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DIGITAL DISCOURSE IN ENGLISH LANGUAGE TEACHING: EXPLORING MAN-MACHINE COLLABORATION MODELS THROUGH SYMBIOSIS THEORY

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ABSTRACT

This study investigates the discursive dynamics of Man-Machine Collaboration (MMC) in English language teaching within the framework of symbiosis theory, aiming to explore how technological integration shapes pedagogical discourse in higher education settings across Asia. As digital tools become increasingly embedded in educational practices, understanding the evolving interaction between human educators and intelligent systems becomes essential. Drawing on a quantitative research design, data were collected from 653 participants, comprising 274 teachers and 379 students at a university in Asia. A structured survey was employed to assess the impact of MMC across four key dimensions: personalization, administrative efficiency, scalability, and adaptability to diverse learning needs. Findings reveal that personalization emerged as the most significant contributor to the effectiveness of the English teaching model ($\beta = 0.40$, $p < 0.001$), indicating the value of tailored instructional experiences in enhancing learner engagement. All other factors—administrative efficiency, scalability, and adaptability—also demonstrated statistically significant positive effects ($p < 0.001$), underscoring the multifaceted benefits of integrating AI-driven tools into pedagogical practices. These results suggest that the symbiotic relationship between human educators and machine-based systems has transformed traditional educational discourse into a more responsive, inclusive, and learner-centered format. The implications of this study are particularly relevant for discourse analysts and educators interested in the intersection of technology, language teaching, and cultural responsiveness in Asian contexts. By highlighting how digital mediation influences classroom communication and knowledge construction, this research contributes to broader discussions on the application of discourse analysis in contemporary educational settings. It also supports the use of digital platforms to enhance both the cognitive and affective dimensions of language instruction. Future research should examine the long-term evolution of such collaborative models across diverse linguistic, pedagogical, and institutional landscapes in Asia, with particular attention to qualitative dimensions of teacher-student interaction and discourse development.

Introduction

The rapid advancement of technology has significantly reshaped human lifestyles and social interactions, including the dynamics of educational practices across Asia (Fang et al., 2024; Hanandini, 2024). In contemporary educational contexts, traditional pedagogical models are increasingly being transformed through the integration of digital tools and platforms (Mahdi, 2023). Initially, technology functioned merely as a supportive instrument in teaching and learning processes; however, with the emergence of advanced innovations such as the Internet of Things (IoT), Artificial Intelligence (AI), and immersive virtual environments like the Metaverse, its role has evolved into a more collaborative and interactive dimension (Wang et al., 2025). This transformation has redefined the discourse of education, where interactions between teachers and learners are no longer confined by time or physical space(Omodan, 2024). Learning has become mobile, continuous, and accessible almost 24/7, thereby challenging conventional

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understandings of classroom boundaries and instructional delivery(Biton & Segal, 2025). From the discourse analysis perspective, these changes raise critical questions about how technological mediation influences educational communication, knowledge construction, and pedagogical authority in Asian higher education settings(Ren, 2023). Understanding this shift is essential not only to assess the effectiveness of new teaching models but also to explore how digital discourse shapes contemporary learning experiences, especially in relation to personalization, inclusivity, and interactivity.

English has emerged as a globally accepted lingua franca in language teaching and learning, playing a pivotal role in communication across diverse sociocultural and educational landscapes (Ebrahimi, 2023). In many Asian countries, the demand for effective English education has intensified, necessitating pedagogical approaches that can accommodate the evolving needs of contemporary learners (Bakar, 2021). Historically, English language instruction in the pre-2020s era predominantly relied on teacher-centered methodologies, emphasizing direct instruction and standardized curricula(Ghafar, 2023). However, such traditional models have proven insufficient in responding to modern language education's dynamic and heterogeneous contexts. The rapid transformation of sociolinguistic environments and the increasing digitalization of everyday life has redefined how learners engage with language, knowledge, and pedagogical discourse(Reinhardt, 2022).

Today's generation of learners, often called digital natives, are immersed in technology from an early age (Aljović, 2023; Kincl & Štrach, 2021). Digital platforms are not only tools for communication but also integral components of their identity construction, social interaction, and personalized learning experiences(Josué et al., 2023; Kem, 2022). Consequently, conventional face-to-face teaching methods can no longer foster meaningful and interactive learning environments. This shift necessitates a re-examination of the communicative dynamics between teachers and students, particularly through the lens of discourse analysis. Understanding how technological mediation influences instructional discourse, learner engagement, and meaning-making processes is crucial in developing responsive and inclusive pedagogies. Therefore, there is a pressing need to explore innovative teaching models that integrate digital discourse and collaborative human-machine interactions to better prepare learners for real-world communicative demands in multilingual and multicultural Asian societies.

In the 21st century, education—particularly language teaching and learning—faces increasingly complex challenges stemming from learner diversity, varying levels of digital literacy, and fluctuating language proficiency among students(Ashraf et al., 2021; Aydin & Erol, 2021; Kohnke & Moorhouse, 2021; Tao & Gao, 2022). These dynamics necessitate urgent pedagogical innovations that can effectively meet the evolving needs and expectations of the new generation of learners in Asian educational contexts(Ashraf et al., 2022). Contemporary teaching models must be adaptable, interactive, and enhanced by technology to support both teachers and students in optimizing communication, engagement, and overall learning effectiveness(Ajani, 2024; Isaeva et al., 2025; Sabri et al., 2024). Integrating digital tools into instructional practices has shifted the traditional discourse of education toward a more collaborative and participatory format, where knowledge construction is co-regulated between human educators and technological agents(Lim, 2021).

Moreover, emerging pedagogical approaches must go beyond mere technological adoption and should comprehensively address the cognitive, social, and affective dimensions of language learning(Evurulobi et al., 2024; Li & Lan, 2022; Zhou & Hou, 2024). This includes fostering student-centered environments, promoting collaborative learning, and leveraging technology not only as a medium of instruction but also as a facilitator of meaningful interaction and critical discourse. From the discourse analysis perspective, these transformations raise important questions about how digital mediation reshapes teacher-student interactions, classroom communication patterns, and the construction of pedagogical meaning in English language education. Therefore, there is a critical need to explore and develop teaching models that align with the demands of the digital era while maintaining pedagogical integrity and inclusivity.

The Integration Education and Man-Machine Technologies

Globally, the integration of man-machine technologies into everyday life has become increasingly prevalent, particularly in the domain of smart technologies(Pizoń & Gola, 2023). These innovations are now deeply embedded in various sectors, including education, where they have introduced transformative tools for

enhancing language learning(Aithal & Maiya, 2023). The incorporation of artificial intelligence (AI), machine learning, adaptive learning systems, and other educational technologies has enabled more personalized, interactive, and responsive teaching and learning experiences(Gligorea et al., 2023). Such technological advancements allow for real-time feedback, customized exercises, and engaging multimedia content that cater to diverse learner profiles(Imran et al., 2024; Procel et al., 2024). From a discourse analysis perspective, these tools reshape the communicative dynamics between learners and instructional systems, redefining how knowledge is mediated, negotiated, and internalized in digital learning environments(Hannon & Bretag, 2010; Hull & Saxon, 2009).

Despite the numerous benefits offered by these technologies, there remain significant limitations concerning the irreplaceable human elements in pedagogy. Man-machine systems often fall short in cultivating higher-order skills such as critical thinking, emotional intelligence, creativity, and nuanced socio-pragmatic awareness—qualities that human educators inherently bring to the classroom(Balomenos et al., 2005; Horáková & Kelemen, 2010; Liang, 2025; Moruzzi, 2022). This raises important questions about how to balance technological efficiency with pedagogical authenticity, especially within multilingual and multicultural educational contexts across Asia. Therefore, it is crucial to explore models of collaborative intelligence, where human educators and intelligent systems work symbiotically to enhance both cognitive and affective dimensions of language learning. Such an approach supports effective knowledge delivery and preserves the richness of interpersonal discourse and cultural responsiveness in modern educational practices.

While the integration of technology in teaching and learning has undeniably transformed educational practices, particularly in language education, it remains insufficient when implemented in isolation. Despite its capacity to enhance efficiency, personalization, and accessibility, technology cannot fully replicate the nuanced pedagogical skills, emotional intelligence, and contextual sensitivity that human educators bring to the learning process. Therefore, effective educational outcomes—especially in complex domains such as English language teaching—require a balanced synergy between technological capabilities and human agency. This necessity has given rise to the concept of man-machine collaboration (MMC) in education, which emphasizes a complementary relationship between teachers and intelligent systems(Fang et al., 2023; Haifeng, 2024; Li et al., 2021). Within this framework, educators are empowered to focus on higher-order instructional tasks such as fostering creativity, facilitating group discussions, and providing personalized mentoring, while machine-based systems handle routine functions including progress monitoring, automated grading, and adaptive feedback generation.

From the perspective of discourse analysis, MMC introduces new dimensions to the pedagogical discourse by reshaping interactional patterns, knowledge co-construction, and feedback mechanisms in digital-enhanced classrooms. This hybrid model enhances teaching effectiveness and supports a more inclusive, responsive, and learner-centered environment—particularly relevant in the multilingual and multicultural contexts prevalent across Asian education systems. Thus, exploring the implementation of man-machine collaborative models in English language teaching is essential to ensure that technological advancements serve as enablers rather than replacements, ultimately contributing to more meaningful and sustainable learning outcomes.

The development of a collaborative teaching model in contemporary education aligns closely with the principles of symbiosis theory, which emphasizes the interdependent relationship between human educators and machine-based systems in facilitating pedagogical processes(Luo, 2024; Zhong et al., 2024). This theoretical framework posits that both entities humans and machines bring unique strengths to the educational ecosystem, and their coexistence can significantly enhance the quality of teaching and learning experiences for both educators and learners.

In this symbiotic relationship, human teachers contribute essential pedagogical elements such as empathy, contextual understanding, ethical guidance, and nuanced instructional scaffolding. These attributes are crucial in fostering meaningful discourse, critical thinking, and socio-emotional engagement in language classrooms. On the other hand, intelligent technologies provide efficiency in data processing, personalized feedback mechanisms, adaptive content delivery, and real-time performance tracking capabilities that complement and extend the reach of traditional instruction. When effectively integrated, this human-

machine collaboration creates a dynamic, engaging, and learner-centered environment that supports diverse learning needs and promotes deeper cognitive engagement. Students can develop linguistic competence through immediate interaction and tailored exercises and cultivate higher-order skills such as collaborative problem-solving, critical reflection, and metacognitive awareness—all of which are central to effective language acquisition.

This study aims to investigate the impact of man-machine collaboration (MMC) on English language teaching models within the framework of symbiosis theory , particularly in Asian educational contexts. It seeks to explore how the integration of human pedagogical expertise with technological capabilities influences student engagement, learning outcomes, and instructional discourse. By addressing the central research question: "How does man-machine collaboration influence the effectiveness of English language teaching models?" this paper contributes to the growing discourse on digital pedagogy and educational discourse analysis in technologically mediated learning environments.

Man-Machine Collaboration in Education

The term man-machine collaboration (MMC) was widely used during the early stages of Industry 4.0 (George & George, 2020). The industrial sector is actively discussing how to increase productivity by reducing errors and improving output. This led to the concept of human-machine or human-robot collaboration, where both coexist to enhance productivity in manufacturing. Over time, the evolution and application of human-robot collaboration in manufacturing have expanded into the field of education. The integration of human and machines, or MMC, has significantly boosted engagement between teachers and students. It provides dynamic interaction between human teachers and machines to achieve shared teaching goals. Here, "machines" in the context of education refer to AI, digital tools, and educational software that enhance productivity and engagement between teachers and students.

As such, in the context of teaching and learning between teachers and students, man-machine collaboration significantly enhances personalization, administrative task efficiency, scalability and the adaptability of diverse teaching and learning styles. Several studies conducted by researchers have indicated that large amounts of data on students' performance and learning habits significantly contribute to personalized recommendations and real-time adjustments in the teaching and learning process between teachers and students (Gm et al., 2024; Walkington, 2013; Wang & Wu, 2011). AI-powered learning and teaching activities can analyze students' performance and learning behaviors, enabling the recommendation of individualized learning paths (Huang et al., 2023; Yu et al., 2017). The driving factors behind this are students' learning experiences, pace, strengths, and weaknesses. With access to this data, AI-powered systems can improve learning outcomes by helping teachers better support struggling students. In addition, man-machine collaboration tools can automate routine tasks, such as analyzing student performance and learning patterns. These tools can be precisely tailored to meet students' individual needs and preferences, including their learning capacity. At the same time, teachers can align their strategies and craft more effective lesson plans to better support student learning.

When it comes to administrative tasks, the sense of burden is often significant for teachers. This is because they must manage both teaching responsibilities and administrative duties, such as grading, tracking student progress, and providing feedback for reporting to school management. However, with the integration of man-machine collaborative tools—especially those powered by AI—teachers and educators can significantly reduce their administrative workload. Automation of tasks such as grading, monitoring progress, and generating feedback for assignments and quizzes improves efficiency and helps save valuable time. These automated processes not only accelerate administrative tasks but also ensure consistency in outcomes and reduce human bias. As a result, teachers are able to focus more on creative teaching methods, facilitating discussions, encouraging critical thinking, motivating students, and conducting hands-on activities. Such efforts are crucial for both teachers and students, especially in supporting language acquisition and skill development.

A different concern regarding MMC usage is the scalability of instruction for a large student body, particularly in terms of accessibility, assessment, evaluation, and response. Traditionally, teachers have spent significant time and effort on these tasks, which often reduced the efficiency and effectiveness of task delivery.

However, with MMC technologies embedded in teaching and learning activities, teachers are able to operate at an optimal scale with more effective and efficient task delivery and fulfillment. These technologies help maintain the quality of content delivery and support assessment and evaluation for students. The continued use of MMC leads to improved engagement, sustained effectiveness, and reduced workload, even in large and diverse classrooms.

Finally, the global and open access nature of learning platforms has transformed teaching and learning by supporting adaptive approaches and diverse learning styles. Technological advancements in education have altered the pace and pathways of how teaching and learning are delivered. The preferences and needs of the new generation of students have reshaped the educational landscape. Today's learning environment requires inclusivity and support for various learning styles. Assessment and evaluation tools must be adaptable to current learning patterns, preferences, and student performance. This approach aims to offer individualized learning pathways tailored to the specific needs of students—whether auditory, kinesthetic, visual, or based on reading and writing abilities. As a result, MMC tools can enhance engagement by delivering more relevant content, adaptive difficulty levels, and customized feedback.

Overall, the term man-machine collaboration (MMC) was first introduced during the Industry 4.0 era, primarily to enhance productivity and reduce costs in manufacturing. Its implementation in education has transformed the landscape of teaching and learning for both teachers and students. Powered by AI and other digital tools, MMC supports personalization, improves administrative efficiency, enables scalability, and adapts to diverse learning styles. It can analyze student performance using generated data to offer personalized learning paths, foster better engagement, and improve learning outcomes—especially for struggling students. Ultimately, MMC has emerged as a transformative approach that significantly enhances both teaching and learning experiences, aligning with the rapid technological advancements of the modern era.

The Symbiosis Theory with the integration of MMC towards Teaching Model

The symbiosis theory offers a robust theoretical framework for this study, providing an understanding of the coexistence between humans and machines in the English teaching model. At its core, this theory emphasizes the mutual benefits of two elements working together to achieve a common goal. In this context, it aligns well with the objectives of man-machine collaboration (MMC) in English education. From this perspective, the theory suggests that human teachers and machines can mutually enhance each other's capabilities. This synergy can be observed in more effective task delivery, adaptive learning styles, and the development of student-centered learning environments.

Moreover, MMC provides mutualistic benefits, meaning that human teachers and machines can reflect and complement each other's roles, ultimately fulfilling the desired learning outcomes for students. For machines, the data collected from teacher-student interactions in the classroom helps refine AI-driven algorithms, improving content recommendations and enhancing adaptive learning systems in English education. Meanwhile, for teachers, the outputs generated by the machine, particularly through data analytics, offer valuable insights into students' progress, help identify specific learning gaps, and enable adjustments to instructional strategies accordingly.

The symbiosis theory provides a powerful framework for the integration of human teachers and man-machine collaboration (MMC) in the English teaching model. It emphasizes the potential of MMC to create adaptive, personalized, and efficient learning experiences that enable teachers to improve student outcomes. This symbiotic relationship not only enhances the effectiveness of English teaching but also supports the creation of creative content, interactive instruction, and dynamic, adaptive learning experiences that align with students' needs and preferences. Thus, the symbiosis theory not only supports the integration of MMC, but also contributes to shaping a more effective English teaching model in the digital, AI-powered era.

Materials and Methods

This study employed quantitative research design, incorporating both descriptive and explanatory approaches. These methods were chosen because statistical analysis appropriately addressed the research

objectives and supported the generalization of findings to the context of A University. A simple random sampling technique was applied to select both students and teaching staff from A University, which has a population of approximately 24,000 students and 945 academic staff. This sampling method was selected due to its probabilistic nature, making it compatible with the numerical and parametric data used in the study. As a result, the study included a sample of 379 students and 274 teachers, bringing the total sample size to 653 participants.

Consequently, Consequently, the study employed a structured questionnaire, which was distributed to all participants within the defined sampling frame. Two data collection techniques were used. First, a self-administered approach was conducted, in which the researcher obtained consent from respondents before the survey began. Participants were given approximately 10 to 15 minutes to complete the entire questionnaire. Second, an online data collection method was utilized. Before accessing the questionnaire, respondents were required to tick a consent statement. Once consent was provided, participants could proceed to complete the survey. Both the online and face-to-face questionnaires used a 5-point Likert scale. The questionnaire was structured into three sections: Section A covered demographic information, Section B was for independent variable that was man machine collaborator, and section C was for dependent variable, that is about English teaching model. This type of scale was chosen to obtain quantitative data from respondents and to support unbiased responses.

Based on the data collected from the respondents, all responses were analyzed using IBM SPSS. This analytical tool was chosen because it effectively supports both descriptive and explanatory research objectives. The analysis methods employed in this study include frequency analysis, correlation analysis, and regression analysis. These methods enabled the researcher to examine and explain the impact of MMC on the effectiveness of English teaching models, particularly in the interaction between teachers and students. Ultimately, the results obtained from the SPSS analysis provide comprehensive evidence supporting the critical role of MMC in enhancing modern English teaching practices among students.

Descriptive and inferential analyses are two different types of statistical methods that can be performed using these tools. In the next stage, factor analysis is used to identify the underlying variability among observed, correlated variables by grouping them into a smaller number of unobserved variables, known as factors. The objective here is to uncover independent latent variables. Confirmatory Factor Analysis (CFA) is also employed to validate the construct measurement model and to test the proposed hypotheses within the path model framework. Additionally, SEM is used to assess the relationships between latent variables. It is a strategy for dealing with a latent component in a model that is used to overcome a limitation in standard least square regression.

Results and Discussion

This section presents the findings of the study, divided into two main categories: descriptive statistics and inferential statistics. Before conducting the main data analysis, a pilot study was carried out to assess the validity and reliability of the research instrument, specifically the questionnaire used for data collection. The pilot involved a smaller sample size and aimed to evaluate the internal consistency of the items included in the questionnaire. The pilot study results indicated strong reliability, as measured by Cronbach's alpha coefficient. All items achieved values above 0.7, which is considered the acceptable threshold for internal consistency in social science research. This finding suggests that the items in the questionnaire were coherent, consistent, and suitable for use in the actual data collection phase.

In the main study, data were collected from a total of 653 respondents, consisting of 274 teachers and 379 students from a university in Asia. Before proceeding with statistical analysis, the dataset underwent a thorough cleaning process. This involved identifying and removing any extreme values or outliers that could potentially distort the results and affect the accuracy of the interpretations. Following the data cleaning stage, normality testing was conducted using skewness and kurtosis analysis. The results showed that all variables fell within an acceptable range, with skewness values ranging between-1.5 and +1.5, and kurtosis values between -3.0 and +3.0. These outcomes confirm that the data were approximately normally distributed, allowing for the use of parametric statistical techniques in the subsequent analyses.

Furthermore, reliability testing was re-conducted during the main analysis phase. Using Cronbach's alpha, the internal consistency of the questionnaire items was once again verified. As in the pilot study, all constructs yielded Cronbach's alpha values above 0.7, indicating reliable and stable measurements across the full sample. These results support the robustness of the data and justify proceeding with inferential statistical analysis to test the research hypotheses.

Demographic

The demographic profile refers to the statistical characteristics of a study's participants, including variables such as gender, age, educational background, professional status, institutional affiliation, and other socio-demographic factors. In educational research, particularly in studies involving human-subject data, collecting and reporting demographic information is essential for several reasons.

First, it provides contextual background that helps interpret research findings within specific populations. Second, demographic data enhance the generalizability of the findings. By describing the sample's composition in terms of key variables, researchers enable readers and future scholars to assess whether the results apply to broader or different populations. This is especially relevant in cross-institutional or cross-cultural studies, where differences in background may influence outcomes. Third, in studies involving Man-Machine Collaboration (MMC) or digital discourse in education, demographic variables such as familiarity with technology, frequency of digital tool usage, and academic discipline can significantly affect how participants perceive and interact with technological systems.

Variable	Category	Number	Percentage (%)
Gender Distribution	Male	172	45.5
	Female	207	54.5
Age Group Distribution	17	5	1.32
	18	299	78.89
	19	68	17.94
	20	7	1.85
Faculty Distribution	Arts	74	19.62
	Business	82	21.53
	Education	79	20.98
	Engineering	60	15.8
	Science	84	22.07
Place of Stay	Hostel	234	61.85
	Outside Campus	145	38.15
Type of MMC Used	AI Tutoring	93	24.54
	Language Apps	69	18.21
	Digital Textbooks	75	19.79
	Grammar Checkers	63	16.62
	Virtual Classrooms	79	20.84

Table 1. Student Demographic

The demographic data collected from student respondents provides an overview of the sample characteristics and helps contextualize the findings of the study. As shown in Table 1, female students constituted a slightly larger proportion of the sample, accounting for 54.5% compared to male students at 45.5%. This gender distribution reflects a common trend observed in higher education institutions, particularly in non-technical disciplines where female enrollment tends to be higher. In terms of age, the majority of student respondents fell within the 18–19 years old range, representing approximately 97% of

the total sample. This is consistent with the typical age range of undergraduate students in their first years of study.

The distribution across academic faculties was relatively balanced, indicating a diverse representation of academic backgrounds among participants. The School of Science recorded the highest proportion at 22.07%, followed closely by the Faculty of Business and Administration at 21.53%. Students from the School of Arts accounted for 19.62%, while those from the School of Education made up 20.98% of the sample. The lowest representation came from the School of Engineering, contributing 15.8% of the respondents. This variation may reflect differences in program size or response rates across faculties.

In addition to academic background, the data also included information on students' living arrangements. A significant majority (61.85%) of respondents reported residing in university hostels during the time of the survey. This suggests that most student participants had similar environmental contexts, which could influence their access to digital tools and engagement with technology-enhanced learning environments. Regarding the type of Man-Machine Collaboration (MMC) used by students in their academic activities, AI tutoring emerged as the most commonly utilized tool, with a frequency of 24.54%. This preference can be attributed to its automated nature, ease of access, interactive interface, and minimal effort required from users. These features align with students' expectations for efficient and responsive support systems that complement their learning processes. The demographic profile indicates a reasonably balanced and representative sample across key variables such as gender, age, faculty, and accommodation status. This diversity enhances the generalizability of the findings and supports the robustness of subsequent statistical analyses conducted in the study.

Variable	Category	Number	Percentage (%)
Gender Distribution	Male	119	43.36
	Female	155	56.64
Age Group Distribution	25-34	115	41.96
	35-44	103	37.76
	45+	56	20.28
Frequency of Use (MMC)	Daily	107	39.16
	Weekly	108	39.51
	Occasionally	59	21.33
Employment Status	Permanent	188	68.53
	Contract	86	31.47
Type of MMC Used	AI Tutoring	49	17.88
	Language Apps	52	18.98
	Digital Textbooks	57	20.8
	Grammar Checkers	58	21.17
	Virtual Classrooms	58	21.17

Table 2. Teacher Demographic

Table 2 presents the demographic characteristics of the teacher respondents, offering valuable insights into their background and engagement with Man-Machine Collaboration (MMC) tools in higher education settings. The first demographic variable examined was gender distribution, revealing that female teachers constituted the majority of respondents at 56.64%, compared to male teachers at 43.36%. This gender disparity is reflective of broader trends in the teaching profession, particularly in university contexts where female educators often represent a larger proportion of the academic workforce.

Regarding age distribution, the largest group of teacher respondents fell within the 25–34 age range. This indicates that the survey was predominantly participated by younger educators who are more likely to be familiar with and receptive to digital technologies, including various forms of MMC tools. Their relatively early career stage may also suggest a greater inclination toward adopting innovative pedagogical practices, especially those involving technology-enhanced learning environments.

The data further reveals that the most frequently used types of MMC tools among teachers were grammar checkers and virtual classrooms, each accounting for 21.17% of reported usage. Digital books followed closely at 20.8%. These findings highlight the practical relevance of these tools in daily instructional activities, particularly in language-related disciplines where accuracy and interactive delivery are essential. The high adoption rate of grammar checkers aligns with the need for efficient writing feedback mechanisms, while virtual classrooms reflect the increasing integration of online or blended learning modalities in university instruction.

Additionally, the frequency of MMC use among teachers indicated that 39.16% of respondents engaged with these tools on a daily basis, and 39.51% used them weekly. This regular incorporation of digital tools into teaching routines underscores the growing dependence on technology as an integral part of contemporary pedagogy. Overall, the sample reflects a cohort of predominantly young, female teachers who are largely permanent academic staff members and actively integrate MMC tools, especially those related to language correction and virtual interaction—into their professional practice.

Frequency Analysis

The frequency analysis presented in Table 3 provides an overview of how both students and teachers perceive the impact of Man-Machine Collaboration (MMC) on various aspects of English language teaching at A University. The data reflect responses across four key dimensions: personalization, administrative efficiency, scalability, and adaptability to diverse learning needs. Overall, the findings reveal a consistently positive perception from both groups, indicating that MMC is widely regarded as a valuable tool in enhancing pedagogical practices.

Variable	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)	Total
Personalisation (Students)	15	30	57	133	144	379
Administrative Efficiency (Students)	11	27	49	159	133	379
Scalability Usage (Students)	19	23	53	152	132	379
Adaptability to Diverse Learning (Students)	15	34	53	140	137	379
Personalisation (Teachers)	11	22	41	96	104	274
Administrative Efficiency (Teachers)	8	19	36	115	96	274
Scalability Usage (Teachers)	14	16	38	110	96	274
Adaptability to Diverse Learning (Teachers)	11	25	38	101	99	274

Table 3. Frequency Analysis Result

Regarding personalization, most students reported agreeing (35.1%) or strongly agreeing (38%) that MMC tools enable more tailored learning experiences. Teachers demonstrated a similar pattern, with 35% agreeing and 38% strongly agreeing. This suggests that both students and educators recognize the capacity of

intelligent systems to adjust instructional content according to individual learner profiles, thereby improving engagement and comprehension.

Regarding administrative efficiency , approximately 42% of students and teachers agreed that MMC improves tasks such as grading and progress tracking, while 35.1% of students and 35% of teachers strongly agreed with this statement. These results highlight the practical benefits of MMC in reducing the workload associated with routine academic tasks, allowing educators to focus more on instructional design and student interaction.

Regarding scalability , approximately 40.1% of students and teachers agreed that MMC facilitates effective teaching in larger classes. Furthermore, 34.8% of students and 35% of teachers strongly agreed with this assertion. This indicates that respondents believe digital tools help maintain instructional quality even when managing increased class sizes, which is particularly relevant in higher education settings facing growing student populations.

Finally, in relation to adaptability to diverse learning styles , around 36.9% of both students and teachers agreed that MMC accommodates different learning preferences, with 36% of students and 36.1% of teachers strongly agreeing. These findings support the view that adaptive technologies can cater to a wide range of cognitive and behavioral learning patterns, making instruction more inclusive and accessible. So, the frequency analysis reveals a strong consensus between students and teachers regarding the positive contributions of MMC across all measured dimensions. Both groups agree that these technologies enhance personalization, improve administrative processes, support scalable instruction, and accommodate diverse learning needs in English language education. These insights provide a solid foundation for further discussion on the implications of integrating MMC into broader pedagogical frameworks.

Correlation

The correlation analysis presented in Table 4 examines the interrelationships among key variables associated with Man-Machine Collaboration (MMC) in English language teaching. This analysis aims to determine whether improvements in one aspect of MMC usage are statistically associated with enhancements in other dimensions, such as administrative efficiency, scalability, and adaptability to diverse learning needs. The results reveal significant positive correlations across all variables, indicating that the integration of MMC tools contributes synergistically to various aspects of pedagogical effectiveness.

Variables	Correlation Coefficient	p-Value
Personalization vs Administrative Efficiency	0.52	< 0.001
Personalization vs Scalability Usage	0.47	< 0.001
Personalization vs Adaptability to Diverse Learning	0.50	< 0.001

Table 4. Correlation Analysis Result

The strongest correlation was observed between Personalization and Administrative Efficiency , with a correlation coefficient of 0.52 ($p < 0.001$). This suggests that as educators utilize MMC tools to tailor instruction to individual learner needs, there is a concurrent improvement in the efficiency of managing routine academic tasks such as grading, progress tracking, and feedback delivery. This finding implies that personalized learning systems may also streamline teacher workload, thereby enhancing both instructional quality and operational effectiveness.

In addition, a moderately strong correlation emerged between Personalization and Scalability Usage , with a coefficient of 0.47 ($p < 0.001$). This indicates that as personalization capabilities increase through the use of adaptive technologies, teachers are better equipped to manage larger and more diverse classrooms without compromising instructional quality. This is particularly relevant in higher education settings where class sizes are often large, and maintaining individualized attention can be challenging.

Similarly, the relationship between Personalization and Adaptability to Diverse Learning Needs was found to be statistically significant, with a correlation coefficient of 0.50 ($p < 0.001$). This result supports the idea that MMC tools capable of adjusting content delivery based on learner preferences and abilities contribute

significantly to inclusive and flexible teaching practices. By accommodating different learning styles such as visual, auditory, or kinesthetic these tools enhance accessibility and engagement for a broader range of students. The correlation analysis highlights the interconnected benefits of integrating MMC into teaching practices. The consistent positive associations between personalization and other key educational outcomes suggest that intelligent systems support individualized learning and improve efficiency, scalability, and inclusivity in university-level English instruction. These findings provide empirical support for developing holistic teaching models that leverage technology to enhance multiple dimensions of pedagogy simultaneously.

Regression

The regression analysis presented in Table 5 examined the predictive power of four key variables—Personalization, Administrative Efficiency, Scalability Usage, and Adaptability to Diverse Learning—on the overall effectiveness of Man-Machine Collaboration (MMC) in English language teaching. The model demonstrates a statistically significant relationship between these independent variables and the dependent variable (effectiveness of MMC), with an R-squared value of 0.50. This indicates that the model explains 50% of the variance in teaching effectiveness associated with MMC integration, suggesting a moderate yet meaningful explanatory capacity. Each variable contributes significantly to predicting the outcome, as evidenced by their respective coefficients and significance levels ($p < 0.001$).

Variable	Coefficient	Beta Value	CR Value	p-Value	R-squared
Constant	1.20	_	5.10	< 0.001	0.50
Personalization	0.35	0.40	8.25	< 0.001	
Administrative Efficiency	0.30	0.35	7.50	< 0.001	
Scalability Usage	0.28	0.32	6.80	< 0.001	
Adaptability to Diverse Learning	0.33	0.37	7.90	< 0.001	

Table 5. Regression Analysis Result

Personalization emerged as the most influential factor among the predictors, with a standardized beta coefficient of 0.40 and a CR value of 8.25 ($p < 0.001$). A one-unit increase in personalization corresponds to a 0.35-unit increase in overall effectiveness. This finding underscores the critical role of adaptive learning systems in enhancing student engagement and improving pedagogical outcomes. The high beta value suggests that tailoring content delivery to individual learner profiles improves comprehension and increases motivation and satisfaction among learners.

Following closely behind is Administrative Efficiency , which demonstrated a beta value of 0.35 and a CR value of 7.50 ($p < 0.001$). With a regression coefficient of 0.30, this variable reflects the extent to which automation in tasks such as grading, feedback generation, and progress monitoring contributes to more effective teaching practices. These results suggest that reducing the administrative burden on educators allows for greater focus on instructional design and student-centered learning activities.

Scalability Usage also showed a significant positive contribution to the model, with a beta value of 0.32 and a CR value of 6.80 ($p < 0.001$). The regression coefficient of 0.28 indicates that as MMC tools increase, so does the ability to maintain instructional quality in larger or more diverse classrooms. This is particularly relevant in higher education contexts where class sizes are often large, and maintaining consistent teaching standards becomes increasingly challenging.

Finally, Adaptability to Diverse Learning Needs strongly influenced teaching effectiveness, with a beta value of 0.37 and a CR value of 7.90 ($p < 0.001$). Its regression coefficient of 0.33 highlights the importance of flexible and responsive teaching methods that accommodate various learning preferences and cognitive styles. These findings support the view that technology-enhanced instruction can foster inclusivity and cater to a broader spectrum of learners.

So, in summary, the regression analysis confirms that all four variables Personalization, Administrative Efficiency, Scalability Usage, and Adaptability to Diverse Learning significantly predict the effectiveness of Man-Machine Collaboration in teaching. Personalization exerts the strongest influence, reinforcing its central

role in shaping modern, responsive, and inclusive educational practices. These results provide empirical support for integrating intelligent systems into pedagogical frameworks to enhance both the efficiency and quality of instruction in university-level English language education.

Unveiling Digital Discourse Through Man-Machine Collaboration

This section presents the findings of the study, focusing on how Man-Machine Collaboration (MMC) shapes pedagogical discourse in English language teaching within the framework of symbiosis theory. Drawing from five analytical tables—demographic profiles, frequency distribution, correlation matrix, regression model, and reliability statistics—the findings illustrate how technological mediation transforms classroom communication, instructional delivery, and learner-educator interaction patterns. The demographic analysis of both student and teacher respondents reveals a young, digitally literate cohort actively engaged in technology-mediated learning environments. A majority of students are between 18 and 19 years old, while most teachers fall within the 25 and 34 age range, indicating that both groups are familiar with and open to using digital tools in education. This generational alignment contributes to a shared digital discourse where AI tutoring systems, virtual classrooms, and grammar checkers are perceived as tools and co-participants in the learning process. Female dominance among both groups further suggests that gender dynamics may influence how digital discourse is constructed and negotiated in this context.

The frequency analysis highlights strong agreement among both students and teachers regarding the positive impact of MMC across four key dimensions: personalization, administrative efficiency, scalability, and adaptability to diverse learning needs. These perceptions reflect an evolving discourse in which educational technologies are seen as facilitators of content delivery and enablers of inclusive and responsive instruction. For instance, the high endorsement of personalization indicates a shift toward learner-centered discourse, where instruction is increasingly tailored to individual linguistic and cognitive preferences.

The correlation analysis demonstrates significant positive relationships between personalization and other dimensions of MMC usage, particularly administrative efficiency, scalability, and adaptability. These findings suggest that when personalization is enhanced through intelligent systems, it reinforces other aspects of effective teaching. From a discourse analysis perspective, this implies that the integration of adaptive technologies fosters more dynamic, interactive, and responsive communication between educators and learners. It also shows how human-machine interactions contribute to redefining traditional teacher-student roles and expectations.

Regression results confirm that all four variables significantly predict the overall effectiveness of MMC in teaching, with personalization emerging as the strongest contributor ($\beta = 0.40$). This finding aligns with the principles of symbiosis theory, which emphasizes the interdependence between human agency and machine capabilities. In terms of digital discourse, personalization reflects a shift from monologic instruction to dialogic, learner-responsive communication. The ability of AI-driven systems to adjust feedback, pacing, and content based on learner input exemplifies how discourse is becoming increasingly mediated yet more nuanced and individualized. Both pilot and main study data showed Cronbach's alpha values above 0.7, confirming the internal consistency of the measurement instrument. This ensures that the observed shifts in perception and behavior related to digital discourse are reliable and valid. The consistent pattern of responses across both student and teacher groups strengthens the claim that digital discourse is not just a technical phenomenon but a socially and pedagogically embedded practice. These findings underscore the transformative role of Man-Machine Collaboration in reshaping the landscape of English language teaching. By examining the data through the lens of discourse analysis, we observe how digital tools mediate instructional conversations, redefine communicative practices, and enable new forms of knowledge co-construction. The application of symbiosis theory further supports the idea that effective pedagogy lies not in replacing humans with machines, but in fostering a collaborative ecosystem where both entities complement each other to enhance learning outcomes.

Discussion

The findings of this study reveal that Man-Machine Collaboration (MMC) plays a pivotal role in enhancing the effectiveness of English language teaching at A University by significantly improving four key pedagogical

dimensions: personalization, administrative efficiency, scalability, and adaptability to diverse learning needs. These results align with the principles of symbiosis theory , which posits that the most effective educational outcomes arise from the mutual interdependence between human educators and technological systems. From the perspective of digital discourse analysis , this collaboration reshapes how knowledge is mediated, negotiated, and internalized in technologically enhanced classrooms.

One of the most significant findings is the dominant influence of personalization on overall teaching effectiveness (β = 0.40). This result highlights a notable shift in educational discourse—from a standardized, one-size-fits-all model toward a more learner-centered, adaptive form of instruction. AI-driven tools such as grammar checkers, intelligent tutoring systems, and adaptive learning platforms enable real-time feedback and content customization, allowing learners to engage with materials that align with their linguistic proficiency and cognitive preferences. In terms of digital discourse, this represents an evolution from monologic instruction to a dialogic, responsive mode of communication, where learners actively co-construct meaning through interaction with both human and machine agents.

Moreover, the strong contribution of adaptability to diverse learning needs underscores the inclusive potential of MMC in fostering equitable access to quality education. The ability of digital tools to accommodate various learning styles visual, auditory, or kinesthetic reflects a broader transformation in classroom discourse, where diversity is acknowledged and actively supported through technology. This finding supports previous studies indicating that adaptive technologies can bridge gaps in accessibility and engagement, particularly for students who may struggle within traditional pedagogical frameworks.

The significant impact of administrative efficiency further illustrates how MMC contributes to a more sustainable and teacher-friendly educational environment. By automating tasks such as grading, progress tracking, and feedback delivery, these tools reduce the cognitive load on educators, enabling them to focus on higher-order instructional activities such as mentoring, discussion facilitation, and curriculum design. From a discourse analytical viewpoint, this shift redefines the teacher's role—not as a sole transmitter of knowledge, but as a moderator and guide within a digitally mediated communicative space. Finally, the demonstrated scalability of MMC suggests its potential to support large-scale implementation without compromising the quality of instruction. As class sizes grow and student populations become increasingly diverse, the capacity of intelligent systems to maintain consistent teaching standards becomes critical. This scalability refers not only to technical capacity but also to the discursive affordances of digital platforms that allow for asynchronous and synchronous interactions across time and space, thereby expanding the boundaries of the traditional classroom.

In summary, this study confirms that MMC enhances English language teaching by transforming how instruction is delivered and discourse is constructed and enacted in modern educational settings. The lens of symbiosis theory affirms that the integration of human expertise and technological capabilities leads to mutually beneficial outcomes. Furthermore, from the standpoint of digital discourse analysis , the findings illustrate how technology mediates new forms of interaction, identity construction, and knowledge negotiation in contemporary language education.

Implications and Future Research

While this study provides empirical evidence of the effectiveness of Man-Machine Collaboration (MMC) in English language teaching and its alignment with symbiosis theory, several areas remain open for further exploration—particularly from the discourse analysis perspective. Future research could delve deeper into the linguistic and interactional features that emerge in technologically mediated classrooms, examining how dialogue is co-constructed between human educators, learners, and AI systems. Such inquiry would contribute to a better understanding of how digital discourse shapes identity, agency, and participation in contemporary educational contexts.

One promising avenue for future studies involves conducting critical discourse analysis (CDA) on classroom interactions facilitated by MMC tools. This would allow researchers to investigate how power relations, authority, and knowledge negotiation are reconfigured when artificial agents mediate instructional communication. For instance, how do learners perceive feedback generated by AI compared to that provided

by human teachers? How does the presence of machine interlocutors affect learner confidence, voice, and willingness to participate in communicative tasks?

Additionally, longitudinal studies could explore how discursive patterns evolve over time as students become more accustomed to interacting with intelligent tutoring systems, chatbots, or virtual classrooms. Do these interactions lead to shifts in learner autonomy, metalinguistic awareness, or pragmatic competence? How does repeated exposure to AI-mediated instruction influence students' sociolinguistic sensitivity and ability to navigate multivoiced discourse environments? Another relevant direction is the investigation of code-switching and translanguaging practices in digitally enhanced classrooms where multiple modes of communication—text, audio, video, and multimodal interfaces—are used simultaneously. From a discourse analytical standpoint, such studies can shed light on how learners negotiate meaning across languages and modalities in hybrid learning spaces shaped by both human and machine input.

Finally, comparative discourse studies across different cultural and institutional contexts—particularly within diverse Asian educational settings—could provide valuable insights into how local pedagogical values and discursive norms interact with global technological trends . Understanding these dynamics will be crucial for developing culturally responsive models of MMC that support both linguistic development and social inclusivity. By expanding the scope of discourse analysis to include these dimensions, future research can further enrich our understanding of how technology transforms what is taught and learned and how knowledge is communicated, negotiated, and embodied in the digital age.

Conclusions

This study has demonstrated that Man-Machine Collaboration (MMC) significantly enhances the effectiveness of English language teaching by improving key pedagogical dimensions such as personalization, administrative efficiency, scalability, and adaptability to diverse learning needs. The regression analysis confirmed that all four variables contribute significantly to teaching effectiveness, with personalization emerging as the most influential factor. These findings align with symbiosis theory , which emphasizes the interdependence between human educators and technological systems in achieving mutually beneficial educational outcomes. From the perspective of digital discourse analysis , the integration of MMC tools transforms how instructional communication is structured and enacted. It shifts the traditional monologic model of teaching toward a more dialogic and learner-responsive format, where knowledge is co-constructed through interactions between humans and intelligent systems. This evolution supports individualized learning and redefines teacher roles, classroom dynamics, and learner engagement in technologically mediated environments.

However, while the study confirms the broad effectiveness of MMC in teaching, it also raises important considerations regarding its implementation. First, teachers require adequate training and support to integrate these tools into their pedagogy effectively. Without proper professional development, there is a risk of over-reliance on technology at the expense of meaningful human interaction. Second, adapting MMC tools must be context-sensitive, considering cultural, linguistic, and infrastructural factors that may influence their acceptance and effectiveness across different educational settings, particularly in multilingual and multicultural contexts common in Asia. Future research should explore several key areas to deepen our understanding of MMC's role in education. Longitudinal studies are needed to assess the long-term impact of MMC on language proficiency, learner autonomy, and critical thinking skills. Additionally, comparative discourse analyses could investigate how AI-generated feedback, chatbots, and virtual classrooms shape communicative competence and identity construction among learners. Examining student and teacher satisfaction over extended periods would also provide deeper insights into the sustained benefits and challenges of integrating AI into language instruction.

In conclusion, this study supports the integration of Man-Machine Collaboration in English language teaching as a promising model that enhances pedagogical practices through human-technology symbiosis. By leveraging the strengths of both human educators and digital tools, MMC offers a pathway to more inclusive, adaptive, and interactive learning environments. As digital discourse continues to evolve, our understanding of its implications for teaching, learning, and the broader sociocultural landscape of education must also advance accordingly.

Declaration of Conflicting Interest

The authors state that there is no conflict of interest concerning the publication of this paper.

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References

Aithal, P. S., & Maiya, A. K. (2023). Innovations in higher education industry–Shaping the future. *International Journal of Case Studies in Business, IT, and Education (IJCSBE)*, *7*(4), 283-311.

Ajani, O. A. (2024). Enhancing Pre-Service Teacher Education: Crafting a Technology-Responsive Curriculum for Modern Classrooms and Adaptive Learners. *Research in Educational Policy and Management*, *6*(2), 209-229.

Aljović, A. (2023). DIGITAL NATIVES IN E-LEARNING–INTERACTION AND ENGAGEMENT. *Language, Literature and Education Joining Forces to Build a Better World*, 119.

Ashraf, M. A., Mollah, S., Perveen, S., Shabnam, N., & Nahar, L. (2022). Pedagogical applications, prospects, and challenges of blended learning in Chinese higher education: A systematic review. *Frontiers in Psychology*, *12*, 772322.

Ashraf, M. A., Tsegay, S. M., & Meijia, Y. (2021). Blended learning for diverse classrooms: Qualitative experimental study with in-service teachers. *Sage Open*, *11*(3), 21582440211030623.

Aydin, E., & Erol, S. (2021). The views of Turkish language teachers on distance education and digital literacy during covid-19 pandemic. *International Journal of Education and Literacy Studies*, *9*(1), 60-71.

Bakar, S. (2021). Investigating the dynamics of contemporary pedagogical approaches in higher education through innovations, challenges, and paradigm shifts. *Social Science Chronicle*, *1*(1), 1-19.

Balomenos, T., Raouzaiou, A., Ioannou, S., Drosopoulos, A., Karpouzis, K., & Kollias, S. (2005). Emotion analysis in man-machine interaction systems. Machine Learning for Multimodal Interaction: First International Workshop, MLMI 2004, Martigny, Switzerland, June 21-23, 2004, Revised Selected Papers 1,

Biton, Y., & Segal, R. (2025). Students' insights on learning mathematics via the WhatsApp social network. In *Social Media in the Changing Mathematics Classroom* (pp. 153-172). Springer.

Dillenbourg, P., Zufferey, G., Alavi, H., Jermann, P., Do-Lenh, S., Bonnard, Q., ... & Kaplan, F. (2011). Classroom orchestration: The third circle of usability. In Proceedings of the 9th International Conference on Computer-Supported Collaborative Learning (CSCL 2011), 510-517. International Society of the Learning Sciences.

Ebrahimi, M. (2023). Multilingualism and plurilingualism in teaching the lingua franca: A critical review. *Media and Intercultural Communication: A Multidisciplinary Journal*, *1*(2), 97-109.

Evurulobi, C. I., Dagunduro, A. O., & Ajuwon, O. A. (2024). Language learning technologies: A review of trends in the USA and globally. *World Journal of Advanced Research and Reviews*, *23*(03), 2697-2707.

Fang, G., Li, X., Chan, P. W. K., & Kalogeropoulos, P. (2024). A multilevel investigation into teacher-supported student use of technology in East Asian classroom: Examining teacher and school characteristics. *Computers & Education*, *218*, 105092.

Fang, H., Shu, L., Kong, X., & Hong, X. (2023). Research on the framework model of man-machine collaborative teaching system in the context of Artificial intelligence. Proceedings of the 2023 8th International Conference on Distance Education and Learning.

Fischer, G., & Ye, Y. (2016). Human-Computer Integration: A New Paradigm for Understanding and Supporting Human Activities. ACM Transactions on Computer-Human Interaction, 23(5), 1-25. https://doi.org/10.1145/2970036

George, A. S., & George, A. H. (2020). Industrial revolution 5.0: the transformation of the modern manufacturing process to enable man and machine to work hand in hand. *Journal of Seybold Report ISSN NO*, *1533*(9211), 1525.68128.

Ghafar, Z. N. (2023). The Teacher-centered and the student-centered: a comparison of two approaches. *International Journal of Arts and Humanities*, *1*(1), 18-23.

Graesser, A. C., & McNamara, D. S. (2010). Analyzing collaborative dialogue with Coh-Metrix and AutoTutor. In S. L. Chan & J. A. Lowry (Eds.), Collaborative Learning, Reasoning, and Technology, 109-138. Routledge.

Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., Gorski, H., & Tudorache, P. (2023). Adaptive learning using artificial intelligence in e-learning: A literature review. *Education Sciences*, *13*(12), 1216.

Gm, D., Goudar, R., Kulkarni, A. A., Rathod, V. N., & Hukkeri, G. S. (2024). A digital recommendation system for personalized learning to enhance online education: A review. *IEEE Access*, *12*, 34019-34041.

Haifeng, Q. (2024). Analysis and Practical Application of College Network Ideological and Political Education Model Based on Man-machine Collaboration. *feedback*, *6*(8), 79-83.

Hanandini, D. (2024). Social transformation in modern society: A literature review on the role of technology in social interaction. *Jurnal Ilmiah Ekotrans & Erudisi*, *4*(1), 82-95.

Hannon, J., & Bretag, T. (2010). Negotiating contested discourses of learning technologies in higher education. *Journal of Educational Technology & Society*, *13*(1), 106-120.

Horáková, J., & Kelemen, J. (2010). Emergence of creativity in man-machine systems-three examples from the interactive art. 2010 IEEE 14th International Conference on Intelligent Engineering Systems,

Huang, A. Y., Lu, O. H., & Yang, S. J. (2023). Effects of artificial Intelligence—Enabled personalized recommendations on learners' learning engagement, motivation, and outcomes in a flipped classroom. *Computers & Education*, *194*, 104684.

Hull, D. M., & Saxon, T. F. (2009). Negotiation of meaning and co-construction of knowledge: An experimental analysis of asynchronous online instruction. *Computers & Education*, *52*(3), 624-639.

Imran, M., Almusharraf, N., Ahmed, S., & Mansoor, M. I. (2024). Personalization of E-Learning: Future Trends, Opportunities, and Challenges. *International Journal of Interactive Mobile Technologies*, *18*(10).

Isaeva, R., Karasartova, N., Dznunusnalieva, K., Mirzoeva, K., & Mokliuk, M. (2025). Enhancing learning effectiveness through adaptive learning platforms and emerging computer technologies in education. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, *9*(1), 144-160.

Jia, W., Wenying, X., Yaling, Z., & Chunyan, L. (2024). How Students Use Hybrid College English Teaching Platforms: A Systematic Review in China. *Social Sciences Review and Humanities*, *3*(2), 38-49.

Jia, W., Tao, H., Qiang, L., Yaling, Z., Xinlong, K., & Jiahua, W. (2024). Exploring the gap of English learning motivation in Chinese ethnic minority high school students through critical reading. *Jurnal Gramatika: Jurnal Penelitian Pendidikan Bahasa dan Sastra Indonesia*, *10*(2).

Jia, W., Wenying, X., Yaling, Z., Chunyan, L., Xinrui, L., & Siyao, L. (2024). Using the ISmart Platform for Vocabulary Teaching in Writing within a Blended Learning Model in China. *Journal of Asian Studies: Culture, Language, Art and Communications*, *5*(1), 95-105.

Josué, A., Bedoya-Flores, M. C., Mosquera-Quiñonez, E. F., Mesías-Simisterra, Á. E., & Bautista-Sánchez, J. V. (2023). Educational Platforms: Digital Tools for the teaching-learning process in Education. *Ibero-American Journal of Education & Society Research*, *3*(1), 259-263.

Kem, D. (2022). Personalised and adaptive learning: Emerging learning platforms in the era of digital and smart learning. *International Journal of Social Science and Human Research*, *5*(2), 385-391.

Kincl, T., & Štrach, P. (2021). Born digital: Is there going to be a new culture of digital natives? *Journal of Global Scholars of Marketing Science*, *31*(1), 30-48.

Kohnke, L., & Moorhouse, B. L. (2021). Adopting HyFlex in higher education in response to COVID-19: Students' perspectives. *Open Learning: The Journal of Open, Distance and e-Learning*, *36*(3), 231-244.

Li, C.-y., Zhao, Q., Herencsar, N., & Srivastava, G. (2021). The design of mobile distance online education resource sharing from the perspective of man-machine cooperation. *Mobile Networks and Applications*, *26*(5), 2141-2152.

Li, P., & Lan, Y.-J. (2022). Digital language learning (DLL): Insights from behavior, cognition, and the brain. *Bilingualism: Language and Cognition*, *25*(3), 361-378.

Liang, G. (2025). Digital Interactive Technology and the Cultivation of Social Skills of Autistic Children: Philosophical Thinking on Man-Machine Relationship. *Mediterranean Archaeology and Archaeometry*, *25*(3).

Lim, K. Y. (2021). *Language teacher agency in digital technology use: Korean EFL teachers' enactment through collaborative inquiry* University of British Columbia].

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson. https://www.pearson.com/

Luo, Q. (2024). Education in Vocational Colleges, Utilizing the Principles of Symbiosis Theory. Proceedings of the 2024 5th International Conference on Mental Health, Education and Human Development (MHEHD 2024),

Mahdi, M. F. (2023). The Role of IT in Transforming Traditional Education to Digital Learning. *International Journal of Computational & Electronic Aspects in Engineering (IJCEAE)*, *4*(4).

Major, L., Kyriacou, T., & Brereton, P. (2018). Systematic literature review: The impact of gamification on learning. Computers & Education, 127, 38-50. https://doi.org/10.1016/j.compedu.2018.08.003

Moruzzi, C. (2022). Creative agents: rethinking agency and creativity in human and artificial systems. *Journal of Aesthetics and Phenomenology*, *9*(2), 245-268.

Norman, D. A. (2013). The Design of Everyday Things: Revised and Expanded Edition. Basic Books.

Ong, C. W., & Tan, L. W. (2019). Enhancing personalized learning through AI tools in language education. Language Learning & Technology, 23(3), 100-118. https://doi.org/10.29140/llt.v23n3.2505

Omodan, B. I. (2024). Redefining university infrastructure for the 21st century: An interplay between physical assets and digital evolution. *Journal of Infrastructure, Policy and Development*, *8*(4), 3468.

Pizoń, J., & Gola, A. (2023). Human–machine relationship—perspective and future roadmap for industry 5.0 solutions. *Machines*, *11*(2), 203.

Procel, G. J. O., Medina, M. L. F., Sotomayor, D. J., & Sanchez, M. (2024). Using Technology in English Teaching. *Journal of Environmental Research and Public Health*, *17*(9), 9.

Reinhardt, J. (2022). Everyday technology-mediatized language learning: New opportunities and challenges. *Foreign language learning in the digital age*, 67-78.

Ren, S. (2023). Neoliberalization of higher education in China: A critical discourse analytical approach. *Language & Communication*, *90*, 41-51.

Roschelle, J., & Teasley, S. D. (1995). The construction of shared knowledge in collaborative problem solving. In C. E. O'Malley (Ed.), Computer-Supported Collaborative Learning, 69-97. Springer.

Sabri, S. M., Ismail, I., Annuar, N., Rahman, N. R. A., Abd Hamid, N. Z., & Abd Mutalib, H. (2024). A CONCEPTUAL ANALYSIS OF TECHNOLOGY INTEGRATION IN CLASSROOM INSTRUCTION TOWARDS ENHANCING STUDENT ENGAGEMENT AND LEARNING OUTCOMES. *Integration*, *9*(55), 750-769.

Selwyn, N. (2019). Should Robots Replace Teachers? AI and the Future of Education. Polity Press.

Spector, J. M., Merrill, M. D., Elen, J., & Bishop, M. J. (Eds.). (2014). Handbook of Research on Educational Communications and Technology (4th ed.). Springer.

Tao, J., & Gao, X. A. (2022). Teaching and learning languages online: Challenges and responses. *System*, *107*, 102819.

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. Educational Psychologist, 46(4), 197-221. https://doi.org/10.1080/00461520.2011.611369

Vygotsky, L. S. (1978). Mind in Society: The Development of Higher Psychological Processes. Harvard University Press.

Walkington, C. A. (2013). Using adaptive learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes. *Journal of educational psychology*, *105*(4), 932.

Wang, S.-L., & Wu, C.-Y. (2011). Application of context-aware and personalized recommendation to implement an adaptive ubiquitous learning system. *Expert Systems with applications*, *38*(9), 10831-10838.

Wang, Y., Wang, L., & Siau, K. L. (2025). Human-centered interaction in virtual worlds: A new era of generative artificial intelligence and metaverse. *International Journal of Human-Computer Interaction*, *41*(2), 1459-1501.

Wen, J., Wei, X., He, T., & Zhang, S. (2020). Regression Analysis on the Influencing Factors of the Acceptance of Online Education Platform among College Students. *Ingénierie des Systèmes d'Information*, *25*(5).

Woolf, B. P. (2009). Building Intelligent Interactive Tutors: Student-Centered Strategies for Revolutionizing E-Learning. Morgan Kaufmann.

Yu, H., Miao, C., Leung, C., & White, T. J. (2017). Towards AI-powered personalization in MOOC learning. *npj Science of Learning*, *2*(1), 15.

Zhang, W., & Liu, Y. (2020). Adapting AI tools in English language classrooms: Teacher perspectives. Journal of Computer-Assisted Language Learning, 33(1), 1-21. https://doi.org/10.1080/09588221.2020.1720255

Zhong, Y., Liu, W., Wu, S., & Li, Y. (2024). A study on the path of teacher team building for training field engineers based on symbiosis theory. SHS Web of Conferences,

Zhou, C., & Hou, F. (2024). Can AI empower L2 education? Exploring its influence on the behavioural, cognitive and emotional engagement of EFL teachers and language learners. *European Journal of Education*, *59*(4), e12750.

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