



## Investigating the role of mindful, meaningful, and joyful learning in promoting deep learning in AI-based language learning

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### Abstract

This study aimed to investigate whether Mindful Learning (MiL), Meaningful Learning (MeL), and Joyful Learning (JL) are predictors of Deep Learning (DL) in AI-based language learning. The study employed a convergent mixed-methods design by combining phenomenology and *ex-post facto* approaches. This study recruited eight EFL students for the interviews and 276 EFL students for the quantitative part. The data were collected through semi-structured interviews, researcher field notes, and questionnaires. The data were analyzed using inductive thematic analysis, descriptive statistics, *Pearson Product Moment*, and *Structural Equation Modeling (SEM)*. The findings revealed that qualitatively, MiL, MeL, and JL are related to DL. However, the *SEM* outputs indicated that JL is the only non-predictor. The study offers four implications directed for the use of AI-based applications in facilitating DL in AI-based learning in EFL contexts.

**Keywords:** AI-based learning, deep learning, meaningful learning, mindful learning, joyful learning

### Introduction

Adopting a suitable teaching strategy would help to properly apply AI-based applications in students' online learning. Effective learning results depend on student participation in online environments. But, it can be challenging to keep concentration, motivation, and interaction in virtual classrooms (Khatami et al., 2025). Among recent learning approaches, DL appears to be one of the most suitable for integrating technology (Jiang, 2022), including AI-based instruction.

DL is characterized by a learner's active effort to connect new information with prior knowledge, integrate multiple sources of understanding, and apply knowledge in novel contexts (Elbashbishy, 2024; Hotman et al., 2025).

A few attempts have been conducted to investigate DL constructs (e.g., Fullan, Quinn, & Mceachen, 2018; Jiang, 2022; Rahimi & Sevilla-Pavón, 2024), yielding different constructs. According to the current literature, there is increasing recognition that MiL (Voreopoulou et al., 2024), MeL, and JL (Feriyanto & Anjariyah, 2024) are central components of deep learning processes. Despite this growing interest, current research has rarely examined the combined influence of MiL, MeL, and JL on DL, particularly in AI-based learning in EFL context (Tai & Chen, 2022; Waer, 2021; Waluyo & Kusumastuti, 2024; Wang et al., 2022). Most existing studies have addressed these constructs in isolation, leaving a gap in understanding how they interact within a unified framework of deep learning in AI-mediated settings.

Given the rapid expansion of AI in language education, it is essential to explore how these affective and cognitive learning dimensions contribute to deeper engagement. Therefore, this study seeks to investigate whether MiL, MeL, and JL are significant predictors of DL among EFL learners using AI-based applications. The following research question was formulated to guide this exploration: "To what extent do Mindful, Meaningful, and Joyful Learning predict Deep Learning in AI-based language learning?"

## Literature Review

### *Artificial Intelligence in Language Learning*

Literature indicated that AI has revolutionized language learning and teaching (Abdelaal & Al Sawi, 2024; Gonulal, 2021; Kusuma et al., 2024, 2025; Liang et al., 2021; Waer, 2021). It is challenging traditional teaching methods and transforming the educational landscape (Alhwaiti, 2023). Several benefits of using AI for language educations include providing word meanings and contextual understanding (Kohnke et al., 2023), assisting with paraphrasing (El-Garawany, 2024), evaluating written work (Es-Sarghini & Boumahdi, 2025), and providing tutoring in composition (Huang et al., 2023). It also facilitates language translation (Baskara & Mukarto, 2023; Tsai, 2022), conducting conversations with the users (Fitria, 2023; Kohnke et al., 2023; Sriganesh & Eamer, 2025). AI can also be integrated in gamified language learning (Fathi & Nosrati, 2024). AI therefore has the potential to improve all language skills (Fitria, 2023; Hong, 2023; Kohnke et al., 2023).

AI empowers English teachers to deliver personalized and complex learning experiences, and it catered to individual student needs (Cotton et al., 2023; Farrokhnia et al., 2023; Hong, 2023). Numerous studies have been devoted to investigating the potential of AI-based applications for English language learning. They revealed the implementation of AI in listening courses (Runge et al., 2024), speaking courses (Tai & Chen, 2020), reading courses (Daweli & Mahyoub, 2024), writing (Alkamel & Alwagieh, 2024; Rad et al., 2023), and vocabulary learning (Agnes & Srinivasan, 2024). The incorporation of AI into language instruction will probably widen as it develops, and it improves tailored and flexible learning opportunities for pupils all around.

### *Deep Learning*

Deep learning is a concept proposed by Marton and Säljö (1976) to depict a type of learning that applies learning to a new context which is different from surface learning. Further other scholars explore this concept to enrich the literature. For example, Entwistle and Ramsden (1983) argued that DL manifested through the resolution and investigation of complex problems in unfamiliar contexts by integrating existing and new knowledge. DL also denotes the ability to transfer knowledge gained from one experience and apply it effectively to new situations (Elbashbishy,

2024). DL is the students' deliberate effort to understand the subject by actively connecting new knowledge with prior learning and integrating information from various sources (Hotman et al., 2025). With DL techniques, students take ownership of their education, actively seeking to understand both the material and the learning process itself (Voreopoulou et al., 2024). It is believed that DL is associated with the course materials, students' experiences (Wibawa et al., 2022), the capacity for critical thinking, and problem-solving (Weng et al., 2023).

A few studies have been conducted to investigate the DL constructs (e.g., Fullan, Quinn, & Mceachen, 2018; Jiang, 2022; Rahimi & Sevilla-Pavón, 2024). For example, Fullan et al. (2018) in their book proposed 6Cs of Global competencies, such as character, citizenship, collaboration, communication, creativity, and critical thinking, characterized DL. On the contrary, Jiang (2022) examined four factors that characterized DL, namely competence, engagement, strategy, and motivation. Rahimi and Sevilla-Pavón (2024) proposed different deep approach construct, such as instructional support, technical support, and peer support.

On the other hand, recent literature suggests that DL is reinforced by various other types of learning (Warburton, 2003). For example, DL is closely linked to meaningfulness, as it helps students connect new information with prior knowledge, and it fosters a deeper understanding (Voreopoulou et al., 2024). DL allows students to gain a deep understanding of the material through focused engagement, meaningful experiences, and enjoyable learning activities, as another different claim (Feriyanto & Anjariyah, 2024). MiL, MeL, and JL therefore play a crucial role in fostering deep learning among students. However, further investigations should be conducted to profoundly examine the relationships among those constructs.

### ***Mindful, Meaningful, and Joyful Learning***

Mindfulness is a broad research field that spans multiple disciplines. It includes philosophy, cognitive psychology, psychiatry, and neuroscience (Lange, 2025). It is a relaxation practice derived from Buddhism (Do & Giang, 2024; Pektaş, 2023) linked to positive outcomes, particularly when it is used as a coping strategy for managing stress and anxiety (Lange, 2025). Mindfulness is the practice of focus awareness (Khatami et al., 2025) as well as a powerful technique to help stay present (Junkersfeld et al., 2025). It also reduces stress and anxiety in adolescents while also enhancing their working memory capacity (Bishop et al., 2004; Wu & Zhao, 2023). Mindfulness can aid in emotion regulation, minimize effort, and reduce cognitive overload (Skelly & Estrada-Chichon, 2021). In educational setting, MiL is about how individual can stay focus on learning and increase their awareness (Khatami et al., 2025; Pektaş, 2023; Wu & Zhao, 2023). For example, when conversing with a friend, one can be deeply attentive to the interaction, and they remain sensitively aware of the subtle emotional tones underlying the conversation (Brown & Ryan, 2003). This suggests that integrating MiL training with academic studies can significantly enhance students' focus and attention levels (Ersanlı & Ünal, 2022; Skelly & Estrada-Chichon, 2021). According to ELT research, students who received mindfulness training were better able to manage their anxiety about making mistakes while speaking, both inside and outside the classroom (Aladini et al., 2025; Ersanlı & Ünal, 2022).

Another form of deep learning is MeL. It arises through deductive reasoning and occurs when new information is effectively connected to prior knowledge (Ausubel, 1963). Unlike the traditional learning that requires the acts of remembering information (Bryce & Blown, 2024), MeL enables students to grasp the context and relevance of the material and it fosters deeper understanding, retention (Feriyanto & Anjariyah, 2024; Wong et al., 2024), and motivation to engage with learning (Blinkoff et al., 2023). Conversely, students perceive learning as less meaningful when it involves rote memorization without deeper understanding or connection to prior knowledge (Adolfo & Sinang, 2025). Inquiry-based and problem-solving

tasks are also appropriate with MeL as they help learners explore, analyze, and connect new concepts with their existing knowledge (Voreopoulou et al., 2024). Various studies highlighted several criteria for achieving MeL. It should be intentional, authentic, and cooperative, fostering engagement, real-world relevance, and collaborative interactions (Adolfo & Sinang, 2025). For students to comprehend materials effectively, they must possess prior knowledge, which helps them connect new information with existing understanding (Lopes & Vieira, 2023). Furthermore, learning should be dynamic and innovative to ensure that students can engage with the material meaningfully and effectively (Andres & Holguin, 2022). MeL is therefore crucial in language learning because it enables learners to connect new linguistic concepts with prior knowledge, fostering deeper comprehension, retention, and practical application.

Joyful learning is recognized as a type of learning that fosters DL (Feriyanto & Anjariyah, 2024). JL is said to be one of the positive emotions (Liu & Zhou, 2024). It is the opposite of boredom, which denotes a low-activation academic emotion associated with negative feelings such as frustration, anxiety, and dissatisfaction (Li & Dewaele, 2020). Enjoyment arises when we push our limits or challenge ourselves to achieve something new or unexpected (Zhang et al., 2024). JL plays a crucial role in enhancing students' ability to absorb and retain knowledge effectively (Liu & Zhou, 2024). When students find learning enjoyable, they are more likely to engage actively, stay motivated, develop a positive attitude towards acquiring new skills (Blinkoff et al., 2023), and increase awareness of the input for the learning process (Liu & Zhou, 2024). JL can be influenced by various factors, including activities that incorporate gamification elements (Waluyo & Balazon, 2024), the use of interactive technology like AI (Gonulal, 2021; Tai & Chen, 2022), and the role of the teacher (Liu & Zhou, 2024; Parua & Hayath Basha, 2023). However, joy in learning may decrease as learners grow older, potentially leading to increased anxiety (Liu & Hong, 2021). Research suggests that students who received JL can perform academically better than those who did not (Parua & Hayath Basha, 2023). JL can play a significant role in reducing anxiety in the learning process (Waluyo & Balazon, 2024; Zhang et al., 2024).

### **Previous Studies**

A few studies have been dedicated to investigating MiL practices and online English learning, and they yield inconsistent results. A study by Aladini et al. (2025) found that AI usage contributed to increased MiL among EFL students in writing courses. However, Khatami et al. (2025) discovered MiL activities did not effectively reduce stress or promote involvement. The data implied that mindfulness alone may not be beneficial in increasing student engagement in online EFL situations. Waluyo and Kusumastuti (2024) discovered that focused learning with generative AI improved student engagement in EFL settings, though this engagement did not directly impact their scores. On the contrary, Wang et al. (2022) found that AI-based applications could improve students' cognitive presence in EFL learning. Ersanlı and Ünal's (2022) research discovered that MiL brought positive outcomes to students' willingness to communicate and speaking anxiety. Further research is necessary to explore the relationship between technology, MiL, and student outcomes in EFL learning given the aforementioned contradictory findings. Furthermore, research that studies how AI assists MiL remains unclear, as AI only recently garnered significant attention from educators when ChatGPT launched (Hong, 2023).

Recent studies have increasingly focused on the integration of technology to support MeL across various educational contexts. For example, Lestari et al. (2023) conducted classroom action research and found that technology could promote MeL during distance learning. Kumala et al. (2023) created an Android-based application that they discovered to enhance students' outcomes and facilitate MeL. Regarding the implementation of AI-based applications

and meaningful learning, a growing body of research has explored the intersection of technology and MeL. Waer (2021) found that using AI-powered feedback in student writing facilitated MeL by providing detailed feedback, enhancing students' writing knowledge and skills. Yang et al. (2022) examined AI-based personal assistants and discovered that students benefited from authentic learning materials, and it significantly improved both listening and speaking skills. Tai and Chen (2022) further confirmed that AI-based personal assistants enhanced MeL by providing students with real conversations, and it significantly improved their speaking skills. This aligns with previous research emphasizing the importance of authenticity in MeL, especially in language acquisition.

Numerous studies have been devoted to investigating the implementation of technology to support JL. For instance, Nabil and Kiswati (2023) conducted a study during the post-covid pandemic and found technology could facilitate JL and brought positive outcomes to motivation and grammar mastery. Hsbollah and Hassan (2022) provided another example where they combined problem-based learning with active fun learning. They discovered that this combination could create meaningful and JL which could facilitate students developing soft and technical skills. Conversely, Waluyo and Balazon (2024) found that JL through digital gamification only brought very little effect on students' learning. Regarding the implementation of AI-based applications to provide JL, Yang et al. (2022) conducted research on the implementation of AI-based personal assistants to facilitate the acquisition of English as a foreign language. They found that the students found it engaging and enjoyable to learn personally with AI, as it allowed them to investigate everything. In the same year, Wang et al. (2022) conducted research on the implementation of an AI-based tutoring application for EFL students. They found that the appearance of the application had an impact on the enjoyment of EFL students, a finding that was also observed in Kohnke et al.'s (2025) study. However, Wang et al. found that the usage of the application did not affect the enjoyment of learning.

From the above reviews, the following hypotheses could be formulated:

- H<sub>1</sub>: Mindful learning is a positive predictor of deep learning
- H<sub>2</sub>: Meaningful learning is a positive predictor of deep learning
- H<sub>3</sub>: Joyful learning is a positive predictor of deep learning

## Research Methods

### Research Design, Setting, and Context

This study employed a convergent mixed-methods design by comparing both qualitative and quantitative data (Creswell & Creswell, 2018, 2023). The qualitative part in this study employed a phenomenology approach, while the quantitative part employed an *ex-post facto* study. The phenomenology approach was employed to explore participants' experiences (Merriam & Tisdell, 2016) of using AI-based applications that facilitated EFL students' DL through MiL, MeL, and JL. Meanwhile, the *ex-post facto* administered *SEM* to examine the relationship among DL, MiL, MeL, and JL. The research was conducted in the Departments of English Language Education at a state education university and a private university in Indonesia. These departments were selected because they had potential EFL students who were learning as EFL preservice teachers. As learners navigating both language acquisition and pedagogical training, these preservice teachers were considered ideal participants for this study. Moreover, the department's active integration of educational technology into its curriculum provided a relevant and supportive environment to examine how AI applications interact with core dimensions of DL in an EFL context.

Participants and Researchers

The researchers sought and obtained approval from the Institutional Review Board at the researchers’ institution to recruit participants prior to conducting the research. The researchers distributed a Google Form to provide an explanation of the study, its purpose, risks, and benefits, and to collect informed consent from the potential participants. Eight participants (three males and five females) were purposively selected from an initial pool of fifteen to ensure balanced representation across the four AI-based applications. The selection criteria included (1) having used AI-based applications for EFL learning for at least six months and (2) being able to recall their learning experiences using those applications. Of the remaining seven individuals who did not join, four were excluded because they did not meet the eligibility criteria, and the other three declined to participate in the interviews for personal reasons. All participants were third-year EFL students, with an average age of 21. Pseudonyms were used throughout the study to maintain confidentiality. Detailed demographic information of the participants is provided in Table 1.

Table 1. Participants’ demographic information

| No | Pseudonyms | Gender | Ages | AI-based applications used | Length of usage     |
|----|------------|--------|------|----------------------------|---------------------|
| 1  | Surya      | Male   | 22   | Elsa Speak                 | Seven months        |
| 2  | Dina       | Female | 21   | Duolingo                   | One year            |
| 3  | Nando      | Male   | 21   | Duolingo                   | Six months          |
| 4  | Putri      | Female | 21   | ChatGPT                    | One year six months |
| 5  | Santi      | Female | 22   | Quillbot                   | Six months          |
| 6  | Sintya     | Female | 21   | Elsa Speak                 | Seven months        |
| 7  | Marsha     | Female | 21   | Quillbot                   | Eight months        |
| 8  | Hendra     | Male   | 21   | ChatGPT                    | Two years           |

For the quantitative part, the researcher sent online questionnaires using Google Forms and invited 350 EFL students using a convenience sampling technique to participate in this study. Convenience sampling was employed because the researcher needed timely and practical access to a large pool of EFL learners actively enrolled in courses during the academic year in which the study was conducted. This approach enabled efficient recruitment of participants who were readily accessible and willing to respond. However, only 276 (56 male, 216 female) agreed to participate and returned the questionnaires with a 79% return rate, which is considered acceptable for survey research (Holtom et al., 2022).

Methods of Data Collection and Instruments

The researcher employed semi-structured interviews over a two-month period to deepen the researchers’ understanding of the participants’ experiences of using AI-based applications that facilitated EFL students’ DL through MiL, MeL, and JL. Each participant was invited to attend two individual online interview sessions conducted via Zoom, each lasting approximately 30 minutes. The audio recordings generated by Zoom were then downloaded for transcription purposes. The interviews were held in Indonesian to reduce participants’ anxiety and encourage

open communication during data collection. The researchers also maintained researcher notes to record key points throughout the interviews. An interview protocol was developed, and it consisted of five demographic questions and six semi-structured questions. For the quantitative part, the researchers administered a survey to collect the data. The researchers developed a questionnaire consisting of 20 items rated on a 1–5 rating scale, where 1 = “never” and 5 = “very often.” The items covered four dimensions of AI-based learning, such as DL, MiL, MeL, and JL.

Methods of Data Analysis

An inductive thematic analysis was conducted to analyze the interview results to yield the themes and subthemes to explore how AI-based applications facilitated EFL students’ DL through MiL, MeL, and JL. It followed Braun and Clarke’s (2006) six-phase framework, which included familiarization, coding, generating themes, reviewing themes, defining and naming themes, and producing the report. For the quantitative data, descriptive statistics, *Pearson Product Moment*, and *SEM* were employed to test the postulated hypotheses. *Cronbach’s alpha coefficients* ( $\alpha$ ) were calculated for all scales to evaluate internal consistency in this study. The overall  $\alpha$  for the complete questionnaire was 0.808, surpassing the minimum requirement of 0.70, indicating a robust reliability.

Results

Interview Results

The analysis of participants’ experiences with AI-based applications for informal English learning revealed three themes and seven subthemes with thirty-two relevant excerpts as summarized in Table 2 below.

Table 2. Inductive thematic analysis results

| Themes                                                 | Subthemes                                                                                                                                   |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Structured and Focused Learning                        | AI-based Applications Encourage Focused Learning Sessions<br>AI Features Enhance Mindfulness                                                |
| AI-based Applications Facilitate Knowledge Integration | AI-based Applications Provide Contextual Learning<br>AI Enhances Language Learning<br>AI Supports Real-world Application of Language Skills |
| Gamification and Motivation                            | AI-based Applications Provide an Enjoyable and Rewarding Experience<br>Feedback and Progress Tracking Enhance Enjoyment                     |

Structured and Focused Learning

Five participants showed that they experienced structured and focused learning. The experiences of Sintya and Putri illustrate how these structured interactions shaped their learning routines. Sintya had the opportunity to practice her speaking skills with Elsa Speak after her lecturer introduced the entire class to the application and encouraged them to give it a try. Sintya approached her pronunciation practice with seriousness and full engagement. The structured exercises gave her clear targets. The moment she opened the app, she would repeat the phrases given, carefully mimicking the model pronunciation. If the AI pointed out a mistake, she would

correct herself immediately. Furthermore, Putri is a frequent ChatGPT user, and she used this application for informal English learning, where she asked about many things that she did not understand. She mentioned, “*ChatGPT provided me with the full information, as I think very is important for my learning. I think I need to learn the information as I never had this complete information before,*” and this made her to learn the information seriously.

Three participants indicated that AI-based applications helped them to enhance mindfulness. Nando and Santi’s experiences demonstrate how participants felt more immersed in their learning while using AI-based applications. Nando had been using Duolingo for some time to improve his English skills. The app’s interactive exercises kept him actively involved, and it encouraged real-time decision-making and sustained engagement. Nando approached his Duolingo sessions with focus and intention. The application’s interactive features, instant feedback, and gamified exercises kept his mind actively involved in the learning process. He described how the structured yet flexible nature of AI-supported learning allowed him to stay present and attentive, as he mentioned, “*In Duolingo, the material presented is also interactive, so I feel more involved in each exercise.*” Santi was a frequent user of Quillbot. She used it because she understood she needed to improve her writing and speaking skills to be like native speakers, particularly with vocabulary and how to use it in sentences. Her use of Quillbot heightened her sensitivity to vocabulary and pronunciation differences, and she seemed to like it.

### **AI-based Applications Facilitate Knowledge Integration**

Three participants claimed that AI-based applications helped them connect and apply newly acquired information more effectively. Surya and Dina’s experiences were the best to illustrate it. Surya, like Sintya, used Elsa since his lecturer presented this AI-based application to his class. Surya’s experience with Elsa Speak went beyond generic language exercises. He had chosen topics that resonated with his personal interests, which made the learning process more engaging. Because he was passionate about fitness, he selected health-related content, which introduced him to domain-specific vocabulary. Dina was a frequent user of Duolingo, and she had been utilizing this application for the purpose of becoming more proficient in the English language for about a year. She found that Duolingo mirrored real-life situations. It made the material easier to absorb. The app provided examples that she found immediately applicable to her daily life. She explained:

*For example, when I was learning the present continuous tense, I was given exercises such as ‘I am reading a book now,’ or ‘She is cooking dinner.’ So these exercises were easy to understand because they were directly related to the activities I do every day.* (Dina, Female, Personal Interviews)

Four participants perceived that AI-based applications enhanced language learning, and it highlighted its role in improving vocabulary, pronunciation, and overall linguistic awareness. Marsha and Hendra experiences are best to illustrate this data. Marsha made the decision to utilize Quillbot after hearing that this AI-based application had the potential for paraphrasing. She thought that by using Quillbot, she would be able to learn how to use English more efficiently and become more similar to a native speaker. She regularly took short stories she found online and paraphrased them. It made the language more conversational and fun. Hendra was an active user of ChatGPT. He perceived that ChatGPT served as a valuable resource for deepening her understanding of complex linguistic concepts. He frequently turned to the AI tool for explanations and clarifications, particularly when he encountered idiomatic expressions in various forms of media, such as songs, movies, and articles. By engaging with ChatGPT, he was

able to grasp the meanings and contextual nuances of these expressions. He said, *“I was once confused by the idiom in Taylor Swift’s song, ‘Shake It Off.’ I tried asking ChatGPT, and it explained the meaning in language that was easy to understand.”*

Seven participants in the study recognized that AI-based applications support the real-world application of language skills. It enabled them to bridge the gap between theoretical learning and practical usage. Among them, Putri and Surya exemplified this connection most clearly. Putri described that the tools in ChatGPT were very useful for her, as she could use them for many practical tasks that were related to language skills. Surya often shared his experiences of how the knowledge he gained from Elsa Speak was directly applicable to real-world conversations. He stated, *“I think the information from Elsa Speak is valid, and I can use it directly. If one day I chat with someone who likes fitness in English, I’m sure I can follow the conversation more confidently.”*

**Gamification and Motivation**

Five participants perceived that AI-based applications provided an enjoyable and rewarding experience in their language-learning journey. Among them, Nando and Santi’s experiences best illustrate this perception. Nando often shared stories of how he felt challenged by Duolingo when he was involved in some challenging language games. He mentioned, *“I feel like playing a game. There are levels, there are challenges, so I always want to keep learning. If I can complete the exercise without mistakes, I feel proud and more enthusiastic.”* Santi also had a similar experience and expressed how much she enjoyed using this application, particularly for informal English learning.

Four participants mentioned that the feedback and progress tracking enhanced their enjoyment. For example, Dina and Sintya’s experiences are best to illustrate this data. Dina appreciates the application’s reward system, which encourages her to study consistently. The sense of achievement and progress tracking makes learning more enjoyable. It reinforced her enthusiasm for continuing her language-learning journey. Sintya, during the interviews, mentioned that she was happy every time she received feedback along with the statistics of her performance from Elsa Speak when she tried the pronunciation practices. She mentioned, *“... because Elsa Speak is interactive, for example, when we use the roleplay, if our accuracy in speaking or pronouncing sentences in English is good, we will also be given detailed statistics.”*

**Descriptive Statistics**

The descriptive statistics for the measures (Table 3) are MiL ( $M = 3.757, SD = 0.652$ ), MeL ( $M = 3.947, SD = 0.608$ ), JL ( $M = 3.843, SD = 0.657$ ), and DL ( $M = 3.934, SD = 0.636$ ). The *skewness* and *kurtosis* values of the four constructs are within the range of  $\pm 1$ , indicating that the data distribution is close to normal. Meanwhile, the *kurtosis* value, which is close to zero, indicates that there are no extreme spikes in the data distribution.

**Table 3.** Descriptive statistics outputs

| Construct           | Mean  | SD    | Skewness | Kurtosis |
|---------------------|-------|-------|----------|----------|
| Mindful Learning    | 3.757 | 0.652 | 0.106    | −0.110   |
| Meaningful Learning | 3.947 | 0.608 | −0.123   | −0.259   |
| Joyful Learning     | 3.843 | 0.657 | 0.050    | −0.649   |
| Deep Learning       | 3.934 | 0.636 | −0.106   | −0.556   |

Exploratory Factor Analysis

The *exploratory factor analysis (EFA)* was performed to enhance the interpretability of identified factors inside the unrestricted measurement model. The results in this study (Table 4), particularly the *KMO* and *Bartlett’s test* results, indicated that the *KMO* measure was above 0.60 (*KMO* = 0.941) and the *Bartlett’s test* result was significant ( $p < 0.001$ ), assuming that there were significant factors to be extracted from the current data.

Table 4. *KMO and Bartlet test results*

| KMO and Bartlet test results            |                                 |  |          |
|-----------------------------------------|---------------------------------|--|----------|
| <i>KMO measure of sampling adequacy</i> |                                 |  | 0.941    |
| <i>Bartlett’s test of sphericity</i>    | <i>Approximately chi-square</i> |  | 3256.256 |
|                                         | <i>df</i>                       |  | 190      |
|                                         | <i>significance</i>             |  | <0.001   |

Confirmatory Factor Analysis

A *confirmatory factor analysis (CFA)* model was employed to validate the constrained measurement items and evaluate the model’s data fit. The results of the *CFA* analysis indicated that all factor loading values were greater than  $\pm 0.50$ , ranging from 0.690 to 0.807 (See Table 5), showing strong significance. The reliability and validity of the constructs in the measurement model were measured by *internal consistency*, *convergent validity*, and *discriminant validity analyses*. Concerning *internal consistency*, the *Cronbach’s  $\alpha$*  coefficients for all measures exceeded 0.70, indicating the initial attainment of internal consistency. Moreover, all *composite reliabilities (CRs)* and *average variance extracted (AVE)* were above 0.70. These demonstrated that all item loadings surpassed the accepted thresholds. As shown by Table 6 All constructs in this study showed strong positive correlations with each other. The highest correlation was found between MeL and DL at 0.791, indicating that the higher the participants’ perception of meaningful learning, the more likely they were to experience deep learning.

Table 5. *Confirmatory factor analysis outputs*

| Construct           | Loadings | Cronbach’s alpha | CR    | AVE   |
|---------------------|----------|------------------|-------|-------|
| Mindful Learning    |          | 0.771            | 0.768 | 0.528 |
| Mind1               | 0.690    |                  |       |       |
| Mind2               | 0.726    |                  |       |       |
| Mind3               | 0.762    |                  |       |       |
| Meaningful Learning |          | 0.862            | 0.864 | 0.559 |
| Meaningful1         | 0.709    |                  |       |       |
| Meaningful2         | 0.747    |                  |       |       |
| Meaningful3         | 0.763    |                  |       |       |

(Continued)

(Continued)

| Construct       | Loadings | Cronbach's alpha | CR    | AVE   |
|-----------------|----------|------------------|-------|-------|
| Meaningful4     | 0.770    |                  |       |       |
| Meaningful5     | 0.747    |                  |       |       |
| Joyful Learning |          | 0.847            | 0.846 | 0.581 |
| Joy1            | 0.807    |                  |       |       |
| Joy3            | 0.765    |                  |       |       |
| Joy4            | 0.719    |                  |       |       |
| Joy5            | 0.756    |                  |       |       |
| Deep Learning   |          | 0.855            | 0.856 | 0.547 |
| Deep1           | 0.716    |                  |       |       |
| Deep2           | 0.755    |                  |       |       |
| Deep3           | 0.726    |                  |       |       |
| Deep4           | 0.711    |                  |       |       |
| Deep5           | 0.787    |                  |       |       |

Table 6. Correlation between constructs

|                     | Mindful Learning | Meaningful Learning | Joyful Learning | Deep Learning |
|---------------------|------------------|---------------------|-----------------|---------------|
| Mindful Learning    | 1                |                     |                 |               |
| Meaningful Learning | 0.689            | 1                   |                 |               |
| Joyful Learning     | 0.678            | 0.777               | 1               |               |
| Deep Learning       | 0.686            | 0.791               | 0.752           | 1             |

Hypothesis Testing

The *Structural Equation Modelling* was employed to test the hypothesis. The outputs (Table 7) showed that the *Chi-square/df* value of 2.579 is below the maximum threshold of 3.0, indicating that the model has an adequate overall fit. The *Goodness of Fit Index (GFI)* of 0.892 is slightly below the ideal threshold of  $\geq 0.90$ , but is still acceptable because the difference is relatively small. Meanwhile, the *Adjusted Goodness of Fit Index (AGFI)* value of 0.854 meets the minimum criterion of  $\geq 0.85$ , indicating that the model fits the complexity of the data well. The *Comparative Fit Index (CFI)* value of 0.934 also exceeds the threshold of  $\geq 0.90$ , indicating that the model has a very good fit compared to the null model. Additionally, the *Root Mean Square Error of Approximation (RMSEA)* value of 0.076 remains within the tolerance limit of  $\leq 0.08$ , indicating that the model has a low approximation error. Finally, the *Standardized Root Mean Square Residual (SRMR)* value of 0.042 is also well below the maximum limit of 0.10, indicating that the difference between empirical covariances and model covariances is

relatively small. Overall, despite a slight deviation in the *GFI* value, this research model has met most of the goodness-of-fit criteria, so it can be concluded that the model has good fit with the data used.

Moreover, the hypothesis testing results (Table 8) showed that the first hypothesis (H1) suggests that mindful learning has an effect on deep learning with  $\alpha = 0.221$  and the *t* value of 1.831. Although  $p < 0.1$ , it has not reached the conventional significance level of 0.05. This effect can be categorized as moderate or marginally significant, meaning there is a tendency for mindful learning to contribute to deep learning, although the strength of the evidence is not very strong. The second hypothesis (H2) shows that meaningful learning has a significant effect on deep learning with  $\alpha = 0.702$  and the *t* value of 3.399. Since  $p < 0.05$ , this effect is considered significant, indicating that meaningful learning is a strong predictor in explaining the formation of deep learning among participants. Meanwhile, the third hypothesis (H3) states that joyful learning does not significantly influence deep learning, with  $\alpha = 0.180$  and the *t* value of 1.035. This value does not meet the significance criteria ( $p > 0.1$ ), so it can be concluded that there is insufficient statistical evidence to support the influence of joyful learning on deep learning in the context of this study. The parameter estimates of the structural model is represented by Figure 1.

**Table 7.** *Values of Goodness-of-fit indices for the research model*

|           | <i>Chisq/df</i> | <i>GFI</i> | <i>AGFI</i> | <i>CFI</i> | <i>RMSEA</i> | <i>SRMR</i> |
|-----------|-----------------|------------|-------------|------------|--------------|-------------|
| Model     | 2.579           | 0.892      | 0.854       | 0.934      | 0.076        | 0.042       |
| Threshold | ≤ 3,0           | ≥ 0,9      | ≥ 0,85      | ≥ 0,9      | ≤ 0,08       | ≤ 0,10      |

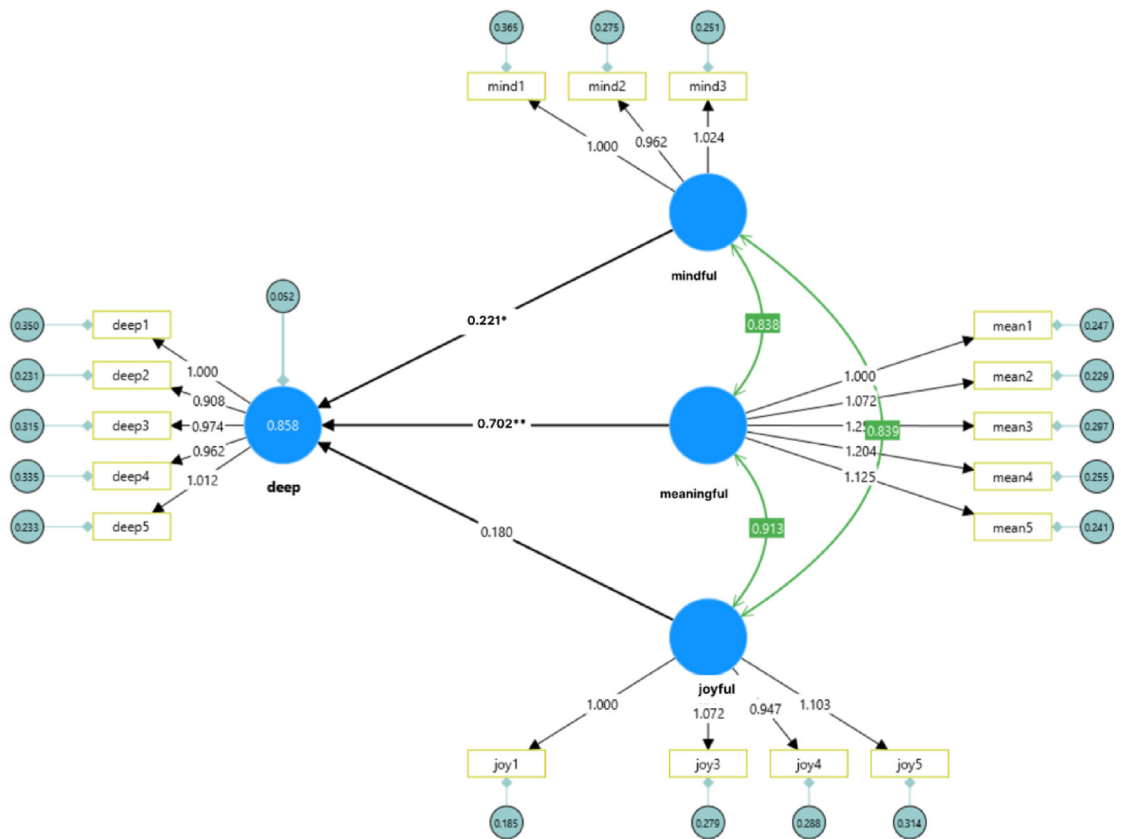
**Table 8.** *Summary of hypotheses testing results*

|                                                                  | $\beta$ | <i>t</i> | Result |
|------------------------------------------------------------------|---------|----------|--------|
| H1: Mindful learning is a positive predictor of Deep learning    | 0.221*  | 1.831    | Accept |
| H2: Meaningful learning is a positive predictor of Deep learning | 0.702** | 3.399    | Accept |
| H3: Joyful learning is a positive predictor of Deep learning     | 0.180   | 1.035    | Reject |

Notes: \* $p < 0,1$ ; \*\* $p < 0,05$

Discussion

The quantitative findings reveal that MiL is a significant but modest predictor of DL. This suggests that when learners engage mindfully, by focusing their attention, regulating distractions, and being present, they are more likely to experience deep learning outcomes. This is consistent with educational research asserting that mindfulness can improve working memory, enhance attention, and reduce anxiety in academic contexts (Skelly & Estrada-Chichon, 2021; Wu & Zhao, 2023). In the context of AI-based language learning, the qualitative data indicated that AI applications facilitated structured and focused learning, enhanced mindfulness, and promoted



**Figure 1.** Parameter estimates of the structural model

$p < .05^*$ ;  $p < .01^{**}$ ;  $p < .001^{***}$

knowledge integration. These results align with earlier studies suggesting that AI tools like ChatGPT or ELSA Speak can enhance learner focus and reduce speaking anxiety (Aladini et al., 2025; Ersanlı & Ünal, 2022). However, previous studies also indicate some inconsistencies in MiL's impact on engagement and performance in digital contexts (Khatami et al., 2025), which might explain the modest effect size observed in this study.

Among the three predictors, MeL emerged as the strongest and most significant predictor of DL. This finding is theoretically grounded in Ausubel's (1963) theory of meaningful learning, which emphasizes the integration of new knowledge with prior understanding. Qualitative themes also support this quantitative result, highlighting that AI applications support real-world application of language, facilitate contextual learning, and allow learners to integrate knowledge meaningfully. These results are congruent with recent research showing that AI-based applications promoted MeL by delivering authentic and problem-based experiences, which are essential for deep cognitive processing (Tai & Chen, 2022; Waer, 2021). As such, AI appears to offer affordances, such as personalized feedback and real-time conversation simulations, that promote reflection and meaningful engagement with language tasks, ultimately fostering deeper understanding.

In contrast, the data shows that JL is not a statistically significant predictor of DL in this study, leading to the rejection of Hypothesis 3. This is a somewhat surprising finding, given that the literature suggests JL can reduce anxiety, enhance motivation, and promote retention (Q. Liu &

Zhou, 2024; Waluyo & Balazon, 2024). However, the qualitative data adds nuance to this finding. While learners did report enjoyable and rewarding experiences using AI, particularly due to gamification and progress tracking, this affective response may not have translated into the deep, reflective learning characterized by knowledge integration or problem-solving. One plausible explanation is that JL in AI-based learning may enhance surface-level engagement or motivation but not necessarily result in the cognitive restructuring required for DL. This aligns with recent findings that digital gamification may have limited effects on substantive learning gains (Waluyo & Balazon, 2024), and that enjoyment alone does not guarantee deep understanding.

Four implications are directed to AI-based learning related to DL. Theoretically, the findings in this study enrich the literature about DL, MiL, MeL, and JL. Empirically, the strong predictive relationship between MeL and DL suggests that AI tools should be intentionally designed to promote deeper cognitive processing. Developers of AI-assisted language platforms should incorporate authentic tasks, problem-solving scenarios, and contextual feedback that allow learners to connect new input with prior knowledge. Also, although MiL showed a moderate effect, its significance supports the integration of focus-enhancing features in AI learning environments. Educators can harness AI to support mindfulness through features like adaptive pacing, guided attention, or focus timers that help students stay present and aware during their learning sessions. These tools are especially beneficial for learners managing cognitive overload or anxiety in language learning settings. Training students in mindfulness strategies, such as digital journaling or self-monitoring using AI-generated analytics, may further enhance attention and metacognitive awareness. Lastly, the non-significant impact of JL on DL invites educators and designers to critically evaluate the limits of gamification and enjoyment-based approaches. While enjoyable learning experiences can sustain motivation and reduce anxiety, this study suggests that joy alone does not necessarily drive the deep cognitive engagement required for DL. Therefore, JL should be seen as a supporting mechanism rather than a core strategy for promoting deep learning. AI tools should still incorporate engaging elements, but these must be intentionally aligned with deeper learning objectives, rather than serving as isolated motivators.

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## Conclusion

This study investigated whether MiL, MeL, and JL are predictors of DL in AI-based language learning. Through a combination of quantitative hypothesis testing and qualitative thematic analysis, the results demonstrate partial support for the proposed relationships, offering nuanced insight into how different types of learning experiences contribute to deeper cognitive engagement.

## References

- Abdelaal, N. M., & Al Sawi, I. (2024). Perceptions, challenges, and prospects: University professors' use of artificial intelligence in education. *Australian Journal of Applied Linguistics*, 7(1). <https://doi.org/10.29140/ajal.v7n1.1309>

- Adolfo, J. H., & Sinang, A. J. (2025). Meaningful learning in social studies: An exploratory factor analysis. *European Journal of Social Sciences Studies*, 10(5), 81–108. <https://doi.org/10.46827/ejss.v10i5.1888>
- Agnes, D., & Srinivasan, R. (2024). Fostering vocabulary memorization: Exploring the impact of AI-generated mnemonic keywords on vocabulary learning through Anki flashcards. *World Journal of English Language*, 14(2), 434–451. <https://doi.org/10.5430/wjel.v14n2p434>
- Aladini, A., Ismail, S. M., Ahmad Saleem Khasawneh, M., & Shakibaei, G. (2025). Self-directed writing development across computer/AI-based tasks: Unraveling the traces on L2 writing outcomes, growth mindfulness, and grammatical knowledge. *Computers in Human Behavior Reports*, 17. <https://doi.org/10.1016/j.chbr.2024.100566>
- Alhwaiti, M. (2023). Acceptance of artificial intelligence application in the post-Covid era and its impact on faculty members' occupational well-being and teaching self efficacy: A path analysis using the UTAUT 2 model. *Applied Artificial Intelligence*, 37(1). <https://doi.org/10.1080/08839514.2023.2175110>
- Alkamel, M. A. A., & Alwagieh, N. A. S. (2024). Utilizing an adaptable artificial intelligence writing tool (ChatGPT) to enhance academic writing skills among Yemeni university EFL students. *Social Sciences and Humanities Open*, 10. <https://doi.org/10.1016/j.ssaho.2024.101095>
- Andres, C., & Holguin, J. (2022). Meaningful learning in English as a foreign language classrooms: A culinary experience as comprehensible input. *The Asian Institute of Research Education Quarterly Reviews*, 5(1), 185–200. <https://doi.org/10.31014/aior.1993.05.01.430>
- Ausubel, D. P. (1963). *The psychology of meaningful verbal learning*. Grune & Stratton.
- Baskara, R., & Mukarto. (2023). Exploring the implications of ChatGPT for language learning in higher education. *Language Learning in Higher Education Indonesian Journal of English Language Teaching and Applied Linguistics*, 7(2), 343–358. <http://dx.doi.org/10.210>
- Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Specia, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, 11(3), 230–241. <https://doi.org/10.1093/clipsy/bph077>
- Blinkoff, E., Nesbitt, K. T., Golinkoff, R. M., & Hirsh-Pasek, K. (2023). Investigating the contributions of active, playful learning to student interest and educational outcomes. *Acta Psychologica*, 238. <https://doi.org/10.1016/j.actpsy.2023.103983>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822–848. <https://doi.org/10.1037/0022-3514.84.4.822>
- Bryce, T. G. K., & Blown, E. J. (2024). Ausubel's meaningful learning re-visited. *Current Psychology*, 43(5), 4579–4598. <https://doi.org/10.1007/s12144-023-04440-4>
- Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1–12. <https://doi.org/10.1080/14703297.2023.2190148>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). Sage.
- Daweli, T., & Mahyoub, R. (2024). Exploring EFL learners' perspectives on using AI tools and their impacts in reading instruction: An exploratory study. *Arab World English Journal*, 10, 160–171. <https://doi.org/10.24093/awej/call10.11>
- Do, T. T., & Giang, T. V. (2024). Mindfulness-based social-emotional learning program: Strengths and limitations in Vietnamese school-based mindfulness practice. *Heliyon*, 10(12). <https://doi.org/10.1016/j.heliyon.2024.e32977>
- Elbashbishi, E. M. (2024). Deep learning in education. *Sustainability Education Globe*, 1(2), 15–21. <https://seg.journals.ekb.eg/>
- El-Garawany, M. S. M. (2024). The effects of a QuillBot-based intervention on English language majors' EFL writing performance, apprehension, and self-efficacy. *Language Teaching Research Quarterly*, 43, 167–189. <https://doi.org/10.32038/ltrq.2024.43.10>

- Entwistle, N. J., & Ramsden, P. (1983). *Understanding student learning*. Croom Helm.
- Ersanlı, C. Y., & Ünal, T. (2022). Impact of mindfulness training on EFL learners' willingness to speak, speaking anxiety levels and mindfulness awareness levels. *Education Quarterly Reviews*, 5(4), 429–448. <https://doi.org/10.31014/aior.1993.05.04.634>
- Es-Sarghini, A., & Boumahdi, A. (2025). Interactive eAssessment of writing competency in French as a foreign language: development and implementation of an AI-enhanced progress monitoring system. *Australian Journal of Applied Linguistics*, 8(1). <https://doi.org/10.29140/ajal.v8n1.102495>
- Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*, 1–15. <https://doi.org/10.1080/14703297.2023.2195846>
- Fathi, J., & Nosrati, S. (2024). Investigating the impact of Duolingo on second language learning achievement and self-regulated learning among French as a foreign language learners. *Computer Assisted Language Learning Electronic Journal (CALL-EJ)*, 25(4), 379–413. <http://orcid.org/0000-0003-1146-1024>
- Feriyanto, F., & Anjariyah, D. (2024). Deep learning approach through meaningful, mindful, and joyful learning: A library research. *Electronic Journal of Education, Social Economics and Technology*, 5(2), 208–212. <https://doi.org/10.33122/ejeset.v5i2.321>
- Fitria, T. N. (2023). Artificial intelligence (AI) technology in OpenAI ChatGPT application: A review of ChatGPT in writing English essay. *Journal of English Language Teaching*, 6(1), 44–58. <http://journal.unnes.ac.id/sju/index.php/elt>
- Fullan, M., Quinn, J., & Meechen, J. (2018). *Praise for deep learning: Engage the world change the world*. Corwin.
- Gonulal, T. (2021). Investigating EFL learners' humorous interactions with an intelligent personal assistant. *Interactive Learning Environments*. <https://doi.org/10.1080/10494820.2021.19744>
- Holtom, B., Baruch, Y., Aguinis, H., & A Ballinger, G. (2022). Survey response rates: Trends and a validity assessment framework. *Human Relations*, 75(8), 1560–1584. <https://doi.org/10.1177/00187267211070769>
- Hong, W. C. H. (2023). The impact of ChatGPT on foreign language teaching and learning: Opportunities in education and research. *Journal of Educational Technology and Innovation*, 37–45.
- Hotman, F., Damanik, S., & Muhammad, G. (2025). The deep learning approach in sociology education at the high school level. *SocioEdu: Sociological Education*, 6(1), 48–54. <https://e-journal.unmuhk-upang.ac.id/index.php/se>
- Hsbollah, H. M., & Hassan, H. (2022). Creating meaningful learning experiences with active, fun, and technology elements in the problem-based learning approach and its implications. *Malaysian Journal of Learning and Instruction*, 19(1), 147–181. <https://doi.org/10.32890/mjli2022.19.1.6>
- Huang, X., Zou, D., Cheng, G., Chen, X., & Xie, H. (2023). Trends, research issues and applications of artificial intelligence in language education. *Technology & Society*, 26(1), 112–131. <https://doi.org/10.2307/48707971>
- Jiang, R. (2022). *Understanding, investigating, and promoting deep learning in language education: A survey on Chinese college students' deep learning in the online EFL teaching context*. 1–18.
- Junkersfeld, S. E., Bakken-Gay, R., Loy, C., & Braun-Trocchio, R. (2025). Exploring mindfulness and exercise: Insights from a technology-delivered intervention. *Journal of Technology in Behavioral Science*. <https://doi.org/10.1007/s41347-025-00487-1>
- Khatami, M., Shayery, A. J., Behera, S. K., He, D., Coker, D., & Curle, S. (2025). Exploring Bangladeshi English as a foreign language learners' mindfulness and engagement in the online learning context. *Acta Psychologica*, 253. <https://doi.org/10.1016/j.actpsy.2025.104750>
- Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *RELC Journal*, 1–14. <https://doi.org/10.1177/00336882231162868>
- Kohnke, L., Zou, D., & Su, F. (2025). Exploring the potential of GenAI for personalised English teaching: Learners' experiences and perceptions. *Computers and Education: Artificial Intelligence*, 8. <https://doi.org/10.1016/j.caeai.2025.100371>
- Kumala, F. N., Ibrahim, J., Anggi Ambarwati, H., Mafulah, S., & Rahayu, S. (2023). Mock up based on Android through multimedia development live cycle: Science meaningfull learning. *Journal of Education Technology*, 7(1), 133–145. <https://doi.org/10.23887/jet.v7i1.51890>

- Kusuma, I. P. I., Budiarta, L. G. R., & Maharani, A. A. P. (2025). Bridging knowledge and academic integrity: AI integration for TPACK development in EFL teacher education program. *LLT Journal: A Journal on Language and Language Teaching*, 28(2), 667–686. <https://doi.org/10.24071/llt.v28i2.12809>
- Kusuma, I. P. I., Roni, M., Dewi, K. S., & Mahendrayana, G. (2024). Revealing the potential of ChatGPT for English language teaching: EFL preservice teachers' teaching practicum experience. *Studies in English Language and Education*, 11(2), 650–670. <https://doi.org/10.24815/siele.v11i2.34748>
- Lange, V. (2025). A reductive account of mindfulness as metacognitive control. *Review of Philosophy and Psychology*. <https://doi.org/10.1007/s13164-025-00767-y>
- Lestari, N., Winarsih, M., & Kusumawardani, D. (2023). The use of meaningful learning in distance learning. *Jurnal Teknologi Pendidikan*, 25(1), 42–53. <https://doi.org/10.21009/JTP2001.6>
- Li, C., & Dewaele, J. (2020). The predictive effects of trait emotional intelligence and online learning achievement perceptions on foreign language class boredom among Chinese university students. *Foreign Languages and Their Teaching* (《外语与外语教学》), 5, 33–44.
- Liang, J.-C., Hwang, G.-J., & Chen, M.-R. A. (2021). Roles and research foci of artificial intelligence in language education: An integrated bibliographic analysis and systematic review approach. *Interactive Learning Environments*. <https://doi.org/10.1080/10494820.2021.19583>
- Liu, M., & Hong, M. (2021). English language classroom anxiety and enjoyment in Chinese young learners. *SAGE Open*, 11(4). <https://doi.org/10.1177/21582440211047550>
- Liu, Q., & Zhou, W. (2024). The impact of teachers' emotional support on EFL learners' online learning engagement: The role of enjoyment and boredom. *Acta Psychologica*, 250. <https://doi.org/10.1016/j.actpsy.2024.104504>
- Lopes, A. L. S., & Vieira, M. M. S. (2023). Meaningful learning and effectiveness in virtual learning spaces. *European Journal of Education*, 6(1), 100–112.
- Marton, F., & Säljö, R. (1976). On qualitative differences in learning: I-outcome and process. *Br. J. Educ. Psychol.*, 46, 4–1.
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.
- Nabil, W., & Kiswati. (2023). Post joyful learning: An alternative in post pandemic era. *ELITE Journal*, 5(1), 133–142. <https://www.elitejournal.org/index.php/ELITE>
- Parua, R. K., & Hayath Basha, S. (2023). *Using joyful learning approach to develop social skills and achievement of visually impaired students*. <https://www.researchgate.net/publication/384634663>
- Pektaş, R. (2023). Delving into the mindfulness: A window of opportunity for EFL preservice- inservice teachers in Türkiye. In K. Büyükkarçı & A. Önal (Eds.), *Current studies in foreign language education* (pp. 144–169). <https://www.researchgate.net/publication/377925555>
- Rad, H. S., Alipour, R., & Jafarpour, A. (2023). Using artificial intelligence to foster students' writing feedback literacy, engagement, and outcome: a case of Wordtune application. *Interactive Learning Environments*. <https://doi.org/10.1080/10494820.2023.2208170>
- Rahimi, A. R., & Sevilla-Pavón, A. (2024). A pathway from surface to deep online language learning approach: The crucial role of online self-regulation. *Acta Psychologica*, 251. <https://doi.org/10.1016/j.actpsy.2024.104644>
- Runge, A., Attali, Y., LaFlair, G. T., Park, Y., & Church, J. (2024). A generative AI-driven interactive listening assessment task. *Frontiers in Artificial Intelligence*, 7. <https://doi.org/10.3389/frai.2024.1474019>
- Skelly, K. J., & Estrada-Chichon, J. L. (2021). Mindfulness as a coping strategy for EFL learning in education. *International Journal of Instruction*, 14(3), 965–980. <https://doi.org/10.29333/iji.2021.14356a>
- Sriganesh, N., & Eamer, A. (2025). Chatting with AI capone: Leveraging virtual conversational agents in emotional landscapes. *Australian Journal of Applied Linguistics*, 8(2). <https://doi.org/10.29140/ajal.v8n2.102513>
- Tai, T. Y., & Chen, H. H. J. (2020). The impact of Google Assistant on adolescent EFL learners' willingness to communicate. *Interactive Learning Environments*, 1–18. <https://doi.org/10.1080/10494820.2020.1841801>
- Tai, T. Y., & Chen, H. H. J. (2022). The impact of intelligent personal assistants on adolescent EFL learners' speaking proficiency. *Computer Assisted Language Learning*, 1–28. <https://doi.org/10.1080/09588221.2022.2070219>

- Tsai, S. C. (2022). Chinese students' perceptions of using Google Translate as a translingual CALL tool in EFL writing. *Computer Assisted Language Learning*, 35(5–6), 1250–1272. <https://doi.org/10.1080/09588221.2020.1799412>
- Voreopoulou, A., Mystakidis, S., & Tsinakos, A. (2024). Augmented reality escape classroom game for deep and meaningful English language learning. *Computers*, 13(1). <https://doi.org/10.3390/computers13010024>
- Waer, H. (2021). The effect of integrating automated writing evaluation on EFL writing apprehension and grammatical knowledge. *Innovation in Language Learning and Teaching*, 17(1), 47–71. <https://doi.org/10.1080/17501229.2021.1914062>
- Waluyo, B., & Balazon, F. G. (2024). Exploring the impact of gamified learning on positive psychology in CALL environments: A mixed-methods study with Thai university students. *Acta Psychologica*, 251. <https://doi.org/10.1016/j.actpsy.2024.104638>
- Waluyo, B., & Kusumastuti, S. (2024). Generative AI in student English learning in Thai higher education: More engagement, better outcomes? *Social Sciences and Humanities Open*, 10. <https://doi.org/10.1016/j.ssaho.2024.101146>
- Wang, X., Pang, H., Wallace, M. P., Wang, Q., & Chen, W. (2022). Learners' perceived AI presences in AI-supported language learning: a study of AI as a humanized agent from community of inquiry. *Computer Assisted Language Learning*, 1–27. <https://doi.org/10.1080/09588221.2022.2056203>
- Warburton, K. (2003). Deep learning and education for sustainability. *International Journal of Sustainability in Higher Education*, 4(1), 44–56. <https://doi.org/10.1108/14676370310455332>
- Weng, C., Chen, C., & Ai, X. (2023). A pedagogical study on promoting students' deep learning through design-based learning. *International Journal of Technology and Design Education*, 33(4), 1653–1674. <https://doi.org/10.1007/s10798-022-09789-4>
- Wibawa, A. P., Dwiyanto, F. A., & Utama, A. B. P. (2022). Deep learning in education: A bibliometric analysis. *Bulletin of Social Informatics Theory and Application*, 6(2), 151–157. <https://doi.org/10.31763/businta.v6i2.596>
- Wong, Y. L., Bothma, T., & Smith, A. (2024). Effects of meaningful choices in serious games for meaningful learning. *International Journal of Serious Games*, 11(3), 71–87. <https://doi.org/10.17083/ijsg.v11i3.745>
- Wu, J., & Zhao, Q. (2023). The contribution of mindfulness in the association between L2 learners' engagement and burnout. *Heliyon* (Vol. 9, Issue 11). Elsevier Ltd. <https://doi.org/10.1016/j.heliyon.2023.e21769>
- Yang, C. T. Y., Lai, S. L., & Chen, H. H. J. (2022). The impact of intelligent personal assistants on learners' autonomous learning of second language listening and speaking. *Interactive Learning Environments*, 1–21. <https://doi.org/10.1080/10494820.2022.2141266>
- Zhang, Z., Gao, X. (Andy), & Liu, T. (2024). Enjoyment in foreign language learning: A systematic review. *Heliyon*, 10(17). <https://doi.org/10.1016/j.heliyon.2024.e37215>