A Study on Integrating Artificial Intelligence into Teaching Activities in Rural Communities for Elementary School Students

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***Abstract*—Artificial Intelligence (AI) is currently reshaping the education sector, particularly in remote areas. It has enhanced teaching effectiveness while reducing the rural-urban educational gap. With the continuous evolution of AI, this study investigates its role among elementary school students in rural areas of Taiwan. It explores how the implementation of AI technology in school activities influences the satisfaction levels of students participating in these events. By collecting the perspectives of students, parents, and community members regarding the integration of AI into school activities, the research aims to analyze their experiences, satisfaction, and intentions related to their engagement in teaching activities in underserved rural regions. This study employs a structured model and regression path analysis to explore the extent of impact that integrating artificial intelligence into teaching activities in rural communities has on local elementary school students. The results of this study indicate that the integration of AI into teaching activities in rural communities has a positive impact on the relationships among three dimensions: activity experience, activity satisfaction, and behavioral intention. Specifically, (1) Within the activity experience dimension, sensory action and emotional experience have a significant positive correlation with teaching activity satisfaction, explaining 39.3% of the variance in satisfaction. (2) Teaching activity satisfaction is positively correlated with behavior intention, with a notable explanatory power of 34.3%. The findings indicate that sensory action and emotional experience are crucial for enhancing student satisfaction. Reflects students' willingness to participate in further teaching activities based on their satisfaction levels. These results not only showcase the effectiveness of AI in enhancing teaching experiences but also emphasize the critical role of emotional and sensory engagement in fostering student satisfaction and future participation in teaching activities, particularly in underserved rural areas.**

***Keywords*—Artificial Intelligence (AI), rural areas education, activity satisfaction, behavioral intention, regression path analysis**

I. INTRODUCTION

In recent years, AI has rapidly developed and been widely applied, profoundly changing various fields, including school education in remote towns [1]. The integration of AI into teaching activities has sparked considerable interest and demand among many students. However, despite these modern technologies introducing new possibilities for learning, they also highlight the reality of the digital divide [2]. This situation is particularly pronounced in rural areas, exemplified by elementary schools in Chiayi County, Taiwan. Most of these schools are located in mountainous regions, where the roads are rugged and prone to landslides and falling rocks. Students seldom have the opportunity to go down the mountain, often facing issues such as a lack of cultural stimulation, low learning motivation, dysfunctional family education, and a digital gap. They must rely on schools to provide rich learning resources, and most schools are acutely aware of this predicament. Therefore, they frequently collaborate with the community and government to offer diverse courses. As a result, leveraging the abundant natural ecological resources in rural areas, such as stars, fireflies, mullet, bioluminescent mushrooms, flying squirrels, ancient trees, historic temples, traditional houses, bamboo shoots, tea gardens, and coffee plantations, schools actively invite community elders, industry experts, and fruit farmers to serve as lecturers on campus. This initiative aims to cultivate students' sense of identity with their growing community and help them understand their parents' industries, encouraging them to actively support family businesses.

Due to the widespread application of AI, the channels and modes of student learning have changed compared to the past. Through the analysis of students' learning patterns, AI platforms can customize teaching content, ensuring that each student receives guidance tailored to their individual needs. This personalization ensures that all students, regardless of their starting point, have equal opportunities to progress and excel [3]. Integrating AI-related supplementary teaching into the curriculum has become a trend and have generated great expectations for the future impact of AI in Education and Learning (AIED) [4]. This study incorporates AI into teaching activities for elementary school students in rural communities and uses post-activity questionnaires to understand the perceptions and opinions of students, parents, and community members regarding the integration of AI into school activities. This study focuses on exploring the impact of AI integration in teaching activities on the experiences, satisfaction levels, and behavioral intentions of elementary school students in rural communities, their parents, and community members. The objectives of the study include:

1) Analyzing the impact of AI integration in teaching activities on the participation levels of students, parents, and community members.
2) Examining whether the integration of AI into teaching activities can enhance the satisfaction and experiences of students, parents, and community members regarding the activities.
3) Evaluating the acceptance of AI-integrated teaching models among parents and community members, as well as their subsequent behavioral intentions.

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II. Literature Review

According to the Ministry of Education's "Standards for Classification and Identification of Schools in Remote Areas of Taiwan," the definition of remote area schools refers to those located in regions that are geographically isolated and have inconvenient transportation or areas that are disadvantaged in digital learning [5]. Data from the Ministry of Education's Statistics Department in 2018 shows that there are currently 1,106 approved remote area schools below the high school level, accounting for nearly 30% of the total 3,307 schools nationwide [6].

This study integrates AI into the teaching activities of elementary school students in rural communities and, based on the concept of Experiential Marketing proposed by Schmitt [7], examines the extent of the impact on the experiences, satisfaction, and behavioral intentions of students, parents, and community members regarding the integration of AI into teaching activities. The concept emphasizes packaging products or services as a rich, emotional experience, allowing consumers to feel enjoyment, challenge, or emotional satisfaction while using the product or service. Experience provides sensory, emotional, cognitive, action-oriented, and relational value. From the perspective of experiential marketing, it is evident that experiential marketing involves designing experiences based on five key elements of the consumer: sensory perception, emotion, cognition, relationship, and action.

This study explores the relationship between Experiential Marketing in AI-integrated teaching activities, activity satisfaction, and behavioral intention. Tough [8] posits that satisfaction is the feeling or attitude of students towards learning activities; a positive feeling or attitude reflects satisfaction, while a negative feeling or attitude indicates dissatisfaction. Furthermore, Domer [9] believes that students' learning satisfaction depends on the degree of difference when comparing an individual's "expected level" with the "actual outcomes" achieved. The smaller the gap between the "expected level" and the "actual outcomes," the more satisfied the student feels; conversely, a larger gap leads to greater dissatisfaction. Therefore, student satisfaction in this study aims to explore students' feelings and perceptions regarding the integration of AI technology into teaching activities, whether they feel excited and positive about the use of AI tools during the learning process, and whether the learning outcomes meet their expected benefits.

Additionally, in the theory of behavioral intention, it is believed that individuals' actions are driven by their intentions; when a person intends to take a specific action, they are more likely to actually perform that action. Therefore, researching an individual's intention toward a particular action can help understand the motivations and decision-making processes behind their behavior. Ajzen [10] defines behavioral intention as the intention or plan of an individual to engage in a specific action or behavior, representing the decision-making process regarding the choice to perform a particular behavior. Through questionnaire measurements, this can be converted into an individual's willingness to make efforts or the degree of effort they are willing to invest, thus allowing for the explanation and prediction of actual behavioral performance. Regarding research on behavioral intention, Davis [11] developed the Technology Acceptance Model (TAM) based on the Theory of Reasoned Action to explain users' behavioral intentions after using a new information technology, as well as to analyze various factors affecting users' acceptance and use of that technology. Based on the concepts of behavioral intention proposed by Ajzen [10] and Davis [11], this study utilizes a questionnaire on behavioral intention to understand the tendency of participants to continue participating or engage in specific behaviors, such as their willingness to participate in the event again after it concludes or to share their experiences from the event with friends and family and recommend their participation.

III. Materials and Methods

The purpose of this study is to investigate whether the integration of AI into teaching activities in rural elementary schools can provide students and participants with a different experience, enhance their satisfaction with the activities, and influence their behavioral intentions after the activities. This study uses Chatgpt and Open-AI models to assist rural teaching activities [12]. Participants can input keywords or questions, and the AI can produce relevant teaching content, including presentation slides, course outlines, and detailed answers. This process uses deep learning to add teaching activity sources, sample questions, and learning materials in advance. OpenAI's dialogue model combines machine learning algorithms to analyze and predict student performance to provide personalized learning materials during activities. In the relevant teaching activities of this study, schools are equipped with teaching equipment such as tablet computers, touch screens, and electronic whiteboards. In the past, teachers would pre-set the content of teaching activities in relevant equipment for teaching and explanation. Due to the large number of participants in each activity, teachers cannot take into account the individual teaching needs of each participant. Through AI assistance, teachers can now create or link teaching content and customized Q&A information that are suitable for this event in advance, and operate them freely at the event site (see Fig. 1). During the activity, participants can interact with the AI in real time through their personal mobile phones or tablets provided by the school (see Fig. 2). Through Chatgpt deep learning, teachers can customize teaching activity content and Q&A information to ensure correct activity content and teaching quality to meet the actual needs of participants.

Fig. 1. AI-assisted teaching activity content and Q&A information.

Fig. 2. Live Q&A and teaching media using tablet during the event.

On the other hand, this study employs a quantitative approaches to aspect includes a survey to collect data on participants' experiences, satisfaction, and behavioral intentions after participating in AI-integrated teaching activities. A structured questionnaire will be developed to measure: (1) Activity Experience Dimension, which refers to the concept of strategic experience discussed by Schmitt [7]; (2) Activity Satisfaction Dimension, which is based on the concepts of learning activity satisfaction by Tough [8] and Domer [9]; and (3) Behavioral Intention Dimension, which draws from the concepts of behavioral intention as outlined by Ajzen [10] and Davis [11]. This study explores the impact of AI technology integration into teaching activities on the experiences, satisfaction, and behavioral intentions of the participants (students, parents, and community members). The teaching activities in this study are divided into six themes: reading promotion teaching, community ginger garden inspection, community vegetable garden inspection, hand-made coffee teaching activities, tea banquet teaching activities, and diverse exploration activities. Since the host school is a small school in a rural area with only about 10 students in each grade, the teaching activities were held in six sessions, and all students in the school were invited to invite parents and community members to freely participate in at least one activity. Registration for each activity was limited to 50 people. The aforementioned six activities have been held regularly every year in the past, but AI technology-assisted teaching has not been integrated into teaching activities in the past. In this study, we used a stratified random sampling method to ensure a representative sample of participants from rural primary schools. A total of 255 participants were targeted to gain diverse perspectives based on grade level and demographics. The sample stratification included participants in grades 1 through 6, with approximately 30 students and parents per grade. In addition, we included input from approximately 80 community members to enrich the data and provide context for students' experiences. This comprehensive sampling approach not only increases the reliability of our findings but also ensures that the voices of various stakeholders in the education community are represented. The research framework is broadly divided into three major parts: (1) Activity Experience of Participants (sensory, emotional, action-oriented, cognitive, and relational); (2) Satisfaction of Participants (facilities, processes, explanations, and overall satisfaction); (3) Behavioral Intentions of Participants (re-participation, recommendations, sharing, and promotion.). The research framework is shown in Fig. 3.

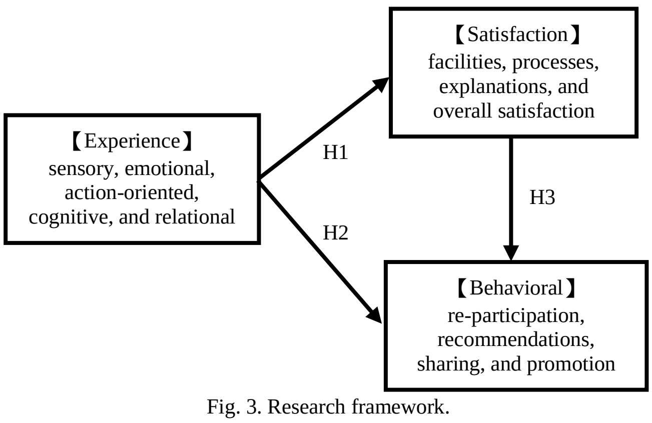

Fig. 3. Research framework.

The teaching activity experience referred to in this study involves all participants in the activities, including students, parents, and community members. Activity satisfaction is also assessed among these participants. Behavioral intention pertains to the same group: students, parents and community members.

Based on Schmitt's five strategic experience model [7], this research aims to integrate technology into the activities, creating diverse experiential formats for participants in the teaching activities to enhance their satisfaction and willingness to continue participating in the future. By understanding the activity experiences of the involved participants, the study hopes to improve satisfaction levels and increase the intention to continue engaging in future activities. Therefore, based on the research framework, motivations, and objectives, the following research hypotheses are proposed:

Hypothesis 1: After the integration of AI technology into teaching activities, the "activity experience" of participants significantly affects their "satisfaction." (H1: Activity experience positively influences the activity satisfaction of participants.)

Hypothesis 2: After the integration of AI technology into teaching activities, the "activity experience" of participants significantly affects their "behavioral intention." (H2: Activity experience positively influences the behavioral intention of participants.)

Hypothesis 3: After the integration of AI technology into teaching activities, the "satisfaction" of participants significantly affects their "behavioral intention." (H3: Activity satisfaction positively influences the behavioral intention of participants.)

The teaching activities referred to in this study are categorized into six themes: "Reading Promotion Teaching," "Community Ginger Garden Investigation," "Community Vegetable Garden Investigation," "Hand Brewed Coffee Teaching Activity," "Tea Ceremony Teaching Activity," and "Diverse Exploration Activities." Since the schools involved in the research are all rural elementary schools, these activities are designed to include the participation of all students and community members, with the integration of AI technology to assist in the teaching process.

IV. RESULT AND DISCUSSION

This study conducted a survey after teaching activities, with the survey period from September 1, 2024, to November 31, 2024. A total of 255 questionnaires were collected, and after excluding 5 invalid questionnaires, there were a total of 250 valid questionnaires, resulting in a valid sample recovery rate of 98.04%. The questionnaire used the Likert scale as an assessment tool for the options, employing a five-point scale for measurement [13].

Statistical Package for the Social Sciences (SPSS) will be employed to conduct all quantitative analyses. This software is user-friendly and widely used in educational research for various statistical tests. The reliability indicators for the three research dimensions were examined using Cronbach's α coefficient [14]. Specifically, (1) The activity experience dimension includes 13 items related to sensory, emotional, action, thinking, and relational aspects, with a Cronbach's α value of 0.783 (> 0.07). (2) The activity satisfaction dimension comprises 4 items concerning facilities, processes, explanations, and overall satisfaction, with a Cronbach's α value of 0.757 (> 0.07). (3) The behavioral intention dimension includes items regarding re-participation, recommendations, sharing, and promotion, with a Cronbach's α value of 0.778 (> 0.07). In addition, the total number of items in the questionnaire amounts to 21, and the overall Cronbach's α coefficient is 0.856 (> 0.07). The examination of Cronbach's α values across the various dimensions indicates that this study's questionnaire demonstrates consistency and stability in both individual dimensions.

Table 1. The component matrix after rotation

Activity Experience Dimension	Classification	Component 1	Component 2	Component 3
Q1	Sensory	0.815		
Q2		0.836		
Q3		0.767		
Q4	Emotional			0.789
Q5				0.833
Q6				0.875
Q7	Action	0.859		
Q8		0.837		
Q9	Cognitive		0.795	
Q10			0.769	
Q11			0.838	
Q12	Relational		0.789	
Q13			0.793	

The validity analysis of each dimension was conducted using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure value [15]. The KMO values for the three dimensions in the scale were 0.739, 0.726, and 0.756 (> 0.7), and the significance of Bartlett's test of sphericity was 0.000 (< 0.05), reaching a significant level, indicating that the data for the three dimensions in this study's scale are suitable for factor analysis. This study employed Exploratory Factor Analysis (EFA) to assess the validity of each dimension and further understand whether there was a need to subdivide the dimensions and which items should be included in sub-dimensions and which should be deleted. Using principal component analysis and the varimax method for orthogonal rotation, factors with eigenvalues greater than 1 were extracted, and items with factor loadings less than 0.4 were deleted. Based on the factor analysis of the activity experience dimension, no items were deleted. The results of the factor analysis after using principal component analysis and the varimax method for orthogonal rotation are summarized in Table 1, indicating that three factors could be extracted for the activity experience dimension. Therefore, the sub-dimensions of the activity experience dimension were named "Sensory Action," "Cognitive Relation," and "Emotional Experience," as shown in Table 2.

Table 2. Naming of sub-dimensions of activity experience

Classification	Sensory Action	Cognitive Relation	Emotional Experience
Sensory	3 Questions		
Emotional			3 Questions
Action	2 Questions		
Cognitive		3 Questions	
Relational		2 Questions	

Additionally, after conducting exploratory factor analysis on 4 question items for each of the two dimensions of activity satisfaction and behavioral intention, no items were deleted, and it was not possible to extract more factors. Therefore, the dimensions of activity satisfaction and behavioral intention cannot be differentiated into sub-dimensions. Summarizing the results of the factor analysis, the impact scale of AI technology integration into teaching activities in rural elementary schools includes three research dimensions: (1) The activity experience dimension can be divided into three sub-dimensions: sensory action, emotional experience, and cognitive relation. (2) The activity satisfaction dimension. (3) The behavioral intention dimension.

Through the Pearson correlation coefficient, the degree of mutual influence between different dimensions can be assessed. By using a correlation matrix, the correlation between different variables can be examined. The test results show that the highest correlation coefficient among the research dimensions is 0.532, all of which are less than 0.8. Therefore, there is no significant multicollinearity among the research dimensions in this study, making it suitable for regression path analysis. This study adopts Structural Modeling and Regression Path Analysis to explore the relationships and influence levels between independent and dependent variables in the research framework. According to the results of the factor analysis, the impact scale of digital technology integration into teaching activities in rural elementary schools includes three research dimensions: (1) The activity experience dimension can be divided into three sub-dimensions: sensory action, emotional experience, and cognitive relation. (2) The activity satisfaction dimension. (3) The behavioral intention dimension. Based on the research framework of this study (as shown in Fig. 3), a structural model of each individual dimension and sub-dimension after factor extraction is shown in Fig. 4.

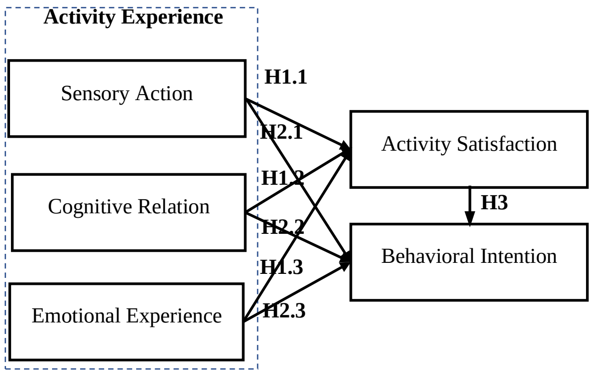

Fig. 4. Structural model and research hypotheses.

The hypotheses H1, H2, and H3 propose that the research dimensions activity experience, activity satisfaction, and behavioral intention have positive and significant effects on each other. Based on these hypotheses, the study proposes the following research hypotheses:

H1.1: Sensory Action in Activity Experience can influence participants activity satisfaction and has a positive relationship.

H1.2: Emotional Experience in Activity Experience can influence participants activity satisfaction and has a positive relationship.

H1.3: Cognitive Relation in Activity Experience can influence participants' activity satisfaction and has a positive relationship.

H2.1: Sensory Action in Activity Experience can influence participants behavioral intention and has a positive relationship.

H2.2: Emotional Experience in Activity Experience can influence participants behavioral intention and has a positive relationship.

H2.3: Cognitive Relation in Activity Experience can influence participants behavioral intention and has a positive relationship.

H3: Activity Satisfaction can influence participants behavioral intention and has a positive relationship.

Based on the research framework and hypotheses, we conducted structural modeling and regression path analysis, using the obtained p-value to evaluate the significance of the paths to verify whether the hypotheses are supported. Here, coefficients (***) represent significance at a two-tailed level of 0.001. The unstandardized regression path coefficients and significance analysis results for this study are shown in Fig. 5.

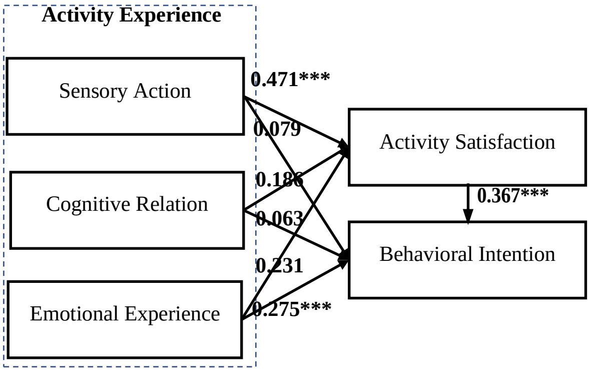

Fig. 5. Unstandardized regression path analysis.

Finally, the study summarizes the path analysis coefficients and the test results of the research hypotheses, as shown in Table 3. According to this table, it can be found that sensory actions and emotional experiences can significantly affect satisfaction. Due to the novel performance of AI, participants' use of AI-assisted teaching activities can strengthen these aspects more than traditional teaching methods. However, not all hypotheses were supported, for example, neither H2.1 nor H2.2 was established. This means that although the participants are satisfied with the auxiliary functions of AI, it is not enough to affect their behavioral intention to continue participating in teaching activities in the future. Therefore, in the case of this study, AI can only play a supporting role and cannot shake the overall content of teaching activities.

Table 3. Path analysis coefficients and research hypothesis test results

Research Hypothesis	Path Coefficient	Significance	Standardized Coefficient	Test Results
H1.1	0.471	***	0.545	Established
H1.2	0.186	0.002	0.231	Established
H1.3	0.231	0.001	0.223	Established
H1	0.828	***	0.566	Established
H2.1	0.079	1.043	0.093	Not Established
H2.2	0.063	1.015	0.075	Not Established
H2.3	0.275	***	0.296	Established
H2	0.459	***	0.314	Established

Based on the above research results, this study illustrates the established paths among the hypotheses and utilizes the path coefficients to determine the hypotheses that present significant relationships. The significant correlated dimensional path relationships all show positive correlations. The results of the standardized regression path analysis of the study framework are shown in Fig. 6.

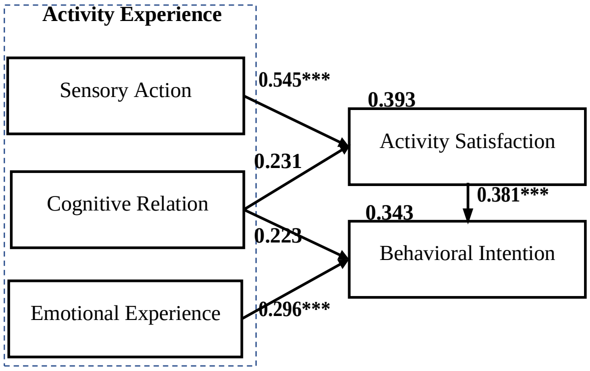

Fig. 6. Standardized regression path analysis.

V. Conclusion

This study explores the relationship among the activity experience, activity satisfaction, and behavioral intentions of participants in teaching activities using AI technology for elementary school students in rural areas. The results indicate:

1) Activity experience can influence participants' activity satisfaction, and there is a positive relationship. Especially for participants who are experiencing AI technology for the first time, beyond generating curiosity, the presentation of teaching methods through AI technology helps participants visualize the learning content more effectively, resulting in a significant increase in their satisfaction with the activity.
2) Activity experience can influence participants' behavioral intentions, and there is a positive relationship. In the experience of teaching activities integrated with AI technology, sensory stimulation significantly affects participants' behavioral intentions, including their willingness to participate again, as well as to share and promote the activity with friends and family. In contrast, in the experience of teaching activities integrated with AI technology, emotional experiences and cognitive connections had less of a positive relationship with participants' behavioral intentions.
3) Activity satisfaction can influence participants' behavioral intentions, and there is a positive relationship. In the experience of teaching activities integrated with AI technology, most participants expressed satisfaction with the experience of the activity. Participants who felt satisfied with the activity were more willing to share the experience with others, even promoting and encouraging others to participate in the activity.

This study is limited to a few elementary schools in a rural area of Taiwan because the researcher is assisting local teachers in implementing digital teaching, aiming to provide students with diverse digital stimuli through the integration of AI technology into their teaching activities. Since the subjects of the study are limited to a few elementary schools in rural areas, this may lead to insufficient representation of the research sample, potentially affecting the generalizability and representativeness of the findings. Therefore, we must treat the conclusions drawn from this study with caution and be wary of generalizing them to other rural schools. Future research should consider expanding the sample size and including a more diverse range of rural elementary schools across different regions of Taiwan. This wider representation can enhance the generalizability of the findings. Moreover, conduct longitudinal studies to assess the long-term impacts of AI integration in teaching. Tracking changes in student engagement, satisfaction, and academic performance over time will provide more robust insights.

Moreover, in order to strengthen the current research and leverage existing AI technology, future research can apply State-of-the-Art (SOTA) deep learning technology [16–18] in the construction of teaching content and activities. These SOTA deep learning models can be applied to personalize teaching experiences, ultimately improving learning outcomes. This suggests that adapting teaching strategies to students' individual needs can further increase student engagement and satisfaction, thereby fostering their motivation to learn.

Conflict of Interest

The author declares no conflict of interest.

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