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Establishing a Five-Stages of AI Learning Based on Class Observation

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Abstract: *This paper presents a five-stage framework for AI learning based on classroom observations. It defines the stages and explores how teachers and students develop confidence in utilizing various AI tools, acknowledging both their constructive advantages and potential risks. The study emphasizes the transformative influence of integrating AI into the dynamics of learning and teacher-student relationships, fostering a more interactive educational environment. Through case studies conducted in South Korean classrooms, this research offers practical steps and considerations for educators and administrators to successfully integrate AI technologies, with the aim of enhancing digital and AI competencies in education. The findings highlight the significance of adopting a comprehensive approach to AI-integrated instruction, taking into account factors such as educational level, subject, and students' preparedness. This framework is designed to provide guidance for the effective utilization of AI in educational settings, supporting the objective of promoting AI literacy and closing educational gaps.*

Keywords: Artificial intelligence (AI); AI-driven language education; AI/digital competency; AI-embedded English education; AI utilization in education; IDLE; stages of AI learning; class observation

1. Introduction

The world is on edge with the proliferation of artificial intelligence (AI). Not only OpenAI's ChatGPT, but various countries are also developing AI optimized for their respective languages, through their own search engines, such as Naver in South Korea and Baidu in China. The field of education is no exception. AI-integrated lessons are being implemented in elementary, middle, and high school classrooms in South Korea with programs like Smart Math Expedition, AI Peng Talk for English education, One Hour, etc. Using AI-assisted tools can promote educational equity by making the cost of learning more affordable, thus benefiting socially disadvantaged groups. However, there is also the possibility that private education may expand with the advancement of AI, leading to both benefits and risks. [1]. There could be huge differences between countries based on their commitment to and use of AI in education. For instance, in countries that oppose using AI (which might include some developed nations) or in countries where building the necessary AI infrastructure is difficult (often developing nations), students may not develop digital and AI literacy. This highlights the importance of national interest in AI education for shaping future educational policies.

Artificial intelligence (AI) is revolutionizing the educational landscape, transforming traditional teaching methodologies and enhancing learning experiences. In the case of South Korea, every classroom in primary, middle, and high schools is equipped with electronic whiteboards and well-established Wi-Fi (wireless internet) [2, 3]. Due to the government's one-student-one-tablet policy, all students have free-use digital tablets in class. This infrastructure was fully established during the COVID-19 period, allowing schools to achieve an optimal setup for digital and AI-utilized classes in the post-COVID era. Initially, there were concerns about the underutilization of this infrastructure in classes. However, South Korean teachers and students quickly adapted, going beyond being ‘digital natives’ to becoming ‘AI natives’ [4]. Many teachers enthusiastically started integrating AI into their lessons, having students share their activities on Padlet, conducting group learning

through various Google Classroom management tools, and using gamification for formative assessments. Furthermore, the government has announced plans to invest substantial funds into training programs aimed at enhancing teachers' AI and digital competencies [5, 6].

However, both teachers conducting AI-utilized classes and those who have yet to start are experiencing confusion due to the lack of clear criteria on what constitutes an AI-utilized class. This research proposes a "Five-Stage Framework for AI-Integrated Education," focusing on practical steps and considerations for educators, administrators, and learners. Developed based on observations from AI-utilized classes, the framework aims to guide the effective use of AI technologies in educational settings. The study aims to propose a comprehensive framework for integrating AI into education, based on the analysis of classroom case studies. This framework is designed to be applied to AI-integrated classroom lessons and to enhance digital/AI competencies in teacher training.

2. Literature Review

In the literature review, it was found that to help AI natives engage in the classroom with joy and comfort, teachers need to design lessons utilizing AI. Such lessons not only enhance the cognitive benefits of personalized and individualized instruction through AI, increasing educational efficiency, but also play an affective role in transforming classroom anxiety into classroom enjoyment [4]. This approach not only realizes Universal Design for Learning (UDL) [7] but also introduces an innovative instructional design that disrupts traditional classroom hierarchies. UDL is an educational framework aimed at making learning accessible and effective for all students by providing flexible teaching methods, materials, and assessments to meet diverse learning needs. In traditional settings where teachers held a hierarchical advantage over students, AI-assisted instruction allows both teachers and students to become active participants and co-learners, promoting a non-hierarchical learning environment [4], [8], [9]. Thus, AI-based lessons can offer solutions to various problems currently faced by our schools. In this regard, AI-based lessons can help address problems such as social conflicts, mental health issues, and well-being concerns, and could be a future solution for these challenges in Korean schools. As demonstrated in the study on affective variables and informal digital learning of English (IDLE) [10], digital learning activities significantly influence engagement and emotional states, which are crucial for second language communication. Notably, the educational advantages of affective factors such as perseverance, self-assurance, and motivation, along with productive IDLE activities, should be highlighted to encourage students' willingness to communicate in a second language. These findings expand the current understanding of IDLE and second language communication behavior, helping to bridge the interdisciplinary gap between computer-assisted language learning, second language acquisition, and psychology.

AI-enhanced education has become an imperative for the current and future learners who are AI natives, rather than merely an option. In line with these contemporary demands, in South Korea, it is highly commendable that from 2025, all teachers of mathematics, English, and information subjects will receive training to enhance their digital and AI competencies with the introduction of digital textbooks utilizing AI functionalities [5, 6]. However, before investing substantial budgets into teacher training, it is crucial to establish clear criteria for what constitutes AI-based instruction.

Recent previous research conducted in South Korea on AI-assisted instruction is as follows:

In a study that developed a teaching design model for elementary English speaking using an AI chatbot [11], the research presented design principles, a conceptual model, and a process model for introducing AI chatbots into English speaking skill education and evaluated their effectiveness in a real classroom environment. The study demonstrated that AI chatbots could positively impact the improvement of English communication skills, increase student engagement, and provide personalized feedback. This suggests that AI chatbots have the potential to bring positive changes to class improvement and effectiveness in elementary English education.

[12]'s study, "Development of Instructional Design Model for English Speaking Classes Using AI-powered Chatbot in Elementary School," investigated changes in speaking skills and affective domains (interest, confidence, motivation, attitude) among fourth-grade students using the AI Peng Talk program. The study found that utilizing AI Peng Talk positively impacted both speaking skills and affective domains. It particularly noted that elements considering novelty effects (wow effects) and individual developmental characteristics of learners had a positive influence on increasing interest.

A study titled "The effects of AI chatbot-based activities on elementary English learners' vocabulary abilities and affective domains" examined the impact of AI chatbots on students' English vocabulary and emotional engagement. In the study, 109 fifth-grade students were divided into an experimental group using

chatbots and a control group that did not. The findings showed that chatbots positively influenced vocabulary learning and boosted learners' interest and confidence. However, the study noted that the chatbot's voice recognition accuracy needs improvement [13].

In the comparative study on deductive and inductive methods of English vocabulary learning using ChatGPT [14], researchers conducted an experiment with 104 sixth-grade students from an elementary school in Gyeonggi Province. The students were divided into two groups: one group received deductive vocabulary instruction, while the other group received inductive vocabulary instruction. The results showed that the immediate effects of the deductive learning method were significantly more effective than those of the inductive learning method. However, there was no significant difference between the two methods in terms of long-term effects. This study suggests that using ChatGPT for English vocabulary learning as a foreign language can foster a positive perception among students. A meta-analysis study [15] examined the impact of AI chatbot-based English education programs on language learning effectiveness. Researchers analyzed 44 studies published between 2002 and March 2023, focusing on learners of English as a foreign language. The meta-analysis found that these programs had a moderate, significant educational effect, with an effect size of 0.43. Key moderating variables included the educational level by age group and the duration of each lesson. Programs targeting university students showed the highest effectiveness.

3. Methodology

3.1 Participants and Setting

For this study, a total of six AI-utilized classes were observed: For three schools, on April 15th and 16th, 2024, we visited the schools to directly observe the AI-utilized classes using a framework for observing AI-utilized English classes [16]. We visited S Elementary School in Special City S, D High School in Metropolitan City D, and H High School in K Province to observe English classes. After observing the classes, we conducted face-to-face interviews with each teacher. Additionally, J High School in Metropolitan City D was visited on May 22, 2024, to observe Teacher J's AI-utilized class using ChatGPT and Kahoot. Only one of the two researchers attended the class and recorded the lesson, then shared the results with the other researcher.

For the other two schools, instead of direct class observation, we analyzed AI-utilized class videos provided by the teachers who conducted those classes to review the various types of AI classes conducted using a framework for observing AI-utilized English classes [16]. To understand the different types of AI-utilized classes, we analyzed the AI Peng Talk class video from 2021 by a teacher from C Elementary School in G Metropolitan City. We conducted a face-to-face interview on April 16, 2024, and a 30-minute phone interview on May 22, 2024. For the middle school class, we were provided with weekly class videos from the first semester of the 2024 academic year by a teacher from H Middle School in K Province, and we conducted a face-to-face interview on May 28, 2024.

3.2 Using the Framework for Observing AI-Utilized English Classes

The classes were analyzed using the 'S.M.A.R.T. Framework for Observing AI-Utilized English Classes' like below.

Table 1. S.M.A.R.T. Framework for Observing AI-Utilized English Classes (Modified from [16])

	S.M.A.R.T. Teaching and Learning Activities using AI	
1	(Self-directed) Activities to enhance self-directed learning ability	1 – 2 – 3 – 4 – 5
2	(Motivated) Motivational activities through creative learning experiences	1 – 2 – 3 – 4 – 5
3	(Adaptive) Individualized activities tailored to levels and aptitudes using AI	1 – 2 – 3 – 4 – 5
4	(Resource Free) Utilizing rich educational content through AI	1 – 2 – 3 – 4 – 5
5	(Technology Embedded) Activities to improve digital literacy	1 – 2 – 3 – 4 – 5
6	Enhancing immersion in enjoyable AI-utilized English classes	1 – 2 – 3 – 4 – 5

7	Reducing student anxiety and increasing class concentration through effective class management	1 – 2 – 3 – 4 – 5
	Active Student Participation in Classes	
8	Active communication exchange between teacher and students	1 – 2 – 3 – 4 – 5
9	Efficient teacher questioning to encourage creative thinking	1 – 2 – 3 – 4 – 5
10	Student interaction and creative collaboration	1 – 2 – 3 – 4 – 5
11	Students' self-directed learning abilities	1 – 2 – 3 – 4 – 5
	Observation Items for Utilization of Smart Classroom Equipment	
12	AI utilization conditions of the classroom environment (facilities, equipment, infrastructure, etc.)	1 – 2 – 3 – 4 – 5
13	Appropriateness of AI program selection considering learning tasks and student interests	1 – 2 – 3 – 4 – 5
14	Achievement of learning objectives through AI-utilized classes	1 – 2 – 3 – 4 – 5
15	Teacher's proficiency in using AI and smooth lesson delivery	1 – 2 – 3 – 4 – 5

4. Findings

Based on observations of five AI-enhanced lessons, we developed the "Five Stages of AI Learning." Each stage is explained below, along with examples of corresponding lessons. Through the analysis of classroom case studies and recent literature, we propose a "5-Stage Criteria for AI-Enhanced Education" for AI-integrated instruction and teacher training in digital/AI competencies. When using these criteria, note that this framework is not intended to rank teachers by how much they incorporate AI into their lessons. Instead, it allows teachers to freely choose the appropriate stage, from 1 to 5, for each lesson based on specific objectives. Factors to consider include educational level, subject, grade, timing, learning goals, students' readiness, and the school's AI environment. This approach ensures that teachers maintain autonomy in their instructional design.

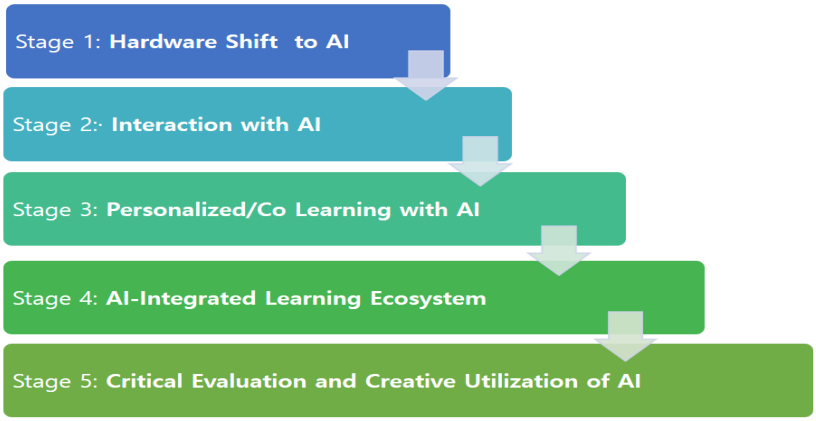


Figure 1. Five Stages of AI learning

The explanation of the five stages of AI-utilized classes presented in Figure 1 is as follows:

Stage 1 mainly involves changes in hardware. Students shift from traditional methods of writing on paper to recording learning activities on digital tablets. However, student engagement often centers on simply using the devices, rather than actively and creatively utilizing them for their own purposes. Teaching methods remain traditional, with teachers directing students instead of allowing them to explore and engage with AI tools on their own. This stage corresponds to the classes at D High School in City D. These classes are optimized for preparing students for some kinds of exams (mid/final term exam, college entrance exams, etc.). Considering that the day after the class observation was the school's midterm exam, it can be said that the teacher effectively utilized the Stage 1 approach, taking into account the students' needs and timing.

Stage 2 involves the introduction of AI-based features such as automatic grading systems, AI assistant teachers, or adaptive learning platforms. AI helps personalize learning experiences based on individual student needs and learning styles, incorporating gamification and simulations to aid student understanding. Stage 2 corresponds to the classes conducted by Teacher J at J High School in Metropolitan City D. In this class, Teacher J integrated subjects by teaching scientific content about the formation of hurricanes in English. Students used ChatGPT in teams to independently explore the "process of hurricane formation," and then shared their findings through a "Gallery Walk," fostering a learner-centered approach. The class made full use of the S.M.A.R.T. elements from the observation tool in [16], scoring high on the S.M.A.R.T. Teaching and Learning Activities using AI (items 1-7) and also achieving high scores on Active Student Participation in Classes (items 8-11).

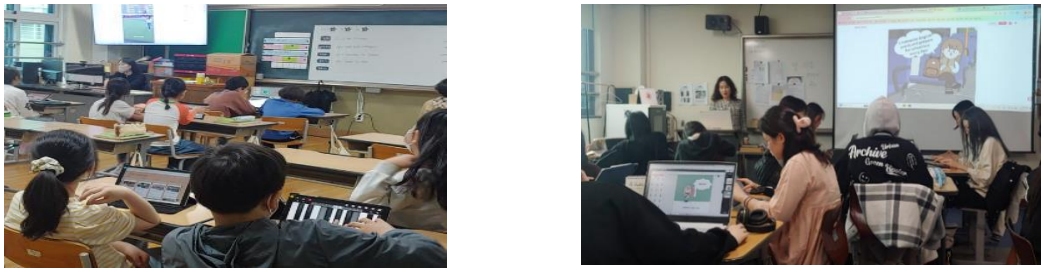
(**a**) (**b**)

Figure 2. Class examples of Stage 1(a) and Stage 2(b) of AI learning

Stage 3 highly interactive learning experiences are tailored to each student's pace, preferences, and skill level using AI. AI provides personalized feedback, recommendations, and adaptive learning paths based on real-time data analysis. Computer Adaptive Testing (CAT) for individual student assessments also becomes possible. This stage corresponds to the classes conducted by teachers at S Elementary School in City S.

Stage 4 is integrated into all aspects of the learning environment, including wearable devices, augmented reality tools, and smart classroom infrastructure. AI facilitates collaborative learning experiences, peer feedback, and immersive simulations and virtual environments for real-world problem-solving. It personalizes learning materials in real-time through AI-driven content creation and curation using advanced data analytics and machine learning algorithms.

In the final stage, students not only use AI but also gain a deep understanding of its strengths and weaknesses. They become adept at strategically dividing tasks between human and AI collaborators. Cutting-edge AI technologies, such as brain-computer interfaces, holographic displays, and neuro-adaptive systems, are seamlessly integrated into all aspects of the learning environment. In these classes, students form cognitive partnerships with AI, critically evaluating AI outputs and creatively modifying and enhancing them. This stage is exemplified by the AI-utilized classes at H High School in Province K, where students move "Beyond AI" by critically evaluating and creatively leveraging AI outputs.



(**a**) (**b**)

Figure 3. Class examples of Stage 3(a) and Stage 5(b) of AI learning

After a demonstration class, in an interview with teachers, J, a teacher from Metropolitan City D who implemented a 2 step AI-assisted class, mentioned that the attention span of today's students has significantly decreased compared to students in the past. To keep students engaged in class, it is necessary to prepare a variety of AI-assisted lessons, which help maintain their focus and enhance cognitive effects through AI-based teaching. Additionally, K, a teacher from K Province who implemented a 4-5 step AI-assisted lesson, stated that since incorporating AI into their English lessons, even students who rarely participated (those who had given up on English) were able to creatively and critically engage with stories related to their own lives with the help of AI. This made all students feel like the main characters in the class, and they no longer felt anxiety or boredom towards English.

5. Discussion and Conclusion

To support AI-native students in enjoying and participating in classroom activities, educators need to design AI-integrated lessons. These lessons not only enhance cognitive benefits by improving educational efficiency through personalized instruction but also reduce classroom anxiety, transforming it into enjoyment [4], [8], [9], [10]. Korea's digital-based classroom environments in elementary, middle, and high schools are among the best globally, equipped with one tablet per student and electronic blackboards in every classroom. Building on this advanced hardware, a swift and systematic implementation of AI-based education can position Korea as a global leader in AI-integrated education. The combination of top-down policies from the Korean government [5, 6] and the bottom-up initiatives of individual teachers, as observed in this study, could serve as a model for AI-based education worldwide. The government's proactive investment and interest in AI-based education can establish Korea as a strong AI education nation. To achieve this, the 5-step criteria for AI-based education should allow teachers to flexibly conduct AI lessons according to the situation and the needs and readiness of the students.

For the efforts of the government and individual teachers aspiring for 'K-Edu with AI' to be fruitful, schools need to swiftly and systematically implement various AI-integrated lessons. Nationwide digital and AI competency training for teachers is essential, and the government is already preparing for this. However, to minimize trial and error, it is crucial to respect teachers' autonomy, allowing them to freely choose among the five stages of AI integration. This will foster an environment where teachers can comfortably select the appropriate level of AI utilization. We hope that this 'Five-Stages of AI Learning' framework will enhance students' focus during lessons and transform school classes into sources of joy and fun, rather than anxiety and fear.

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