# Investigating the Effects of Artificial Intelligence on Students' Creativity and Learning Outcomes: A Case Study at Van Hien University

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**Abstract**

*Artificial Intelligence (AI) is increasingly having a strong impact on higher education, particularly in improving students' learning outcomes. To evaluate the influence of AI on students' creativity and academic performance, this study conducted a survey among students at Van Hien University, thereby constructing and testing the relationships between the following factors: the benefits of using AI, awareness levels, information accuracy, personalization, creativity, and learning outcomes. The data were collected via Google Forms during April and May 2025, with 231 valid responses, and analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. The research findings indicated that AI had a positive impact on awareness, personalization, and information accuracy. At the same time, the study also demonstrated that artificial intelligence (AI) positively affected students' learning outcomes through the mediating roles of personalization and creativity. Through these results, the study aimed to contribute important theoretical and practical insights for students and educational institutions in the processes of learning and teaching.*

***Keywords:*** *Artificial intelligence, awareness level, creativity, learning outcomes, personalization*

## 1. Introduction

In the context of the Fourth Industrial Revolution, Artificial Intelligence (AI) emerged as a core tool in higher education. AI is applied in various aspects, including adaptive learning systems, personalized instruction, and immediate feedback mechanisms (Luckin et al., 2016). Numerous studies have highlighted the expanding role of AI in improving the quality and efficiency of education (Zawacki-Richter et al., 2019; Chen et al., 2020; Crompton and Burke, 2023).

Beyond this potential, AI also shapes students' creativity and learning outcomes. Recent research and analyses suggest that this technology can enhance academic performance, reduce cognitive load, and foster the development of 21st-century skills (García-Martínez et al., 2023; Bearman et al., 2023). However, Selwyn (2022) cautions that over-reliance on AI may lead to learner passivity, necessitating balanced and cautious approaches.

In Vietnam, research on AI applications in education is still in its early stages. Several recent studies have focused on surveying students' perceptions and usage behaviors toward AI tools (Dang et al., 2024; Nhat et al., 2024; Bui et al., 2024).

Initial findings indicate that AI brings positive effects on learning motivation, self-directed learning, and academic achievement. Nevertheless, most studies in Vietnam remain largely descriptive or synthetic and have not yet clarified the relationships between the benefits of AI and factors such as personalization, creative thinking development, and learning outcomes in the university context.

Addressing these gaps, this study was conducted to examine the relationships in a proposed model comprising the following factors: benefits of using AI, level of awareness, personalization, information accuracy, creativity, and learning outcomes, based on a survey of students at Van Hien University. Additionally, the study investigates the mediating roles of personalization and creativity in the relationship between AI and learning outcomes, thereby aiming to provide empirical evidence for the educational context at Van Hien University in particular, and Vietnamese universities in general.

## 2. Theoretical Foundation and Research Hypotheses

### 2.1. Key Concepts and Theoretical Background

AI is increasingly widely applied in education, offering numerous benefits such as personalized learning, optimized knowledge acquisition, and rapid problem-solving support (Luckin et al., 2016). AI helps students improve efficiency, save time, and enhance learning autonomy. These benefits motivate students to maximize the use of technology. However, research on how these benefits influence outcomes through mediating factors such as awareness and creativity particularly in Vietnamese higher education remains limited.

Students' level of awareness refers to their ability to absorb, analyze, and apply knowledge in learning (Biggs et al., 2022). Awareness of AI's role and potential enables students to use these tools effectively, thereby promoting creativity and improving learning outcomes. Nevertheless, there is a lack of in-depth research on the relationship between AI awareness and students' creativity in Vietnamese higher education.

The quality of information systems in AI tools (e.g., ChatGPT, Gemini, Nuclia), including the accuracy and effectiveness of the information generated by AI (DeLone and McLean, 2003). This quality is directly related to the quality of feedback, evaluated based on the accuracy and relevance of results during interactions (Tlili et al., 2023). Therefore, information system quality plays a pivotal role in influencing students' learning outcomes.

Personalization is the ability to adapt learning experiences to the individual needs and learning styles of each learner (Chen and Wang, 2021). AI supports the creation of personalized learning pathways, recommending appropriate materials that enhance retention and interest in learning (Rouhiainen, 2019). Personalization not only improves knowledge acquisition but also creates a flexible environment that promotes student proactivity and creativity.

Creativity is understood as the latent capacity within each individual that enables them to perform tasks in a more innovative and effective manner than conventional methods (Baillie and Walker, 1998). Creativity is not only an essential human trait but also the ability to develop new ideas and practical solutions (Vu, 2021).

Learning outcomes reflect the knowledge, skills, and competencies students attain after the learning process. AI not only supports increased knowledge acquisition but also enhances learning motivation, proactivity, and commitment (Wang and Fan, 2025). AI platforms that track progress help improve skills and career development. Foroughi et al. (2024) also noted that students highly value AI writing assistants for their accurate suggestions and editing, which improve writing skills.

### 2.2. Research Hypotheses

**Benefits of Using AI → Awareness Level:** Previous studies have demonstrated that the benefits of using AI in education contribute to enhancing students' awareness of the technology's role and potential (Luckin et al., 2016). However, this relationship has not been sufficiently examined in the context of Vietnamese higher education. Therefore, the study proposes:

**H1:** The benefits of using AI have a positive influence on students' level of awareness.

Specifically, when students perceive that AI offers benefits such as rapid information retrieval, personalized learning pathways, and the development of self-learning skills, they will heighten their awareness of the importance and effective application of AI in learning.

**Benefits of Using AI → Information Accuracy**: The quality of the system and the accuracy of information provided by AI are considered important factors in enhancing trust and learning efficiency (DeLone and McLean, 2003; Tlili et al., 2023). However, research on this relationship in the Vietnamese context remains limited. Thus, the study proposes:

**H2:** The benefits of using AI have a positive influence on information accuracy.

Specifically, when AI provides accurate information and reduces errors in processing learning data, students will place greater trust in the information source, enabling more effective knowledge acquisition and minimizing mistakes.

**Benefits of Using AI → Personalization:** Studies also indicate that AI can promote personalization in learning by enabling the design of pathways and methods suited to each individual (Rouhiainen, 2019; Chen and Wang, 2021). However, the direct impact of AI benefits on personalization in Vietnamese higher education has not been extensively researched. Therefore, the study proposes:

**H3:** The benefits of using AI have a positive influence on personalization in learning.

Specifically, when AI offers the ability to customize learning content according to each student's needs and pace, personalization in learning will be enhanced, creating motivation and improving individual learning efficiency.

**Awareness Level → Creativity:** Strong awareness of technology supports the development of creativity, enabling students to generate new learning solutions and critical thinking (Amabile, 1983; Hennessey and Amabile, 2010). However, in the Vietnamese AI education context, this relationship has not been deeply studied. Thus, the study proposes:

**H4:** Students' level of awareness has a positive influence on creativity.

Specifically, students with a clear understanding of AI will effectively utilize

technological tools to develop new ideas, creative learning solutions, and greater efficiency.

**Personalization → Creativity:** Personalization creates favorable conditions for students to develop creativity by allowing them to learn according to their own needs and styles (Chen and Wang, 2021). However, this impact has not been researched in Vietnamese universities. Therefore, the study proposes:

**H5:** Personalization in learning has a positive influence on students' creativity.

Specifically, a personalized learning environment encourages students to freely explore and experiment with new learning methods, thereby effectively promoting creativity.

**Information Accuracy → Creativity:** Accurate information serves as a foundation for students to develop creativity in learning (Eisbach et al., 2023). This relationship has not been fully examined in Vietnamese higher education, so the study proposes:

**H6:** Information accuracy has a positive influence on students' creativity.

Specifically, access to accurate information enables students to build creative learning and research solutions based on sound knowledge, avoiding errors caused by misinformation.

**Creativity → Learning Outcomes:** Creativity plays a crucial role in promoting learning outcomes by enhancing problem-solving skills, critical thinking, and proactivity in learning (Amabile, 1983; Wang and Fan, 2025). Therefore, the study proposes:

**H7:** Creativity has a positive influence on students' learning outcomes.

Specifically, creativity helps students develop new ideas, improve skills and learning attitudes, thereby achieving higher academic performance.

**Mediating Role of Creativity:** Creativity is considered an important factor mediating the relationship between influencing factors such as awareness and personalization and students' learning outcomes. Several studies have shown that creativity not only helps students develop new ideas and effective learning solutions but also enhances motivation and proactivity in the learning process (Amabile, 1983; Hennessey and Amabile, 2010).

Specifically, AI-driven personalization helps students construct learning pathways suited to their individual needs and styles, thereby fostering creativity in selecting learning methods, problem-solving, and developing new skills. Consequently, this creativity serves as a vital mediating bridge that transforms the positive effects of AI benefits and personalization into improved learning outcomes. In other words, creativity enhances the effectiveness of AI use, leading to marked improvements in knowledge, skills, and learning attitudes. Therefore, examining the mediating role of creativity not only clarifies the underlying mechanisms but also helps guide solutions to improve education quality through AI.

**H8:** Students' creativity mediates the relationship between personalization and learning outcomes.

**H9:** Personalization and creativity jointly mediate the relationship between the benefits of using AI and learning outcomes.

**H10:** Personalization mediates the relationship between the benefits of using AI and creativity.

Based on the research hypotheses, the proposed research model is presented as follows (Figure 1):

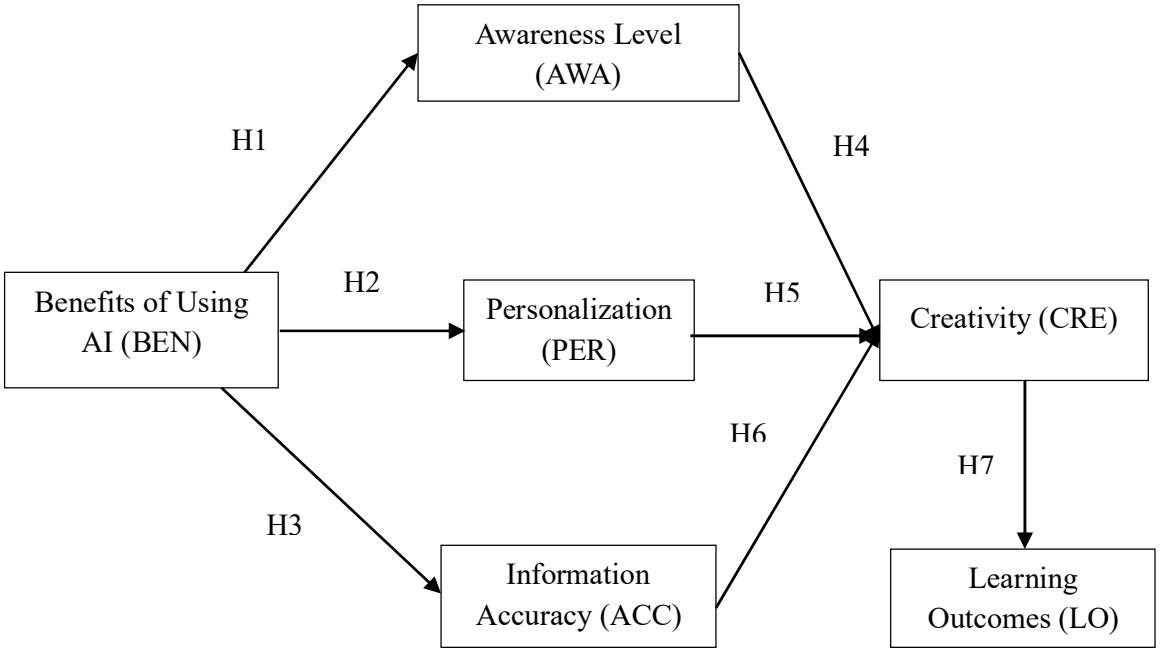


**Figure 1.** Proposed Research Model

## 3. Research Methodology

### 3.1. Data Collection

This study employed a quantitative approach. The survey was conducted online via Google Forms in April and May 2025. The target population consisted of students at Van Hien University, with anonymity assured to comply with research ethics. Convenience sampling was adopted due to practical constraints, although it may limit generalizability. For studies using PLS-SEM, sample sizes should generally range between 100 and 400. Samples that are too small cannot adequately explain results or support conclusions, while excessively large samples may be affected by sampling errors (Hair et al., 2019a). The initial survey collected 412 responses; after cleaning for straight-lining and careless responses, 231 valid responses remained.

### 3.2. Data Analysis

Collected data were coded and processed using quantitative techniques, with model analysis performed via Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.2.9 software.

Descriptive statistics were used to analyze the demographic characteristics of the sample. Measurement scales were assessed for reliability using Cronbach's Alpha coefficients. Discriminant validity was evaluated using the Heterotrait-Monotrait ratio (HTMT), while the structural model was assessed through path coefficients, T-values, and P-values. Model fit was examined using the coefficient of determination ($R^2$) and predictive relevance (Stone-Geisser's $Q^2$).

## 4. Results and Discussion

### 4.1. Sample Characteristics

The study surveyed 231 students currently enrolled at Van Hien University. Regarding gender, 153 respondents were female (66.2%) and 78 were male (33.8%). In terms of academic level, 226 respondents were undergraduates (97.8%) and 5 were postgraduates (2.2%). Regarding frequency of AI use, 93 respondents used AI occasionally (a few times per month, 40.3%), 104 used it frequently (a few times per week, 45%), and 34 used it almost daily (14.7%) (Table 1).

Additionally, statistics on AI tools used by students showed that the most commonly used tools for learning were ChatGPT (91 respondents, 39.4%), Gemini (34 respondents, 14.7%), Copilot (11 respondents, 4.8%), other tools (22 respondents, 9.5%), and more than 4 tools (73 respondents, 31.6%). It is evident that students at Van Hien University demonstrate diversity in using multiple AI tools, with ChatGPT being the most popular due to its high applicability and contribution to improving learning outcomes (Table 1).

**Table 1.** Sample Characteristics

| Characteristic | | N | (%) |
|---|---|---|---|
| Gender | Male | 78 | 33.8 |
| | Female | 153 | 66.2 |
| Education level | Undergraduate | 226 | 97.8 |
| | Postgraduate | 5 | 2.2 |
| AI usage frequency | Occasional (few times/month) | 93 | 40.3 |
| | Frequent (few times/week) | 104 | 45 |
| | Almost daily | 34 | 14.7 |
| AI tools used | ChatGPT | 91 | 39.4 |
| | Gemini | 34 | 14.7 |
| | Copilot | 11 | 4.8 |
| | Other tools | 22 | 9.5 |
| | More than 4 tools | 73 | 31.6 |

### 4.2. Measurement Model Assessment

All scales in the model demonstrated satisfactory reliability, with Cronbach's Alpha (CA) and composite reliability (CR) values exceeding 0.7. Convergent validity was achieved, as average variance extracted (AVE) values were greater than 0.5, and all outer loadings exceeded 0.78, confirming indicator reliability (Hair et al., 2019a) (Table 2).

**Table 2.** Summary of outer loadings and scale reliability

| Scale | Indicators | Outer Loadings | CA | CR | AVE |
|---|---|---|---|---|---|
| Personalization (PER) | 4 | 0.827–0.901 | 0.891 | 0.925 | 0.755 |
| Learning Outcomes (LO) | 4 | 0.876–0.887 | 0.908 | 0.935 | 0.782 |
| Benefits of AI Use (BEN) | 4 | 0.879–0.896 | 0.910 | 0.937 | 0.788 |
| Awareness Level (AWA) | 4 | 0.853–0.884 | 0.896 | 0.928 | 0.762 |
| Creativity (CRE) | 4 | 0.872–0.889 | 0.907 | 0.935 | 0.782 |
| Information Accuracy (ACC) | 4 | 0.828–0.874 | 0.865 | 0.908 | 0.712 |

All pairs of latent constructs yielded HTMT values below 0.9, confirming acceptable discriminant validity according to the criteria established by Henseler et al. (2015) (Table 3).

**Table 3.** HTMT Correlation Coefficients

| | PER | LO | BEN | AWA | CRE | ACC |
|---|---|---|---|---|---|---|
| Personalization (PER) | | | | | | |
| Learning Outcomes (LO) | 0.780 | | | | | |
| Benefits of AI Use (BEN) | 0.567 | 0.509 | | | | |
| Awareness Level (AWA) | 0.797 | 0.700 | 0.671 | | | |
| Creativity (CRE) | 0.892 | 0.844 | 0.506 | 0.735 | | |
| Information Accuracy (ACC) | 0.856 | 0.740 | 0.589 | 0.881 | 0.772 | |

## 4.3. Structural Model Assessment

### *4.3.1. Hypothesis testing*

The structural model was evaluated based on key criteria, including path coefficients, T-values, and P-values, to determine the statistical significance of the relationships between variables.

Hypothesis H1: The benefits of using AI positively promote students' level of awareness ($\beta = 0.608$, $T = 8.124$, $P < 0.05$) (Table 4). This finding is consistent with the research of Luckin et al. (2016), which indicated that AI tools such as intelligent tutoring systems help students gain a deeper understanding of theoretical concepts.

Hypothesis H2: The benefits of using AI have a positive impact on the provision of accurate and reliable information, helping students avoid errors in their learning ($\beta = 0.529$, $T = 6.579$, $P < 0.05$) (Table 4). This result supports the views of previous studies (Rouhiainen, 2019; Chen and Wang, 2021), which emphasize that the accuracy of AI-generated responses is a critical factor in enhancing learning quality.

Hypothesis H3: The benefits of AI positively influence personalization in the learning process. For example, analyzing learning data and recommending suitable learning pathways promotes

personalization (β = 0.513, T = 6.874, P < 0.05) (Table 4). This result reinforces the arguments of DeLone and McLean (2003) and Tlili et al. (2023) regarding the role of AI in optimizing personalized learning experiences.

Hypothesis H4 proposed that the level of awareness has a positive influence on students' creativity. However, the test results showed that this relationship was not statistically significant (β = 0.129, T = 1.813, P > 0.05) (Table 4). Therefore, Hypothesis H4 is rejected. This finding suggests that students' awareness of the role, benefits, and potential of AI is not sufficient to automatically translate into creative competence in learning. A plausible explanation is that, in this context, awareness primarily reflects students' "knowledge" and "understanding" of AI as a learning support tool, rather than their ability to apply AI to explore new ideas, restructure problems, or develop differentiated approaches.

Descriptive data indicate that ChatGPT is the most commonly used AI application among students (39.4%), followed by Gemini, Copilot, and other tools. This shows that most students have quickly adopted generative AI platforms. However, in the actual learning context in Vietnam, these tools are primarily used for information retrieval, document summarization, concept explanation, or completing assignments more quickly. Learning still tends to focus on knowledge acquisition, memorization, and fulfilling course requirements. Students may view AI more as a tool to "get things right" rather than as a tool for experimentation or developing new ideas. In other words, a positive perception of AI may help students accept and use the technology more effectively, but if its usage mainly aims at optimizing speed and convenience, such perception does not necessarily lead to creative thinking. Therefore, a good level of awareness of AI in this study sample did not create a significant impact on creativity.

Hypothesis H5: Personalization has a positive impact on students' creativity (β = 0.623, T = 9.111, P < 0.05) (Table 4). This result indicates that educational institutions should invest in adaptive AI systems to encourage creative thinking. It also clarifies the research of Eisbach et al. (2023) on the relationship between personalization and creative thinking.

Hypothesis H6 proposed that the accuracy of information has a positive influence on students' creativity. However, the test results showed that this relationship was not statistically significant (β = 0.117, T = 1.392, P > 0.05) (Table 4). Therefore, Hypothesis H6 is rejected. This finding suggests that accurate information from AI helps students reduce errors, increase reliability, and complete learning tasks more effectively, but it is not sufficient to directly stimulate creative thinking. Creativity requires not only correct information but also processes such as questioning, comparing possibilities, critiquing answers, and developing new approaches.

In the context where students commonly use tools like ChatGPT, the accuracy of information may make learners feel more confident when accessing knowledge. However, it also carries the risk of increasing dependence on ready-made answers. When AI is used as a "quick information source," students may prioritize receiving correct answers and

completing tasks over delving deeper into problems or experimenting with different ideas. In other words, accurate information supports effective learning in the direction of reproduction and task completion but does not automatically lead to creativity if there is a lack of active interaction, critical thinking, and appropriate pedagogical guidance. This result is consistent with Selwyn (2022) and Bearman et al. (2023), which emphasize that the use of AI without proper guidance can make learners more passive rather than innovative. Compared with the studies by Chen and Wang (2021) and García-Martínez et al. (2023), the findings of this research further clarify that, in the Vietnamese context, creativity is strongly encouraged only when AI supports personalization.

Hypothesis H7: Creativity has a positive impact on learning outcomes (β = 0.767, T = 23.642, P < 0.05) (Table 4). Students with higher creativity tend to solve problems more flexibly and achieve better academic performance. This result aligns with the research of Amabile (1983) and Wang and Fan (2025), which shows that AI-supported exploration of new learning methods leads to improved academic performance.

Additionally, Hypotheses H8, H9, and H10 (Table 5) were all statistically significant. The study results confirm the mediating role of students' creativity in the relationship between personalization and learning outcomes. Personalization acts as a mediator in the relationship between the benefits of using AI and students' creativity. At the same time, personalization and creativity together serve as mediators in the relationship between the benefits of using AI and students' learning outcomes.

**Table 4.** Hypothesis testing results

| Hypothesis | Path Coefficient (β) | T-value | P-value | Result |
|---|---|---|---|---|
| H1: BEN → AWA | 0.608 | 8.124 | 0.000 | Supported |
| H2: BEN → ACC | 0.529 | 6.579 | 0.000 | Supported |
| H3: BEN → PER | 0.513 | 6.874 | 0.000 | Supported |
| H4: AWA → CRE | 0.129 | 1.813 | 0.070 | Not Supported |
| H5: PER → CRE | 0.623 | 9.111 | 0.000 | Supported |
| H6: ACC → CRE | 0.117 | 1.392 | 0.164 | Not Supported |
| H7: CRE → LO | 0.767 | 23.642 | 0.000 | Supported |

**Table 5.** Mediation testing results (Personalization and Creativity)

| Hypothesis | Path Coefficient (β) | T-value | P-value | Result |
|---|---|---|---|---|
| H8: PER → CRE → LO | 0.478 | 8.191 | 0.000 | Supported |
| H9: BEN → PER → CRE → LO | 0.245 | 4.995 | 0.000 | Supported |
| H10: BEN → PER → CRE | 0.319 | 5.319 | 0.000 | Supported |

Overall, the research findings indicate that AI plays a positive role in students' learning outcomes within the sample surveyed. However, this impact does not occur directly or uniformly through all mechanisms. The rejection of H4 and H6 has shown that AI does not automatically promote creativity merely through good awareness or accurate information. In this study sample, creativity appears to be strongly activated only when AI creates personalized learning experiences, that is, when the tools support students according to their individual needs, pace, and approaches. This suggests that the mechanism by which AI influences creativity does not lie solely in learners' positive perception of the technology or access to accurate information, but rather in how the technology is integrated into the learning process to encourage proactivity, experimentation, and the development of new ideas.

#### *4.3.2. Evaluation of the coefficient of determination ($R^2$)*

The $R^2$ value is defined as the percentage of variance in the endogenous variable explained by the exogenous variables. $R^2$ values at the thresholds of 0.75, 0.5, and 0.25 correspond to substantial, moderate, or weak predictive power, respectively (Hair et al., 2019a). According to the analysis results, the adjusted $R^2$ coefficients for the variables of personalization, awareness level, and information accuracy fall within the range of 0.25-0.5, indicating a weak level of explanatory power. Meanwhile, the $R^2$ values for learning outcomes and creativity range from 0.5-0.75, showing a moderate level of explanation (Table 6).

This implies that, in addition to the relationships tested in the model, there are still other important factors influencing the endogenous variables that have not been considered. In the context of research on learning behavior and technology acceptance, factors such as family environment, individual psychological characteristics, digital competence, AI usage experience, academic pressure, and societal attitudes toward technology may all contribute to explaining the variance in the aforementioned variables. Therefore, the low $R^2$ values do not invalidate the significance of the model; rather, they indicate that the research phenomenon is complex and needs to be further expanded in future studies.

**Table 6.** Coefficient of determination $R^2$

| Endogenous Variable | Adjusted $R^2$ | Explanatory Power |
|---|---|---|
| Personalization (PER) | 0.259 | Low |
| Learning Outcomes (LO) | 0.586 | Moderate |
| Awareness Level (AWA) | 0.367 | Low |
| Creativity (CRE) | 0.662 | Moderate |
| Information Accuracy (ACC) | 0.277 | Low |

#### *4.3.3. Evaluation of predictive relevance ($Q^2$)*

The results of assessing the model's predictive relevance (Stone-Geisser's $Q^2$) are as follows: In the structural model, a $Q^2$ value greater than 0 for an endogenous latent variable indicates that the exogenous constructs have predictive relevance for the endogenous constructs (Hair et al., 2019b). According to Hair et al. (2019b), the guidelines are $Q^2 \geq 0.35$: high predictive relevance; $0.15 \leq Q^2 < 0.35$: moderate predictive relevance; $Q^2 < 0.15$: low predictive relevance.

Specifically, the $Q^2$ value for personalization is 0.193, for level of awareness is 0.277, and for information accuracy is 0.190. All of these fall within the range of $0.15 \leq Q^2 \leq 0.35$, indicating moderate predictive relevance. The $Q^2$ value for the learning outcomes variable (KQ) is 0.456, while the $Q^2$ value for the creativity variable is 0.515. Both exceed 0.35, demonstrating high predictive relevance for these variables (Table 7). Thus, the predictive relevance of the factors in the model is relatively good.

**Table 7.** Predictive Relevance $Q^2$

| Endogenous Variable | $Q^2$ | Predictive Power |
|---|---|---|
| Personalization (PER) | 0.193 | Moderate |
| Learning Outcomes (LO) | 0.456 | High |
| Awareness Level (AWA) | 0.277 | Moderate |
| Creativity (CRE) | 0.515 | High |
| Information Accuracy (ACC) | 0.190 | Moderate |

## 5. Conclusion

The research results have demonstrated that artificial intelligence (AI) has a positive impact on students' learning outcomes, particularly through the roles of personalization and creativity. A personalized learning environment supported by AI helps students enhance their proactivity and flexibility, thereby creating an important mediating mechanism in transforming the benefits of AI into positive learning outcomes. However, factors such as awareness of AI and the accuracy of information did not show a clear influence on creativity in the context of this study. This opens up the need for further research to verify these relationships in other educational settings.

The present study has several limitations. The use of convenience sampling confined to a single university restricts the generalizability of the findings to the broader population of university students in Vietnam or to other international contexts. Furthermore, the exclusive reliance on quantitative methods specifically questionnaire surveys and the SEM-PLS technique may not fully capture abstract constructs such as learners' emotions and complex cognitive processes.

Accordingly, future research should aim to expand the scope of the survey by employing a larger and more diverse sample. In addition, the adoption of a mixed-methods approach is recommended to capitalize on the strengths of both

quantitative and qualitative methodologies. This would provide a more comprehensive and multidimensional understanding of the impact of artificial intelligence (AI) on students' learning and skill development within contemporary educational contexts.

**Conflict of Interest**

The authors declare no conflict of interest.

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