



## Enhancing digital competency and linguistic accuracy through AI-powered flipped classroom :A study of Wasit university EFL learners

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تعزيز الكفاءة الرقمية واللغوية من خلال دراسة الفصل الدراسي المعكوس المدعوم بالذكاء الاصطناعي  
لمتعلمي اللغة الانجليزية كلغة أجنبية في جامعة واسط

الملخص:

يعد دمج الذكاء الاصطناعي في نماذج الفصول الدراسية المعكوسة أفقًا واعدًا للارتقاء بتعليم اللغات. هدفت هذه الدراسة إلى بحث الآثار المقارنة للفصول الدراسية المعكوسة المدعومة بالذكاء الاصطناعي، والفصول الدراسية المعكوسة التقليدية، والتعليم التقليدي على المهارات الرقمية والإتقان اللغوي لدى طلاب اللغة الإنجليزية كلغة أجنبية في الجامعات العراقية. استخدمت الدراسة تصميمًا شبه تجريبي، وشارك فيها تسعون طالبًا من طلاب اللغة الإنجليزية كلغة أجنبية، تم توزيعهم على ثلاث مجموعات: مجموعة مسيطرة ومجموعتان تجريبيتان. استخدم الباحثون مقياس الكفاءة الرقمية ومعايير كامبريدج للغة الإنجليزية لقياس متغيرات الدراسة، وذلك لتحديد تأثيرات المعالجات المختلفة عليها. أظهرت النتائج إلى وجود فرق ذات دلالة إحصائية بين المجموعات في كل من الكفاءة الرقمية والدقة اللغوية في نتائج الاختبار البعدي. كما تبين أن أداء الفصل الدراسي المعكوس المدعوم بالذكاء الاصطناعي كان أفضل من أداء المجموعتين الأخرين. ومن اللافت للنظر أنه لم يُلاحظ أي فرق دال إحصائيًا بين المجموعة المسيطرة والفصل الدراسي المعكوس التقليدي. توضح النتائج أن استخدام أدوات الذكاء الاصطناعي المتكاملة التي توفر تغذية راجعة حقيقية وشخصية يُعد أداة فعالة لتحسين التعلم. توصلت الدراسة إلى بعض النتائج والمقترحات لإجراء المزيد من البحوث

### Abstract

The integration of Artificial Intelligence (AI) into flipped classroom models presents a promising frontier for enhancing language education. This study investigated the comparative effects of an AI-assisted flipped classroom, a conventional flipped classroom, and traditional instruction on the digital competency and linguistic accuracy of Iraqi EFL university students. Quasi-experimental design was used in this study. Ninety EFL students participated in the current research and they were assigned to three groups of a control and two experimental groups. The researchers used a digital competency scale and Cambridge English Rubrics to measure the variables of the study to find the effects of different treatments on them. The results indicated that there was a significant difference among groups for both digital competency and linguistic accuracy in the posttest scores. Moreover, it was indicated that the AI flipped classroom outperformed the other groups. Surprisingly, no significant difference was found between the control group and the conventional flipped classroom. The results demonstrated that using the AI integrated tools that provide real and



personalized feedback could be regarded as effective tools to improve learning. The study provided some implication and suggestions for further research.

## 1. Introduction

During the past years, educational conditions are going through a significant transformation that includes rapid development in using digital platforms and new technologies (Selwyn, 2016). In big classes, teacher-centered EFL teaching methods are not provide enough practice and real life situations for the learners (Butler, 2015). Accordingly, the members of educational settings are looking for new methods to improve the learners' level of learning and engagement. Using methods such as flipped classroom is one of the most effective ways that puts a great emphasis on learners as active participants of the process of teaching and learning (Bishop & Verleger, 2013). In this method, there is a change in the learning sequence and the learners experience direct teaching outside the classroom and the class time is devoted to some interactive and collaborative tasks (Strayer, 2012).

Integrating Artificial Intelligence (AI) tools with flipped model in EFL contexts provide a great opportunity for learners to improve their learning experience (Kim & Sim, 2024). Personalized adjustment based on learners' abilities and preferences, as is provided in AI-driven technologies, leads to the development of their performance (García-Pérez, 2023). The AI driven technologies provide automatic real time feedback via adaptive learning environments and interactive materials (Reddy et al., 2024). They not only equipped with some standard educational technologies that adjust the level of difficulty of content for each student, but also present adaptive learning ways along with real feedback (VanLehn, 2011; Woolf, 2009). Doulingo Max is an example of such tools, which is used, in the current study.

Doulingo, as a popular AI based language learning application, allows for individualized adaptations in content based on the learners' performances (Vesselinov & Grego, 2012). Using conversational practice and personal elaboration on the learners' errors, it can be used as a tool for pre-class preparation (Chapelle & Sauro, 2017) which in turn enables the teachers to devote the class time to communicate with learners. Adding AI platforms to flipped classes bring personalized learning and feedback for learners, which will results in academic achievement. It also provides more engaging and effective experience for learners in language learning (Chen et al., 2020).

In the current digital age, an essential skill is proficiency in different digital tools and platforms that is necessary for academic success (Alismail & McGuire, 2015). Digital competency in EFL context includes the capability to make communication, collaboration, and critique using technological platforms (Kassymova, et al., 2023). Moreover, linguistic accuracy is one of the goals of language learning since it could be considered as a crucial element of effective communication in English. Integrating AI in a flipped classroom can develop language accuracy by engaging learners in collaborative



tasks and real time feedback that will improve both fluency and accuracy (Amir et al., 2025).

In spite of growing interest in AI and flipped classroom, based on literature review, there are not many studies to explore their combined effects in Iraq as an EFL context. Previous studies have explored these aspects separately and studies analyzing their impacts together are rare. This gap addresses an opportunity to integrate AI driven practices to EFL education particularly flipped classrooms to benefit its possible impacts on EFL learners' academic success.

**Overall, the main aim of this study is to fill this gap by exploring the impacts of an AI driven flipped classroom on the Iraqi EFL learners' digital competence and linguistic achievement.** Using a mix-methods design, this study will explore how this model develops students' language accuracy and prepare them for communicative challenges. Moreover, the results of this study provide some implications for educators by highlighting the opportunities to integrate different models of language teaching with AL platforms to prepare students for a technology driven world.

## 2. Literature Review

### 2.1 Flipped Classroom Model

One of the recent teaching models is flipped classroom in which the conventional classroom instructions are assigned as homework and practices usually considered as homework are performed in the class time (Akçayır&Akçayır, 2018; Sohrabi&Iraj, 2016). In this model, the class time is used to recognize the learners' problems and to boost the class interactions (Angadi et al., 2019). Since flipped learning is considered as blended learning, it demands the learners' active engagement prior and during the class (Jovanović et al., 2017). Moreover, using this model leads to effective outcomes in different subjects (Roehling et al., 2017).

The basic framework, is to use AI to pass the limitations of the conventional flipped model, changing it into a highly adaptive model (Ray&Sikdar, 2024). The core of this model is personalization as AI-driven platforms can provide adaptive content, suggest more practices, and provide personal learning paths by analyzing learners' data (Li&Peng, 2022). In addition, previous researches (e.g. Li&Peng, 2022) reported a significant correlation between this personalized approach and the level of learners' motivation and engagement. As pre-class AI driven activities can develop learners' level of confidence and readiness for collaborative tasks, it leads to the reduction in their cognitive load (Li&Peng, 2022).

However, the findings of Ray and Sikdar (2024) indicate that there are some challenges in the path to influential use. Firstly, there are significant infrastructural and pedagogical obstacles. As Ray and Sikdar (2024) note, educators need professional development not only to use the technology but also to improve new educational strategies to boost the effects of AI-mediated education. Ethical and equity considerations are the second important issues. The



results of previous studies reported high levels of concern regarding privacy of data and the possibility for keeping the educational unfairness.

In addition, there are learner-centric and psychological challenges. One of the significant challenges is lack of lacking authenticity in learner-AI interaction that if not managed, can decrease learning motivation (Lo&Hew, 2023). Previous researches indicated that learners' intrinsic motivation could be decreased if the AI tools are considered as disconnected from meaningful context (Varnavsky, 2022; Ito et al., 2021). The learners' over-reliance on feedbacks provided by AI may also increase the risk of decreasing the learners' level of critical thinking creativity (Rahmawati, 2025).

Accordingly, this study aims to answer the following questions:

1. **Does the AI-assisted flipped classroom model improve the digital competency of Iraqi EFL students?**
2. **Does the AI-assisted flipped classroom model enhance the linguistic achievement of Iraqi EFL students?**

## Methodology

### Research Design

This study uses a comparative quasi-experimental pre-test/post-test control group design to look into how an AI-assisted flipped classroom model affects the digital competency and linguistic accuracy of Iraqi EFL students in comparison with traditional teaching and conventional flipped classroom (without any usage of AI). It also looks at how technology and language acquisition affect each other (Hwang et al., 2020).

### Participants and Sampling

The target sample consists of **90 EFL university students**. A **cluster sampling** technique was used to select them, divided equally into the first **experimental group** (conventional flipped classroom), the second experimental group (AI-assisted flipped classroom) and a **control group** (traditional instruction). The participants' age ranged 19-29 years old. All of them were native speakers of Arabic, learning English as a foreign language. Three intact classes were chosen and randomly assigned to different groups. The first group, control group, was instructed using traditional way of teaching that is common in many Iraqi EFL settings, with teacher-led lessons, drills, and exercises in class, but without the flipped learning arts or particular AI integration. Specifically, their 90-minute class sessions consisted of direct grammar instruction, vocabulary drills from the textbook, and controlled practice exercises completed individually. The first experimental group went through a conventional flipped classroom. Each week the instructor sent a 10-15 minute pre-recorded video lectures and reading texts to the participants of this group as the out of class components. Moreover, the time of the class was devoted to doing collaborative tasks and peer review them according to the pre-class content. The second experimental group used Duolingo Max's advanced features.

### Instruments and Materials



## The AI Platform and Intervention Tool: Duolingo Max

The primary intervention tool and AI platform chosen for the implementation of the AI-enhanced flipped classroom in this study is **Duolingo Max**. It is a language learning application, which is integrated with OpenAI's GPT-4 abilities. By providing interactive features, learners experienced a gamified environment with personalized support. Due to its accessibility, and AI integration in tandem with the principles of flipped model, it is an ideal choice for the current study. This app has two AI-powered features as Explain My Answer and Role-play, which help learners to engage more in the learning process.

### Instruments

#### 1. DIALANG Test

The DIALANG test was used at the onset of the study to assess the participants' level of language proficiency and to homogenize the participants in different groups at the beginning of the study.

#### 2. The Linguistic Accuracy Production Task

The researchers designed a **Linguistic Accuracy Production Task** to assess the participants' **linguistic accuracy**, which consists of two parallel forms (Form A for the pre-test, Form B for the post-test) to assess the effects of treatment. Both forms were similar in difficulty level and structure with different content and included two parts as follows. **The first part included a written production component in which** the participants were asked to write a paragraph (100-150) words to describe the events of a picture-cued narrative prompt that included a four images showing a short story in 20-minutes. The second part was designed to assess the participants' oral production regarding their speaking accuracy. After receiving a prompt from the teacher, the participants had a limited time to prepare themselves and speak in two minutes and their answers were audio recorded for further analysis using a detailed analytical rubric.

Moreover, their writing samples regarding grammar and textual coherence were analyzed using 'The Cambridge English Writing Assessment Rubric'. In addition, the speaking rubric was utilized to analyze the participants' speaking. Both rubrics were aligned with CEFR B1 descriptors. Two trained raters scored the answers independently to ensure reliability and they discuss together to solve the differences in their views. Moreover, inter-rater reliability (Cohen's Kappa,  $\kappa = .88$ ) was calculated to establish the consistency of scoring. The digital literacy scale (Avinç and Doğan, 2024) that includes 20 items on 5-point Likert scale, was used to measure the level of the participants' digital literacy. This scale was particularly developed to assess the level of digital literacy of EFL learners.

### Data Analysis

To compare the performance of the participants of the three groups, the post test scores were analyzed. Statistical analyses, including a set of descriptive statistics and Kruskal Wallis Test, were employed to identify the impact of the intervention on participants' linguistic accuracy and digital competency.



## Results

The obtained data was fed into SPSS (27.00). To answer the first research question, descriptive statistics and Kruskal Wallis test were conducted. The aim of running this test was to compare the post-test scores of the groups. Before running this test, the normality of data was assessed using Kolmogorov-Smirnov test. The results of this test indicated that most variables violated the assumption of normality. Accordingly, Kruskal Wallis test was performed to compare the groups.

To address the second research question and to compare the three groups regarding the effects of different instructions on the **linguistic achievement**, the Kruskal Wallis test was used. This non-parametric test was selected to compare the outcomes of the three independent groups. Table 1 reports the descriptive statistics for digital competency scores of the three groups. It provides an overall view of the level of the digital competency levels of all groups before and after the intervention.

Table 1

*Descriptive Statistics of Digital Competency of Pre-tests and Post-tests*

|   | N      | Minim<br>um | Maxim<br>um | Mean  | Std.<br>Deviation |
|---|--------|-------------|-------------|-------|-------------------|
| Control group<br>digitalcompetency pre-test     | 3<br>0 | 24.00       | 56.00       | 39.46 | 7.89              |
| Control group digital<br>competency post        | 3<br>0 | 28.00       | 58.00       | 40.93 | 7.46              |
| flipped group digital<br>competency pre-test    | 3<br>0 | 26.00       | 56.00       | 39.00 | 8.64              |
| flipped digital competency<br>post-test         | 3<br>0 | 30.00       | 60.00       | 42.70 | 8.42              |
| AIflipped group digital<br>competency pre-test  | 3<br>0 | 24.00       | 56.00       | 38.00 | 7.18              |
| AIflipped group digital<br>competency post-test | 3<br>0 | 36.00       | 68.00       | 49.33 | 7.45              |
| Valid N (listwise)                              | 3<br>0 |             |             |       |                   |

The descriptive statistics shows that the participants of all of the groups enjoy the similar levels of digital competency at the onset of the study and significant differences at the end of it. The most substantial improvement in post-scores belongs to AI flipped group, which highlights the effects of integrating AI tools such as Duolingo Max into flipped learning environments. To assess the normality of the data and to select the proper statistical test, One-Sample Kolmogorov-Smirnov test was used.

Table 2

*Normality Assessment of Digital Competency Scores Across Pre-Test and Post-Test Using One-Sample Kolmogorov-Smirnov Test*



|  |                                   | Contr<br>ol<br>group<br>pretes<br>t | Contr<br>ol<br>group<br>post-<br>test | Flipped<br>group<br>pretest | Flippe<br>d<br>group<br>post-<br>test | AI<br>Flipped<br>group<br>pretest | AI<br>Flipped<br>group<br>post |      |
|--|-----------------------------------|-------------------------------------|---------------------------------------|-----------------------------|---------------------------------------|-----------------------------------|--------------------------------|------|
| N  |                                   | 30                                  | 30                                    | 30                          | 30                                    | 30                                | 30                             |      |
| Normal<br>Parameters <sup>a,b</sup>                | Mean                              | 39.46                               | 40.93                                 | 39.00                       | 42.70                                 | 38.00                             | 49.33                          |      |
|  | Std. Deviation                    | 7.89                                | 7.46                                  | 8.64                        | 8.42                                  | 7.18                              | 7.45                           |      |
| Most<br>Extreme<br>Differences                     | Absolute                          | .13                                 | .17                                   | .23                         | .19                                   | .14                               | .20                            |      |
|  | Positive                          | .13                                 | .17                                   | .23                         | .19                                   | .14                               | .20                            |      |
|  | Negative                          | -.09                                | -.11                                  | -.10                        | -.08                                  | -.08                              | -.10                           |      |
| Test Statistic                                     |                                   | .13                                 | .17                                   | .23                         | .19                                   | .14                               | .20                            |      |
| Asymp. Sig. (2-tailed) <sup>c</sup>                |                                   | .16                                 | .01                                   | .000                        | .006                                  | .12                               | .003                           |      |
| Monte<br>Carlo<br>Sig. (2-<br>tailed) <sup>d</sup> | Sig.                              | .16                                 | .01                                   | .000                        | .006                                  | .11                               | .003                           |      |
|  | 99%<br>Confide<br>nce<br>Interval | Lower<br>Bound                      | .15                                   | .01                         | .000                                  | .004                              | .10                            | .001 |
|  |                                   | Upper<br>Bound                      | .171                                  | .017                        | .001                                  | .008                              | .126                           | .004 |
|  |                                   |                                     |                                       |                             |                                       |                                   |                                |      |

a. Test distribution is Normal.

Based on the results of the normality test, since there were significant deviation from normality for most pre and posttest scores, nonparametric Kruskal-Wallis H test was selected for statistical analyses to ensure robustness and validity.

Table 3

*Kruskal-Wallis H Test for Differences in Post-Test Digital Competency Scores Across Groups*

|                               |                     |
|-------------------------------|---------------------|
| Total N                       | 90                  |
| Test Statistic                | 24.897 <sup>a</sup> |
| Degree Of Freedom             | 2                   |
| Asymptotic Sig.(2-sided test) | .000                |

a. The test statistic is adjusted for ties.

To evaluate the differences in post-test digital competency of groups, aKruskal-Wallis H test was conducted. As it is clear from Table 3, there is a statistically significant difference among groups ( $p < .001$ ). Based on the results in could be concluded that using different instructional methodology had a significant influence on the development of learners' digital competency. Accordingly, it is necessary to perform post-hoc pairwise comparisons to identify the specific group differences.

Table 4



*Bonferroni post hoc test of Post-Test Digital Competency Scores of the Three Groups*

| Sample 1-Sample 2  | Test Statistic | Std. Error | Std. Test Statistic | Sig. | Adj. Sig. <sup>a</sup> |
|--------------------|----------------|------------|---------------------|------|------------------------|
| flipped-control    | 6.51           | 6.71       | .97                 | .33  | .99                    |
| flipped-AI flipped | -31.73         | 6.71       | -4.72               | .000 | .000                   |
| control-AI flipped | -25.21         | 6.71       | -3.75               | .000 | .001                   |

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

As it is clear from the above table, the comparison between the AI-Assisted Flipped Classroom and the control group indicated a highly significant difference ( $P=.001$ ), showing that the performance of the participants of the AI-Assisted group was better than the other two groups

( $p<.001$ ). Moreover, there was not any significant difference between the Conventional Flipped Classroom and the control groups ( $p = .996$ ).

To answer the second research question that aimed at finding the different effects of different instructions on the participants regarding linguistic achievement, descriptive statistics and Kruskal Wallis test were run.

Table 5

*Descriptive Statistics of Linguistic Accuracy of Pre-tests and Post-tests*

|  | N  | Minimum | Maximum | Mean | Std. Deviation |
|--|----|---------|---------|------|----------------|
| Control group linguistic accuracy pre-test     | 30 | 1.00    | 6.00    | 3.63 | 1.40           |
| Control group linguistic accuracy post         | 30 | 3.00    | 6.00    | 4.80 | .96            |
| flipped group linguistic accuracy pre-test     | 30 | 1.00    | 6.00    | 3.66 | 1.44           |
| flipped linguistic accuracy post-test          | 30 | 2.00    | 7.00    | 5.10 | 1.21           |
| AI flipped group linguistic accuracy pre-test  | 30 | 1.00    | 7.00    | 3.66 | 1.56           |
| AI flipped group linguistic accuracy post-test | 30 | 5.00    | 9.00    | 7.10 | 1.32           |
| Valid N (listwise)                             | 30 |         |         |      |                |



Table 5 reveals that participants of all three groups were at comparable levels of linguistic accuracy at the onset of the study as indicated by their closely aligned pre-test mean scores. However, at the end of the intervention, clear differences in their post-test scores were observed. Based on the results, the participants of AI flipped group, outperformed the other groups. This result strongly highlights the effect of integrating AI-driven tools like Duolingo Max for developing linguistic accuracy within a flipped classroom model.

Table 6

*Kruskal-Wallis H Test for Differences in Post-Test Scores of Linguistic Accuracy of the Three Groups*

|                               |                     |
|-------------------------------|---------------------|
| Total N                       | 90                  |
| Test Statistic                | 24.897 <sup>a</sup> |
| Degree Of Freedom             | 2                   |
| Asymptotic Sig.(2-sided test) | .000                |

According to Table 6, there is a significant difference ( $p < .001$ ) among the three groups regarding linguistic accuracy which indicated the effect of different teaching methods. At the next stage of data analysis and to find the between group differences, a post-hoc test was run.

Table 7

*Bonferroni post hoc test of Post-Test Linguistic Accuracy Scores of the Three Groups*

| Sample 1-<br>Sample 2 | Test<br>Statistic | Std.<br>Error | Std. Test<br>Statistic | Sig. | Adj.<br>Sig. <sup>a</sup> |
|-----------------------|-------------------|---------------|------------------------|------|---------------------------|
| control-<br>flipped   | -6.80             | 6.59          | -1.03                  | .303 | .908                      |
| control-AI            | -37.75            | 6.59          | -5.72                  | .000 | .000                      |
| flipped-AI            | -30.95            | 6.59          | -4.69                  | .000 | .000                      |

To find the particular differences in posttest scores of linguistic accuracy, some pairwise comparison were run using Bonferroni post-hoc test. As it is clear from the next table, the AI driven flipped classroom outperformed the other two groups. Moreover, no statistical differences were found between the control group and the conventional flipped group ( $p = .908$ ).

### Discussion

The obtained results regarding the first research question indicates the different effects of teaching methods on the learners' level of digital competency. Based on the results, it could be concluded that AI driven flipped class had a significant effect on the level of digital competency of EFL learners. This conclusion is in line with previous studies that highlighted the effects of using AI platforms in education (Bushuyev, et al., 2025; González-González, 2023; Gupta, 2024). Moreover, the findings confirmed that not only using the flipped model but



also integrating it with AI supported tools is the primary catalyst to develop digital skills. As was indicated by the previous studies, using AI as an adaptive educational tool is beyond passive delivery of content and develop the required levels of digital competencies(Ahmad, et al., 2025; Celik, et al, 2024).

According to Xu and Li (2024)the outperformance of the AI assisted group is attributable to the utilized technology.Duolingo Max an AI supported tool that includes features such as “Role play” and “Explain my answer”, provide a personalized and authentic environment necessary for digital interaction. These features demand the learners activate collaboration to interpret AI generated answers to produce their own input that results in practicing a range of digital skills such as digital competency. Such process transforms students from passive recipients of digital contents in to active members in a digital educational environment (Kessler, 2018). Accordingly, the significant outperformance of the participants of the AI flipped group is the consequence of the cognitive and practical demands imposed by the interactive AI, that is absent in the other two groups. Conversely, the non-significant difference between the conventional flipped and traditional groups suggests that passive exposure to digital materials, such as watching pre-recorded videos, is insufficient for developing robust digital competency. True competency is fostered through active, hands-on interaction with dynamic digital tools, which was only a core component of the AI-assisted model.

**The results of data analysis regarding linguistic accuracy (second research question) provide valuable results about the effect of different instructional model in language learning. The core finding indicates the significant outperformance of AI-assisted flipped model over the other groups.Regarding the learners level of linguistic accuracy, the results indicated the importance and efficacy of the role of intelligent and interactive technologies in developing grammatical accuracy. These results are in tandem with previous studies that emphasized the role of real and individualized feedback in language learning(Canals, et al., 2020; Leeser&Kregar, 2011; Uludağ, 2025).The AI assisted educational tools such as Doulingo Max, through its unique features such as ‘Explain My Answer’, shortens this time gap and provides a learning loop in which the learners pay enough attention to their errors, receive immediate feedbacks, and can try to correct it. This in line with Schmidt’ noticing Hypothesis, indicates that students should consciously pay attention to linguistic features in the input to get it.The lack of significant improvement in the conventional flipped classroom further reinforces this conclusion; while learners in that group engaged in collaborative in-class activities, they lacked the constant, individualized, and immediate corrective mechanism that the AI platform provided, a feature which appears to be the primary driver of enhanced linguistic accuracy.**

## **Conclusion**



The comparative effects of traditional, conventional flipped, and AI-assisted flipped classrooms on Iraqi EFL learners' linguistic accuracy and digital competency were assessed in the current study. The results indicated that adding an AI tool to the flipped learning model was the only effective educational model since the participants of the AI-driven flipped classroom group outperformed the other two groups in both linguistic accuracy and digital competency. In contrast, the lack of a significant difference between the other two groups (conventional flipped classroom and the traditional control group) indicates that only using a conventional flipped model is not sufficient to improve the learners' performance. The obtained results support previous evidence that the effectiveness of flipped learning hinges on the quality of learning activities, not the format itself (Doo & Bonk, 2021; Shen, 2023; van Alten et al., 2019). Accordingly, it is clear that in the current study, the success factor was not the flipped model, but integrating AI in this model and its capacity for immediate personalized feedback results in the outperformance of the participants of the AI-assisted flipped group.

### **Pedagogical Implications**

The results of this study provide some implications. First, EFL teachers and practitioners should try to integrate the flipped model with technological tools and not just use the traditional models of it. The main focus should be on choosing interactive, AI-integrated platforms that present individualized real feedback rather than those that only provide passive feedback. Moreover, the success of AI-integrated models is dependent on training professional teachers to use such tools and in planning their class activities based on the selected AI-integrated tools.

### **Limitations and Suggestions for Future Research**

There were some limitations in the current study. First, since only one AI tool was used in this research, the results are not generalizable to other AI-driven language technologies. Second, the selected design for this study, the quasi-experimental design, limits the possibility of making causal claims. Moreover, the participants of this study were university students in an Iraqi EFL context and there is an urgent need to find out if it is possible to apply the results to other age groups. Accordingly, it is necessary for future researchers to compare the effects of different AI tools on learning. In addition, it could be interesting to conduct longitudinal studies to find the long-term effects of AI tools on learners' learning and development.

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