures arising from the transition from the school environment to the university environment (Nadif & Fayzullaevna, 2024; Nadif, 2025). Study pressure is the primary motivation behind students' reliance on these applications, as they use them to reduce academic burdens and improve their efficiency in completing tasks. In the same vein, time pressure, reward seeking, and quality seeking did not show significant effects, suggesting that students' reliance on GenAI may be driven primarily by a desire to manage their study load rather than by a pursuit of academic excellence or improved performance quality.

The use of AI applications by students has a dual effect. On the one hand, moderate use of these applications enhances students' academic performance by providing innovative technical solutions that help them complete tasks more efficiently. On the other hand, excessive use was associated with a greater

tendency to procrastinate and poorer memory skills, reflecting a negative impact on the development of students' self-skills and mental abilities.

These results highlight the importance of guiding students' use of AI applications towards responsible, thoughtful use, which requires the development of clear educational policies that enhance students' awareness of the need to balance benefiting from these tools with relying on their personal abilities. Academic institutions must also develop educational programs focused on developing digital skills in ways that enhance critical and creative thinking without compromising academic integrity.

The results also reveal the need for extensive and in-depth research on the long-term effects in the Moroccan and Arab environment, as well as the impact of cultural differences, psychological effects, sustainable education models, teacher-student interaction, and the ethical and legal challenges of using generative artificial intelligence in education. This research can contribute to the development of integrated and comprehensive educational strategies that make the most of these technologies while ensuring safe and responsible use.

With a view to achieving this goal, the current study directs the attention of researchers to promising prospects in the field of scientific research and generative artificial intelligence in relation to education in general, including the call to (1) study the impact of using artificial intelligence on students' academic performance; (2) uncover the factors that influence students' adoption of artificial intelligence technologies in the educational environment; (3) investigate the impact of artificial intelligence on social interaction in the university environment; consider the use of artificial intelligence in improving personal learning and academic guidance; (4) highlight the ethics and security concerns related to the use of artificial intelligence in education; reimaging the role of institutional policies and laws in supporting or hindering the use of artificial intelligence in education; (5) rethink the long-term impact of using generative AI applications on academic performance; (6)evaluate the psychological impact of students' use of generative AI applications in learning; (7) develop sustainable educational models using generative AI that take into account risks and challenges; and (8) conduct experimental studies to test the impact of new variables that may contribute to a better understanding of the impact and impact associated with the use of generative AI applications by students. This study also recommends a set of practical measures that would address the challenges posed by the use of generative AI applications among students, including (a) launching awareness programs and workshops aimed at introducing students to the advantages and limitations of using generative AI applications, with a focus on planned, ethical and responsible use; (n) developing educational curricula that integrate AI applications in a practical way to enhance critical and creative thinking, while providing students with analysis and accountability skills when using them; (c) formulating rules and laws that define how students use technology to complete assignments and tests, which

enhances the values of integrity and transparency; (d) providing training courses for faculty members and researchers to qualify them to understand AI applications and how to effectively employ them in the educational process; (e) supporting and encouraging ongoing studies to explore the long-term effects on academic performance and educational behavior, with the aim of improving usage policies; and (f) developing innovative evaluation mechanisms that take into account the impact of AI use and stimulate creative thinking and students' self-abilities.

In conclusion, it is worth noting that the use of artificial intelligence in the university educational environment has great potential, but it requires the adoption of a thoughtful and integrated methodology that considers the various challenges, risks and variables. This study has attempted to contribute, alongside the efforts made, to achieving a balance between technical innovation, academic integrity, and the ethical and responsible use of artificial intelligence technologies in education. This study also represents a call for more experimental studies to explore its long-term impact on the behavior of students and learners, and on their academic performance, which would enhance understanding of the future, and preparation for it.

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