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## Exploring the Role of Artificial Intelligence-Powered Facilitator in Enhancing Digital Competencies of Primary School Teachers

Thi Hong Chuyen Nguyen\* 

Thai Nguyen University of Education, VIETNAM

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**Abstract:** This study aimed to investigate the relationship between teacher professional development, quality of lecture design, student engagement, teacher technical skills, pedagogical content knowledge and teacher satisfaction in using Artificial Intelligence (AI)-Powered Facilitator for designing lectures. The study used a non-random sample technique, and 208 participants answered a survey via Google Form after one semester, using a 5-point Likert scale to rate their responses. The structural equation model was used to analyze the data, and six factors were included in the study. The study confirmed hypotheses that teacher professional development, quality of lecture design, student engagement, and pedagogical content knowledge have a positive effect on teacher satisfaction. However, the study also revealed that teacher technical skills have a negative effect on teacher satisfaction, and pedagogical content knowledge has no significant effect. The proposed conceptual model explained 55.7% of the variance in teacher satisfaction. Theoretical and practical implications were also discussed. These findings provide insights into the factors that contribute to teacher satisfaction in utilizing AI-Powered Facilitator for designing lectures and could inform the development of effective teacher training programs.

**Keywords:** *AI-powered facilitators, digital competencies, lecture design, teacher professional development, technological pedagogical content knowledge.*

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### Introduction

Over the past decade, there has been a significant push towards education reform to better prepare students for the digital age (Herawati et al., 2022; Ouabich et al., 2023; Salim et al., 2023). The goal of education reform is to equip students with the skills they need to thrive in a rapidly changing technological landscape (Haug & Mork, 2021). One crucial component of this education reform is the development of digital competencies, which refer to the skills, knowledge, and attitudes required to use technology effectively and ethically (Herawati et al., 2022). Figure 1 highlights keywords that have received sudden attention in the "European Journal of Educational Research" journal between 2018 and 2023. It is clear that technology, competence, and skill are among the emerging keywords that have been the subject of extensive research in recent years.

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\* **Correspondence:**

Thi Hong Chuyen Nguyen, Thai Nguyen University of Education, Vietnam. ✉ [chuyennh@tnue.edu.vn](mailto:chuyennh@tnue.edu.vn)





their workload (Chen et al., 2020). AI tools can automate routine tasks, such as grading, feedback, and lesson planning, freeing up more time for teachers to focus on higher-order tasks such as creating engaging and personalized learning experiences for their students (Lameras & Arnab, 2022). This can ultimately lead to increased job satisfaction and reduced burnout among teachers, as they have more time to focus on tasks that are rewarding and meaningful to them. Moreover, AI-powered design tools have the potential to improve the quality of lectures and other teaching materials (Nazaretsky et al., 2022; Yeoun & Jung, 2021). For instance, AI algorithms can analyze student data and provide insights into their learning progress, allowing teachers to adapt their teaching strategies accordingly (Kulkarni & Eagle, 2020; Laxmaiah et al., 2022; Nazaretsky et al., 2022). AI tools can also generate personalized learning materials for individual students, taking into account their learning preferences and styles (Bagheri, 2015; Kulkarni & Eagle, 2020). Such personalized approaches have been shown to improve student motivation and engagement (Huang et al., 2023).

The previous discussion emphasizes the scarcity of pertinent studies in this field and underscores the importance of investigating this issue, thus the purpose of this study was to investigate the impact of AI-powered facilitator on teachers' satisfaction, as well as the factors that influence the effective use of these tools in the classroom. The study focused on primary school teachers, as they are often responsible for teaching a broad range of subjects and are therefore likely to benefit most from the use of AI-powered design tools. The study aimed to identify the digital competencies required for effective use of AI-powered design tools, as well as the impact of these tools on the quality of lecture design and student engagement. This study provides valuable insights into the impact of AI-powered design on teachers' satisfaction and the factors that influence the effective use of these tools in the classroom. The findings of this study have important implications for educators, policymakers, and designers of AI-powered design tools. By identifying the digital competencies required for effective use of these tools and the impact of these tools on the quality of lecture design and student engagement, this study contributes to our understanding of how AI can be effectively integrated into education.

### Literature Review

Teacher professional development, quality of lecture design, student engagement, teachers' satisfaction, teacher technical skills, and pedagogical content knowledge are important factors in education. In the context of this study, Teacher Professional Development (TPD) is understood as the process of continuous growth and enhancement of teaching skills and knowledge through various professional development activities, such as workshops, training, and courses (Fernandes et al., 2020; Postholm, 2012). Quality of Lecture Design (QLD) encompasses the effectiveness of designing and delivering lectures, which includes organization of content, clarity of presentation, use of multimedia, and other factors that contribute to student engagement and understanding (Devinder & Datta, 2003; Mohammadreza & Safabakhsh, 2021). Student Engagement (SE) refers to the level of participation, attention, and interest shown by students in the learning process (Chiu, 2022; Pedler et al., 2020). Teachers' satisfaction (TS) refers to the extent to which teachers feel pleased, content, or fulfilled with the experience of using AI-powered design tools to create and deliver their lectures. It encompasses their attitudes towards the ease of use and effectiveness of the tools, as well as their overall level of job satisfaction and motivation towards using the tools in the future (Alhajri, 2022; Liu & Zhang, 2021). Teacher Technical Skills (TTS) are the teachers' proficiency in using technology and other technical tools to enhance the learning experience and engage students (Faltynkova et al., 2020; Hulela et al., 2014; Mo & Yan, 2021). Pedagogical Content Knowledge (PCK) is the teachers' understanding of the subject matter and how to teach it effectively to students, including knowledge of the curriculum, student learning styles, and instructional strategies. The literature shows that they are closely related to each other (Amador et al., 2022; Andyani et al., 2020; Dikmen & Demirer, 2022; Gess-Newsome et al., 2019). The purpose of this literature review is to examine the existing studies on the relationships between these constructs and to develop hypotheses that will guide further research.

#### *Teacher Professional Development and Quality of Lecture Design*

Professional development programs are frequently provided by educational institutions to enhance the lecturing skills of their educators. Nonetheless, few studies have investigated the effectiveness of various approaches to improving these skills (Donath et al., 2023; Mowbray & Perry, 2015). A study by Mowbray and Perry (2015) suggested that teacher professional development programs improved teachers' ability to design effective lectures. Another study by Donath et al. (2023) showed that teacher professional development positively influenced the quality of instruction. Based on these findings, we hypothesize that:

Hypothesis 1 (H1): "Teacher professional development positively affects the quality of lecture design."

#### *Quality of Lecture Design and Student Engagement*

Research suggests that the quality of lecture design positively affects student engagement. A study by Costley et al. (2017) found that students were more engaged in classes with high-quality lecture designs. Similarly, a study by Maunula et al. (2023) showed that well-designed lectures led to increased student engagement. Based on these findings, we hypothesize that:

Hypothesis 2 (H2): "Quality of lecture design positively affects student engagement."

*Student Engagement and Teachers' satisfaction:*

The literature also suggests that student engagement positively affects teachers' satisfaction. A study by Klassen et al. (2012) found that teachers were more satisfied when their students were engaged in the classroom. Another study by Orhan and Beyhan (2020) showed that teachers were more satisfied when they had high levels of student engagement. Based on these findings, we hypothesize that:

Hypothesis 3 (H3): "Student engagement positively affects teachers' satisfaction."

*Quality of Lecture Design and Teachers' satisfaction:*

Research indicates that the quality of lecture design positively affects teachers' satisfaction. A study by Katai and Iclanzan (2023) found that teachers were more satisfied with their work when they were able to design and implement effective lectures. Similarly, prior studies (Fernandes et al., 2020; Maunula et al., 2023; Mowbray & Perry, 2015) showed that teachers who had greater control over the design of their lectures were more satisfied with their work. Based on these findings, we hypothesize that:

Hypothesis 4 (H4): "Quality of lecture design positively affects teachers' satisfaction."

*Teachers' Technical Skills and Teachers' satisfaction*

Previous research has shown that teacher technical skills can have a significant impact on teachers' satisfaction (Chookaew et al., 2021; Nawi et al., 2015). A study by Nawi et al. (2015) found that teachers who had high levels of technical skills were more satisfied with their jobs and enhanced their expertise in the field of teaching. This finding was supported by another study by Chookaew et al. (2021), who found that teachers who received training in the use of technology reported higher levels of job satisfaction. In addition to the impact on teachers' satisfaction, teacher technical skills have also been shown to have a positive impact on student learning. Boel et al. (2023) and Nawi et al. (2015) found that teachers who used technology effectively were more likely to have students who were engaged in the learning process and achieved better academic outcomes. Based on these findings, we hypothesize that:

Hypothesis 5 (H5): "Teacher technical skills positively affect teachers' satisfaction."

*Pedagogical Content Knowledge and Teachers' satisfaction:*

Research also suggests that pedagogical content knowledge positively affects teachers' satisfaction. A study by Sadaf (2019) found that teachers who had a deeper understanding of pedagogical content knowledge were more satisfied with their work. Similarly, a study by Meyer et al. (2023) showed that teachers who had more advanced knowledge of their subject matter were more satisfied with their work. Based on these findings, we hypothesize that:

Hypothesis 6 (H6): "Pedagogical content knowledge positively affects teachers' satisfaction."

Based on the assumptions guiding this study, a conceptual model (see *Figure 2*) was developed. This model comprises a number of constructs, also referred to as latent variables, which are assessed via a series of items. The connections between these constructs are illustrated by arrows, and the model is supported by six hypotheses (designated 1-6).

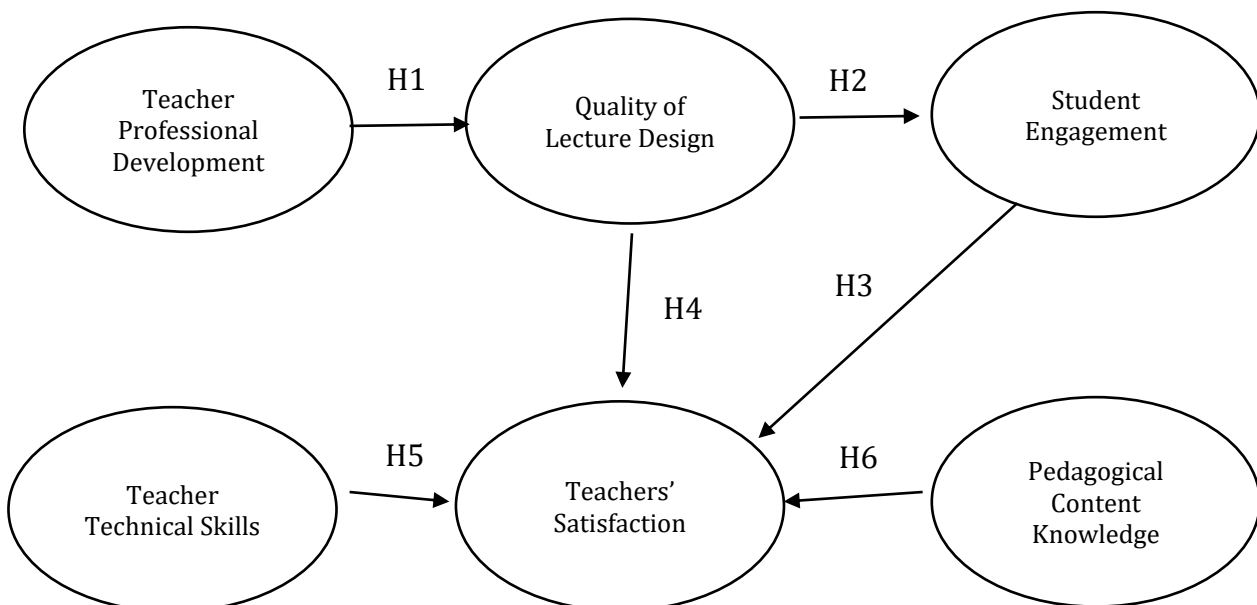


Figure 2. The Proposed Conceptual Model

## Methodology

### Research Design

The current study adopted a quantitative research design methodology to investigate the factors underlying primary school teachers' satisfaction in utilizing AI-powered design tools. The authors provided a training program for primary school teachers on how to use AI-powered design tools in designing lectures via three channels, including face-to-face, online, and pre-recorded videos. From the available tools in the literature (Balbo Di Vinadio et al., 2022; Chen et al., 2020; Ouyang & Jiao, 2021), Microsoft Power Point Designer was selected as it was familiar to the participants. The training was conducted between June and August 2022, and the authors planned to survey the participants after the end of the next semester in December 2022. This approach aligns with the recommended best practices in the literature for evaluating the effectiveness of professional development programs and assessing teachers' satisfaction. The survey was completed in April 2023.

### Sample and Data Collection

The current study targeted primary school teachers from the northern mountainous region of Vietnam, with an accessible population of those teaching in the five provinces of Bac Giang, Lang Son, Thai Nguyen, Lao Cai, and Son La, totaling approximately 500 potential participants. Purposive sampling was employed to select participants from the accessible population. To collect data, an online survey using Google Form was utilized, and participants were provided with information about the research purpose, data type, storage, distribution, and their ability to opt out at any time. The survey was conducted over four months from January 2023 to April 2023, with the questionnaire consisting of two sections: the first section collected demographic data, while the second section contained 18 questions that used the 5-point Likert scale to measure the level of perception toward satisfaction with AI-powered design tools. The questions used in the study were adapted from prior research (Ho & Au, 2006; Koskimäki et al., 2021; Sadaf, 2019) and then modified to fit the context of the present study. Before distributing the questionnaire, the questions were reviewed for reliability and face validity by two experts in the field. Listwise deletion was used to exclude records with missing or abnormal data.

After data collection, the study excluded inappropriate responses, such as those with only one option chosen ( $n=115$ ) and missing values ( $n=83$ ). Therefore, the final sample size for analysis was 208, which accounted for 51.23% of the total responses received ( $n=406$ ). The appropriate sample size for a study is a controversial issue in the literature, with different recommendations from various scholars. For instance, Kock and Hadaya (2018) suggested a minimum sample size of 100-200 subjects, while Anderson and Gerbing (1984) argued that a sample size of 100 is sufficient for convergence, and a sample size of 150 is sufficient for both convergence and accuracy when dealing with factors with three or more indicators. In this study, the sample size was determined using a tool recommended by Kline (2015) and the tool recommended a minimum sample size of 200. Given that the actual sample size of the present study exceeded the recommended threshold of 200, the study met its sample size requirements.

Table 1. Socio-Demographic Characteristics of the Respondents

Variable	Item	No	%
Gender	Male	77	37
	Female	131	63
Age	18 - 25	30	14
	26 - 35	72	35
	36 - 45	68	33
	Over 45	38	18
Level of Education	Vocational training	45	22
	Undergraduate	112	54
	Graduate	51	25
Year of Experience	< 5	74	36
	5-10	64	31
	11-20	43	21
	>20	27	13
Total		208	100

Data from the survey is shown in Table 1, with 37% being male and 63% being female. The age distribution of participants was as follows: 14% were between 18-25 years old, 35% were between 26-35 years old, 33% were between 36-45 years old, and 18% were over 45 years old. In terms of educational background, the majority of participants had an undergraduate degree (54%), followed by those with vocational training (22%) and graduate degrees (25%). With regards to years of experience, the largest proportion of participants had less than 5 years of experience (36%), followed by those with 5-10 years of experience (31%), 11-20 years of experience (21%), and more than 20 years of experience

(13%). Overall, the sample appears to be relatively diverse in terms of gender, age, education, and experience, which may increase the generalizability of the study findings.

### Analyzing of Data

In order to examine the proposed research model, the study employed the Generalized Structured Component Analysis (GSCA) technique (Hwang & Takane, 2014). GSCA is a variance-based Structural Equation Modeling (SEM) technique, which can evaluate both reflective and formative latent variables. It can handle complex models containing multiple types of latent variables and has been applied across a variety of fields. GSCA is advantageous for analyzing complex models with multiple dependent variables, as it can model both formative and reflective latent variables, allowing for a more comprehensive analysis of the relationships between different constructs. Furthermore, GSCA is useful in situations where traditional SEM techniques may not be applicable, such as when the data does not meet assumptions of normality or when sample sizes are small (Hwang & Takane, 2014; V. T. Nguyen & C. T. H. Nguyen, 2023). To account for these issues, GSCA uses robust estimation techniques, making it a flexible and powerful tool for analyzing complex data sets. The GSCA output provides estimates of the model parameters, including factor loadings, path coefficients, and error variances, which can be used to test hypotheses concerning the relationships between observed and latent variables.

### Findings/Results

Table 2 provides construct quality measures for six different constructs, including Teacher Professional Development, Quality of Lecture Design, Student Engagement, Teachers' satisfaction, Teacher Technical Skills, and Pedagogical Content Knowledge. The first measure in the table is AVE (Average Variance Extracted), which is a measure of the amount of variance captured by the construct relative to the amount of variance due to measurement error. All constructs have AVE scores greater than .50 (Hair, 2009; Kline, 2015), indicating that they explain more variance than measurement error and are considered reliable. The second measure in the table is alpha, which is a measure of internal consistency reliability. Alpha scores range from 0 to 1, with higher scores indicating greater internal consistency reliability. All constructs have alpha scores greater than .70 (Hair, 2009; Kline, 2015), indicating good internal consistency reliability. The third measure in the table is rho, which is a measure of composite reliability. Rho scores range from 0 to 1, with higher scores indicating greater composite reliability. All constructs have rho scores greater than .80 (Hair, 2009; Kline, 2015), indicating good composite reliability. Overall, the construct quality measures in the table suggest that the six constructs are reliable and internally consistent measures of the underlying latent variables they represent.

Table 2. Construct Quality Measures

	Teacher Professional Development	Quality of Lecture Design	Student Engagement	Teachers' satisfaction	Teacher Technical Skills	Pedagogical Content Knowledge
AVE	.581	.64	.762	.483	.673	.688
Alpha	.815	.814	.844	.729	.756	.747
Rho	.873	.877	.906	.822	.86	.815

Table 3 provides the standardized factor loadings for a set of latent constructs and their corresponding observed indicators. The factor loadings represent the degree to which each observed indicator is related to the latent construct it represents. The higher the factor loading, the stronger the relationship between the observed indicator and the latent construct.

For the latent construct "Teacher Professional Development" (TPD), all three observed indicators (TPD1 as "I actively engage in professional development activities to improve my teaching skills and knowledge", TPD2 as "I value professional development opportunities to enhance my teaching practices", TPD3 as "I believe that continuous growth through professional development enhances my teaching effectiveness") have high factor loadings ranging from .73 to .82, indicating that they are strongly related to the latent construct.

For the latent construct "Quality of Lecture Design" (QLD), all three observed indicators (QLD1 as "I effectively organize and structure my lectures to facilitate student understanding", QLD2 as "I use multimedia and visual aides to enhance the intelligibility and engagement of my lectures with multimedia and visual aids", QLD3 as "I prioritize the development of lectures that address the varied educational requirements of my students") also have high factor loadings ranging from .78 to .81, indicating that they are strongly related to the latent construct.

For the latent construct "Student Engagement" (SE), all three observed indicators (SE1 as "My students participate actively and are engaged in classroom activities and discussions", SE2 as "I employ teaching strategies that encourage student engagement and interaction", SE3 as "I observe my students to be highly attentive and engaged in the learning process") have very high factor loadings ranging from .82 to .90, indicating a very strong relationship between the observed indicators and the latent construct.

For the latent construct "Teacher Technical Skills" (TTS), all three observed indicators (TTS1 as "I have the technical skills necessary to use technology effectively in my teaching.", TTS2 as "I am adept at utilizing various technological instruments to enhance student engagement and learning", TTS3 as "I continuously develop and improve my technical skills to stay up-to-date with advancements in educational technology") have moderate to high factor loadings ranging from .68 to .79, indicating that they are moderately to strongly related to the latent construct.

For the latent construct "Pedagogical Content Knowledge" (PCK), all three observed indicators (PCK1 as "I have a solid understanding of the subject matter I teach and how to impart it to students effectively", PCK2 as "I modify my instructional strategies to comply with the curriculum and accommodate my students' learning styles", PCK3 as "I use a diversity of instructional strategies to facilitate student comprehension and subject mastery") have high factor loadings ranging from .79 to .85, indicating that they are strongly related to the latent construct.

For the latent construct "Teachers' satisfaction" (TS), all three observed indicators (TS1 as "I feel happy and satisfied when I use AI-powered facilitator to make and give my lessons", TS2 as "I think AI-powered facilitator is easy to use and useful for making my lessons better", TS3 as "I am motivated to continue using AI-powered facilitator in the future based on my positive experience") have moderate to high factor loadings ranging from .69 to .85, indicating that they are moderately to strongly related to the latent construct. Overall, the factor loadings indicate that all the observed indicators are good measures of their corresponding latent constructs.

Table 3. Estimate of Loadings

	Estimate	SE	95%CI	
<b>Teacher Professional Development (TPD)</b>				
TPD1	.787	.034	.712	.841
TPD 2	.73	.035	.659	.794
TPD 3	.816	.025	.759	.86
<b>Quality of Lecture Design (QLD)</b>				
QLD 1	.81	.028	.756	.852
QLD 2	.805	.021	.758	.836
QLD 3	.783	.029	.729	.849
<b>Student Engagement (SE)</b>				
SE1	.901	.013	.871	.925
SE2	.894	.014	.869	.921
SE3	.823	.031	.747	.863
<b>Teacher Technical Skills (TTS)</b>				
TTS1	.723	.039	0.656	0.799
TTS2	.79	.026	.737	.832
TTS3	.683	.056	.549	.765
<b>Pedagogical Content Knowledge (PCK)</b>				
PCK1	.826	.028	.753	.865
PCK2	.787	.041	.689	.843
PCK3	.847	.023	.789	.885
<b>Teachers' satisfaction (TS)</b>				
TS1	.848	.026	.787	.89
TS2	.81	.034	.731	.866
TS3	.692	.053	.568	.781

The experiment from GSCA provided four measures of fit reported in the results: FIT, AFIT, GFI, and SRMR. The FIT and AFIT measures assess the absolute fit of the model, while the GFI assesses the relative fit of the model, and the SRMR assesses the model's discrepancy between the observed and predicted correlations. The FIT measure of .557 indicates that the model has an acceptable fit, with a value between 0 and 1. The AFIT measure of .551 indicates that the model's fit is also acceptable. The GFI measure of .958 indicates that the model's fit is good relative to the null model, which is a model with no relationships among the variables. A GFI value greater than .90 is generally considered an acceptable fit. The SRMR measure of .069 indicates that the model has a good fit, with a value less than .08 indicating an acceptable fit.

Table 4. Path Coefficients

	<b>Estimate</b>	<b>SE</b>	<b>95%CI</b>	
Teacher Professional Development→Quality of Lecture Design (H1)	.546*	.048	.431	.626
Quality of Lecture Design → Student Engagement (H2)	.575*	.041	.491	.647
Student Engagement → Teachers' satisfaction (H3)	.345*	.073	.222	.515
Quality of Lecture Design → Teachers' satisfaction (H4)	.281*	.09	.087	.438
Teacher Technical Skills → Teachers' satisfaction (H5)	-.168*	.075	-.336	-.041
Pedagogical Content Knowledge → Teachers' satisfaction (H6)	.066	.074	-.084	.217

\* Statistically significant at .05 level



Table 4 presents the estimates, standard errors (*SE*), and 95% confidence intervals (*CI*) for six hypotheses related to the relationships among teacher professional development, quality of lecture design, student engagement, teachers' satisfaction, teacher technical skills, and pedagogical content knowledge. Each hypothesis represents a path in a theoretical model and is labeled with an abbreviation (e.g., H1, H2, etc.).

Hypothesis 1 (H1) proposes that teacher professional development positively affects the quality of lecture design. The estimate of the path coefficient is .546, which is statistically significant ( $p < .05$ ) and indicates a moderate positive effect of teacher professional development on quality of lecture design. The *SE* of the estimate is .048, which suggests a relatively precise estimate, and the 95% *CI* ranges from .431 to .626, indicating a high degree of confidence in the estimate.

Hypothesis 2 (H2) proposes that quality of lecture design positively affects student engagement. The estimate of the path coefficient is .575, which is statistically significant ( $p < .05$ ) and indicates a moderate positive effect of quality of lecture design on student engagement. The *SE* of the estimate is .041, which suggests a relatively precise estimate, and the 95% *CI* ranges from .491 to .647, indicating a high degree of confidence in the estimate.

Hypothesis 3 (H3) proposes that student engagement positively affects teachers' satisfaction. The estimate of the path coefficient is .345, which is statistically significant ( $p < .05$ ) and indicates a moderate positive effect of student engagement on teachers' satisfaction. The *SE* of the estimate is .073, which suggests a less precise estimate than the previous two hypotheses, and the 95% *CI* ranges from .222 to .515, indicating a moderate degree of confidence in the estimate.

Hypothesis 4 (H4) proposes that quality of lecture design positively affects teachers' satisfaction. The estimate of the path coefficient is .281, which is statistically significant ( $p < .05$ ) and indicates a small positive effect of quality of lecture design on teachers' satisfaction. The *SE* of the estimate is .090, which suggests a less precise estimate than the previous hypotheses, and the 95% *CI* ranges from .087 to .438, indicating a moderate degree of confidence in the estimate.

Hypothesis 5 (H5) proposes that teacher technical skills positively affect teachers' satisfaction. However, the result of the analysis showed a negative relationship with a correlation coefficient of -.168, which is statistically significant ( $p < .05$ ) and indicates a small negative effect of teacher technical skills on teachers' satisfaction. The *SE* of the estimate is .075, which suggests a less precise estimate than the previous hypotheses, and the 95% *CI* ranges from -.336 to -.041, indicating a moderate degree of confidence in the estimate.

Hypothesis 6 (H6) proposes that pedagogical content knowledge positively affects teachers' satisfaction. The estimate of the path coefficient is .066, which is not statistically significant ( $p > .05$ ) and indicates no significant effect of pedagogical content knowledge on teachers' satisfaction. The *SE* of the estimate is .074, which suggests a less precise estimate than the previous hypotheses, and the 95% *CI* ranges from -.084 to .217, indicating a low degree of confidence in the estimate.

## Discussion

The purpose of this study was to examine the effects of teacher professional development, quality of lecture design, student engagement, teacher technical skills, and pedagogical content knowledge on teachers' satisfaction in utilizing AI-Powered tools for designing lectures. The proposed conceptual model explained 55.7 percent of the variance in teachers' satisfaction, which indicates a good fit of the data.

The results supported four out of six hypotheses. H1 was supported by the data, which showed that teacher professional development had a positive and significant effect on quality of lecture design. This finding is consistent with previous studies that have found that teacher professional development can enhance teachers' knowledge, skills, and confidence in designing and delivering lectures (Donath et al., 2023; Mowbray & Perry, 2015). Teacher professional development can also provide teachers with opportunities to learn from peers, experts, and feedback, which can improve their instructional practices and quality of lecture design (Donath et al., 2023). In terms of H2, it was also supported by the data, which showed that quality of lecture design had a positive and significant effect on student engagement. This finding is in line with previous studies that have found that quality of lecture design can influence student engagement in learning environments (Costley et al., 2017; Lange & Costley, 2020). Quality of lecture design can foster student engagement by providing clear learning objectives, relevant and meaningful content, interactive and collaborative activities, timely and constructive feedback, and appropriate assessment methods (Maunula et al., 2023). With respect to H3, the data showed that student engagement had a positive and significant effect on teachers' satisfaction. This finding is consistent with previous studies that have found that student engagement can enhance teachers' satisfaction in teaching (Klassen et al., 2012; Orhan & Beyhan, 2020). Student engagement can increase teachers' satisfaction by creating a sense of community, interaction, and feedback among teachers and students, which can reduce the feelings of isolation and frustration that teachers may experience in teaching (Klassen et al., 2012; Orhan & Beyhan, 2020). H4 was also supported by the data, which showed that quality of lecture design had a positive and significant effect on teachers' satisfaction. This finding is in line with previous studies that have found that quality of lecture design can influence teachers' satisfaction (Katai & Iclanzan, 2023). Quality of lecture design can increase teachers' satisfaction by providing teachers with a control over their work (Fernandes et al., 2020; Maunula et al., 2023; Mowbray & Perry, 2015). H5 and H6 were not supported, as teacher technical skills had a negative effect on teacher satisfaction, and pedagogical content knowledge had no

significant effect. A possible explanation for the unexpected finding of H5 is that teacher technical skills may not be sufficient to ensure teachers' satisfaction in utilizing AI-powered tools, especially when they are not accompanied by adequate technical support, resources, and training. Another possible explanation is that teacher technical skills may have a negative impact on teachers' satisfaction when they are perceived as a source of stress, anxiety, or frustration due to technical difficulties, glitches, or failures. The finding of H6 is also contrary to previous studies that have found that pedagogical content knowledge can positively influence teachers' satisfaction (Sadaf, 2019) in utilizing AI-powered tools. A possible explanation for this finding is that pedagogical content knowledge may not be a strong predictor of teachers' satisfaction in utilizing AI-powered tools, compared to other factors such as quality of lecture design, student engagement, or teacher professional development. Another possible explanation is that pedagogical content knowledge may not be adequately measured or operationalized in this study, as it is a complex and multidimensional construct that involves teachers' knowledge of subject matter, students' characteristics and needs, and instructional methods and strategies.

The findings of this study have significant theoretical and practical implications. Theoretically, the study adds to the growing body of research on AI-powered design in education by exploring the impact of these tools on teachers' satisfaction. By identifying the digital competencies required for effective use of AI-powered design tools, the study contributes to our understanding of the skills that teachers need to develop to successfully integrate AI into their teaching practice. Practically, the study has several important implications for educators and policymakers. First, the study highlights the potential benefits of AI-powered design tools for reducing teacher workload and improving the quality of lectures. By automating routine tasks such as grading and lesson planning, these tools can free up more time for teachers to focus on higher-order tasks such as creating personalized learning experiences for their students. Second, the study underscores the importance of providing teachers with the training and support they need to effectively use AI-powered design tools. This includes not only technical training but also training on how to integrate these tools into their pedagogical practices. Finally, the study has significant implications for the design and development of AI-powered design tools for education. By identifying the factors that influence the effective use of these tools in the classroom, the study provides insights into how these tools can be designed to better meet the needs of teachers and students.

### **Conclusion**

In conclusion, this study provides valuable insights into the factors that influence teacher satisfaction in utilizing AI-powered tools for designing lectures. The findings of the study confirm that teacher professional development, quality of lecture design, student engagement, and pedagogical content knowledge have a positive effect on teacher satisfaction. However, the study also reveals that teacher technical skills have a negative effect on teacher satisfaction, and pedagogical content knowledge has no significant effect. The proposed conceptual model offers a useful framework for understanding the complex interplay between these factors and their impact on teacher satisfaction. The model explains a significant proportion of the variance in teacher satisfaction, indicating its validity and usefulness in practice. The results of this study have important implications for both theory and practice. The findings highlight the importance of investing in teacher professional development and promoting quality lecture design to enhance teacher satisfaction. Moreover, the study underscores the need to re-examine the role of teacher technical skills in utilizing AI-powered tools and the importance of considering the specific pedagogical context when assessing the impact of pedagogical content knowledge.

### **Recommendations**

Based on the findings of this study, the following recommendations are suggested: First, there is a need to incorporate AI-powered facilitator into the professional development of primary school teachers. The results showed that primary school teachers had positive perceptions of using AI-powered facilitator, and that they found Microsoft Power Point Designer easy to use and beneficial in designing lectures. Therefore, it is recommended that AI-powered facilitators should be integrated into the professional development of primary school teachers to help them become more proficient in their use and increase their satisfaction levels. Second, the study found that training programs via face-to-face, online, and pre-recorded videos were effective in helping primary school teachers learn how to use Microsoft Power Point Designer. Thus, it is recommended that training programs should be provided to primary school teachers to enhance their knowledge and skills in using these tools. Third, since primary school teachers have positive perceptions of using AI-powered facilitator, it is recommended that educational policymakers should develop and implement policies to support their adoption in primary schools. These policies could include providing funding for the purchase of these tools, developing curricula that incorporate their use, and offering incentives for teachers who use them. And finally, the present study provides valuable insights into the factors that influence the satisfaction of primary school teachers in utilizing AI-powered facilitators. However, more research is needed to explore the effectiveness of these tools in improving student learning outcomes and to investigate the potential barriers to their adoption in primary schools.

### **Limitations**

There are several limitations to this study that should be acknowledged. Firstly, the study was conducted only in the Northern mountainous region of Vietnam, so the findings may not be generalizable to other regions or countries.

Secondly, the sample size was limited to 208 primary school teachers, which may not be representative of the entire population of primary school teachers in the region. Thirdly, the study relied on self-reported data from participants, which may have introduced bias or inaccuracies in the responses. Finally, the study did not investigate the long-term effects of incorporating AI-powered design tools into the professional development of primary school teachers, so it is unclear whether the positive perceptions and benefits reported by participants will be sustained over time.

### Ethics Statements

In this study, all participants were informed about the purpose of the research, the type of data collected, how the data would be stored and distributed, and their ability to opt out at any time. No personal information was collected, therefore, this study adhered to the principles of ethical research.

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### Conflict of Interest

The authors declare no conflict of interest with other research.

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