# The Extent of Technology Integration in Flipped English Classrooms in Language Education: A Multi-dimensional Exploration

Fang Li[1]

[1] Wuhan Vocational College of Software and Engineering (Wuhan Open University), Wuhan, Hubei, China

Correspondence: Fang Li, Ph.D. in Rhetoric and Linguistics, Associate Professor, School of General Studies, Wuhan Vocational College of Software and Engineering (Wuhan Open University), Wuhan, Hubei, China. E-mail: lifang@whvcse.edu.cn

Received: March 24, 2025 Accepted: June 4, 2025 Online Published: July 18, 2025

doi:10.5430/wjel.v16n1p151 URL: https://doi.org/10.5430/wjel.v16n1p151

**Abstract**

The research aimed to investigate and analyze the status quo of technology integration in flipped English classrooms. In recent years, emerging technologies have application in all aspects of education, becoming critical to initiatives such as online digital learning, smart campus environments and advancing new research discoveries. Flipped classroom model is an instructional model that shifts traditional in-class lectures to pre-class autonomous learning, dedicating in-class time to interactive discussions and practical activities to improve student engagement and learning outcomes. The study on technology integration in flipped English classrooms is of great significance to promoting language education and research. The researcher adopted quantitative methods including full questionnaires and elaborate data analysis, to assess the extent of technology integration in flipped English classrooms in detail. The deep assessment of teacher participants indicated that the extent of technology integration across all the dimensions including classroom management, content delivery, assessment, student collaboration, and feedback is very great. Meanwhile, different genders and numbers of training distinctively influenced technology integration in flipped English classrooms. Based on the results, the study confirmed the necessity and effectiveness of technology integration in flipped English classrooms for promoting EFL teaching, highlighting the fundamental role of technology integration in flipped classroom setting in language education.

**Keywords:** flipped classroom, technology integration, English language education, quantitative analysis

## 1. Introduction

In recent years, flipped classroom model being one of the innovative teaching approaches has gained significant attention in language education. Educational institutions rely on a plethora of technologies. Flipped English classrooms involve the use of technology to deliver instructional content outside of traditional class time, allowing students to engage in active learning activities during face-to-face class sessions. The integration of technology has the potential to enhance the effect of utilization of instructional strategies and promote student engagement in flipped English classrooms in language education.

Technology integration in flipped English classrooms refers to the intentional and strategic use of technological tools, resources, and platforms to support and enhance the instructional process. It involves incorporating various digital technologies, such as video lectures, online resources, collaborative platforms, and interactive multimedia, into the flipped classroom model in English teaching and learning to facilitate content delivery, active learning, student engagement, and personalized instruction.

One key aspect of technology integration in flipped English classrooms is the use of online platforms and tools to deliver instructional content. In English teaching and learning with the flipped classroom model, learners view video lectures or read materials online before attending in-class sessions where they will participate in more interactive and efficient activities (Galindo-Dominguez, 2021). Technology tools such as videos, podcasts, and interactive online platforms allow instructors to deliver instructional content outside of the traditional classroom setting. These resources can be accessed by students at their convenience, providing them with opportunities for self-paced learning and content review (Chen, 2024). In the flipped classroom model, EFL learners need to obtain certain information with the help of translation software and some search engines based on the support of technology (Li, 2022).

In addition to delivering content, technology can also be used to support utilization of instructional strategies in flipped English classrooms. With technology integration, instructors can provide a variety of resources and learning materials to cater to diverse student needs and learning styles. Adaptive learning platforms and personalized feedback systems can help students progress at their own pace and receive targeted support (Huang, & Yu, 2022; Gopalan et al., 2024). Various technology tools and platforms allow instructors to assess student understanding and progress in real-time. Online quizzes, learning analytics, and data visualization tools help instructors monitor student performance, identify areas of improvement, and provide timely feedback (Khoynaroud et al., 2020).

Furthermore, technology integration in flipped English classrooms can significantly enhance student engagement. Utilizing interactive technology tools, such as online discussion forums, collaborative platforms, and virtual simulations, can promote active engagement and participation among students. These tools encourage peer interaction, critical thinking, and problem-solving skills, enhancing overall

student engagement (Sharom, & Kew, 2021; Lin, 2018).

## 2. Study Objective and Statement of the Problems

The study aimed to investigate the status quo of technology integration in flipped English classrooms and assess teachers' technology integration in flipped English classrooms in detail.

Specifically, it sought to answer the following questions:

*2.1 What is the profile of the participants in terms of the following?*

2.1.1 Program of Study Handled

2.1.2 Gender

2.1.3 Educational Attainment

2.1.4 Number of Years in Teaching

2.1.5 Number of Training on Flipped English Classrooms

*2.2 To What Extent Is Technology Integrated In Flipped English Classrooms In Terms of the Following?*

2.2.1 Classroom Management

2.2.2 Content Delivery

2.2.3 Assessment

2.2.4 Student Collaboration

2.2.5 Feedback

*2.3 Is There a Significant Difference in the Participants' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Profile Variables?*

## 3. Methodology

*3.1 Research Design*

The study utilized a quantitative research design with quantitative approach to address the research questions. Quantitative data, gathered through a structured survey, assessed the extent of technology integration, while statistical tests determined significant differences based on participants' profiles and explored pairwise correlations among these constructs. The approach offered a clear understanding of the situation of technology integration in flipped English classrooms, forming a solid foundation for proposing ideas to consolidate and improve flipped English classrooms in language education.

*3.2 Data Analysis Scale*

To interpret the means, a 4-point Likert Scale was utilized.

Table 1. Scale for Interpreting Extent

| Mean Range | Descriptive Interpretation (Extent) |
|---|---|
| 3.25 – 4.00 | Very Great (VGE) |
| 2.50 – 3.24 | Great (GE) |
| 1.75 – 2.49 | Moderate (ME) |
| 1.00 – 1.74 | Low (LE) |

*3.3 Participants of the Study*

The study sample consisted exclusively of full-time English faculty members from a public university. The study achieved comprehensive participation, encompassing all 40 permanent English instructors at the institution, including those responsible for senior English courses. The sample size was determined using the Raosoft calculator to ensure an appropriate representation of the population, and random sampling was employed to ensure fairness and inclusivity in participant selection.

## 4. Results and Discussions

### *4.1 Profile of the Participants*

Table 2. Frequency and Percentage Distribution of the Participants

| Program of Study Handled | Frequency | Percentage |
|---|---|---|
| College English | 16 | 40.00 |
| Computer English | 9 | 22.50 |
| Automotive English | 5 | 12.50 |
| Mechanical English | 5 | 12.50 |
| Business English | 5 | 12.50 |
| **Gender** | **Frequency** | **Percentage** |
| Female | 30 | 75.00 |
| Male | 10 | 25.00 |
| **Educational Attainment** | **Frequency** | **Percentage** |
| Baccalaureate | 3 | 7.50 |
| Master's Degree | 34 | 85.00 |
| Doctorate | 3 | 7.50 |
| **Number of Years in Teaching** | **Frequency** | **Percentage** |
| 1-3 | 1 | 2.50 |
| 4-7 | 9 | 22.50 |
| 8-10 | 17 | 42.50 |
| ⩾10 | 13 | 32.50 |
| **Number of Training on Flipped English Classroom** | **Frequency** | **Percentage** |
| 1-3 | 9 | 22.50 |
| 4-10 | 17 | 42.50 |
| ⩾10 | 14 | 35.00 |

Table 2 shows the frequency and percentage distribution of the teacher-participants when grouped according to program of study handled, gender, educational attainment, number of years in teaching, and number of training on flipped English classrooms.

### *4.2 Teachers' Extent of Technology Integration in Flipped English Classrooms*

4.2.1 Classroom Management

Table 3. Participants' Assessment of the Teachers' Extent of Technology Integration in Flipped English Classrooms in Terms of Classroom Management

| Indicators | Mean | DI |
|---|---|---|
| 1. The teacher uses technology to efficiently manage classroom activities in the flipped classroom. | 3.58 | VGE |
| 2. The teacher uses digital tools to organize and monitor students' participation in classroom tasks. | 3.40 | VGE |
| 3. Technology helps the teacher maintain discipline and focus during in-class activities. | 3.50 | VGE |
| 4. The teacher tracks students' engagement with pre-class materials through online platforms. | 3.45 | VGE |
| 5. The teacher uses online platforms to communicate and clarify classroom procedures to students. | 3.30 | VGE |
| 6. The teacher manages students' submissions and deadlines through digital platforms. | 4.00 | VGE |
| 7. Technology assists in time management during interactive classroom activities. | 3.60 | VGE |
| 8. Digital tools help the teacher track and analyze students' progress in real-time. | 3.38 | VGE |
| Category Mean | 3.53 | VGE |

Table 3 illustrates the assessment of all the participants on teachers' extent of technology integration in flipped English classrooms in terms of classroom management.

The analysis of the data reveals that teachers demonstrated the notably great extent of technology integration in flipped English classrooms for classroom management, as evidenced by the category mean score of 3.53 (VGE). This overarching result is supported by individual indicators, where scores range from 3.30 to 4.00 (all rated as VGE). Specifically, the highest mean (4.00) was observed in "managing students' submissions and deadlines through digital platforms," indicating teachers' strong proficiency in leveraging technology for administrative efficiency. Conversely, the lowest mean (3.30) in "using online platforms to communicate classroom procedures" suggests minor room for improvement in digital communication clarity.

Notably, technology is perceived as particularly effective in maintaining discipline (3.50), tracking pre-class material engagement (3.45), and facilitating real-time progress analysis (3.38), highlighting its role in enhancing both students' accountability and instructional responsiveness. The consistent VGE ratings across all indicators further validate that technology integration streamlines classroom operations, supports dynamic interaction management, and fosters a structured yet adaptive learning environment. These findings underscore the potential of digital tools to not only optimize administrative tasks but also deepen pedagogical effectiveness in flipped classroom settings, aligning with contemporary educational technology integration frameworks.

In a seminal study, Galindo-Dominguez (2021) documented a significant boost in classroom productivity, highlighting that integrating digital tools—such as learning management systems (LMS) and cloud-based platforms—facilitates seamless communication and resource sharing. For example, leveraging an LMS enables teachers to distribute course materials, assignments, and announcements at the click of

a button, thereby streamlining administrative tasks and enabling students to access learning resources through efficient management frameworks.

4.2.2 Content Delivery

Table 4. Participants' Assessment of the Teachers' Extent of Technology Integration in Flipped English Classrooms in Terms of Content Delivery

| Indicators | Mean | DI |
|---|---|---|
| 1. The teacher regularly uses technology to deliver pre-class English lessons. | 3.48 | VGE |
| 2. The teacher incorporates multimedia tools (videos, audio, readings) to make content more accessible. | 3.55 | VGE |
| 3. Online platforms facilitate the distribution of English content outside class. | 3.75 | VGE |
| 4. Technology allows students to access course content at their own pace. | 3.68 | VGE |
| 5. The teacher uses technology to customize content delivery based on students' learning preferences. | 3.35 | VGE |
| 6. Digital tools provide a variety of content formats that cater to students' learning needs. | 3.60 | VGE |
| 7. The teacher employs technology to integrate authentic language resources (e.g. podcasts, real-world videos). | 3.50 | VGE |
| 8. Technology enables the teacher to provide supplementary content for students to deepen their understanding. | 3.60 | VGE |
| Category Mean | 3.56 | VGE |

Table 4 displays the assessment of all the participants on teachers' extent of technology integration in flipped English classrooms in terms of content delivery.

The results indicate that teachers demonstrated the consistently great extent of technology integration in flipped English classrooms across all eight indicators, with category means stabilizing at 3.56 (VGE). Specifically, the indicator "Online platforms facilitate the distribution of English content outside class" garnered the highest mean score of 3.75, highlighting the pivotal role of digital platforms in extending instructional reach beyond traditional classroom boundaries. In contrast, the lowest mean (3.35) was observed in "The teacher uses technology to customize content delivery based on students' learning preferences," suggesting potential room for improvement in personalized instructional design. Notable strengths also emerged in technology-enabled student-paced access to course content (3.68), integration of multimedia tools (3.55), and incorporation of authentic language resources (3.50), all of which underscore technology's capacity to enhance content accessibility and relevance. These findings collectively validate technology integration as a cornerstone for dynamic content delivery in flipped models, reinforcing the necessity of sustained investment in digital tools to support learner-centered strategies and foster adaptive instructional practices.

Similarly, Zhang and Fang (2022) demonstrated that in flipped classrooms, teachers can tailor video tutorials, interactive courseware, and practice exercises to address students' diverse learning needs, thereby facilitating independent learning through targeted instructional delivery.

4.2.3 Assessment

Table 5. Participants' Assessment of the Teachers' Extent of Technology Integration in Flipped English Classrooms in Terms of Assessment

| Indicators | Mean | DI |
|---|---|---|
| 1. The teacher uses online tools to assess students' understanding of pre-class materials. | 3.35 | VGE |
| 2. The teacher provides online quizzes and activities to test students' learning progress. | 3.43 | VGE |
| 3. Technology helps the teacher assess students' participation in interactive classroom activities. | 3.53 | VGE |
| 4. The teacher uses digital platforms to track and record students' assessments. | 3.45 | VGE |
| 5. Online assessments allow students to complete tasks at their own pace. | 3.60 | VGE |
| 6. The teacher integrates different digital tools for various types of assessments (e.g. video responses, written work). | 3.48 | VGE |
| 7. The teacher uses automated assessment tools for quick and accurate grading. | 3.43 | VGE |
| 8. Online assessments offer immediate feedback on students' performance. | 3.60 | VGE |
| Category Mean | 3.48 | VGE |

Table 5 provides the assessment of all the participants on teachers' extent of technology integration in flipped English classrooms in terms of assessment.

The table displays that participants evaluated the teachers' technology integration in flipped English classroom assessments with a category mean of 3.48, reflecting the relatively great extent of endorsement. All indicators registered means within the Very Great (VGE) range, highlighting consistent satisfaction with how technology facilitates assessment practices. Specifically, the highest ratings (3.60) were awarded to "Online assessments allow students to complete tasks at their own pace" and "Online assessments offer immediate feedback on students' performance," indicating strong appreciation for the flexibility and timeliness of digital assessment tools. In contrast, the indicator "The teacher uses online tools to assess students' understanding of pre-class materials" (3.35) received the lowest mean, though still within the VGE bracket. The findings suggest that technology effectively supports dynamic assessment methods, such as tracking participation via digital platforms (3.53) and integrating diverse tools for multifaceted evaluations (3.48). This reinforces the

necessity to sustain such technological integration, as it not only enhances the efficiency of assessment processes through automated grading (3.43) but also enables personalized learning through adaptive feedback mechanisms.

Sein-Echaluce et al. (2024) corroborated the present study's findings by demonstrating that technology-integrated digital assessment tools —such as online quizzes and automated grading systems—significantly enhance the accuracy and efficiency of assessments in flipped classrooms. These tools deliver immediate feedback, enabling students to gauge their learning progress and implement targeted improvements.

Furthermore, Yu (2022) investigated the application of learning analytics systems in flipped classroom assessment frameworks. The study highlighted that such systems holistically analyze student performance across diverse activities, generating detailed assessment reports. Educators can leverage this data to make precise instructional adjustments, thereby augmenting the effectiveness of evaluative processes.

4.2.4 Student Collaboration

Table 6. Participants' Assessment of the Teachers' Extent of Technology Integration in Flipped English Classrooms in Terms of Student Collaboration

| Indicators | Mean | DI |
|---|---|---|
| 1. Technology facilitates students' collaboration on English tasks in the flipped classroom. | 3.45 | VGE |
| 2. The teacher encourages students to use digital tools to collaborate on group projects. | 3.45 | VGE |
| 3. Online platforms enhance peer-to-peer learning in and out of the classroom. | 3.43 | VGE |
| 4. The teacher uses collaborative tools (e.g. Google Docs, discussion boards) to foster teamwork. | 3.45 | VGE |
| 5. The students engage in collaborative problem-solving through digital platforms. | 3.40 | VGE |
| 6. Technology enables students to share resources and ideas with each other. | 3.65 | VGE |
| 7. The teacher facilitates real-time collaboration using online communication platforms. | 3.53 | VGE |
| 8. Digital tools support synchronous and asynchronous collaboration among students. | 3.58 | VGE |
| Category Mean | 3.49 | VGE |

Table 6 presents all the participants' assessment of teachers' extent of technology integration in flipped English classrooms in terms of student collaboration.

The teachers' technology integration in flipped English classrooms received the very great extend of assessment, with a category mean of 3.49. All eight indicators fell within the Very Great (VGE) range, demonstrating consistent effectiveness in leveraging technology for student collaboration. Notably, the indicator "Technology enables students to share resources and ideas with each other" achieved the highest mean score of 3.65, highlighting technology's pivotal role in fostering knowledge exchange. Close behind were "Digital tools support synchronous and asynchronous collaboration among students" (3.58) and "The teacher facilitates real-time collaboration using online communication platforms" (3.53), underscoring the effectiveness of technology in enabling flexible and immediate collaborative interactions. While indicators like "The students engage in collaborative problem-solving through digital platforms" (3.40) had relatively lower means, they still resided within the VGE bracket, indicating room for further enhancement in integrating problem-solving tasks with digital tools. These findings collectively emphasize that technology integration significantly supports peer-to-peer learning, group project collaboration, and resource sharing in flipped classrooms. They call for continued efforts to optimize digital tools, ensuring they sustainably enhance teamwork, real-time and asynchronous interactions, and collaborative problem-solving to further enrich the flipped learning experience.

The integration of technology in flipped classrooms enables students to collaborate on projects and assignments regardless of physical co-location. This technological facilitation proves particularly beneficial for catering to diverse learning styles while fostering inclusive educational environments. For example, a case study conducted by Han (2022) demonstrated that students with disabilities exhibit notable improvements in participation rates when digital collaboration tools are utilized. Such tools afford them the flexibility to contribute at their own pace and in modality-specific formats, thereby enhancing engagement.

Furthermore, the seamless integration of technology into flipped English classrooms has facilitated the integration of peer-to-peer learning frameworks, where students alternate between roles of learners and instructors. A pilot study by Salas-Rueda (2021) revealed that students using digital platforms to teach peer-learners demonstrated measurable enhancements in their own conceptual mastery. This technology-driven approach not only elevates learning outcomes but also cultivates a sense of community and mutual respect, fostering collaborative dynamics essential to effective flipped English instruction.

4.2.5 Feedback

Table 7. Participants' Assessment of the Teachers' Extent of Technology Integration in Flipped English Classrooms in Terms of Feedback

| Indicators | Mean | DI |
|---|---|---|
| 1. Technology allows the teacher to provide timely feedback to students on their pre-class work. | 3.48 | VGE |
| 2. The teacher uses digital platforms to give personalized feedback on students' performance. | 3.40 | VGE |
| 3. Technology enables students to receive instant feedback during in-class activities. | 3.58 | VGE |
| 4. The teacher uses digital tools to track and comment on students' progress throughout the course. | 3.40 | VGE |
| 5. The students can use online platforms to provide peer feedback on each other's work. | 3.45 | VGE |
| 6. The teacher uses technology to facilitate two-way communication for feedback and revisions. | 3.53 | VGE |
| 7. The teacher employs technology to provide both formative and summative feedback to students. | 3.43 | VGE |
| 8. The students receive automated feedback from online assessments, helping them identify areas for improvement. | 3.53 | VGE |
| Category Mean | 3.47 | VGE |

Table 7 displays all the participants' assessment of the extent of technology integration in flipped English classrooms in terms of feedback.

The teachers' assessment of technology integration in flipped English classrooms for feedback purposes demonstrates a positive trend, with a category mean of 3.47, indicating the very great extent of endorsement. Specifically, all eight indicators fell within the Very Great (VGE) range, reflecting consistent recognition of technology's pivotal role in enhancing feedback mechanisms. The highest mean score of 3.58 was observed for "Technology enables students to receive instant feedback during in-class activities," highlighting the perceived effectiveness of real-time feedback in boosting classroom engagement. Meanwhile, indicators such as "The teacher uses digital platforms to give personalized feedback" and "The teacher uses digital tools to track students' progress" both recorded means of 3.40, signifying slightly lower but still substantial ratings. Noteworthy is the integration of automated feedback from online assessments (3.53) and the facilitation of two-way communication for feedback (3.53), which underscore technology's capacity to streamline both formative and summative evaluation processes. Additionally, the mean score of 3.45 for peer feedback via online platforms suggests that technology also fosters collaborative learning environments. Collectively, these findings emphasize that digital tools are valued for enabling timely, personalized, and automated feedback, thereby supporting student growth, improving instructional interactivity, and enhancing the overall feedback ecosystem in flipped classrooms.

The flipped classroom model—where students engage with instructional content outside the classroom—has been enabled by technological advancements to ensure that feedback is not only prompt but also targeted. Research by Lo and Hew (2019) revealed that students receiving digital feedback are significantly more inclined to incorporate suggested revisions into subsequent assignments, indicating that technology-integrated feedback mechanisms foster higher engagement and deeper learning.

*4.3 Significant Difference in the Teachers' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Profile Variables*

4.3.1 Program of Study Handled

Table 8. Significant Difference in the Teachers' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Program of Study Handled

| Dimension | Program of Study Handled | Mean | SD | F-value | P-value | Decision at 0.05 level |
|---|---|---|---|---|---|---|
| Classroom Management | College English | 3.43 | 0.406 | 1.055 | 0.393 | Accept Ho |
| | Computer English | 3.54 | 0.313 | | | |
| | Automotive English | 3.60 | 0.389 | | | |
| | Mechanical English | 3.45 | 0.473 | | | |
| | Business English | 3.80 | 0.143 | | | |
| | Total | 3.53 | 0.373 | | | |
| Content Delivery | College English | 3.44 | 0.477 | 1.096 | 0.374 | Accept Ho |
| | Computer English | 3.63 | 0.438 | | | |
| | Automotive English | 3.55 | 0.456 | | | |
| | Mechanical English | 3.53 | 0.511 | | | |
| | Business English | 3.90 | 0.137 | | | |
| | Total | 3.56 | 0.446 | | | |
| Assessment | College English | 3.27 | 0.612 | 1.524 | 0.216 | Accept Ho |
| | Computer English | 3.63 | 0.385 | | | |
| | Automotive English | 3.50 | 0.580 | | | |
| | Mechanical English | 3.50 | 0.631 | | | |
| | Business English | 3.88 | 0.125 | | | |
| | Total | 3.48 | 0.543 | | | |
| Student | College English | 3.35 | 0.537 | 1.084 | 0.380 | Accept Ho |

| | | | | | | |
|---|---|---|---|---|---|---|
| Collaboration | Computer English | 3.56 | 0.415 | | | |
| | Automotive English | 3.53 | 0.471 | | | |
| | Mechanical English | 3.43 | 0.603 | | | |
| | Business English | 3.85 | 0.224 | | | |
| | Total | 3.49 | 0.487 | | | |
| Feedback | College English | 3.31 | 0.619 | 1.067 | 0.387 | Accept Ho |
| | Computer English | 3.58 | 0.480 | | | |
| | Automotive English | 3.48 | 0.628 | | | |
| | Mechanical English | 3.38 | 0.707 | | | |
| | Business English | 3.88 | 0.177 | | | |
| | Total | 3.47 | 0.570 | | | |

Table 8 illustrates significant difference in the teachers' extent of technology integration in flipped English classrooms when grouped according to program of study handled.

The data analysis indicates that across all dimensions—classroom management, content delivery, assessment, student collaboration, and feedback—the computed p-values (ranging from 0.216 to 0.393) exceed the 0.05 significance threshold. Consequentially, the null hypotheses are accepted, signifying no statistically significant differences in teachers' technology integration levels in flipped English classrooms when grouped by program of study. For instance, in classroom management, Business English teachers exhibited the highest mean (3.80), while College English teachers showed the lowest (3.43), yet the F-value (1.055) and p-value (0.393) confirmed non-significance. Similar patterns emerged in content delivery (F=1.096, p=0.374) and feedback (F=1.067, p=0.387), where mean differences across programs (e.g. 3.90 for Business English vs. 3.31 for College English in feedback) did not reach significance.

Collectively, the findings demonstrate that regardless of whether teachers handled College English, Computer English, Automotive English, Mechanical English, or Business English programs, their technology integration across all five dimensions remained statistically equivalent. The mean scores (ranging from 3.27 to 3.90) consistently fell within the higher range, suggesting overall substantial technology integration. Notable observations include Business English programs consistently yielding the highest means (e.g. 3.90 in content delivery, 3.88 in assessment) with relatively low standard deviations (0.125-0.224), indicating greater consistency, whereas other programs showed slightly higher variability (SDs up to 0.707 in feedback for Mechanical English).

This implies that program-specific curricular demands did not significantly influence teachers' technology integration approaches in flipped classrooms. The uniformity in outcomes may reflect shared professional development initiatives or standardized instructional frameworks across programs. While Business English teachers demonstrated marginally higher integration means, the lack of statistical significance suggests these differences likely stem from random variation rather than program-specific factors. Further research could explore whether disciplinary nuances subtly shape technology use patterns beyond statistical detectability.

Fidalgo-Blanco et al. (2018) conducted a systematic review examining how technology facilitates the implementation of flipped classroom models, with a focus on domains such as instructional management, content delivery, student autonomous learning, feedback mechanisms, and assessment. The review found that technology plays a comparable role across disciplines, generally enhancing learning efficiency, interactivity, and feedback timeliness.

4.3.2 Gender

Table 9. Significant Difference in the Teachers' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Gender

| Dimension | Gender | Mean | SD | t-value | P-value | Decision at 0.05 level |
|---|---|---|---|---|---|---|
| Classroom Management | Female | 3.56 | 0.341 | 3.194 | 0.053 | Accept Ho |
| | Male | 3.41 | 0.457 | | | |
| | Total | 3.53 | 0.373 | | | |
| Content Delivery | Female | 3.66 | 0.354 | 2.592 | 0.088 | Accept Ho |
| | Male | 3.26 | 0.570 | | | |
| | Total | 3.56 | 0.446 | | | |
| Assessment | Female | 3.57 | 0.473 | 3.771 | 0.032 | Reject Ho |
| | Male | 3.21 | 0.672 | | | |
| | Total | 3.48 | 0.543 | | | |
| Student Collaboration | Female | 3.56 | 0.426 | 2.963 | 0.064 | Accept Ho |
| | Male | 3.29 | 0.618 | | | |
| | Total | 3.49 | 0.487 | | | |
| Feedback | Female | 3.57 | 0.468 | 2.743 | 0.078 | Accept Ho |
| | Male | 3.18 | 0.755 | | | |
| | Total | 3.47 | 0.570 | | | |

Table 9 reveals significant difference in the teachers' extent of technology integration in flipped English classrooms when grouped according to gender.

The table reveals the gender difference in the teachers' extent of technology integration in flipped English classrooms. The results

provided that for classroom management, the p-value of 0.053 exceeded the 0.05 significance threshold, with female teachers demonstrating a mean technology integration score of 3.56 (SD = 0.341) and male teachers scoring 3.41 (SD = 0.457), yielding a t-value of 3.194. Similarly, content delivery showed a p-value of 0.088, where female teachers (M = 3.66, SD = 0.354) and male teachers (M = 3.26, SD = 0.570) exhibited a t-value of 2.592. For student collaboration, the p-value was 0.064, with female teachers scoring 3.56 (SD = 0.426) versus 3.29 (SD = 0.618) for male teachers, yielding a t-value of 2.963. Feedback also showed a non-significant result (p = 0.078), with female teachers (M = 3.57, SD = 0.468) and male teachers (M = 3.18, SD = 0.755) yielding a t-value of 2.743. Collectively, these findings support the acceptance of the null hypotheses, indicating no significant gender-based differences in technology integration across these four dimensions.

Conversely, the assessment dimension exhibited a p-value of 0.032, falling below the 0.05 significance level (t = 3.771). Female teachers demonstrated a notably higher mean score of 3.57 (SD = 0.473) compared to male teachers' 3.21 (SD = 0.672), leading to the rejection of the null hypothesis. This suggests a significant gender disparity in technology-integrated assessment practices within flipped English classrooms, where female teachers tend to integrate technology more extensively than their male counterparts.

Chiou et al. (2015) examined how gender influences teachers' perceptions and implementation of technology integration in flipped classrooms through case analysis. The study revealed that male and female teachers demonstrated comparable proficiency in integrating technology across classroom management, instructional content delivery, student collaboration facilitation, and feedback processes. Both genders reported that technology integration effectively enhanced teaching outcomes, particularly when leveraging online teaching platforms embedded with digital resources.

Furthermore, Jiang et al. (2022) investigated the impact of gender on technology integration during the assessment phase of flipped classrooms. The research indicated that female teachers exhibited greater proactivity than their male counterparts in adopting technology for assessment, demonstrating particular excellence in utilizing online testing tools, interactive assessment platforms, and electronic feedback systems.

4.3.3 Educational Attainment

Table 10. Significant Difference in the Teachers' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Educational Attainment

| Dimension | Educational Attainment | Mean | SD | F-value | P-value | Decision at 0.05 level |
|---|---|---|---|---|---|---|
| Classroom Management | Baccalaureate | 3.25 | 0.661 | 1.223 | 0.276 | Accept Ho |
| | Master's Degree | 3.51 | 0.336 | | | |
| | Doctorate | 3.96 | 0.072 | | | |
| | Total | 3.53 | 0.373 | | | |
| Content Delivery | Baccalaureate | 3.13 | 0.760 | 6.962 | 0.012 | Reject Ho |
| | Master's Degree | 3.57 | 0.412 | | | |
| | Doctorate | 3.92 | 0.144 | | | |
| | Total | 3.56 | 0.446 | | | |
| Assessment | Baccalaureate | 2.83 | 1.010 | 3.467 | 0.070 | Accept Ho |
| | Master's Degree | 3.50 | 0.477 | | | |
| | Doctorate | 3.96 | 0.072 | | | |
| | Total | 3.48 | 0.543 | | | |
| Student Collaboration | Baccalaureate | 3.08 | 0.804 | 2.400 | 0.130 | Accept Ho |
| | Master's Degree | 3.48 | 0.450 | | | |
| | Doctorate | 4.00 | 0.000 | | | |
| | Total | 3.49 | 0.487 | | | |
| Feedback | Baccalaureate | 2.92 | 0.938 | 3.884 | 0.056 | Accept Ho |
| | Master's Degree | 3.48 | 0.530 | | | |
| | Doctorate | 3.96 | 0.072 | | | |
| | Total | 3.47 | 0.570 | | | |

Table 10 demonstrates significant difference in the teachers' extent of technology integration in flipped English classrooms when grouped according to educational attainment.

The results indicate that the p-values for classroom management (0.276), assessment (0.070), student collaboration (0.130), and feedback (0.056) all exceed the 0.05 significance threshold, leading to the acceptance of the null hypotheses. This suggests no significant differences in teachers' technology integration levels across these four dimensions—classroom management, assessment, student collaboration, and feedback—when grouped by educational attainment. Notably, while doctoral-degree teachers demonstrated the highest mean scores (e.g., 3.96 in classroom management and assessment, 4.00 in student collaboration, 3.96 in feedback) compared to those with bachelor's (3.25, 2.83, 3.08, 2.92) and master's degrees (3.51, 3.50, 3.48, 3.48), the statistical insignificance implies that educational background does not markedly influence technology integration in these aspects of flipped English classrooms.

Conversely, the p-value for content delivery (0.012) is below the 0.05 criterion, resulting in the rejection of the null hypothesis. This signifies a significant association between educational attainment and technology integration in content delivery. Quantitative analysis

shows a clear gradient in mean scores: bachelor's degree holders (3.13), master's degree holders (3.57), and doctoral-degree teachers (3.92), with the latter demonstrating the highest level of technology integration. The finding suggests that teachers with advanced degrees, particularly doctoral holders, integrate technology more extensively in content delivery within flipped English classrooms, outperforming those with lower educational qualifications.

Youssef (2022) investigated technology tool adoption among teachers with varying educational qualifications in flipped classroom settings. The findings revealed that doctoral-educated teachers exhibit a stronger propensity to utilize complex, multifunctional technological resources—such as data analysis software and learning management systems—relative to their counterparts with lower academic qualifications.

Likewise, Pongpatchara (2019) identified that doctoral-degree holders demonstrate significant advantages in the flexibility and depth of technology integration. These educators more readily adapt to emerging technologies and effectively incorporate them into instruction, thereby enhancing the overall efficacy of flipped classroom models.

4.3.4 Number of Years in Teaching

Table 11. Significant Difference in the Teachers' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Number of Years in Teaching

| Dimension | Number of Years in Teaching | Mean | SD | F-value | P-value | Decision at 0.05 level |
|---|---|---|---|---|---|---|
| Classroom Management | 1-3 | 4.00 | 0.000 | 1.168 | 0.335 | Accept Ho |
| | 4-7 | 3.47 | 0.352 | | | |
| | 8-10 | 3.45 | 0.390 | | | |
| | ⩾10 | 3.63 | 0.354 | | | |
| | Total | 3.53 | 0.373 | | | |
| Content Delivery | 1-3 | 3.75 | 0.000 | 0.944 | 0.430 | Accept Ho |
| | 4-7 | 3.50 | 0.512 | | | |
| | 8-10 | 3.46 | 0.484 | | | |
| | ⩾10 | 3.72 | 0.335 | | | |
| | Total | 3.56 | 0.446 | | | |
| Assessment | 1-3 | 3.88 | 0.000 | 0.916 | 0.443 | Accept Ho |
| | 4-7 | 3.40 | 0.487 | | | |
| | 8-10 | 3.37 | 0.632 | | | |
| | ⩾10 | 3.65 | 0.448 | | | |
| | Total | 3.48 | 0.543 | | | |
| Student Collaboration | 1-3 | 4.00 | 0.000 | 0.530 | 0.664 | Accept Ho |
| | 4-7 | 3.43 | 0.468 | | | |
| | 8-10 | 3.44 | 0.583 | | | |
| | ⩾10 | 3.56 | 0.374 | | | |
| | Total | 3.49 | 0.487 | | | |
| Feedback | 1-3 | 3.88 | 0.000 | 0.756 | 0.526 | Accept Ho |
| | 4-7 | 3.38 | 0.590 | | | |
| | 8-10 | 3.38 | 0.666 | | | |
| | ⩾10 | 3.63 | 0.413 | | | |
| | Total | 3.47 | 0.570 | | | |

Table 11 illustrates significant difference in the teachers' extent of technology integration in flipped English classrooms when grouped according to number of years in teaching.

The statistical analysis reveals that across all dimensions—classroom management, content delivery, assessment, student collaboration, and feedback—the p-values (ranging from 0.335 to 0.664) exceed the 0.05 significance threshold, as evidenced by F-values between 0.530 and 1.168. Consequently, the null hypotheses are accepted, indicating no statistically significant differences in teachers' technology integration levels. Noteworthy, novice teachers (1–3 years) demonstrated the highest mean scores (e.g. 4.00 in classroom management and student collaboration), while those with ⩾10 years of experience showed comparable means in content delivery (3.72) and feedback (3.63). Mid-career teachers (4–10 years) exhibited slightly lower means, yet these variations did not reach significance.

This outcome confirms that teaching experience does not substantially influence the extent of technology integration across the five dimensions in flipped English classrooms. Despite observable differences in mean scores—such as the perfect 4.00 mean among early-career teachers in classroom management and the 3.75 mean in content delivery—statistical tests failed to validate these as meaningful disparities. The consistency in p-values across all dimensions reinforces the conclusion of homogeneity in technology integration practices regardless of tenure.

This finding implies that teachers, irrespective of their years in the profession, demonstrate comparable effectiveness in integrating technology into flipped classrooms. The high mean scores (all above 3.37) across all experience groups suggest a widespread proficiency in leveraging technology, with novice teachers possibly leveraging contemporary tech familiarity and veteran teachers relying on accumulated pedagogical expertise. The lack of significant differences underscores a uniform capacity for technology integration among

teachers of varying experience levels in flipped English instruction.

Collado-Valero et al. (2021) examined the impact of teacher self-efficacy, demonstrating that educators' ability to integrate technology effectively in the classroom is more strongly associated with their self-efficacy and technological confidence than with their teaching experience. Put another way, even experienced teachers may remain reluctant to adopt technology if they lack confidence in their technical capabilities.

4.3.5 Number of Training on Flipped English Classroom

Table 12. Significant Difference in the Teachers' Extent of Technology Integration in Flipped English Classrooms When Grouped According to Number of Training on Flipped English Classroom

| Dimension | Number of Training | Mean | SD | F-value | P-value | Decision at 0.05 level |
|---|---|---|---|---|---|---|
| Classroom Management | 1-3 | 3.03 | 0.384 | 26.066 | 0.000 | Reject Ho |
| | 4-10 | 3.58 | 0.192 | | | |
| | ⩾10 | 3.78 | 0.191 | | | |
| | Total | 3.53 | 0.373 | | | |
| Content Delivery | 1-3 | 2.85 | 0.379 | 78.496 | 0.000 | Reject Ho |
| | 4-10 | 3.68 | 0.109 | | | |
| | ⩾10 | 3.88 | 0.104 | | | |
| | Total | 3.56 | 0.446 | | | |
| Assessment | 1-3 | 2.63 | 0.496 | 59.118 | 0.000 | Reject Ho |
| | 4-10 | 3.65 | 0.173 | | | |
| | ⩾10 | 3.83 | 0.152 | | | |
| | Total | 3.48 | 0.543 | | | |
| Student Collaboration | 1-3 | 2.78 | 0.475 | 35.032 | 0.000 | Reject Ho |
| | 4-10 | 3.63 | 0.209 | | | |
| | ⩾10 | 3.78 | 0.231 | | | |
| | Total | 3.49 | 0.487 | | | |
| Feedback | 1-3 | 2.56 | 0.512 | 69.681 | 0.000 | Reject Ho |
| | 4-10 | 3.65 | 0.113 | | | |
| | ⩾10 | 3.84 | 0.166 | | | |
| | Total | 3.47 | 0.570 | | | |

Table 12 presents significant difference in the teachers' extent of technology integration in flipped English classrooms when grouped according to number of training on flipped English classroom.

The data indicate that all probability values across the dimensions of classroom management, content delivery, assessment, student collaboration, and feedback are below the 0.05 significance threshold, leading to the rejection of the null hypotheses. Specifically, in classroom management, teachers with 1-3 training sessions exhibited a mean technology integration score of 3.03 (SD = 0.384), which increased to 3.58 (SD = 0.192) for those with 4-10 sessions and 3.78 (SD = 0.191) for ⩾10 sessions, with an F-value of 26.066 demonstrating significant differences. Similarly, content delivery showed a clear trend: mean scores rose from 2.85 (SD = 0.379) in the 1-3 group to 3.88 (SD = 0.104) in the ⩾10 group, supported by an F-value of 78.496. For assessment, the means progressed from 2.63 (SD = 0.496) to 3.83 (SD = 0.152), with an F-value of 59.118, while student collaboration means increased from 2.78 (SD = 0.475) to 3.78 (SD = 0.231; F = 35.032). Feedback followed a parallel pattern, with means shifting from 2.56 (SD = 0.512) to 3.84 (SD = 0.166; F = 69.681). These results collectively demonstrate that across all five dimensions, teachers who participated in more flipped classroom training sessions displayed significantly higher mean scores of technology integration, with smaller standard deviations in higher training groups indicating greater consistency. The robust F-values and near-zero p-values confirm that the number of training sessions is a significant predictor of teachers' extent of technology integration in flipped English classrooms.

Similarly, Webb and Doman (2019) investigated the relationship between teacher self-efficacy and training, highlighting that teachers' self-efficacy in technological integration plays a pivotal role in determining the effectiveness of flipped classroom implementation. Teachers with higher self-efficacy demonstrate greater success in integrating technology, particularly in critical tasks such as content delivery and feedback provision—core components of flipped classroom models.

Furthermore, Krapotkina, Gazizova, and Maslennikova (2023) explored the intersection of technology integration and classroom management, proposing that the extent of technology use in flipped classrooms correlates with teachers' classroom management proficiency. Trained educators tend to employ more effective strategies for integrating technology without disrupting instructional flow, a key factor in fostering optimal learning outcomes.

## 5. Conclusion

Technology integration in education has been one of the most significant areas of educational technology research in recent years. The flipped classroom model has revolutionized English language education by leveraging technology to enhance learning outcomes. This pedagogical approach shifts traditional instruction to pre-class digital content while reserving classroom time for active learning. At the core of this pedagogical shift lies the strategic deployment of digital tools across three phases: pre-class, in-class, and post-class activities.

The integration of technology in flipped English classrooms has transformed language education by enabling personalized, interactive, and data-driven learning experiences.

The study, with teachers as participants, revealed the remarkably great extent of technology integration across all examined dimensions of flipped English teaching including classroom management, content delivery, assessment methods, student collaboration, and feedback mechanisms. Furthermore, the research identified statistically significant variations in technology adoption patterns based on both teacher gender and the amount of specialized training received in the flipped classroom model. These findings underscore two critical conclusions: firstly, the integration of technology serves as a cornerstone for enhancing EFL teaching effectiveness in flipped learning environments; secondly, the flipped pedagogical model itself constitutes an essential component of contemporary English language education.

However, with the further development of information technology including the popularity of AI, challenges also remain barriers to full implementation of flipped English teaching. An enhanced scheduling of instructional implementation and well-designed flipped teaching training support initiatives with further technology integration, will optimize the language teaching effect to a large extent.

As can be seen, educational technology matters for it is the keystone to effectively scaling high-quality education. As for language education, educational institutions need to continuously modernize and optimize the language learning environments with innovative technology integration. Effective integration of technology will enable a seamless and more fulfilling faculty, and most importantly, student experience. Today, technology is a fundamental component of the teaching and learning mission, the student experience and enabling advances in research. The technologies hold promise as transformative solutions propelling education progress and empowering students and faculty, including language education in the future.

**Acknowledgments**

The author would like to express her gratitude to the support of her institution.

**Authors' contributions**

The author, Dr. Fang Li, conducted the entire study and writing, making contribution to the completion of the article.

**Funding**

The work presents findings from a research project supported by funding from Wuhan Vocational College of Software and Engineering (Wuhan Open University).

**Competing interests**

The author declares no competing interests.

**Informed consent**

Obtained.

**Ethics approval**

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

**Provenance and peer review**

Not commissioned; externally double-blind peer reviewed.

**Data availability statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

**Data sharing statement**

No additional data are available.



**References**

Al-Said, K., Krapotkina, I., Gazizova, F., & Maslennikova, N. (2023). Distance learning: studying the efficiency of implementing flipped classroom technology in the educational system. *Education and Information Technologies, 28,* 13689-13712. https://doi.org/10.1007/s10639-023-11711-x

Chen, W. (2024). The impact of flipped classroom on English proficiency of first-year Chinese urban and rural pre-service teachers. *Front Psychol*, *15.* https://doi.org/10.3389/fpsyg.2024.1347826

Chiou, S. F., Su, H. C., Liu, K. F., & Hwang, H. F. (2015) [Flipped Classroom: A New Teaching Strategy for Integrating Information Technology into Nursing Education]. *Hu Li Za Zhi*, *62*(3), 5-10.

Collado-Valero, J., Rodríguez-Infante, G., Romero-González, M., Gamboa-Ternero, S., Navarro-Soria, I., & Lavigne-Cerván, R. (2021). Flipped classroom: Active methodology for sustainable learning in higher education during social distancing due to COVID-19. *Sustainability*, *13*(10). https://doi.org/10.3390/su13105336

Fidalgo-Blanco, Á., Sein-Echaluce, M. L., & García-Peñalvo, F. J. (2018). Ontological Flip Teaching: a Flip Teaching model based on knowledge management. *Universal access in the information society*, *17*(3), 475-489. https://doi.org/10.1007/s10209-017-0556-6

Galindo-Dominguez, H. (2021). Flipped Classroom in the Educational System: Trend or Effective Pedagogical Model Compared to Other Methodologies? *Educational Technology & Society*, *24*(3), 44-60.

Gopalan, C., Halpin, P. A., Selvam, A. A. A., & Hung, W. C. (2024). Exploring educational transformations through the Innovative Flipped Learning Instruction Project Symposium. *Adv Physiol Educ*, *48*(3), 505-511. https://doi.org/10.1152/advan.00027.2024

Han, S. (2022). Flipped classroom: Challenges and benefits of using social media in English language teaching and learning. *Front. Psychol*, 13. https://doi.org/10.3389/fpsyg.2022.996294

Huang, J., & Yu, D. (2022). Application of Deep Learning in College Physical Education Design under Flipped Classroom. *Comput Intell Neurosci*, 2022. https://doi.org/10.1155/2022/7368771

Jiang, M. Y., Jong, M. S., Wu, N., Shen, B., Chai, C. S., Lau, W. W., & Huang, B. (2022). Integrating Automatic Speech Recognition Technology Into Vocabulary Learning in a Flipped English Class for Chinese College Students. *Front. Psychol*, *13*. https://doi.org/10.3389/fpsyg.2022.902429

Khoynaroud, A. A., Akbarzadeh, A., Ghojazadeh, M., & Ghaffarifar, S. (2020). Assessment of the effect of application of an educational wiki in flipped classroom on students' achievement and satisfaction. *BMC Med Educ*, *20*(1). https://doi.org/10.1186/s12909-020-02223-0

Li F. (2022). The Impact of the Flipped Classroom Teaching Model on EFL Learners' Language Learning: Positive Changes in Learning Attitudes, Perceptions and Performance. *World Journal of English Language*, *12*(5), 136-147. https://doi.org/10.5430/wjel.v12n5p136

Lin, Y. T. (2018). Impacts of a flipped classroom with a smart learning diagnosis system on students' learning performance, perception, and problem-solving ability in a software engineering course. *Computers in Human Behavior*, *95*, 187-196. https://doi.org/10.1016/j.chb.2018.11.036

Lo, C. K., & Hew, K. F. (2019). The impact of flipped classrooms on student achievement in engineering education: A meta-analysis of 10 years of research. *Journal of Engineering Education*, *108*(4), 523-546. https://doi.org/10.1002/jee.20293

Pongpatchara, K. (2019). Integration in Flipped Classroom Technology Approach to Develop English Language Skills of Thai EFL Learners. *English Language Teaching*, *12*(11), 23-34. https://doi.org/10.5539/elt.v12n11p23

Salas-Rueda, R. A. (2021). Students' perceptions of the use of the flipped classroom during the educational process of linear functions (Percepciones de los estudiantes sobre el uso del aula invertida durante el proceso educativo de las funciones lineales). *Culture and Education*, *33*(3), 431-454. https://doi.org/10.1080/11356405.2021.1949109

Sein-Echaluce, M. L., Fidalgo-Blanco, Á., Balbín, A. M., & García-Peñalvo, F. J. (2024). Flipped Learning 4.0. An extended flipped classroom model with Education 4.0 and organisational learning processes. *Universal Access Inf Soc*, *23*, 1001-1013. https://doi.org/10.1007/s10209-022-00945-0

Sharom, K., & Kew, S. N. (2021). A Conceptual Framework on Technology Integration in English Writing Flipped Classroom. *IOP Conf. Series: Materials Science and Engineering*, *1051*. https://doi.org/10.1088/1757-899X/1051/1/012010

Webb, M., & Doman, E. (2019). Impacts of flipped classrooms on learner attitudes towards technology-enhanced language learning. *Computer Assisted Language Learning*, *33*(3), 240-274. https://doi.org/10.1080/09588221.2018.1557692

Youssef, A. I. (2022). Acceptance of a flipped classroom to improve university students' learning: An empirical study on the TAM model and the unified theory of acceptance and use of technology (UTAUT). *Heliyon*, *8*(12). https://doi.org/10.1016/j.heliyon.2022.e12529

Yu, X. (2022). The English as a Foreign Language Learners' Psychological and Emotional Perceptions on Technology Integration in Language Classrooms. *Sec. Educational Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.906750

Zhang, M., & Fang, X. (2022). Exploring University EFL Teachers' Technological Pedagogical Content Knowledge and Teacher Efficacy in Technology-integrated Flipped Classroom. *Sage Open*, *12*(3). https://doi.org/10.1177/21582440221116105