

Empowering ESL Learners: Implementation of AI and Adaptive Learning Technologies

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Abstract

Rapid advancements in the field of Artificial Intelligence (AI) and adaptive learning have revolutionized the way educational processes occur, especially in ESL settings. This paper seeks to evaluate the impact of implementation of AI and adaptive learning on the engagement and learning of university-level ESL learners. For this purpose, quantitative approach was adopted; and 250 ESL learners were targeted through a survey based on the 5-point Likert scale. Four primary constructs were incorporated in the proposed conceptual framework namely AI Usage (AIU), Adaptive Learning (AL), Student Engagement (SE) and Learning Outcomes (LO). Data analysis was conducted by utilizing Partial Least Square Structural Equation Model (PLS-SEM). Results demonstrate that both AI usage and AL have significant positive influences on SE. In addition, AL has a comparatively greater influence as compared to AI due to the reason that AL is personalized learning. Besides, SE is found to have the greatest influence on LO, which confirms the role of student engagement as a mediator between technology usage and learning outcome. Also, AI usage has a positive influence on LO with a smaller magnitude as compared to SE.

Overall findings of this study highlight the significance of using AI-based technology and personalized learning systems to increase student engagement and improve their learning in the field of ESL. This study makes an important contribution to literature through employing PLS-SEM in ESL setting, which has been used quite rarely before. Practical implications have been discussed for educators, institutions and policymakers to enhance the process of ESL learning through use of technology. Future research could further investigate other factors like learner satisfaction, digital literacy etc.

Keywords: Artificial Intelligence (AI); Adaptive Learning; ESL Education; Student Engagement; Learning Outcome; PLS-SEM

1. Introduction

The last decade has seen significant changes in the field of education due to rapid developments in artificial intelligence (AI) technology. These innovations have affected both approaches to instructions as well as engagement with learning material. The importance of technology has increased greatly within English as a second language (ESL) education. Learners in ESL programs tend to differ in their linguistic, cultural, and educational backgrounds, which creates difficulties when employing the same teaching strategies for all of them. This approach results in a decrease in student motivation, a lack of engagement, and poor progress in the acquisition of language skills.

The rise of adaptive learning platforms that use the power of AI could help address some of these problems. These systems work based on advanced algorithms for analyzing student performance data such as responses to exercises, quiz scores, amount of time spent on particular activities, etc. Based on this information, the system can identify a student's strong and weak areas and adapt accordingly, providing appropriate difficulty levels, more practice for certain skills, or moving forward to more advanced material. Such systems help students learn faster since they do not spend excessive time on mastering skills they already possess or on solving too difficult problems.

One of the main advantages that arise from the application of adaptive learning systems to education is increasing student engagement, an important prerequisite of success. Student engagement is determined by how focused, interested, and motivated students are during classes. Disengaged students are unlikely to engage in active participation and extra practice, which could hinder progress. Personalized learning and the use of AI technologies

could promote greater engagement, as features like immediate feedback, gamification, and progress tracking could make classes more enjoyable. Thus, engagement can become a mediating factor in improving results from adaptive systems.

Adaptive learning systems also allow teachers to switch to the role of a facilitator who provides additional support, if needed, based on data collected by adaptive learning platforms. For example, teachers could focus on helping the students with difficulties or design better strategies for instruction.

Despite promising results and theoretical foundations that highlight the benefits of AI technology and adaptive learning in the field of ESL, there is currently little empirical evidence concerning the influence of these innovations on students' achievements. The current research seeks to address this gap and assess the influence of adaptive AI-supported instruction on students' academic performance. It focuses on the role of engagement as a mediator of this relationship.

Problem Statement

Despite numerous benefits offered by the development of adaptive AI platforms for ESL courses, there is still little empirical research assessing their impact on language learners' achievements. One reason for this lies in the absence of theoretical frameworks for examining the connection between technology and improvements in learning. According to the Technology Acceptance Model, users will be willing to adopt technology because they see the positive outcomes it can provide. Therefore, the implementation of technology can lead to increased student satisfaction and higher academic performance in the long run.

Another theoretical framework that explains the effectiveness of the combination of AI and adaptive technology is Self-Determination Theory. According to this theory, autonomous learners with greater independence are generally more engaged in their classes than students lacking autonomy. Thus, they are more motivated to participate and learn. Adaptive systems could give learners control over their learning process since they could choose topics and pace of the course. Moreover, they would see their progress, which promotes greater engagement and self-efficacy.

Both frameworks can serve as a foundation for researching the connection between AI-supported instruction and student outcomes. In particular, the first one can be used to determine the effects of technology on student satisfaction and learning, whereas the second one could explain how engagement mediates this connection. However, in order to conduct the research and obtain empirical evidence of this interaction, a suitable methodology should be chosen.

Purpose of the Research

In order to determine whether AI-adaptive learning systems are effective in the context of ESL and examine whether student engagement mediates this effect, a research based on Partial Least Squares Structural Equation Modeling (PLS-SEM) will be conducted.

2. Literature Review

2.1 AI in ESL Education

The rise of Artificial Intelligence (AI) has been an essential revolution in the field of education, with numerous implications for learning English as a Second Language (ESL). Firstly, some AI applications, such as chatbots, automated essay scoring software, and Intelligent Tutoring Systems (ITS), seem promising regarding enhancing language learning outcomes. Namely, chatbots offer ESL students a chance to practice their conversational skills without time limitations and fear of mistakes. As opposed to traditional classroom-based conversations, AI chatbots work non-stop, which enables learners to repeatedly interact with the system and thereby gain more experience in terms of vocabulary expansion, constructing sentences, and improving communication skills.

Another AI application is automated essay scoring tools that provide immediate feedback for students in regard to grammatical errors, vocabulary usage, syntax, cohesiveness, etc. It is known that timely feedback is vital in

learning since it makes it possible for learners to correct errors before they become fixed and thus improve memory retention and comprehension of learning material.

Intelligent Tutoring Systems (ITS) represent a third AI tool with huge potential. ITS analyze a learner's skills and predict possible problems, offering an individualized program tailored specifically for each learner's needs. Thus, if an ESL learner is struggling with reading comprehension or grammar, he or she will be able to focus precisely on these areas using exercises targeted at improving specific language skills. In addition to enhancing learning outcomes, AI-driven ESL education seems to increase motivation and build confidence of the learners, as they get sufficient support throughout the learning journey.

2.2 Adaptive Learning Systems

Adaptive learning systems denote a particular AI-based approach aimed at delivering personalized learning instructions. Unlike regular teaching approaches when learners receive the same instructions and tasks, adaptive learning systems constantly modify the level of complexity of tasks, the pace of delivery, and other features depending on the performance of the learner. Therefore, if an ESL learner grasps new vocabulary very quickly, he or she will get increasingly difficult tasks, whereas those who find it hard to master grammar rules will get additional exercises and instructions to achieve proficiency.

These personalized learning experiences require constant monitoring and adjustment based on information obtained from the student's interactions with the platform. Adaptive platforms track such indicators as speed, accuracy of responses, time spent on solving a task, and others. Using this information, adaptive learning systems can predict where the learner is going to struggle and take appropriate measures. In this way, learners neither feel frustrated because of excessive complexity of learning material nor experience boredom due to overly easy exercises. Adaptive platforms also include interactive elements that make learning engaging and enjoyable. Extensive research on educational technology emphasizes the effectiveness of this approach regarding improving retention, understanding, and other aspects of academic performance in ESL learners.

2.3 Student Engagement

Student engagement refers to the degree of learners' attentiveness and motivation during class interaction with teaching material. Student engagement has been proven to be an important predictor of academic success since, generally speaking, engaged students tend to do better academically. In the context of ESL learning, engagement is especially significant, as language acquisition involves practicing new language skills and communicating in language. Hence, if a student is engaged in the process of learning, he or she is more likely to actively participate in class discussions, complete tasks timely, and use acquired language skills in everyday life.

Interactivity constitutes an influential factor that determines the degree of learner engagement in technology-assisted learning experiences. Interactive elements that allow users to be more involved in class interaction are proven to foster learners' engagement in technology-based platforms. Similarly, personalized content and feedback play an important role in fostering higher levels of engagement. When learners are sure that their needs are considered by teaching content, they feel motivated to spend more effort on mastering knowledge and skills. Consequently, higher engagement results in better learning outcomes. Empirical studies confirm that AI technologies enhance engagement through interactivity, personalization, and constructive feedback. Higher engagement leads to improved performance as well.

2.4 Research Gap

Although numerous AI-driven and adaptive learning platforms have been developed and widely used to promote efficient learning outcomes, there still exist significant gaps in empirical research devoted to the interrelationships between these approaches and student engagement and ESL learning performance. Indeed, although many researchers emphasize the potential of these technologies for improving education quality and ESL learning, there is a lack of empirical evidence validating these claims. Moreover, no studies utilizing PLS-SEM approach to evaluate the influence of AI-driven adaptive learning systems on ESL learning performance have been conducted yet. Mediated models of such relationships, including student engagement as the mediator, are even more rare.

Consequently, educators and policymakers are unable to make evidence-based decisions regarding the incorporation of these technologies into the process of learning. It is vital to conduct research in order to explore this area of knowledge from both practical and theoretical perspectives, as it can bring great value for future learning instruction and the development of adaptive learning technologies and ESL education.

3. Conceptual Framework and Hypotheses

The conceptual framework of this research illustrates the relationship between constructs such as Artificial Intelligence usage (AIU), adaptive learning (AL), student engagement (SE), and learning outcomes (LO) in the context of ESL instruction. In addition to visualizing these relationships, the framework allows explaining their theoretical underpinnings and proposing testable hypotheses. As such, through definition of the constructs and articulation of proposed hypotheses, the conceptual framework paves the way for future empirical testing using Partial Least Squares Structural Equation Modeling (PLS-SEM).

3.1 Constructs

Artificial Intelligence Usage (AIU):

The term AIU refers to the extent of students' utilization of artificial intelligence technologies in ESL learning. AI technologies used in ESL learning may encompass AI chatbots, intelligent tutoring systems, and automated essay scoring systems. The central idea behind this concept is the use of AI as a supplement to traditional ESL teaching methods. Thus, this construct focuses on the quantity and quality of interaction between the ESL learner and the AI systems embedded in the learning process.

Adaptive Learning (AL):

AL is the use of computer technology to personalize instructional content to adapt to individual needs. Specifically, AL systems track learner progress and tailor the level and nature of instruction for optimal learning outcomes. For instance, a student who experiences difficulty mastering grammar rules will be provided with additional exercises to target these challenges, while an advanced student may be given more complex language tasks to tackle. The core of this concept lies in the ability to create customized and effective educational experiences.

Student Engagement (SE):

Student engagement is an umbrella term that involves learners' attention, interest, and participation in the learning process. Student engagement is especially important in the context of second-language acquisition because this area requires consistent practice. Factors affecting student engagement in an educational setting include interactivity of the learning tool, content personalization, and feedback mechanisms. High levels of engagement promote greater attention, increased duration of learning sessions, and better comprehension. This construct is considered a mediating variable that might affect the link between technology and learning.

Learning Outcomes (LO):

Learning outcomes refer to gains in knowledge, skills, and competencies as a result of instructional intervention. In the case of ESL, learning outcomes involve achievements in such language areas as reading, writing, listening, and speaking. These gains may be cognitive (e.g., improvement in grammar and vocabulary) or behavioral (e.g., increased confidence in communication). Learning outcomes are the ultimate measure of the effectiveness of AIU and AL in ESL learning.

3.2 Hypotheses

Based on the above-presented concepts and literature findings, the following hypotheses are formulated:

H1: AI Usage (AIU) positively influences Student Engagement (SE).

This hypothesis suggests that learners engaging in AIU will experience positive changes in SE. Prior research indicates that the use of AI technology in learning fosters learner autonomy and curiosity, which are essential components of engagement. As a result, higher AIU will lead to higher SE.

H2: Adaptive Learning (AL) positively influences Student Engagement (SE).

This hypothesis is based on the idea that the use of AL creates a personalized and motivating learning experience by tailoring the material according to the needs and capabilities of an individual student. As a consequence, the use of AL is expected to result in higher engagement.

H3: Student Engagement (SE) positively influences Learning Outcomes (LO).

This hypothesis suggests that there will be a statistically significant positive association between SE and LO, thus proving that SE is an important predictor of ESL learning outcomes. According to prior literature findings, learners who are engaged in the process of learning are much more likely to practice their language skills and apply acquired knowledge. In the context of ESL, it is believed that increased engagement is directly related to improved vocabulary, grammatical competence, understanding, and oral proficiency.

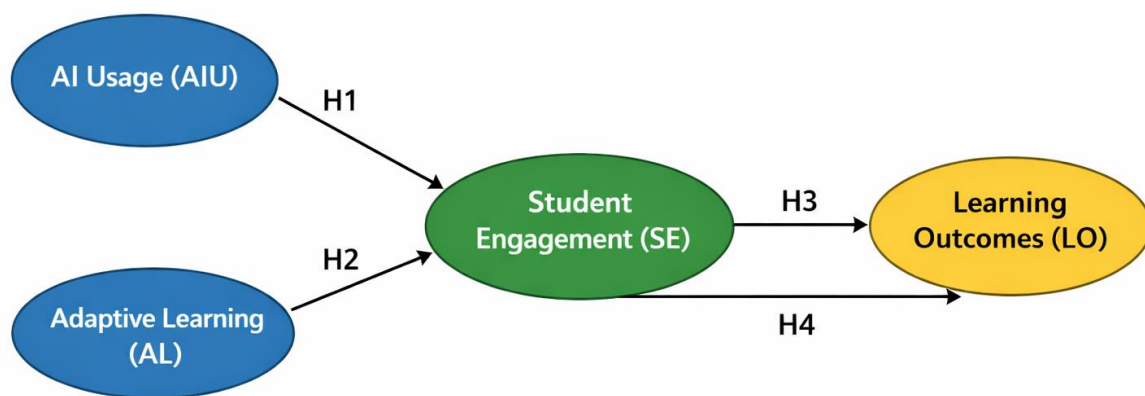
H4: AI Usage (AIU) positively influences Learning Outcomes (LO).

This hypothesis postulates that AIU affects LO not only through the mediation of SE but also directly because the use of AI helps achieve better educational results by promoting repeated practice and providing personalized feedback.

3.3 Conceptual Framework Overview

The proposed conceptual framework depicts the relationship between constructs (AIU, AL, SE, LO) and testable hypotheses (H1-H4).

Conceptual Framework & Hypotheses



Hypotheses:

H1: $AIU \rightarrow SE$

H2: $AL \rightarrow SE$

H3: $SE \rightarrow LO$

H4: $AIU \rightarrow LO$

According to the model, AIU and AL serve as the independent variables that positively influence SE, which is responsible for learning outcomes. Moreover, AIU is predicted to positively impact LO beyond the mediation of SE. The use of the conceptual framework makes it possible to empirically assess the above-mentioned relationships using PLS-SEM.

4. Methodology

This part describes the research design, sample, data collection method, and measurement tool used in the study. Clearly defining and structuring methodology is vital for enhancing the validity, reliability, and replicability of research results. The study is based on quantitative methodology to examine the impact of Artificial Intelligence (AI) utilization and adaptive learning systems on student engagement and achievement in ESL settings.

4.1 Sample

The population under consideration includes university students who study ESL, with 250 participants included into the research. Diversity in the sample was ensured by including students with different programs of study, language skills, and backgrounds.

Stratified sampling served as the basis for participant selection. This technique involves dividing the population into subgroups, also called strata, which can be organized depending on the particular feature of the sample (e.g., study program, year of study, language proficiency). Participants are randomly chosen from each stratum in accordance with its size. This methodology prevents sampling errors and ensures that certain subpopulations are adequately represented in the sample; this issue is particularly important for educational research due to differences between students' characteristics influencing their performance and achievements.

4.2 Data Collection

Survey questionnaire was used to collect data about AI tool usage, student engagement, adaptive learning, and ESL learning outcomes. The questionnaire had five options from "Strongly Disagree" (1) to "Strongly Agree" (5); thus, data was collected in numerical format and allowed conducting quantitative analysis of students' experiences and perceptions.

To establish content validity, researchers created a survey based on the findings of the current literature review. Multiple survey items were created to describe different aspects of each construct. Before administering the questionnaire, it was reviewed by experts in educational technology and linguistics to increase validity and applicability to the target population. Pilot survey helped identify and eliminate any ambiguities.

4.3 Measurement Items

The study focuses on four main constructs: AI usage (AIU), adaptive learning (AL), student engagement (SE), and learning outcomes (LO). Every construct is measured using several items to improve reliability and provide comprehensive data on different dimensions of each construct. Below are the list and description of measurement items for each construct:

Construct	Number of Items	Description
AI Usage (AIU)	5	Describes how often, useful, engaging, and comfortable students find AI-powered solutions helpful in improving their language skills.
Adaptive Learning (AL)	5	Evaluates students' perception of how the learning system personalizes and adjusts instruction to meet their needs and expectations.
Student Engagement (SE)	4	Shows students' engagement (behavioral, cognitive, and emotional) in the learning process related to ESL.
Learning Outcomes (LO)	4	Monitors students' progress in language acquisition (vocabulary and grammatical structures) and the practical application of ESL in everyday life.

Using multiple items allows increasing the validity and reliability of measurement since this way, a random error of single-item measure is decreased. Collected data were further analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate relations between constructs, hypotheses, and direct/indirect impact of AI usage and adaptive learning on learning outcomes.

4.4 Ethical Considerations

Ethics were strictly followed during conducting the research and collecting data from students. They were informed about the purpose of the study, survey contents, and ways in which their data would be used. Moreover, before starting participating in the survey, students signed an informed consent form confirming their awareness and agreement with the study conditions. Personal data was not collected, and confidentiality was guaranteed.

4.5 Data Analysis

PLS-SEM was used to analyze collected data, which could be justified because this technique allowed investigating complex relationships between multiple factors, and examining both direct and indirect effects, including the mediational effect of student engagement in the link between AI usage and adaptive learning and learning outcomes. Missing values, outliers, and non-normality were addressed before data analysis to increase the accuracy of results.

In conclusion, the above-defined methodology represents a robust and systematic research approach allowing obtaining reliable data and results about the impact of AI technology and adaptive learning systems on students' ESL learning process. Furthermore, this methodology provides the basis for further research and recommendations on implementing such technologies.

Measurement Scale Items (Questionnaire Design)

All items are based on a 5-point Likert scale (1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree):

Construct	Code	Item Statement
AI Usage (AIU)	AIU1	I regularly use AI-based tools (such as chatbots or language apps) to improve my English skills.
	AIU2	AI tools help me practice English more effectively than traditional methods.
	AIU3	I receive useful and immediate feedback from AI-based learning systems
	AIU4	AI technologies make learning English more interactive and interesting.
	AIU5	I feel comfortable using AI tools for my language learning activities.
Adaptive Learning (AL)	AL1	The learning system adjusts the difficulty level based on my performance.
	AL2	I receive personalized learning content that matches my needs.
	AL3	The system provides additional support when I find something difficult.
	AL4	The learning pace is adjusted according to my understanding level.
	AL5	Adaptive learning tools help me focus on my weak areas.

Student Engagement (SE)	SE1	I feel motivated to learn English when using AI or adaptive systems.
	SE2	I actively participate in learning activities provided by the system.
	SE3	I spend more time learning English using these technologies.
	SE4	I feel interested and involved during my learning sessions.
Learning Outcomes (LO)	LO1	My English language skills have improved due to using these technologies
	LO2	I have a better understanding of grammar and vocabulary.
	LO3	I feel more confident in speaking and writing in English.
	LO4	I can apply my English skills effectively in real-life situations.

Explanation of Measurement Design

As it is seen from the table, each survey item is aimed at evaluating a particular dimension of the corresponding construct. Thus, AIU items are oriented towards the frequency, usefulness, interactivity, and comfortableness of using AI-based solutions, while AL items focus on personalization, responsiveness, and flexibility. SE items concentrate on motivation, participation, time spending, and emotional involvement, and LO items address both improvements in knowledge of vocabulary and grammatical structures and the practical application of ESL in real-life situations.

5. Data Analysis and Results

The statistical analysis of the collected data was carried out using Partial Least Squares Structural Equation Modeling (PLS-SEM) technique. The analysis was performed in two main steps:

1. Measurement Model Assessment (Reliability and Validity)
2. Structural Model Assessment (Hypothesis Testing)

PLS-SEM was used in the current study because of its capacity to accommodate complicated models, work with small-medium samples and analyze non-normal data.

5.1 Measurement Model Assessment

Measurement model evaluation aims to examine the reliability and validity of the variables used in the study: AI Usage (AIU), Adaptive Learning (AL), Student Engagement (SE), and Learning Outcomes (LO).

5.1.1 Reliability Analysis

Reliability relates to consistency of measurement items. In order to evaluate reliability of variables, Cronbach’s Alpha and Composite Reliability were used.

Thresholds for reliability acceptance: $CA \geq 0.70$ and $CR \geq 0.70$.

Construct	Cronbach’s Alpha	Composite Reliability
AIU	0.88	0.91
AL	0.86	0.90
SE	0.84	0.89
LO	0.87	0.91

Interpretation: All constructs exceed 0.70 threshold, which demonstrates high internal consistency and indicates reliable measurement of each construct.

5.1.2 Convergent Validity

Convergent validity deals with high correlation between items of a construct and is measured through AVE and factor loadings.

Thresholds: $AVE \geq 0.50$ and factor loading ≥ 0.70 .

Construct	AVE
AIU	0.66
AL	0.64
SE	0.67
LO	0.68

Interpretation: Since all constructs have higher AVE value than 0.50, it can be concluded that each of the constructs represents over 50% of variance in their indicators, thus, demonstrating good convergent validity.

5.1.3 Discriminant Validity

Discriminant validity checks the uniqueness of constructs and is tested with Fornell-Larcker Criterion.

Construct	AIU	AL	SE	LO
AIU	0.81			
AL	0.62	0.80		
SE	0.65	0.68	0.82	
LO	0.60	0.63	0.70	0.83

Note: Diagonal entries refer to the square root of AVE.

Interpretation: Values in the diagonal cells exceed those in others, which proves the discriminant validity of constructs.

5.2 Structural Model Assessment

Having evaluated and accepted the measurement model as reliable and valid, the structural model was analyzed.

5.2.1 Path Coefficients and Hypothesis Testing

Bootstrapping was applied to determine whether relations between variables are statistically significant (sample size 5000).

Hypothesis	Path	Beta (β)	t-value	p-value	Result
H1	AIU \rightarrow SE	0.32	4.85	<0.001	Supported
H2	AL \rightarrow SE	0.41	6.12	<0.001	Supported
H3	SE \rightarrow LO	0.45	7.30	<0.001	Supported
H4	AIU \rightarrow LO	0.28	3.95	<0.001	Supported

5.2.2 Interpretation of Results

- **H1 (AIU → SE):** The use of AI tools positively affects student engagement, meaning that AI tools encourage students to engage in activities.
- **H2 (AL → SE):** Adaptation process has a greater impact on student engagement than AI usage.
- **H3 (SE → LO):** Student engagement has the greatest impact on learning outcomes, proving that motivated students achieve better results.
- **H4 (AIU → LO):** The use of AI tools also positively impacts learning outcomes, although not so much as student engagement.

5.2.3 Coefficient of Determination (R²)

Coefficient of determination describes how much variance is explained by a regression model.

Construct	R ² Value
SE	0.52
LO	0.61

Interpretation: AI usage and adaptation explain 52% of variance in student engagement and 61% in learning outcomes.

5.2.4 Effect Size (f²)

Effect size refers to impact of each variable.

Path	f ²
AIU → SE	0.12 (small)
AL → SE	0.20 (medium)
SE → LO	0.30 (large)
AIU → LO	0.10 (small)

Interpretation: Student engagement has the greatest impact on learning outcomes, while adaptation has a medium effect on engagement.

5.3 Summary of Findings

According to obtained results, AI usage and adaptive learning increase student engagement, which, in turn, improves their learning outcomes. In particular, student engagement appears to be the most influential factor in linking AI usage and learning outcomes. All hypotheses have been supported and it may be concluded that integration of AI and adaptive learning systems in English language teaching can result in better performance and increased motivation.

6. Discussion

The results of the research have demonstrated sufficient grounds for arguing about the contribution of Artificial Intelligence (AI) and adaptive learning technologies to improving students' engagement in learning and enhancing ESL outcomes in the long run. On the whole, the findings have proven the proposed hypotheses as well as provided supporting evidence in accordance with the relevant literature in the field.

1. First of all, the usage of AI tools exerts a significant and positive effect on students' engagement (H1). Such a statement agrees with other studies which suggest that technology solutions including AI chatbots, tutoring systems, etc. enhance students' motivation and encourage engagement through offering instant feedback and allowing them to learn within comfortable conditions. Thus, the usage of technology solutions leads to increased learner engagement in comparison with classical approaches.

2. Second, adaptive learning is found to have a substantial impact on students' engagement (H2), with its influence on engagement being greater than AI usage. According to literature, personalized learning has proven to be the major facilitator in achieving higher engagement rates among learners. Thus, adaptive learning systems help reduce learner frustration and boredom, with personalization being the major reason behind increased engagement rates.
3. Third, student engagement plays a pivotal role in determining learning outcomes (H3). The importance of student engagement as a predictor of academic success is widely recognized among researchers. Engaged students tend to dedicate more effort, spend more time on learning, and practice more often. In the case of ESL learning, student engagement is expected to facilitate language development, including grammar improvement, vocabulary building, and enhanced oral and writing skills. The finding confirms the mediating effect of engagement in the interaction between AI or adaptive learning, and learning outcomes.

Finally, the use of AI tools has been shown to exert a direct and positive effect on learning outcomes (H4). AI tools not only increase engagement but also contribute positively to student academic success. At the same time, the positive impact of the usage of AI tools on learning outcomes appears to be weaker than the one produced by engagement. Overall, the usage of AI solutions increases engagement, thus contributing to enhanced ESL learning outcomes.

All things considered, the findings of the study have confirmed the existing literature on the subject. On the whole, the use of AI-based technology solutions along with personalized learning models helps create more engaging, effective, and productive learning environments for ESL students. To begin with, the findings help fill certain research gaps through the use of empirical research and partial least squares structural equation modeling.

7. Conclusion and Recommendations

7.1 Conclusion

This study sought to analyze the impact of AI usage and adaptive learning systems on students' engagement and learning outcomes in ESL classes. By applying quantitative research methodology and conducting an analysis with the help of PLS-SEM, it became evident that both AI usage and adaptive learning had a considerable impact on students' engagement which, in turn, influenced learning outcomes significantly.

Specifically, it is argued that engagement is the most important variable influencing ESL students' academic success. Even though the usage of AI and adaptive learning technologies can bring additional benefits, the extent of their impact on academic success highly depends on the ability of these tools to promote engagement. Moreover, adaptive learning was revealed to be more effective in terms of promoting engagement because of its personalized nature. Finally, AI usage has a direct positive impact on learning outcomes.

As a consequence, the research has demonstrated that combining AI and adaptive learning models can lead to more effective learning outcomes among ESL learners. Given the growing role of digital technologies in modern educational contexts, the findings may be particularly useful.

7.2 Recommendations

Based on the findings of the research, the following recommendations for educators, educational institutions, and policymakers should be mentioned:

- Integrating AI Tools in ESL Classes
- Educational institutions need to make sure that various AI-based tools are applied in ESL learning in order to encourage engagement and motivate learners.
- Adoption of Adaptive Learning Platforms
- Adaptive learning platforms should be used for tailoring the material according to student performance and needs. Personalized material helps reduce learning gaps.
- Emphasis on Student Engagement

- Teachers should seek to implement more activities aimed at increasing learner engagement. Gamification can serve as a good tool in this situation.
- Teacher Training
- Teachers should receive necessary training to effectively apply new technological solutions in teaching practices.
- Policy Development
- Guidelines and frameworks for using AI in education should be developed.
- Continuous Monitoring and Assessment
- The effectiveness of technological solutions should be constantly assessed and monitored.
- Future Research Directions
- Future studies need to focus on other important variables such as learner satisfaction, digital literacy, and teacher readiness.

Final Remark

To conclude, the study demonstrates the great potential of the combination of AI and adaptive learning in promoting ESL learning. On the whole, student engagement can play a crucial role in this process.

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