

AI-Enabled Sustainable Personalized Language Learning: An Empirical Study of Learners' Experiences

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Information of Article

Article history:

Received: 01 July 2026

Presented: 22 August 2026 (INSPIRE-2026, GIBS Bengaluru)

Keywords:

Artificial Intelligence

Personalized Language Learning

Learner Autonomy

Learner Engagement

Sustainable Learning Experiences

ABSTRACT

Artificial Intelligence (AI) is increasingly shaping language education by enabling personalized, adoptive and learner centered learning experiences. AI – powered tools like GenAI as conversational chatbots have enhanced language learning through feedbacks, customized pathways for learning and improved learner engagement. Despite these advancements, the existing studies have predominantly focused on conceptual discussions, technology adoption and the effectiveness of specific language learning AI tools, with limited empirical evidence of examining learner's overall experience of AI enabled sustainable personalized language learning. This research addresses the gap by examining learner's perceptions and experiences of AI- enabled personalized language learning within context of sustainable education. A statistical research design was applied and primary responses was collected from 201 respondents through a structured questionnaire. The collected data was used to analyze descriptive statistics to summarize the respondent's demographics and perceptions, Correlation analysis was used to analyse the relationship among the study variables and simple linear regression model analysis was used to understand the influence of AI- enabled personalized language learning on learner engagement, perceived learning effectiveness, learner autonomy and sustainable experience while learning. The findings of the paper indicated that AI-enabled personalized language learning positively contributed on learner's overall experiences by improving engagement, encouraging learner autonomy and enhancing perceived learning effectiveness. The study addressed the identified research gap by providing empirical evidence on learner's experiences with AI-enabled sustainable personalized language learning. The analysis also offers valuable insights to educators, education institutions, policymakers and EdTech developers to create more effective and sustainable language learning practices.

How to cite: Nanditha C. & Deepak Shyam (2026). AI-Enabled Sustainable Personalized Language Learning: An Empirical Study of Learners' Experiences. *Journal of Reproducible Research*, 1(2), Special Issue: INSPIRE-2026, pp. 145–161.

1. Introduction

Artificial Intelligence is becoming increasingly influential in education, reshaping the ways in which learners engage with, receive and experience learning. The use of Artificial Intelligence such as GenAI, AI Chatbots, intelligent tutoring platforms, adaptive learning applications and automated feedback tools is a new development that provides a new chance for the learners to access the educational content tailored to their individual requirements. This technological advancement is slowly shifting the focus of learning from traditional classroom- based and standardised methods towards more flexible and personalised learnings.

Personalised learning has become significantly important since learners differ in their learning methods, knowledge, abilities, interests and preferred learning modes. A similar learning methods may not necessarily offer the same level of assistance or flexibility to each learner. AI- enable learning platforms can address some of these gaps by personalising learning contents, activities, suggestions and difficulty levels based on individual needs. This allows learners more control over their learning methods and allows them to learn at their own pace of learning. By

integrating the use of AI with personalised learning has the ability to create a more personalised learning environment.

AI-enabled personalisation plays the major role in one of the key areas that is language learning. Language learning largely requires consistent practice, engagement, feedback and constant growth. In traditional classroom learnings, time constraints, class size and individual focus might limit learners' opportunities to success. AI powered language learnings provides various features such as vocabulary development, grammar, translations, writing assistance, conversation and pronunciation practice and quick feedback tools. These technological tools can also allow learners to practice outside the classroom and learn based on their individual needs. Hence AI makes language learning more adaptable, interactive, flexible and personalised. The growing requirement for flexible and continuous learning has led to discussions about sustainability. Sustainable learning involves developing accessible, diverse and adaptable learning experiences that can be moved beyond traditional classroom learning. AI-enabled personalised language learning is helpful by enabling learners to access contents and learn at their own convenience and pace. This adaptability is essential for learners who are increasingly need to develop their skills along with their academic, professional and personal responsibilities.

However, incorporating AI into education creates a several challenges such as inadequate access to technology, privacy concerns, algorithmic bias, inaccurate AI generated contents and over reliance on technology, highlighting the importance of teachers and human connections. As a result, integrating AI in language learning requires balanced consideration between technological skills and learners' actual requirements and experiences. The increasing integration of AI, personalised language learnings and sustainable learning is an essential part of educational transformation as AI provides more personalised and flexible learning opportunities while supporting continued access to traditional classroom learnings. Therefore, it is very much important to understand learners' experiences to determine whether AI-enabled personalised language learning can produce learning environments that are significant, efficient, engaging, personalised and sustainable.

2. Review of Literature

2.1 AI - Enabled Personalised Learning

The growing adoption of AI within the educational sector has led to a change from standardized learning and toward techniques that are more capable of fulfilling the requirements of individual learners. AI technologies can analyse learner patterns and provide adaptive content, feedback, and learning pathways, making personalized learning more practical across different learning environments (Aprilla Fortuna, 2025). Personalised learning has also been associated with adoptable learning pathways that respond to learner's progress, preferences and specific needs (Arani, 2024). The development of GenAI has increased these possibilities by allowing learning materials and feedback to be tailored to individual learning paths (Baskara, 2024). These developments indicate that AI-enabled personalisation can make learning more flexible and learner-centred, while the learners get more control of their learning experiences.

The relationship between AI and personalised learning has also been linked to sustainable education. AI-powered personalised learning can provide learners with adaptable learning opportunities while also promoting long term educational development (Dandachi, 2023). Adaptive AI systems have additionally been associated with resilient and sustainable learning through implementing personalized learning systems and continuous assistance (Manjunath Munenakoppa, 2026). As a result of the rapid development of adaptive learning, there is currently a substantial relationship between personalization and educational sustainability (Wadim Strielkowski, 2024). However, these developments highlight the importance of understanding if the personalization provided by AI can actually be perceived positively by learners.

2.2 Language Learning and Artificial Intelligence

Using AI for language learning provided more opportunities for learners to receive support that is tailored to their language skill and progress. Natural language processing, speech recognition, automated writing evaluation, tutoring

systems, and bots are some examples of AI technologies that are becoming increasingly significant in language learning (Jeong-Bae Son, 2023). AI-powered personalized language learning can also generate adaptive content, feedback from the learner, and learning pathways personalised to every learner's requirement (Arani, 2024). Personalized English language learning has also been linked to adaptive platforms, data-driven learning, and continuous feedback, which can result in more personalized learning experiences (Bhargav H Chohla, 2025). This means that AI is slowly but steadily becoming an integral for the learning process rather than another learning tool.

The application of AI in English Language learning could also enable learners to receive personalized learning materials. Instant feedback and the opportunity for practice at their own pace (Uskanovich, 2025). AI-based adaptive systems have also been known to allow flexible learning, instant feedback and increase language learning opportunities (Wah, 2025). According to other researches done on AI tools for personalized language learning, adaptive systems can affect the engagement, motivation and autonomy of the students (Kazi Bushra Orpy, 2026). This growing body of evidence is causing the emphasis to shift from the capabilities of AI to the learner experiences in using AI.

2.3 Learner Engagement and Perceived Learning Effectiveness

Learner engagement is an essential component of these experiences since personalized content and immediate feedback can motivate learners to become more engaged in language-learning activities. AI-enabled English language learning has been associated to enhanced engagement, motivation, and self-directed learning. Personalized AI systems can also boost learner motivation by lowering language fear and offering learning support tailored to individual needs (Wah, 2025). AI-supported multimodal language activities can enhance learner engagement and motivation by linking language learning to sustainability-related subjects (Aydın Yıldız, 2025). These findings indicate that personalization can make language learning more relevant and interesting for learners.

The significance of AI-generated learning content can also have an impact on how learners evaluate their learning effectiveness. Learners and instructors have indicated positive perceptions of AI-based personalized learning, demonstrating that adaptive learning approaches are acceptable (Ali Al-Badia, 2022). AI-generated location-based vocabulary resources have also received favourable feedback with regard to relevance, accuracy, motivation, and learning efficiency (Liuyi Yang, 2025). However, learning outcomes from AI-supported language learning are influenced not just by technology, but also by instructional design, learning activities, and trainer engagement (Yan Li, 2025). This suggests that perceived learning efficiency should be understood through the learner's experience rather than determined based on the availability of AI technologies.

2.4 AI and Learner Autonomy

Personalized learning can also provide learners more control over their learning experience. AI-driven personalized learning enables learners to choose learning resources, learn at their own pace, and continue studying outside traditional learning environments (K. Bayly-Castaneda, 2024). AI-supported language learning has also been linked to individual learning, which allows learner to take charge for better proficiency. Based on to the empirical evidence on personalized language learning, learner autonomy is one of the most significant outcomes related with AI powered learning (Kazi Bushra Orpy, 2026). These findings suggest that AI personalization may help learners become more independent in managing their learning.

However, having greater access to AI does not always result in increased learner autonomy. Excessive reliance on AI could encourage dependency and diminish learners' motivation to engage in independent learning tasks (Wah, 2025). The efficiency of AI-supported in learning the language is also determined by how teachers and students engage with AI in the learning environment (Yan Li, 2025). Hence, the key issue is not whether AI enables personalized learning, but if that personalization genuinely increases learners' independence and autonomy.

2.5 Sustainable Learning Experiences

The backbone of continuous and flexible learning leads to inclusion of sustainability as a component of personalized learning using artificial intelligence. Generative AI can assist learners build skills in more flexible educational

environments while also providing personalized learning experiences (Baskara, 2024). AI-enabled personalized learning has also been related to learner empowerment, meaningful learning, and skill development (Dandachi, 2023). Adaptive AI can contribute to more sustainable and resilient education by providing flexible learning methods and personalized learning assistance (Manjunath Munenakoppa, 2026). AI-supported language learning can also assist learners acquire language skills based on their unique needs, hence contributing to long-term growth (Omar Ali Al-Smadi, 2024). This shows that sustainability can include not only environmental challenges but also flexible and adaptable learning.

When AI is used to personalize language learning, the relationship becomes critical. The use of location-based vocabularies enables learners to get personalized language content in real-world circumstances outside of the classroom. AI-driven multi-modal language learning promotes sustainability, reflection, and engagement (Aydin Yıldız, 2025). AI-powered adaptive systems can provide learners with instant feedback and personalized learning opportunities while also increasing engagement and proficiency in languages (Vo, 2025). Similarly, AI-based personalized learning can help to ensure long-term learning by adapting learning content to learners' pace, preferences, and performance while also enabling ongoing assessment and feedback (Fatima Rahioui, 2025). Learners that adopt AI-generated content have more positive perceptions of long-term tailored learning (Zhileng Xiong, 2026). These findings confirm the relationship between AI, personalization, and sustainable learning, but they also demonstrate that sustainability is frequently considered within specific purposes rather than as part of the overall learner experience.

3. Research Gap

The review of the existing literature indicates a comprehensive discussion of AI-enabled personalized learning, language learning, learner engagement, learning effectiveness, learner autonomy, and sustainable education. These studies provide important insights into AI's ability to personalize learning and improve learner experiences. However, there has been little empirical research on the relationship between AI enabled personalized language learning and long-term learning experiences from the perspective of learners. Sustainability is frequently considered at a higher conceptual or educational level, whereas research on AI enabled language learning has primarily focused on engagement, motivation, language performance, and autonomy. The most recent studies has started to connect AI-generated content to long-term personalized learning, but the combined impact of AI- enabled personalization on learner engagement, perceived learning effectiveness, learner autonomy, and long-term learning experiences is still unexplored (Xiong & Huang, 2026). Considering all of these gaps, this paper aims to address them by empirically examining these four characteristics from the learners' perspective, particularly examining how AI enabled personalized language learning to long-term learning experiences.

4. Research Objectives

- To examine learner's perception of AI-enabled personalized language learning within the sustainable education.
- To analyse the relationship between AI-enabled personalized language learning, learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.
- To evaluate the influence of AI-enabled personalised language learning on learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

5. Research Methodology

5.1 Research Design

This study uses a quantitative research approach to study learner's experiences with AI-enabled personalized language learning and its influence on learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

5.2 Research Variables

Independent Variables: AI- Enabled Personalized Language Learning
Dependent Variables: Learner Engagement, Perceived Learning Effectiveness, Learner Autonomy, Sustainable Learning Experiences.

5.3 Population

The population of the study consist of learners who have experience using AI-powered tools for language learning.

5.4 Sample Design

- A total of 239 responses were collected through structured questionnaire. After screening the collected responses, 201 valid responses were considered for statistical analysis.
- The sampling unit includes learners who have participated in the survey and have used AI Tools for language learning.
- The study has used convenience sampling method. Respondents was selected as per their availability and their willful participation in filling their response.

5.5 Data Collection

- Primary Data was obtained through a structured questionnaire with close ended questions. The questionnaire was distributed digitally through Google Forms.
- The questionnaire included demographic questions and their experiences with AI-enabled personalized language learning questions followed by statements related to research variables were measured using Likert Points Scale where Strongly Disagree was 1 and Strongly Agree was 5.
- The questionnaires was prepared based as per the research objectives and hypothesis.

5.6 Formulation of Hypothesis

Hypothesis 1: The relationship between AI-enabled personalized language learning and learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

Null Hypothesis (H01): There is no statistically significant relationship between AI-enabled personalized language learning and learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

Alternative Hypothesis (H11): There is significant positive relationship between AI-enabled personalized language learning and learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

Hypothesis 2: The impact of Artificial Intelligence enabled personalized language learning on learner engagement, perceived effectiveness of learning, Learner Autonomy and Sustainable Learning Experience. **Null Hypothesis (H02):** AI- enabled personalized language learning does not have significant influence on learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. **Alternative Hypothesis (H12):** AI- enabled personalized language learning have significant positive influence on learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

5.7 Data Analysis Tools & Techniques

The data that was collected were analyzed using descriptive statistics, correlation and simple linear regression.

- Descriptive Statistics: was used to understand the summary of the data and understand the overall response patterns.
- Pearson Correlation: was for examining the relationship of AI-enabled personalized language learning and learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

- Simple Linear Regression (SLR): were used to understand the influence of AI-enabled personalized learning with learner engagement, perceived effectiveness, learner autonomy and sustainable learning experiences.

6. Data Analysis and Interpretation

The data analysis part of the paper is conducted to assess the role of AI-enabled personalized language learning influencing learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. For the analysis, composite scores were calculated for five variables: AI-enabled personalized language learning, learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. The analysis begins with demographic analysis of the respondents and their patterns of AI usage in language learning followed by Cronbach's Alpha Reliability Analysis; Descriptive Statistics, which provides an overall understanding of the data; Correlation Analysis, which examines the relationship between the research variables and tests the correlation hypothesis (H01/ H11) and regression analysis, which evaluates the influence of AI-enabled personalized language learning on learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences and tests the regression hypothesis (H02/ H12).

6.1 Demographic Analysis

6.1.1 Gender

Gender Distribution (N=239)

Gender	Frequency	Percentage (%)
Female	127	53.14%
Male	108	45.19%
Prefer not to say	4	1.67%
Total	239	100.00 %

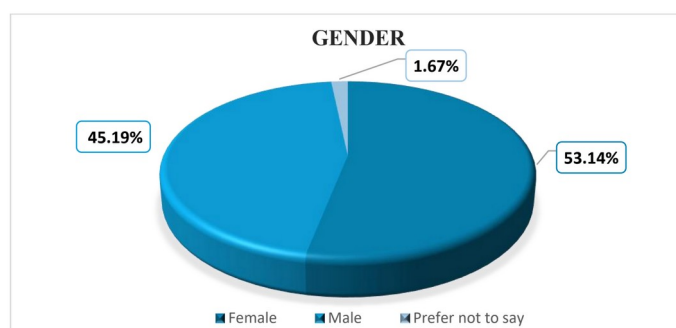


Figure 1: Gender distribution of respondents

The sample consists of 239 respondents with a relatively even representation across gender categories. Female respondents are of 53.14% (127 females), while male respondents are of 45.19% (108 males). A small portion of 1.67% (4 responders), preferred not to disclose their gender. The distribution indicates that responses obtained were from both male and female participants in fairly comparable proportions, providing representation from both groups for the study.

6.1.2 Age

Age Group (N=239)

Age group	Frequency	Percentage (%)
18-25	202	84.52%
26-30	27	11.30%
31-40	5	2.09%
Above 40	5	2.09%
Total	239	100.00%

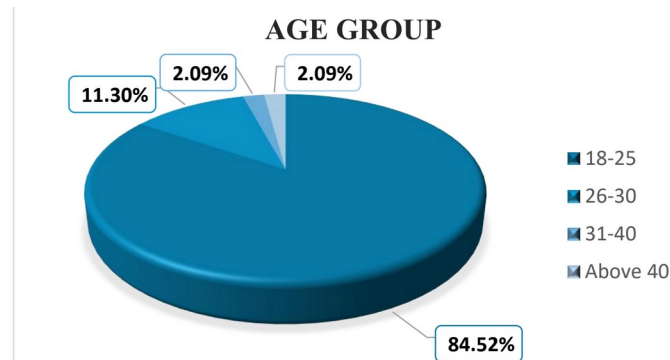


Figure 2: Age group of respondents

The age distribution shows that the respondents in the study are of different age groups. Respondents aged 18-25 years were 84.52% (202 respondents), followed by those aged 26-30 years at 11.30% (27 respondents). The 31-40 years and above 40 age categories both had 2.09% (5 respondents). Overall, the sample includes respondents across all four age categories, with a larger representation of younger participants.

6.1.3 Occupation

Occupation (N=239)

Current Occupation	Frequency	Percentage (%)
Student	197	82.43%
Working Professional	32	13.39%
Others	10	4.18%
Total	239	100.00%

Note: Others category includes doctors, teachers, research scholars and job seekers.

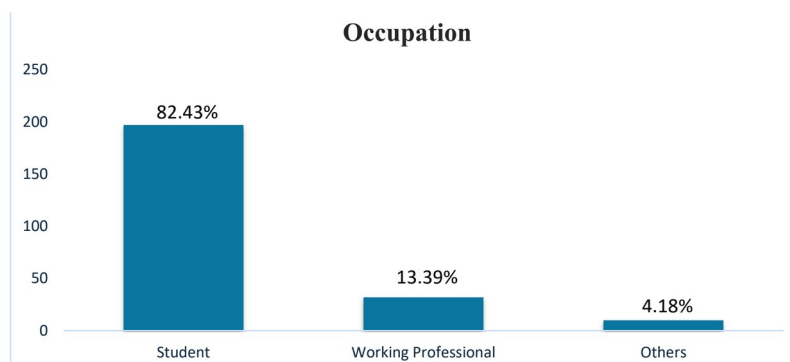


Figure 3: Occupation of respondents

The respondents are divided into various occupational groups, with 197 respondents (82.43%) are students and 32 respondents (13.9%) are working professionals. The remaining 10 respondents (4.18%) fall under other categories which includes doctors, teachers, research scholars and job seekers. This shows that the study includes participants from both student and professional backgrounds, with some representation from other occupational groups as well.

6.2 Patterns of AI Usage in Language Learning

6.2.1 How many have used AI tools for language learning?

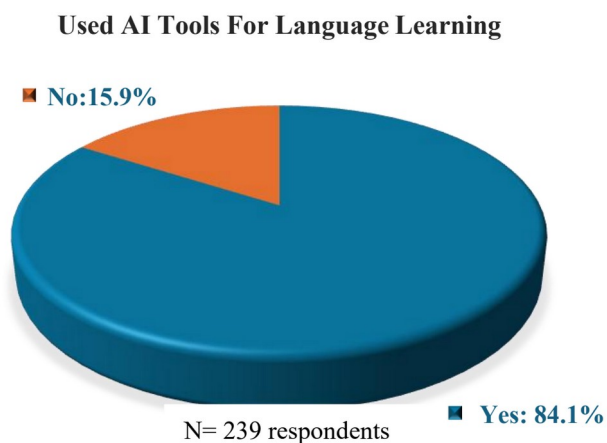


Figure 4: Respondents who have used AI tools for language learning

The above analysis shows that out of 239 total respondents, 201 (84.1%) respondents have use AI- powered tools language learning while 38 (15.9%) respondents have not used any AI tools for language learning. This indicates that AI tools are already being used by a large number of respondents as part of their language learning activities, The remaining respondents who have not used AI tools also indicates that there remains scope for further adoption. Based on these results, the 201 respondents who have used these tools for learning are considered as respondents in the analysis of this paper.

6.2.2 AI Tools Used for Language Learning

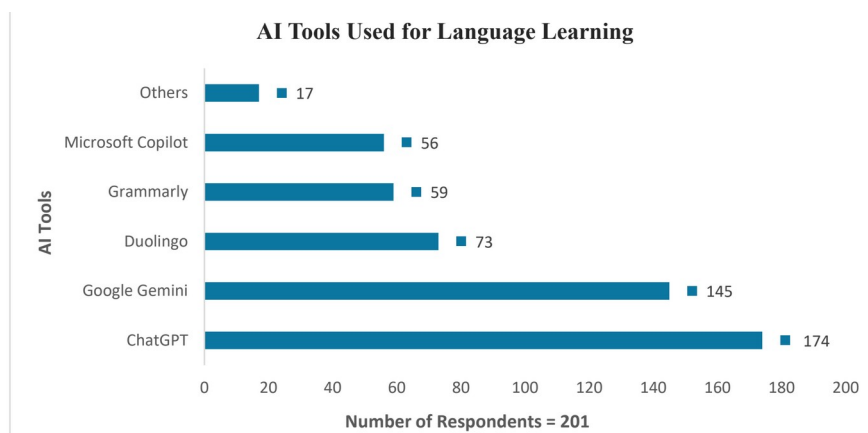


Figure 5: AI tools used for language learning

Among 201 respondents who reported using AI-based tools for language learning ChatGPT was the most frequently used tool with 174 (86.6%) respondents followed by Google Gemini with 145 (72.1%) respondents, Duolingo was used by 73 respondents (36.3%), while Grammarly and Copilot were used by 59 (29.4%) and 56 (27.9%) respondents respectively. The remaining 17 (8.5%) respondents reported using other tools such as Claude, DeepL Write, Perplexity, Grok and Google Translate. This analysis indicates that the respondents use a mix of general-

purpose AI tools and specified language learning applications. The relatively high use of ChatGPT and Google Gemini shows that general - purpose GenAI tools are also being used for language learnings alongside platforms specifically designed for language learning.

6.2.3 Frequency of Users Using AI for Language Learning

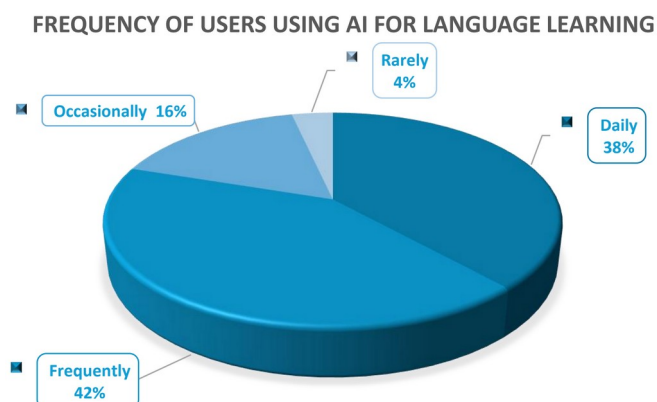


Figure 6: Frequency of using AI for language learning

The above analysis shows that among the 201 respondents who use AI tools for language learning, 84 (41.8%) reported using them frequently, and 77 (38.3%) reported using them daily. A further 33 respondents (16.4%) use AI tools occasionally, while only 7 respondents (3.5%) indicate they use them rarely. Overall, the analysis indicates that a significant majority of respondents use AI products on a regular basis, with 80.1% indicating daily or frequent use. This shows how Artificial Intelligence has become an major part of many respondents' for language learning experience.

6.2.4 Duration for Language Learning with AI Tools

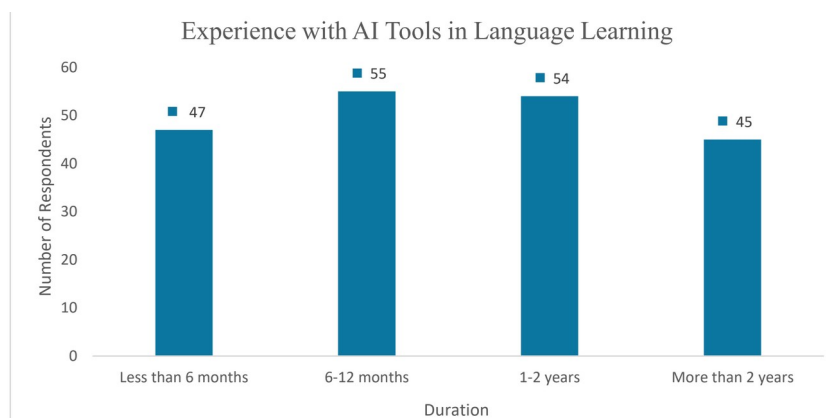


Figure 7: Experience with AI tools in language learning

The analysis show that 55 respondents (27.4%) have been using AI tools for 6-12 months, which was closely followed by 54 respondents (26.9%) with 1-2 years of experience. 47 (23.4%) of respondents have used AI tools. Some 45 (22.4%) have been using them for over 2 years, while less than 6 months put in by others. Overall, respondents' attitudes are generally. The duration groups were distributed evenly across the new users and experienced ones.

6.3 Cronbach's Alpha Reliability Analysis

Reliability Analysis of Research Variables

Variables	Cronbach's Alpha (α) Value	Reliability Level
AI-Enabled Personalized Learning	0.9166	Excellent
Learner Engagement	0.8907	Good
Learning Effectiveness	0.9001	Excellent
Learner Autonomy	0.9090	Excellent
Sustainability Learning	0.9192	Excellent
Overall	0.9715	Excellent

The reliability analysis indicates that the Cronbach's Alpha values for the research variables are within the range of good to excellent levels, 0.8907 to 0.9192. The Cronbach's alpha value of 0.9715 shows high level of reliability across the variables. The results indicate that the measurements applied in the study are consistent, and are suitable for subsequent statistical analysis.

6.4 Descriptive Statistics

Descriptive Statistics of Research Variables

Statistic	AI-Enabled Personalized Learning	Learner Engagement	Perceived Learning Effectiveness	Learner Autonomy	Sustainable Learning Experiences
Mean	3.753	3.738	3.753	3.779	3.843
Standard Deviation	0.985	0.914	0.972	1.010	0.987
Standard Error	0.069	0.064	0.069	0.071	0.070
Kurtosis	1.073	0.977	0.707	0.779	1.292
Skewness	-1.247	-1.071	-1.106	-1.150	-1.327

The analysis shows that mean values for all five variables are higher than the midpoint of five-point scale, ranging from 3.738 to 3.843. Sustainable Learning Experiences has the highest mean, followed by Learner Autonomy. AI-Enable Personalised Language Learning and Learning Effectiveness have similar mean values, while Learner Engagement has the lowest mean. Overall, the analysis indicates that respondents had generally positive views across the different aspects of AI-Enabled Personalised Language Learning.

The standard deviation values range between 0.914 to 1.010 indicating some variation in the responses. The negative skewness values for all five variables ranges from -1.071 to -1.327, indicating that respondents were generally towards higher end of the scale. The kurtosis values range from 0.707 to 1.292, indicating relatively greater concentration of responses around the centre. The Skewness & Kurtosis values fall within the commonly accepted range ± 2 , indicating that the distribution do not show substantial departures from normality. Therefore, the data are considered reasonably reliable for the Pearson Correlation and Simple Linear Regression analysis.

6.5 Correlation Analysis

Pearson's Correlation was conducted to analyze the relationship between the research variables, which includes AI-enabled personalized learning, learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences.

Pearson Correlation Matrix

	AI-Enabled Personalized Learning	Learner Engagement	Perceived Learning Effectiveness	Learner Autonomy	Sustainable Learning Experiences
AI-Enabled Personalized Learning	1.000	0.770	0.741	0.738	0.725
Learner Engagement	0.770	1.000	0.767	0.709	0.752
Perceived Learning Effectiveness	0.741	0.767	1.000	0.839	0.842
Learner Autonomy	0.738	0.709	0.839	1.000	0.839
Sustainable Learning Experiences	0.725	0.752	0.842	0.839	1.000

The analysis shows that AI-enabled personalized language learning has strong positive relationship among all four dependent variables. AI-enabled personalized language learning has strong positive correlation with learner engagement ($r=0.770$), followed by perceived learning effectiveness ($r=0.741$), learner autonomy ($r=0.738$) and sustainable learning experiences ($r=0.725$). This indicates that respondents who experienced higher levels of AI-enabled personalized language learning reported more positive learning experiences. Among the four variables, learner engagement has the strongest relationship with AI-enabled personalized learning.

The dependent variables also indicate strong positive relationships among the dependent variables. Perceived learning effectiveness is strongly correlated with learner autonomy ($r=0.839$) and substantial learning experiences ($r=0.842$) while learner autonomy is strongly correlated with sustainable experiences ($r=0.839$). These relationships indicate that the different dimensions of learning experiences are closely interconnected.

Since the relationships between AI-enabled personalized language learning and four dependent variables are significant at $p < 0.001$. Therefore, we reject null hypothesis (H01) and accept alternative hypothesis (H11). The result indicate there is significant positive relationship between AI-enabled personalized learning, learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. Overall, the correlation analysis supports the relationship between the research variables and provide a basis for the further regression analysis.

6.6 Regression Analysis

To test Hypothesis, four separate simple linear regression models were estimated, with AI-enabled personalized language learning as independent variable and learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences as dependent variables.

6.7 Hypothesis 1: AI-Enabled Personalized Language Learning → Learner Engagement

Regression Statistics	Value
Multiple R	0.770
R Square	0.593
Adjusted R Square	0.591
Standard Error	0.584
Observations	201

	df	SS	MS	F	Significance F
Regression	1	98.951	98.951	289.730	1.09×10^{-40}
Residual	199	67.964	0.342		
Total	200	166.915			

Regression Coefficients — AI-Enabled Personalized Language Learning Predicting Learner Engagement

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	1.058	0.163	6.503	6.22×10^{-10}	0.737	1.379
AI-Enabled Language Learning	0.714	0.042	17.021	1.09×10^{-40}	0.631	0.797

6.7.1 Regression Equation

$$\text{Learner Engagement} = 1.058 + 0.714 \times (\text{AI-Enabled Personalized Language Learning})$$

Interpretation

The model is significant statistically, $F(1, 199) = 289.730$, $p < 0.001$, shows that AI-enabled personalized learning significantly predicts learner engagement. The R^2 value of 0.593 shows that AI-enabled personalized learning explains 59.3% of the variation in learner engagement, while the Adjusted R^2 of 0.591 indicates a similar level of explanatory power after adjustment. The Value of Multiple R was 0.770 which indicates a strong linear relationship of these variables.

The regression coefficient for AI-enabled personalized learning is positive and statistically significant ($B = 0.714$, $t = 17.021$, $p < 0.001$). That means that a increase in AI-enabled personalized learning is associated with an estimated 0.714-unit increase in learner engagement. The regression coefficient has a 95% confidence interval ranging from 0.631 to 0.797, meaning the estimated coefficient is still positive within this interval. Since p-value falls below the 0.05 level of significance, the correlation between the use of AI enabled personalized learning and the level of engagement of learners is statistically significant. Thus, the Null hypothesis (H_0) is rejected, while Alternative hypothesis (H_1) is accepted. The results suggest a strong relationship between personalized learning based on AI and student engagement, namely a positive predictive relationship.

6.8 Hypothesis 2: AI-Enabled Personalized Language Learning → Learner Effectiveness

Regression Statistics	Value
Multiple R	0.741
R Square	0.548
Adjusted R Square	0.546
Standard Error	0.655
Observations	201

	df	SS	MS	F	Significance F
Regression	1	103.662	103.662	241.614	3.41×10^{-36}
Residual	199	85.379	0.429		
Total	200	189.040			

Regression Coefficients — AI-Enabled Personalized Language Learning Predicting Perceived Learning Effectiveness

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	1.010	0.182	5.538	9.59×10^{-8}	0.651	1.370
AI-Enabled Language Learning	0.731	0.047	15.544	3.41×10^{-36}	0.638	0.824

6.8.1 Regression Equation

$$\text{Effectiveness Score} = 1.010 + 0.731 \times (\text{AI-Enabled Personalized Language Learning})$$

Interpretation

The model is significant statistically, $F(1, 199) = 241.614$, $p < 0.001$, indicating that AI-enabled personalized language learning significantly predicts perceived learning effectiveness. The R^2 value of 0.548 shows that AI-enabled personalized language learning explains 54.8% of the variation in perceived learning effectiveness, while the Adjusted R^2 of 0.546 indicates a similar level of explanatory power after adjustment. The value of Multiple R was 0.741 which shows a strong linear relationship between the variables.

The estimated regression coefficient for AI-enabled personalized language learning is positive ($B = 0.731$, $t = 15.544$, $p < 0.001$). This means that increase in AI-enabled personalized language learning is associated with an estimated 0.731-unit increase in perceived learning effectiveness. The regression coefficient has a 95% confidence interval ranging from 0.638 to 0.824, shows that the estimated coefficient remains positive across the interval.

Since p-value is less than the 0.05 level of significance, the relationship between AI-enabled personalized language learning and perceived learning effectiveness is significant. Thus, the Null hypothesis (H_0) is rejected, while Alternative hypothesis (H_1) is accepted. The result shows that AI-enabled personalized language learning has a significant positive predictive relationship with perceived learning effectiveness.

6.9 Hypothesis 3: AI-Enabled Personalized Language Learning → Learner Autonomy

Regression Statistics	Value
Multiple R	0.738
R Square	0.545
Adjusted R Square	0.542
Standard Error	0.683
Observations	201

	df	SS	MS	F	Significance F
Regression	1	111.142	111.142	238.124	7.55×10^{-36}
Residual	199	92.881	0.467		
Total	200	204.023			

Regression Coefficients — AI-Enabled Personalized Language Learning Predicting Learner Autonomy

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.938	0.190	4.932	1.71×10^{-6}	0.563	1.314
AI-Enabled Language Learning	0.757	0.049	15.431	7.55×10^{-36}	0.660	0.853

6.9.1 Regression Equation

$$\text{Learner Autonomy} = 0.938 + 0.757 \times (\text{AI-Enabled Personalized Language Learning})$$

Interpretation: The model is significant statistically, $F(1, 199) = 238.124$, $p < 0.001$, which suggests that the model is predictive of learner autonomy and that AI-enabled personalized language learning has a significant impact. The R^2 value of 0.545 reveals that the AI-based personalized language learning model accounts for 54.5% of the variance in learner autonomy, and the Adjusted R^2 value was 0.542, nearly the same. The multiple correlation coefficient is 0.738, which means that the two variables are indicating a strong relationship between the two variables.

The estimated regression coefficient for AI-enabled personalized language learning is positive ($B = 0.757$, $t = 15.431$, $p < 0.001$). This means that increase in AI-enabled personalized language learning is associated with an

estimated 0.757-unit increase in learner autonomy. The regression coefficient has a 95% confidence interval ranging from 0.660 to 0.853, indicating that the estimated coefficient remains positive across the interval.

Since p-value is less than the 0.05 level of significance, the relationship between AI-enabled personalized language learning and learner autonomy is significant. Thus, the Null hypothesis (H02) is rejected while Alternative hypothesis (H12) is accepted. The findings show that AI-enabled personalised language learning has a significant positive predictive relationship with learner autonomy.

6.10 Hypothesis 4: AI-Enabled Personalized Language Learning → Sustainable Learning Experience

Regression Statistics	Value
Multiple R	0.725
R Square	0.526
Adjusted R Square	0.524
Standard Error	0.681
Observations	201

	df	SS	MS	F	Significance F
Regression	1	102.556	102.556	221.075	4.02×10^{-34}
Residual	199	92.316	0.464		
Total	200	194.872			

Regression Coefficients — AI-Enabled Personalized Language Learning Predicting Sustainable Learning Experiences

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	1.114	0.190	5.875	1.75×10^{-8}	0.740	1.489
AI-Enabled Language Learning	0.727	0.049	14.869	4.02×10^{-34}	0.631	0.823

6.10.1 Regression Equation

$$\text{Sustainability Learning Experience} = 1.114 + 0.727 \times (\text{AI-Enabled Personalized Language Learning})$$

Interpretation

The model is significant statistically, with $F(1, 199) = 221.075$, $p < 0.001$, as AI-enhanced personalized language learning is a significant predictor for sustainable learning experiences. The R^2 value of 0.526 means that AI-based personalized language learning is able to account for 52.6% of the variation in the sustainable learning experiences, and the Adjusted R^2 value (0.524) indicates a similar explanatory power after adjustment. The Multiple R is 0.725 an indication of a strong linear relationship between both variables.

The regression coefficient of AI enabled personalized language learning is statistically significant ($B = 0.727$, $t=14.869$, $p < 0.001$) and positive. This implies that the estimated increase in sustainable learning experiences is 0.727-unit for every one-unit increase in AI-enabled personalized language learning. The regression coefficient has a 95% confidence interval ranging from 0.631 to 0.823, which shows that estimated regression coefficient is positive in this interval.

Since p-value is less than the 0.05 level of significance, the relationship between AI-based personalized language learning and sustainable learning experiences is statistically significant. So, the Null hypothesis (H02) is rejected, while alternative hypothesis (H12) is accepted. The findings show that personalized language learning using AI has good positive predictive effects on sustainable learning experience.

6.11 Summary of Testing Hypothesis

Hypothesis	Test Performed	Value	Analysis
H01 / H11 — Correlation	Pearson r (AI-enabled personalized language learning with Engagement, Effectiveness, Autonomy and Sustainability)	$r = .725$ to $.770$, all $p < .001$	H01 rejected; H11 accepted
H02 / H12 — Regression (Engagement)	Simple linear regression	$R^2 = .593$, $F(1,199) = 289.730$, $p < .001$	H02 rejected; H12 accepted
H02 / H12 — Regression (Effectiveness)	Simple linear regression	$R^2 = .548$, $F(1,199) = 241.614$, $p < .001$	H02 rejected; H12 accepted
H02 / H12 — Regression (Autonomy)	Simple linear regression	$R^2 = .545$, $F(1,199) = 238.124$, $p < .001$	H02 rejected; H12 accepted
H02 / H12 — Regression (Sustainability)	Simple linear regression	$R^2 = .526$, $F(1,199) = 221.075$, $p < .001$	H02 rejected; H12 accepted

7. Findings

The results obtained from the correlation and regression analysis shows a significant positive relationship between AI-assisted personalized language learning and engagement, learning effectiveness and sustainable learning experiences. The correlation values fall within the range of 0.725 to 0.770. The regression results further show that AI-enabled personalization significantly contributes to each outcome, with the models explaining between 52.6% and 59.3% of the variation in the respective outcomes.

Among the four outcomes, learner engagement shows the strongest relationship with AI-enabled personalization ($r = 0.770$; $R^2 = 0.593$). This suggests that when learners experience more personalized and adaptive support through AI tools, remain involved in their learning activities. The results for perceived learning effectiveness, learner autonomy and sustainable learning experiences also show strong positive relationships, suggesting that personalized AI support may help learners feel more effective in their learning, take greater control of their learning process and maintain a more flexible and continuous learning experience.

Overall, the findings suggest that AI-enabled personalization can play an important role in supporting learner-centered and sustainable language learning. Rather than being used only as a technological assistant, AI-based personalization appears to be connected with learners' engagement, learning effectiveness, learner autonomy and sustainability of their learning experience.

8. Recommendations

The findings suggest that AI-enabled personalized language learning has scope for wider adoption, particularly among groups that have not yet used these tools. Working professionals and respondents in the 26-30 age group indicates relatively higher non-adoption rates, although these results should be interpreted with caution because some groups had fewer respondents.

Future AI-enabled personalized language learning platforms could provide flexible learning schedules, short learning modules and career-oriented language content to suit working professionals and young adults. For older users, simple interfaces, guided onboarding and voice-based features may make these tools easier to use. Overall, greater attention to needs of different learner groups can help make AI-enabled personalized language learning more accessible, flexible and sustainable.

9. Limitations

- The study included 201 respondents who have using AI based tools for personalized language learning. Since a number of participants is limited, the findings may not be fully represent the wider population of language learners.
- The study mainly focusses on primary data gathered using a structured questionnaire. Since the responses are based on participants personal experiences and perceptions, the findings may be affected by response bias.
- The study follows cross-sectional research design where data were gathered at one point in time. As a result, it doesn't show how learning experiences with AI- enabled personalized language learning might change over a long period of time.
- The study examined only few factors such as learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. Other factors such as learning performance, digital skills and institutional support were not considered.
- The respondents used different variety of AI tools for language learning. The difference between specific AI-tools were not examined separately, which may influence learners' experiences.

10. Future Scope of the Study

- Future research could consider broader and more varied groups of learners including people from different age groups and educational backgrounds. This would help make the findings more representative and applicable to a wider population.
- Long-term studies could be carried out to understand how learners' experiences with AI-enabled personalized language learning develop and change over the period of time instead of at single point of time.
- Further studies can compare different AI based learning tools to identify whether learner engagement, perceived effectiveness, learner autonomy and views on sustainable learning differ depending on the platform they use.
- Further research could combine learners' perceptions with measurable learning outcomes such as improvements in vocabulary, grammar, speaking ability and writing skills. This would provide a clear picture of the actual learning benefits.
- Future research could also take a broader view of sustainable factors such as accessibility, digital inclusion, responsible use of AI, data privacy and whether AI – supported learning can be maintained effectively over the long-term.

11. Conclusion

This study examined how AI-enabled personalized learning of languages influences learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. The respondents showed positive perceptions across all four areas with sustainable learning experiences having the highest mean score. The correlation analysis also revealed strong positive relationship between AI-enabled personalization and each of the four outcomes. The regression findings further confirmed that personalization through AI significantly contributes to learner engagement, perceived learning effectiveness, learner autonomy and sustainable learning experiences. Among these outcomes, Learner engagement demonstrated strongest relationship.

Taken together, these findings suggest that AI based personalization can offer more than just convenience in language learning. By adopting learning assistance to individual needs, it can encourage learners to participate more actively perceived greater learning value and take greater responsibility for their own learning.

Overall, the paper highlights the potential of AI-enabled personalization as a learner-centered approach. However, its wider adoption should be accompanied by responsible use of AI, privacy and the diverse need of learners. This

research thus adds to the increasing debate on the application of AI Technology in the creation of engaging, effective, autonomous and sustainable language learning environments.

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