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Empowering English Language Learners: Harnessing AI for Enhanced ESL Education

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Abstract - This paper looks into how studying English as a second language (ESL) might be made easier and more enjoyable by using artificial intelligence (AI). We look at cutting-edge tools like chatbots and smart apps that help kids learn at their own pace. There are challenges to be addressed, though, such making sure that these resources are equal and accessible to all. We also go over how AI can assess your English skills and give you instant feedback so you can get better. We'll also look at how virtual reality and artificial intelligence (AI) can be used to simulate an English-speaking nation while teaching. It's similar like setting out on a language adventure without ever leaving your chamber! Lastly, we offer a sneak peek at potential future developments for AI in ESL, such as utilizing ever-more cutting-edge technology to impart English in ever-more creative ways. Everyone stands to gain from more efficient, interesting, and customized AI-based English language instruction.

Keywords: Empowering, English Language, Learners, Harnessing AI, ESL Education

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INTRODUCTION

Language learning plays a crucial role in today's interconnected world, enabling individuals to communicate effectively across cultural boundaries and fostering global understanding. However, traditional instructional approaches often struggle to meet the diverse needs and preferences of language learners, resulting in limited personalization and engagement (Chiu & Lai, 2019). To address these challenges, there is growing interest in the integration of multipleintelligences and artificial intelligence (AI) in language learning, as they offer promising avenues for enhancing personalization and engagement.(Outman et al., 2023)

This review article explores the potential of social media platforms in teaching English as a second language and expanding language learning horizons. The article discusses various strategies and activities that utilize social media to enhance language learning, such as using multimedia resources, leveraging interactive features and tools, and promoting authentic language input and exposure to native speakers. Language teachers present success stories and case studies highlighting the implementation of social media in teaching. The review also examines research findings and measurable impacts of social media on language learning, including increased language proficiency, enhanced intercultural competence, and improved motivation and engagement. Additionally, the article addresses challenges and considerations associated with social media use, such as privacy concerns, managing information overload, and promoting inclusivity in access to technology. The article concludes by emphasizing the transformative potential of social media in expanding language learning horizons. It highlights the importance of social media in creating dynamic and interactive learning environments beyond traditional classroom boundaries. Furthermore, the article discusses the future implications of social media in English as a second language education, emphasizing the need for educators to stay informed, adapt to emerging trends, and explore innovative approaches. Overall, this review article underscores the significance of social media in language teaching and the opportunities it offers to enhance language learning experiences. It provides insights and recommendations for educators and researchers interested in harnessing the potential of social media platforms for teaching English as a second language.

This research offers valuable insights for educators and learners, equipping them with innovative pedagogical tools to enhance the ESL learning experience. Ultimately, it explores how AI, specifically Virtual Assistants, can transform ESL education by fostering greater learner autonomy, enriching the educational landscape, and empowering students to take charge of their learning journeys.(Tahir & Tahir, 2023)

The current research delves into the realm of artificial intelligence (AI) and its impact on enhancing the communication skills of English Language Learners (ELLs) within the Khairpur district. Employing a qualitative research method, the study unfolded in the backdrop of Khairpur Mir's Sindh, focusing on a diverse population of 200 students from various departments of the university. This research sought to understand the nuances of AI's involvement in strengthening communication skills among male and female students. Data collection was conducted through email and WhatsApp, targeting undergraduate students. A qualitative approach was taken using a 5-point Likert scale to gather responses, and the collected data underwent thorough statistical analysis presented in columns. The study's outcomes were the confirmatory, indicating that the utilization of Artificial Intelligence (AI) proves beneficial for English Language Learners (ELLs). Furthermore, the results suggest that ELLs can effectively harness AI to ameliorate their overall communication skills, highlighting the promising potential of AI in language education.(Gomathi et al., 2023)

Aim and Objectives:

This study aims to learn English with proper understanding by using AI. Language learning play a crucial role in enhancing language skill and motivating learners.

Objectives:

1. Create interactive and immersive learning experience using AI technologies such asvirtual reality, Argument reality.

2. Implement scaffolding techniques to support comprehension and language production such as pre-teaching vocabulary and offering sentence formations

3. Increase vocabulary knowledge by language proficiency. Improve grammatical accuracy in speaking and writing.

4. Increase the percentage of student actively participating in class discussion andactivities.

5. Improving the frequency and quality of student.

LITERATURE REVIEW

AI based learning:

Online learning has been widely applied due to developments in information technology. However, there are fewer relevant evaluations and applications for primary school students. All innovation efforts in learning are directed at improving the quality of education by creating anactive learning atmosphere for students. Students' participation in the teaching-learning process can be improved by selecting appropriate learning materials suitable to the student's learning style. The research aims to develop and measure the impact of an Artificial-Intelligence (AI)-based learning style prediction model in an online learning portal for primary school students. We formulated a new AI approach that enables collaborative filtering-based AI models to be driven by learning style prediction. With this AI algorithm, the online learning portal can provide material recommendations tailored specifically to the learning style of each student.(Pardamean et al., 2022)

The advance of Artificial Intelligence (AI), especially recent breakthroughs in generative AI (GenAI) and foundation models [104], has a foreseeable impact on higher education [28, 53, 73]. This is evident by the increasing use of AI tools by students to assist intheir learning tasks [11, 23, 38]. Students use AI, such as ChatGPT [60], to resolve confusion and assist with time-consuming tedious tasks, such as debugging and documentation, allowing students to focus more on essential learning tasks [23]. Despite the benefits of using AI in students' learning, this shift also creates new challenges for education practitioners. One critical question that often arises is how to fairly evaluate students' learning outcomes when AI contributes to the completion of learning tasks [4]. It is undesirable that assessments end up measuring the capabilities of AI rather than reflecting the students' acquisition and applicationof skills.

Pedagogical Adaptations:

In the modern world, where information technology and educational needs are rapidly developing, adapting teaching methods to modern educational trends is becoming an integral part of the educational process. This issue is especially important because pedagogical methods and approaches that served students effectively in the past may become outdated and inadequate for today's needs. (Obidovna, 2023) Modern educational trends such as active learning, personalized learning, digital technologies and many others are not only changing the way knowledge is acquired, but also require educators to reconsider and modernize their teaching methods. In this article, we will look at the importance of adapting teaching methods to modern educational trends with special emphasis on the pedagogical aspect.

The integration of AI in language learning carries significant pedagogical implications. Research by Zheng and Xing (2020) delved into the pedagogical benefits of an AI-powered adaptive learning platform, revealing its effective personalization of language instruction to meet individual learner needs. The study emphasized the importance of adaptive assessments and personalized feedback in fostering learners' progress and engagement. Additionally, Zhang et al. (2023) explored the role of AI-based chatbots in language learning, highlighting their capacity to provide immediate and interactive language practice opportunities. Learners reported increased motivation and engagement when

interacting with chatbots, facilitating natural language conversations and offering personalized feedback. These findings underscore the pedagogical value of AI technologies in promoting learner autonomy and tailoring learningexperiences.(Gomathi et al., 2023)

Language Proficiency gains:

(Moore et al., 2021) important for practitioners and learners alike as it indicates realis-tic expectations concerning linguistic proficiency pre-departure to a year studying abroad. The evidence from the review shows that, where expectations have not been met, learners can become disillusioned with learning the second language. These findings could, for example, be used in pre-departure workshops to facilitate the setting up of realistic expectations. From a policy perspective, the findings sup-port the importance of study abroad in second language acquisition and the need for governments to ensure learners have this opportunity.

This article explores the relationship between course performance, English language proficiency, motivation, and academic language skills in an English medium instruction (EMI)university context. It analyses test and questionnaire data from 146 students from an EMI business program at a Japanese university, and follow-up interviews with seven students. Proficiency test and subject exam scores revealed that knowledge of English language and academic English skill were statistically significant predictors of success in EMI, suggesting that lower proficiency students require more targeted language support in order to increase their likelihood of success. A motivation measure did not correlate with higher grades, contradicting research in language learning contexts. Interview data uncovered the multi-faceted nature of success in EMI 'suggesting that students see success as a combination of final grades, lecture comprehension, English language proficiency gains, and long-term career advancement.(Roseet al., 2019)

Student Engagement Levels:

Student engagement refers to the degree of interest, motivation, or curiosity that students demonstrate in their learning. It is a complex construct that encompasses several factors and has evolved from a traditional didactic model to a modern cocreated collaborative model. The concept of student engagement includes four dimensions: behavioural, affective/emotional, cognitive, and social (dis-)engagement. Engaging students in their learning is a key goal of educators as it leads to meaningful learning experiences and enhanced skills in all learning domains. Active learning methods and the behaviour of lecturers play a significant role in promoting student engagement. Jazuli et al., 2023)

If Artificial Intelligence (AI) technologies presents both promises and challenges. However, a conspicuous void exists in our comprehension of how precisely AI influences student engagement and academic performance. This research addresses the pressing need for a thorough exploration, encompassing students' awareness, ethical considerations, and the integration of AI into academic curricula. The crux of the issue lies in the imperative to bridge the gap between the technological surge and traditional pedagogy

Educator training and support:

The AI-powered platform continuously monitors and evaluates students' development, giving teachers and students access to real-time data. It provides thorough performance reports for pupils, identifying areas for growth and monitoring language proficiency over time. Teachers can use this data to create customized lessons and offer focused help. Students gain from personalized instruction, quick feedback, focused practice, and interesting conversational experiences when artificial intelligence (AI) is integrated into the ESL classroom through a language learning platform and real-life scenarios. In addition to providing students with rapidfeedback, the AI system facilitates their language learning process by allowing them to advance at their own speed, receive personalized attention, and effectively improve their English language proficiency. Furthermore, the AI platform frees up teachers' time so they can concentrate on mentoring, leading discussions, and giving each student individualized help. Future language education should use conversational AIs despite the lack of evidence supporting their collaboration with human teachers. This is because conversational AIs can enhance intelligence amplification and lighten the workload of human teachers by orchestrating classrooms.

Hypothesis Development:

A hypothesis in supervised machine learning is a function that best describes the target. The hypothesis that an algorithm might generate is influenced by the data as well as the constraints and biases we have applied to the data.

Hypothesis 1:

The study of artificial intelligence is essential to learning English.(Kim, 2019) has suggested doing research to go into further detail on how employing AI chatbots can improve Korean college students' proficiency in English. There were seventy scholars involved in the study. There were two research sets: one with thirty-six chatbot learners and the other with thirty-four human learners. Pre- and post-tests were completed in order to examine changes in the contestant's grammatical skills over time. Furthermore, an autonomous t-test was conducted to establish a correlation between the improvement in these sets. Both groups of contestants sawa notable improvement in their language proficiency. They demonstrated the useful qualities of having conversations and demonstrating how to use chatbots most efficiently; the analysis verified that their abilities had increased. Future chatbot suggestions communicate based on these results.

According to(Qushem et al., 2021). multimodal equipment affects how learning is updated, research is conducted, and products like artificial intelligence (AI) and learning management systems (LMS) are used. The results showed that by increasing learners' knowledge of their accomplishments and abilities, comprehensive learning strategies could regulate the instructional viewpoint of instructional materials and instruments. The framework for virtual digital education is extensive. Encouraging presumptions were identified in blended learning contexts, and a multitude of relationships were discussed regarding precision education's impact on students' productivity, success, and luck. In addition to ground plan preparation and restructuring that multimodal equipment can include into the instructional framework, the study makes claims for research and practices.(Bin & Mandal, 2019) According to, the configuration automatic counting method is both feasible and fictitious. The study explains how AI is used in mid-institute English instruction through the use of collected works analysis, disciplined learning, and associated syllabus concepts. Based on this, employing artificial intelligence is an approach used by English universities to support the educational system. The goal of the English training system is to improve and formalize English instruction. Artificial intelligence is used in English language instruction to enhance and impact the field'sworth.

Hypothesis 2:

The integration of Artificial Intelligence (AI) in education holds great potential to revolutionizelanguage learning, with a focus on English education. This study looks at how AI affects English language learners' fluency, comprehension, and language acquisition. Its objectives are to analyse AI applications in English classrooms, investigate how they affect teaching strategies, and gauge how teachers and students feel about them. The literature reviewhighlights the various applications of AI for improved language competency and tailored learning, such as natural language processing and adaptive learning platforms. Using a mixed- method approach, qualitative insights from surveys, interviews, and observations are combined with quantitative analysis of language results. Anticipated outcomes seek to illustrate AI's beneficial impact by enhancing language proficiency, increasing engagement, and promoting customized learning environments. Implementation issues with AI, like accessibility and pedagogical adaption, are being looked into. The consequences of this discovery are broad(Tahir & Tahir, 2023).

Hypothesis 3: In-class teaching assessment, which measures the effectiveness of teachers' instruction as well as students' learning in a classroom setting, is becoming more and more important in monitoring and advancing the quality of education. Artificial intelligence (AI) technology is advancing at a quick pace, and this has led to continuous improvement and a progressive integration of the notion of smart education into all facets of educational application. The integration of AI technology into the assessment of in-class instruction has emerged as a research hotspot, given the predominant role that classroom instruction plays in elementary and undergraduate education. In this work, we present a comprehensive model based on ensemble learning and statistical modelling that is intended for in-class teaching evaluation through the use of AI technologies like computer vision (CV) and intelligent speechrecognition (ISR). First, we introduce an index system that includes a set of indicators for teaching evaluation that combine new values obtained from AI analysis based on CV and ISR with established assessment scales. Next, we combine the analytic hierarchy process-entropy weight (AHP-EW) and AdaBoost-based ensemble learning (AdaBoost-EL) techniques to create a comprehensive in-class teaching evaluation model. Experiments confirm the effectiveness of the suggested model for AI-based in-class teaching evaluation in addition to demonstrating how the two model modules are relevant, respectively, to the computation of indicators with distinct properties. This thorough in-class evaluation methodology selects the ensemble learning module with the lowest root mean square error (RMSE) of 8.318 and 9.375 for students' engagement and concentration. Furthermore, the statistical modeling module's evaluation of the media consumption and kind of teachers approaches higher accuracy with 0.905 and 0.815. Rather, when assessing teachers' styles, ensemble learning comes close to an accuracy of 0.73, outperforming the statistical modeling module, which achieves an accuracy of 0.69(Guo et al., 2021).

METHODOLOGY:

Research Design: In this examination, quantitative research methodologies were applied. By exploring each student's unique learning style, this design makes it easier to adapt the language learning process to meet their needs. When gathering numerical data for analysis of numerical trends, patterns, and correlations between variables, quantitative research design is helpful.

Sampling Technique:

Sample size: In order to determine the transformative function of AI in English language education and its ability to meet the various demands of language learners, a sample size of 300 participants was used in this study. Educators and legislators can make well-informed decisions to maximize the impact of AI technology on the development of effective communication skills among English language learners by knowing the current state of research and investigating the opportunities and challenges presented by AI in language learning.

Data Collection: A structured questionnaire was the primary data gathering tool employed in this study. The questionnaire assesses how using AI-ML technology affects learning outcomes and

instructional strategies in the classroom. This paper uses a comprehensive analysis of the corpus of accessible literature to provide an overview of the state of AI-ML integration in education today and highlight its potential benefits, challenges, and ramifications for various stakeholders.

Data procedure: Depending on the participants' interests and accessibility, data was collected both offline and online. Conduct in-depth interviews with students to find out about their opinions on the benefits, challenges, and experiences of using AI tools. conducting interviews with educators to find out more about their experiences incorporating AI, any needs for professional growth, and the outcomes they have observed in their pupils.

Data analysis: We used a rigorous statistical approach called structural equation modeling (SEM) to investigate the intricate relationships between various components. By allowing themto investigate both direct and indirect impacts, it enables researchers to look at how various elements interact within a theoretical framework. Component analysis and regression analysis are two statistical methods used by SEM to evaluate how well the proposed model fits the data.This analytical approach helps us better understand the things we are examining and validate and modify our research hypotheses by spotting complex patterns and relationships. SEM analysis is crucial to our work because it sheds light on the complex connections between digital innovation, organizational growth, perceived confidence, and strategy management, as well as the possible implications for enterprises and organizations.

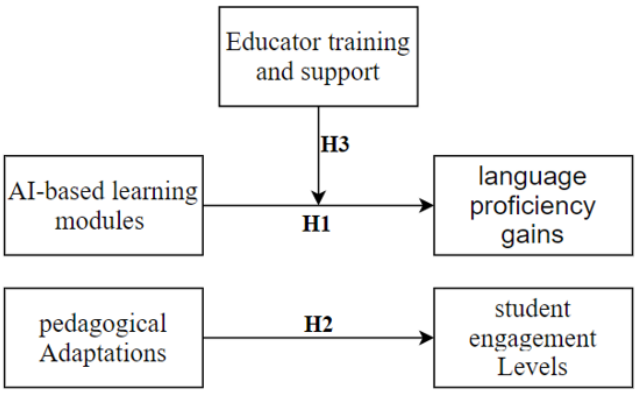
Tools and Techniques of this study:

Tools:

In this work, the statistical packages SPSS and AMOS are utilized.

Techniques: Our methodical statistical technique, known as structural equation modeling (SEM), allowed us to examine the complex interrelationships between different parts. It allows academics to examine how different variables interact within a theoretical framework by allowing them to look into both direct and indirect impacts. SEM uses two statistical techniques, component analysis and regression analysis, to assess how well the suggested model fits the data. By identifying intricate patterns and relationships, this analytical method aids in the validation and modification of our research hypotheses as well as a deeper understanding of the subjects we are studying. SEM analysis is essential to our work because it draws attention to the intricate relationships and potential consequences between opportunities and challenges, AI integration, customized approaches, and demographic diversity.

Conceptual Framework:



HYPOTHESIS:

H1: ESL students who utilize AI-based learning modules exhibit significantly greater improvements in English language proficiency compared to those who receive traditional instruction.

H2: ESL classrooms that integrate AI technologies into pedagogical Adaptations practices experience significantly higher levels of student engagement Levels compared to classrooms using traditional methods.

H3: The relationship between the utilization of AI-based learning modules and language proficiency gains among ESL students is moderated by the level of educator training and support.

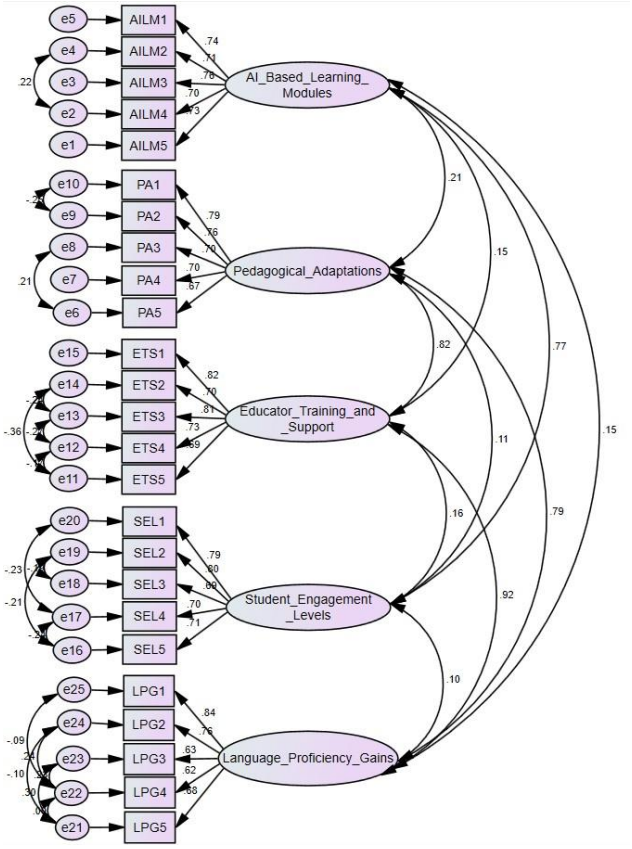


Table 1 Regression Weights: (Group number 1 - Default model)

PATH			Un std. Estimate	S.E.	Std. Estimate	C.R.	P
AILM5	<---	AI_Based_Learning__Modules	1.000		.731		
AILM4	<---	AI_Based_Learning__Modules	.953	.074	.697	12.877	***
AILM3	<---	AI_Based_Learning__Modules	1.078	.076	.758	14.105	***
AILM2	<---	AI_Based_Learning__Modules	.989	.076	.706	13.058	***
AILM1	<---	AI_Based_Learning__Modules	1.028	.075	.737	13.728	***
PA4	<---	Pedagogical Adaptations	1.000		.703		
PA3	<---	Pedagogical_Adaptations	1.047	.082	.696	12.838	***
PA2	<---	Pedagogical_Adaptations	1.120	.083	.764	13.559	***
PA1	<---	Pedagogical_Adaptations	1.184	.084	.794	14.092	***
ETS5	<---	Educator_Training_and__Support	1.000		.685		
ETS4	<---	Educator_Training_and__Support	1.147	.093	.733	12.347	***
ETS3	<---	Educator_Training_and__Support	1.204	.084	.807	14.344	***
ETS2	<---	Educator_Training_and__Support	1.126	.102	.703	11.029	***
ETS1	<---	Educator_Training_and__Support	1.517	.103	.821	14.691	***
SEL4	<---	Student_Engagement__Levels	1.000		.699		
SEL3	<---	Student_Engagement__Levels	1.025	.088	.688	11.685	***
SEL2	<---	Student_Engagement__Levels	1.138	.089	.797	12.862	***
SEL5	<---	Student_Engagement__Levels	1.060	.094	.713	11.223	***
PA5	<---	Pedagogical_Adaptations	.950	.077	.667	12.309	***
SEL1	<---	Student_Engagement__Levels	1.301	.102	.790	12.795	***
LPG5	<---	Language_Proficiency_Gains	1.000		.682		
LPG4	<---	Language_Proficiency_Gains	.902	.082	.620	10.951	***
LPG3	<---	Language_Proficiency_Gains	.947	.070	.629	13.607	***
LPG2	<---	Language_Proficiency_Gains	1.136	.088	.759	12.924	***
LPG1	<---	Language_Proficiency_Gains	1.421	.097	.844	14.658	***

Table 2 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.924
Bartlett's Test of Sphericity	Approx. Chi-Square	5238.534
	df	300
	Sig.	.000

Using KMO and Bartlett's tests to evaluate the appropriateness for factor analysis. The KMO value obtained was 0.924, indicating a high level of sampling adequacy. Additionally, the Bartlett's test yielded a highly significant result (P = 0.00), providing further support for the factor analysis**.**

Table 3 Post CFA, Cronbach alpha, factor loadings

Factors and items	Cronbach alpha values	Post CFA factor loadings	AVE	CR
AI-Based Learning Modules	.853		0.7258	0.46113629
AILM5		.731		
AILM4		.697		
AILM3		.758		
AILM2		.706		
AILM1		.737		
Pedagogical Adaptations	.850		0.7248	0.46045115
PA5		.667		
PA4		.703		
PA3		.696		
PA2		.764		
PA1		.794		
Educator Training and Support	.840		0.7498	0.47733927
ETS5		.685		
ETS4		.733		
ETS3		.807		
ETS2		.703		
ETS1		.821		
Student Engagement Levels	.835		0.7374	0.46902545
SEL5		.713		
SEL4		.699		
SEL3		.688		
SEL2		.797		
SEL1		.790		
Language Proficiency Gains	.851		0.7068	0.44798325
LPG5		.682		
LPG4		.620		
LPG3		.629		
LPG2		.759		
LPG1		.844		

Discriminant validity:

Discriminant validity is not a specific test performed in SPSS or any other statistical software but a concept within the context of validating measurement instruments and assessing the relationships between variables. Discriminant validity is crucial to ensure that different constructs or variables in a study are truly distinct and not measuring the same underlying concept. Researchers use various techniques such as confirmatory factor analysis (CFA) or correlation analysis to demonstrate that the measures intended to assess different constructs are, indeed, different and not highly correlated. Discriminant validity helps ensure that the measurement instruments accurately represent the unique concepts they are meant to measure,preventing construct overlap or redundancy and allowing for more robust and accurate data analysis and interpretation.

Table 4 Discriminant Validity Test

	AI_Based_ Learning_M odules	Pedagogic al_Adaptat ions	Educator_Trai ning_and_Sup port	Student_Eng agement_Le vels	Language_P roficiency_G ains
AI_Based_Lea rning_Modules	0.851939				
Pedagogical_A daptations	.182**	0.851352			
Educator_Trai ning_and_Support	.131**	.712**	0.86591		
Student_Engag ement_Levels	.671**	.108*	.140**	0.85872	
Language_Prof iciency_Gains	.130**	.668**	.788**	0.097	0.840714

In the study of using AI in ESL teaching, the correlation matrix shows how the different factors are related to each other. There are strong positive correlations between Pedagogical Adaptations and both Educator Training and Support (r = 0.712, p < 0.01) and Language Proficiency Gains (r = 0.668, p < 0.01). This means that as teaching methods change, and teachers get more training and help, ESL students get better at speaking and understanding English. Also, there is a strong positive relationship (r = 0.671, p < 0.01) between AI-Based Learning Modules and Student Engagement Levels. This means that as more AI-driven tools are used, more students are interested in learning activities. The link between AI-Based Learning Modules and Language Proficiency Gains, on the other hand, is smaller (r = 0.130, p < 0.01), showing that there isn't a direct link between using AI to teach and learning a language. These results show how important new ways of teaching and teacher help are for improving language learning outcomes in English as a Second Language (ESL) classes. They also show how AI could have a good effect on student participation.

Table 5 Model Fit Summary

Variable	Value
Chi-square value(χ^2)	428.024
Degrees of freedom (df)	248
CMIN/DF	1.726
P value	0.000
GFI	.919
RFI	0.903
NFI	0.920
IFI	0.965
CFI	0.964
RMR	0.039
RMSEA	0.043

The quality of fit was acceptable representation of the sample data ($\chi 2$ = 428.024), NFI (Normed Fit Index) =0.920; IFI (Incremental fit index) = 0.965, GFI (Goodness of Fit) = 0.919, RFI (Relative Fit Index) = 0.903 and CFI (Comparative Fit Index) =0.964 which is much largerthan the 0.90. Similarly, RMR (Root Mean Square Residuals) =0.039 and RMSEA (Root mean square error of approximation) = 0.043 values is lower the 0.080 critical value. Results indicated a good fit for the model presented including RMSEA of 0.043, RMR of 0.039, GFI of 0.919, and CFI of 0.964.

H1: ESL students who utilize AI-based learning modules exhibit significantly greater improvements in English language proficiency compared to those who receive traditional instruction.

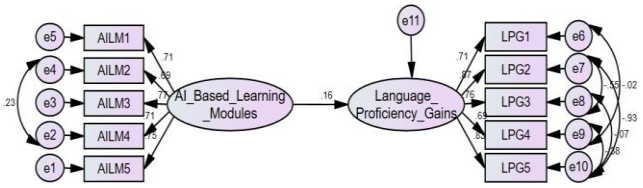


Table 6 Regression Weights: (Group number 1 - Default model)

PATH			Un std. Estimate	S.E.	Std. Estimate	C.R.	P
Language_Proficiency_Gains	<---	AI_Based_Learning_Modules	.175	.072	.162	2.425	.015
AILM5	<---	AI_Based_Learning_Modules	1.000		.751		
AILM4	<---	AI_Based_Learning_Modules	.943	.073	.708	12.835	***
AILM3	<---	AI_Based_Learning_Modules	1.063	.076	.769	14.035	***
AILM2	<---	AI_Based_Learning_Modules	.935	.075	.686	12.421	***
AILM1	<---	AI_Based_Learning_Modules	.967	.074	.712	13.115	***
LPG1	<---	Language_Proficiency_Gains	1.000		.714		
LPG2	<---	Language_Proficiency_Gains	1.088	.278	.874	3.908	***
LPG3	<---	Language_Proficiency_Gains	.947	.245	.756	3.860	***
LPG4	<---	Language_Proficiency_Gains	.834	.064	.689	13.128	***
LPG5	<---	Language_Proficiency_Gains	1.011	.263	.827	3.845	***

Table depicts a hypothetical structural equation model that show cases the interdependence between Two variables, namely the AI-based learning modules and Language proficiency gains. In the present model, the independent variable is the AI-based learning modules, whereas the dependent variable is Language proficiency gains. The findings of the investigation indicate a positive and statistically significant relationship between AI-based learning modules and Language proficiency gains (β=.162, P<.05).

The standardized coefficient of 0.162, a positive association between AI-based learning modules and

Language proficiency gains, as shown in the route connecting these two variables. The correlation coefficient values (C.R. values) show large magnitudes, suggesting that the observed associations are statistically significant. The fit indices indicate that the model has a good fit, since the factors exhibit statistical significance with p-values over 0.05. The total model fit was evaluated by using seven distinct fit indices, which together demonstrated a statistically significant positive association between AI-based learning modules and Language proficiency gains**.**

Table 7 Model Fit Summary

Variable	Value
Chi-square value(χ^2)	30.370
Degrees of freedom (df)	28
CMIN/DF	1.085
P value	.346
GFI	0.985
RFI	0.971
NFI	0.982
IFI	0.999
CFI	0.999
RMR	0.027
RMSEA	0.015

The quality of fit was acceptable representation of the sample data (χ^2 = 30.370), NFI (Normed Fit Index) =0.982; IFI (Incremental fit index) = 0.999, GFI (Goodness of Fit) = 0.985, RFI (Relative Fit Index) = 0.971 and CFI (Comparative Fit Index) =0.999 which is much larger than the 0.90. Similarly, RMR (Root Mean Square Residuals) =0.027 and RMSEA (Root meansquare error of approximation) = 0.015 values is lower the 0.080 critical value. Results indicated a good fit for the model presented including RMSEA of 0.015, RMR of 0.027, GFI of 0.985, and CFI of 0.999.

H2: ESL classrooms that integrate AI technologies into pedagogical Adaptations practicesexperience significantly higher levels of student engagement Levels compared to classrooms using traditional methods.

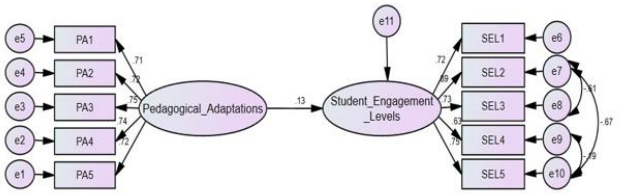


Table 8 Regression Weights: (Group number 1 - Default model)

PATH			Un std. Estimate	S.E.	Std. Estimate	C.R.	P
Student_Engagement_ _Levels	<---	Pedagogical_Adaptations	.149	.065	.127	2.307	.021
PA5	<---	Pedagogical_Adaptations	1.000		.721		
PA4	<---	Pedagogical_Adaptations	1.029	.077	.743	13.329	***
PA3	<---	Pedagogical_Adaptations	1.100	.082	.751	13.447	***
PA2	<---	Pedagogical_Adaptations	1.027	.079	.719	12.949	***
PA1	<---	Pedagogical_Adaptations	1.031	.080	.710	12.805	***
SEL1	<---	Student_Engagement_Levels	1.000		.719		
SEL2	<---	Student_Engagement_Levels	1.071	.082	.887	13.104	***
SEL3	<---	Student_Engagement_Levels	.917	.071	.730	12.834	***
SEL4	<---	Student_Engagement_Levels	.761	.062	.632	12.342	***
SEL5	<---	Student_Engagement_Levels	.947	.077	.755	12.294	***

Table depicts a hypothetical structural equation model that show cases the interdependence between Two variables, namely the Pedagogical Adaptations, Student engagement Levels. In the present model, the independent variable is the Pedagogical Adaptations, whereas the dependent variable is Student engagement Levels. The findings of the investigation indicate apositive and statistically significant relationship between Pedagogical Adaptations, Student engagement Levels (β=.127, P<.05).

The standardized coefficient of 0.127, a positive association between Pedagogical Adaptations, Student engagement Levels, as shown in the route connecting these two variables. The correlation coefficient values (C.R. values) show large magnitudes, suggesting that the observed associations are statistically significant. The fit indices indicate that the model has a good fit, since the factors exhibit statistical significance with p-values over 0.05. The total model fit was evaluated by using seven distinct fit indices, which together demonstrated a statistically significant positive

association between Pedagogical Adaptations, Student engagement Levels.

Table 9 Model Fit Summary

Variable	Value
Chi-square value(χ^2)	53.234
Degrees of freedom (df)	31
CMIN/DF	1.717
P value	0.008
GFI	0.972
RFI	0.950
NFI	0.966
IFI	0.985
CFI	0.985
RMR	0.039
RMSEA	0.042

The quality of fit was acceptable representation of the sample data (χ^2 = 53.234), NFI (Normed Fit Index) =0.966; IFI (Incremental fit index) = 0.985, GFI (Goodness of Fit) = 0.972, RFI (Relative Fit Index) = 0.950 and CFI (Comparative Fit Index) =0.985 which is much larger than the 0.90. Similarly, RMR (Root Mean Square Residuals) =0.039 and RMSEA (Root meansquare error of approximation) = 0.042 values is lower the 0.080 critical value. Results indicated a good fit for the model presented including RMSEA of 0.042, RMR of 0.039, GFI of 0.972, and CFI of .985.

H3: The relationship between the utilization of AI-based learning modules and language proficiency gains among ESL students is moderated by the level of educator training andsupport.

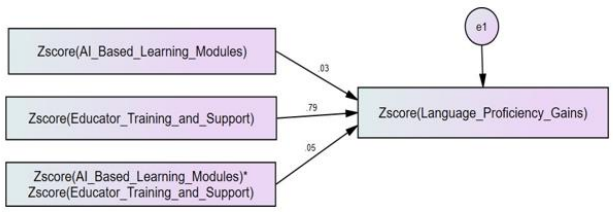


Table 10 Regression Weights: (Group number 1 - Default model)

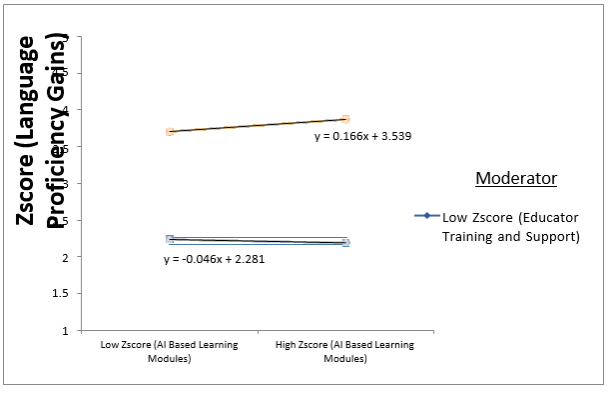
PATH			Un std. Estimate	S.E.	Std. Estimate	C.R.	P
ZLanguage_Proficiency_Gains	<---	ZAI_Based_Learning_Modules	.030	.031	.030	.970	***
ZLanguage_Proficiency_Gains	<---	ZEducator_Training_and_Support	.788	.031	.788	25.724	***
ZLanguage_Proficiency_Gains	<---	Interaction	.049	.028	.053	1.736	***

The Structural Equation Model (SEM) examining the association between Zscore (AI Based Learning Modules) and Zscore (Language Proficiency Gains), with moderation by Zscore (Educator Training and Support), is presented in Table 10. This comprehensive analysis allows for testing all relevant paths, considering measurement errors and feedback directly within the model. Hypothesis resulting based on path analysis shows that Zscore (AI Based Learning Modules) is positively and significantly associated with Zscore (Language Proficiency Gains) (β=0.030, P<0.05). Zscore (Educator Training and Support) is positively and significantly associated with Zscore (Language Proficiency Gains) (β= .788, P<0.05).

Moderation testing:

The moderation analysis is conducted by treating, Zscore (AI Based Learning Modules) as independent variables, Zscore (Language Proficiency Gains) as dependent variable, and Zscore (Educator Training and Support) as moderator variable. The results are calculated by creating interaction terms from standardized score of variables using SPSS.

PATH			Un std. Estimate	S.E.	Std. Estimate	C.R.	P
ZLanguage_Proficiency_Gains	<---	Zscore (AI_Based_Learning _Modules) *Zscore (Educator_Training_and_Support)	.049	.028	.053	1.736	***



We tested the Zscore (Educator Training and Support) as a moderator. Result indicates that interaction term of Zscore (Educator Training and Support) and Zscore (AI Based Learning Modules) exerts positive and a significant influence on Zscore (Language Proficiency Gains) (β= 0.053, P<.05). The result shows that there is statistical support for

the moderating role of Zscore (Educator Training and Support) in our data.

DISCUSSION

The examination of three hypotheses about the incorporation of AI-based learning modules and pedagogical adjustments in ESL courses shows encouraging results. Firstly, the use of AI- based learning modules shows a strong positive correlation with improved language ability among ESL students. Furthermore, the use of AI technology into educational adjustments is directly associated with higher levels of student involvement. Furthermore, it is clear that educator training and support play a crucial role in regulating the link between AI-based learning modules and language proficiency improvements. This highlights the need of having well-trained educators in order to fully use the advantages of AI integration. These results emphasize that AI technology has the potential to greatly enhance language learning outcomes and student engagement in ESL educational environments. However, it is crucial for educators to have sufficient assistance in order to effectively use these technologies.

CONCLUSION

The study's structural equation models confirm the assumptions that ESL students get advantages from AI-based learning modules, exhibiting notable enhancements in language competency and increased levels of engagement in comparison to conventional techniques. Furthermore, the study demonstrates that the connection between AI-based learning and improvements in language competency is influenced by the training and support provided to educators. This highlights the need of adequately preparing educators to maximize the success of integrating AI in ESL education. These findings highlight the capacity of AI technologies to improve language learning results in ESL classrooms, provided that educators are given appropriate support systems.

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