Relationship Between Artificial Intelligence (AI) in Supporting Differentiated Learning for Patient-Students in School in Hospital (SIH)

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DOI: https://doi.org/10.47772/IJRISS.2026.1026EDU0053

Received: 17 January 2026; Accepted: 22 January 2026; Published: 03 February 2026

ABSTRACT

This study aims to identify the level of Artificial Intelligence (AI) usage in teaching at Schools in Hospitals (SiH), determine the level of effectiveness of differentiated learning, and to analyze the relationship between both variables in the context of patient-students. The study employed a quantitative descriptive correlational design involving 48 SiH teachers selected through purposive sampling. Data were collected using a structured five-point Likert-scale questionnaire and analyzed using IBM SPSS Statistics. Descriptive analysis, the Shapiro–Wilk normality test, and Spearman's correlation were conducted. The findings indicate that the level of AI usage (M = 2.91) and differentiated learning (M = 2.40) were at a moderate level. However, the correlation analysis revealed a significant and strong positive relationship between AI usage and differentiated learning (r_s = 0.643, p < .05). The study concludes that AI has the potential to support a more flexible and adaptive implementation of differentiated learning in SiH. Future studies are recommended to examine the long-term effects of AI usage on the academic development and well-being of patient-students.

Keywords: Artificial Intelligence, Differentiated Learning, School in Hospital, Patient-Students

INTRODUCTION

The global educational landscape is undergoing a radical transformation phase through the integration of Artificial Intelligence (AI), which offers a new dimension to the teaching and learning (T&L) process. According to UNESCO (2023), AI is not merely a digital aid but an adaptive system capable of enhancing educational quality through learning analytics and the provision of precise personal support. In Malaysia, this aspiration is manifested through the MoE Digital Transformation Plan 2021–2025, which emphasizes the construction of a smart education ecosystem to produce digitally fluent and competitive students (Ministry of Education, MoE 2021). This shift demands a move from traditional pedagogical methods toward more flexible, responsive, and personalized approaches, aligning with the requirements of the Education 5.0 era (Nurul Haniza et al., 2025).

The need for personalized learning becomes increasingly critical when involving vulnerable groups, specifically patient-students in School in Hospital (SiH). The SiH program is an inclusive initiative to ensure the continuity of education for students facing health constraints. However, teaching in SiH presents unique challenges as teachers must cater to students with diverse cognitive levels and physiological conditions simultaneously. In this context, differentiated learning emerges as a primary pedagogical strategy. According to Nor Lailatul Azilah et al. (2025), adapting difficulty levels and providing materials suited to the students' learning profiles are key to ensuring effective education for students with special needs.

The synergy between AI and differentiated learning offers innovative solutions to the constraints in SiH. Recent research by Gligorea (2023) proves that AI can support adaptive e-learning, allowing students to learn at their own pace. Furthermore, M. Haziq Saharuddin et al. (2025) emphasize that teachers who master AI technology can optimize the preparation of personalized instructional materials more efficiently. Teacher's acceptance of this smart technology is also becoming increasingly positive; Hamdan Husein Batubara et al. (2025) states that teacher's readiness to integrate AI is high when they perceive a tangible impact on student engagement. Ultimately, the introduction of AI in the SiH ecosystem not only supports the technical execution of

differentiated learning but also acts as a catalyst for the democratization of education for patient-students in Malaysia.

Problem Statement

The School in Hospital (SiH) program was established as a manifestation of inclusive education to ensure patient-students do not drop out of the formal education system. However, the implementation of T&L in SiH faces complex constraints, including inconsistent student energy levels, emotional distress due to chronic illness, and unpredictable treatment schedules that affect attendance and learning continuity (MoE, 2021). These conditions make the learning experience of patient-students non-linear, requiring pedagogical approaches that are flexible and responsive to individual needs.

Differentiated learning is a critical necessity because patient-students represent various ages, cognitive levels, and physical abilities within a single T&L session. However, implementing differentiated learning manually poses significant challenges, particularly in preparing personalized materials and activities. Time and resource limitations potentially jeopardize the effectiveness of pedagogical interventions, thereby impacting the motivation, engagement, and academic achievement of patient-students (Nor Lailatul Azilah et al., 2025).

In the era of digital transformation, AI is seen as having great potential as a catalyst for adaptive learning through its ability to generate materials automatically, adjust content to individual needs, and provide immediate feedback (UNESCO, 2023). Yet, the integration of AI within the SiH context in Malaysia remains at a concerning level. Previous studies have found that primary challenges include pedagogical competency in using AI and concerns regarding the transparency and validity of assessments in digital environments (Wan Nur 'Irfah Ilhami & Mohd Isa Hamzah, 2024; Nurul Haida & Zamri Mahamod, 2025).

Furthermore, empirical evidence specifically linking AI usage to the effectiveness of differentiated learning for patient-students is limited. The absence of systematic data on this relationship creates a significant research gap (M. Haziq Saharuddin et al., 2025). Therefore, this study was conducted to evaluate the relationship between the level of AI usage in T&L and the effectiveness of differentiated learning in SiH to fill the contemporary literature gap and support the development of more inclusive and sustainable educational practices (Rajeswary & Mohd Jasmy, 2025).

Research Objectives

This study was conducted to achieve the following objectives:

i. To identify the level of AI usage in teaching among SiH teachers.

ii. To determine the level of effectiveness of differentiated learning among patient-students in SiH.

iii. To analyze the relationship between AI usage and the effectiveness of differentiated learning among patient-students in SiH.

Research Questions

i. What is the level of AI usage in T&L among SiH teachers?

ii. What is the level of effectiveness of differentiated learning among patient-students in SiH?

iii. Is there a significant relationship between AI usage and the effectiveness of differentiated learning among patient-students in SiH?

Research Hypotheses

i. **H_0:** There is no significant relationship between the level of AI usage by teachers and the effectiveness of differentiated learning among patient-students in SiH.

ii. **H_a:** There is a significant relationship between the level of AI usage by teachers and the effectiveness of differentiated learning among patient-students in SiH.

LITERATURE REVIEW

Pedagogical Transformation Through AI

The integration of AI in education has surged in line with the MoE Digital Transformation Plan 2021–2025 (MoE, 2021). UNESCO (2023) notes that AI now acts as an adaptive pedagogical system capable of analyzing student needs in real-time. M. Haziq Saharuddin et al. (2025) emphasize that AI effectiveness depends on the teacher's Technological Pedagogical Content Knowledge (TPACK). AI has the potential to reduce teacher cognitive load through automated material generation and immediate feedback (Küçükuncular & Ertugan, 2025).

Importance of Differentiated Learning in Inclusive Education

Differentiated learning is a core strategy for educational equity. Nor Lailatul Azilah et al. (2025) state that teachers must differentiate content and processes according to student readiness. In the SiH context, this flexibility is mandatory due to unpredictable treatment cycles. This strategy allows for T&L that is responsive to student energy and emotions, supporting cognitive well-being during hospitalization (Nurul Haida & Zamri Mahamod, 2025).

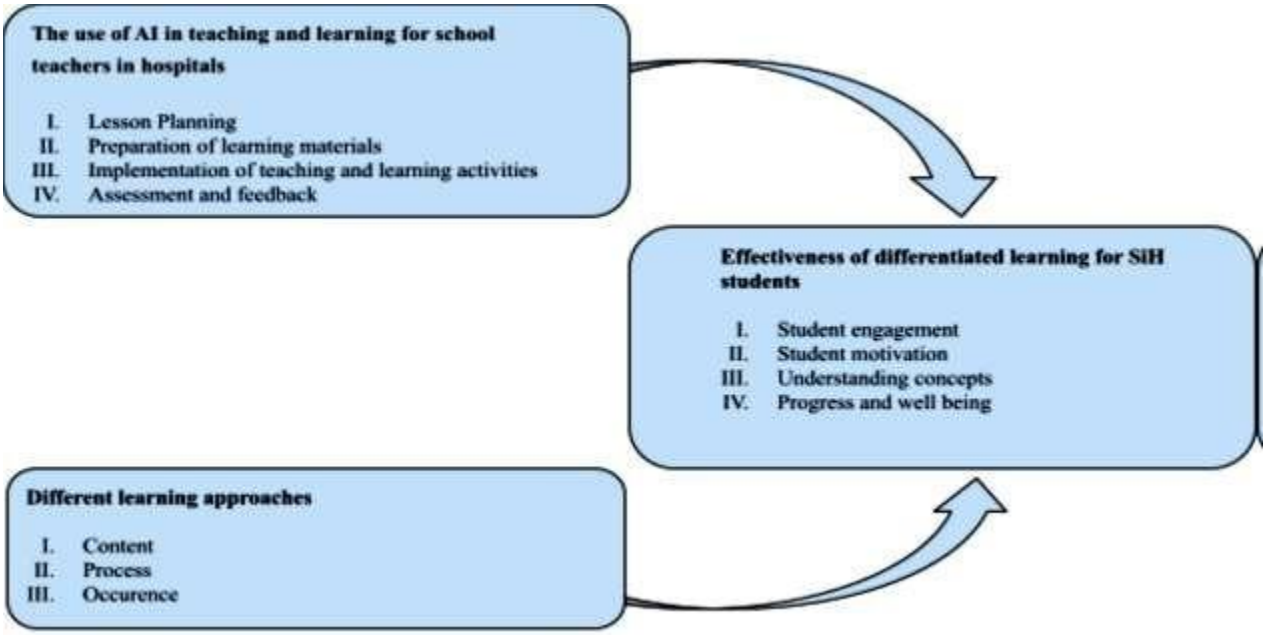
Synergy of AI in Empowering Differentiated Learning

Recent studies prove AI acts as an enabler for efficient differentiated learning. Cizem Bas and Askin Kiraz (2025) found that AI allows teachers to provide personalized STEM modules rapidly. In Malaysia, Nurul Haniza et al. (2025) argue that AI in the 5.0 era bridges learning gaps through adaptive content. This is reinforced by Regina Kana et al. (2025), who found that smart tools stimulate motivation among learners with access barriers.

Conceptual Framework

This study links AI Usage (Independent Variable) with the Effectiveness of Differentiated Learning (Dependent Variable) in SiH. AI usage is defined through three dimensions: content adaptation, teaching process facilitation, and learning outcome monitoring. Effectiveness is measured through engagement, motivation, and achievement.

Figure 1 Conceptual Framework of the Study



METHODOLOGY

Research Design

This study utilized a quantitative descriptive correlational approach to assess the level of AI usage and its relationship with differentiated learning in SiH. Correlational design is appropriate for examining relationships between variables without manipulation (Creswell & Creswell, 2021).

Population and Sample

The population consisted of teachers serving in Schools in Hospitals (SiH). A total of 48 SiH teachers were involved in the sample area Kuala Lumpur and Selangor. Selection was made via purposive sampling, focusing on those directly involved in T&L with digital experience (Etikan et al., 2020).

Instrumentation

A structured questionnaire was developed based on previous studies. It was distributed via Google Forms (Salkind, 2022).

Measurement Scale and Reliability

A five-point Likert scale was used. Internal reliability was tested using Cronbach's Alpha, yielding a value of $\alpha = .765$, which is considered satisfactory (Hair et al., 2022).

Data Analysis Procedure

Data were analyzed using IBM SPSS Statistics. Descriptive analysis determined levels of usage and effectiveness. The Shapiro–Wilk test assessed normality. Since data were not normally distributed, Spearman's Correlation was used for inference (Pallant, 2020).

FINDINGS

Normality Analysis

As shown in Table 1, the Shapiro–Wilk significance values for both variables were less than 0.05, indicating non-normal distribution. Consequently, non-parametric tests were employed.

Table 1 Normality Test (Kolmogorov-Smirnov & Shapiro-Wilk)

Variable	Test	Statistic	df	Sig. (p)	Result
AI usage skor	Kolmogorov-Smirnov	0.145	48	0.013	Non-Normal
	Shapiro-Wilk	0.942	48	0.020	Non-Normal
Differentiated learning score	Kolmogorov-Smirnov	0.146	48	0.012	Non-Normal
	Shapiro-Wilk	0.921	48	0.003	Non-Normal

Level of AI Usage

Descriptive statistics (Table 2) show that the level of AI usage was moderate ($M = 2.91$, $SD = 0.66$).

Table 2 Descriptive Statistics for AI Usage

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Penggunaan AI	48	1.50	4.20	2.91	0.66

Level of Differentiated Learning

Table 3 shows that the effectiveness of differentiated learning was also at a moderate level ($M = 2.40$, $SD = 0.49$), leaning toward the lower end of the moderate scale.

Table 3 Descriptive Statistics for Differentiated Learning

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Pembelajaran Terbeza	48	1.20	3.10	2.40	0.49

Relationship Between AI Usage and Differentiated Learning

Spearman's correlation (Table 4) indicated a significant and strong positive relationship (r_s = 0.643, p < .01). Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted.

Table 4 Spearman's Correlation Results

Variable	r_s	Sig. (2-tailed)	N	Result
AI Usage & Differentiated Learning	0.643	0.000	48	Significant

DISCUSSION

The findings show that AI usage in SiH is at a moderate level (M = 2.91), indicating that while teachers have begun utilizing AI, it is not yet comprehensive. This is likely due to hospital constraints like short T&L durations and fluctuating student health. Similarly, differentiated learning is at a moderate level (M = 2.40).

The strong positive correlation (r_s = 0.643) confirms that as AI usage increases, the effectiveness of differentiated learning also improves. In SiH, AI serves as a facilitator that helps teachers adapt materials and provide rapid feedback tailored to patient-students' unique needs.

CONCLUSION

This study concludes that integrating AI into differentiated learning holds significant potential for enhancing T&L in SiH. AI supports personalization and maintains student engagement despite health limitations. It is recommended that professional teacher training and digital infrastructure be strengthened. Future research should focus on the long-term impact of AI on the holistic development of patient-students.

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