A Systematic Literature Review on the Flipped Formative Assessment Practices in Higher Education

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ABSTRACT

A flipped classroom, also known as an inverted classroom, has garnered significant attention from educational researchers and educators. In this instructional approach, traditional lecture content is delivered outside the classroom, while in-class time is dedicated to interactive and student-centered learning activities. However, despite its advantages, numerous studies have highlighted the challenges associated with the implementation of flipped classrooms. The mixed findings from past research motivated this study to conduct a systematic literature review on assessment practices in higher education. This study conducts a systematic literature review focusing specifically on formative assessment practices in flipped classrooms at the tertiary level. The review aims to examine (i) current formative assessment practices, (ii) the types of formative assessment employed, and (iii) the tools used to support formative assessment in flipped classroom settings. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol to ensure methodological rigor and transparency. Relevant studies were identified through comprehensive searches of major academic databases, including Web of Science and Scopus. In this process, a total of 471 articles were selected and 13 articles were identified adhering to the inclusion criteria. The findings of this study guide educators, researchers, and stakeholders in effectively implementing assessment practices in the flipped classroom at higher institutions.

Keywords: Formative Assessment in FC, Innovative Assessment in FC, E-assessment in FC, Assessment and Feedback Practices in FC

INTRODUCTION

Flipped Classroom (FC) can be defined as a combination of synchronous and asynchronous online learning [1]; [2]; [3]. According to [4]; [5]; [6]; [7], the Flipped Classroom Model (FCM) has been primarily studied to enhance the teaching and learning experience and optimize classroom time by substituting traditional lectures with more interactive, collaborative activities and individualized support. The flipped classroom model is considered a modern teaching approach that promotes student-centered learning through both synchronous and asynchronous e-learning. As noted by [8]; [9]; [10], instructors act as facilitators to guide students and ensure that learning takes place, while students take responsibility for their own independent learning in the flipped classroom environment [11]; [12]; [13].

Many studies have reported that flipped classrooms enhance student engagement, achievement, and performance, while promoting active learning [14]; [15]; [16]. Assessment in flipped classrooms is a key component in flipped classroom implementation as it evaluates students' progress and fosters self-regulated learning. Formative assessment techniques have been widely used to prepare assessments in flipped classrooms by integrating technology such as technology-enhanced assessment tools, digital rubrics, peer and self-assessment, inquiry based assessment, LMS and so on.

Despite the reported benefits of flipped classrooms, the literature identifies several interrelated challenges that affect their effective implementation, particularly in relation to assessment practices in flipped classroom. These

challenges can be broadly categorised into (i) learner-related factors, (ii) instructor-related competencies and workload, and (iii) institutional and technological constraints. Learner-related challenges include difficulties in student adaptation to flipped learning environments and limited understanding of assessment objectives and class activities [17]; [18], [19]; [20];[21];[22]. Instructor-related challenges frequently involve limited experience with flipped learning, difficulties in designing effective formative assessments, and increased workload arising from teaching multiple subjects and developing diversified instructional materials using Web 2.0 tools [26]; [27]; [28]; [29]; [30]. In addition, institutional and technological challenges such as insufficient technological infrastructure and inadequate professional training prior to implementation have been widely reported as barriers to effective assessment design and execution in flipped classrooms [17]; [18], [31]; [32]; [33]; [34]. Collectively, these challenges highlight the need for lecturers, students, and peers to play active and coordinated roles in fostering meaningful learning experiences and for assessment practices to be thoughtfully aligned with the interactive and student-centred nature of flipped classroom models [23]; [24]; [25]. Therefore, the main aim of this study is to explore assessment practices in flipped classrooms in higher education. This focus is crucial due to the limited number of systematic literature reviews (SLR) available on this topic.

This study aims to systematically review past literature on assessment practices for the flipped classroom in higher education, with a focus on assessment preparation strategies, types of formative assessment and the tools used in formative assessment practices in flipped classrooms in higher education. As a result, this SLR study is driven by the three following research questions.

RO1: To analyse formative assessment practices in the flipped classroom model within higher education.

RO2: To analyse the types of formative assessment and the tools used in formative assessment practices in flipped classrooms in higher education.

By synthesizing findings from peer-reviewed literature, this study aims to contribute to the ongoing discourse on innovative and technology-driven assessment methods in flipped learning environments. The review will offer practical insights for educators, policymakers, and researchers seeking to optimize assessment strategies in higher education for a successful implementation.

REVIEW METHODOLOGY

A systematic review was conducted using the reporting checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). While PRISMA has been widely used in medicine and public health fields, it is also relevant and applicable to Arts and Social Sciences studies. According to [35], PRISMA consists of a 27-item checklist and a four-phase flow, which can be used as a protocol to conduct a systematic review. Additionally, [36] stated that researchers can minimize bias in systematic literature reviews (SLR) and gain a comprehensive understanding of the research by employing PRISMA. Therefore, all the collected journals were analyzed based on the four steps highlighted in PRISMA: identification, screening, eligibility, and inclusion.

Step 1: Identification

Identification is an important process in this SLR study, where researchers need to diversify keywords to search for relevant articles or references. The relevance and accuracy of the articles can be improved by using diverse keywords during the process of gathering and identifying the articles. In this stage, four keywords were chosen based on the research questions of the study: flipped assessment, formative assessment, assessment for learning, and flipped learning in higher education or higher institutions. The implementation of the flipped classroom model and assessment practices in the flipped classroom were the main focus of this study. These keywords were then refined using Boolean operators such as 'AND' and 'OR' during the search process.

The following step in the identification process is the selection of databases. In this SLR study Web of Science and Scopus were selected as the main databases. According to [37], these databases offer greater accuracy in terms of comprehensive and advanced search functionality, with more stable search results compared to other databases. Additionally, both databases feature a systematic indexing system and superior quality control, which are considered major advantages over other databases.

Next is the search technique for identifying relevant articles from Scopus and Web of Science. An advanced searching method was employed, which used Boolean operators (AND, OR), phrase searching, truncation, wildcard, and field code functions. Through the process of selecting keywords, databases, and search techniques, a total of 54 articles from Scopus and 417 articles from Web of Science were successfully identified. The next step is screening, where all these articles will be carefully reviewed in the second stage.

Step 2: Screening

The second stage is screening. According to [38] in the screening process, researchers need to set inclusion and exclusion criteria to select appropriate articles and references. In this stage, 471 articles identified during the identification process will be reviewed in the screening process. The screening process began with the most important criterion: the selection of the year of publication (publications from 2021 to 2025). The justification for choosing articles from these five years is that a large number of articles have been published during this period. In addition, only journal articles were selected for this SLR study to ensure quality, and only articles published in English were chosen to avoid confusion and ensure a comprehensive understanding of the research topic. Next, articles with data were selected, and all review papers were excluded as they were irrelevant to the systematic literature review in this study. According to [39], the aim of a systematic literature review (SLR) is to provide insights into a topic based on research findings over a significant period. The inclusion criteria for this study involved selecting articles that specifically addressed assessment practices in the flipped classroom. Therefore, a total of 389 articles were excluded during the screening process for not meeting the inclusion criteria. Finally, the remaining 82 articles proceeded to the next stage.

Step 3: Eligibility

The following screening process is known as eligibility where only relevant articles will be selected in this SLR study. The selection of the articles will be carried out based on the title and abstract of the articles. In this process, a total of 69 articles were eliminated for not focusing on assessment practices in the flipped classroom especially in higher education. Additionally, duplicated articles and those without full access were also removed. After this elimination process, only 13 articles were selected for the next step, which is quality assessment. The following Figure 1 shows the flow diagram of systematic review process based on PRISMA.

Quality Assessment of Included Studies

The next stage of the screening process involved the quality assessment of the selected articles to ensure methodological rigour in this SLR study. In this process, the 13 articles identified from the eligibility stage were evaluated based on predefined quality criteria. These criteria included the research design of the study, adequacy of sample size, appropriateness of data collection methods, and clarity of data analysis and reporting. Articles that demonstrated acceptable methodological quality and relevance to formative assessment practices in flipped classrooms were retained for synthesis. This quality assessment process ensured that only credible and reliable studies were retained for the final analysis. As a result, the findings of this review were based on reliable evidence.

Articles Included

All the selected articles focus on assessment practices in the flipped classroom or flipped learning in higher education. The summaries of the 13 selected articles from the two main databases, Scopus and WOS are presented in Table 3. The main objective of this SLR study is to shed light on assessment practices for the flipped classroom in higher education.

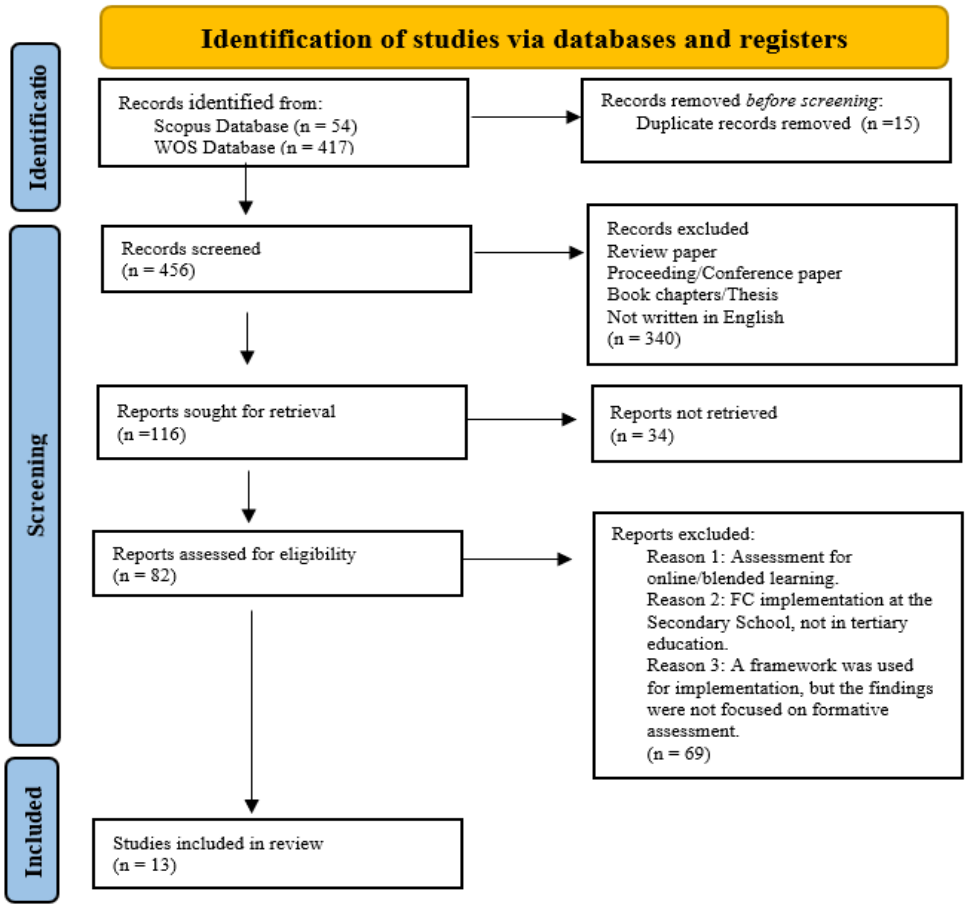

Figure 1: PRISMA 2020 Flow Diagram of systematic review process

Data Extraction And Analysis

Next, the data extraction process was carried out by two researchers. This process was done carefully to ensure the quality of the extracted data from the 13 finalised journals. The extraction of data was mainly based on the abstract, results, and discussion, while other sections of the selected articles were included based on the relevancy of the data. The extracted data were then summarized in a table to be followed by a deeper analysis process.

I. Data Extraction (Abstract, results and discussion)
II. Analysis of the extracted data (Themes and Subthemes)

The data extraction and analysis process identified three main themes and multiple sub-themes from the 13 reviewed journals. All of the extracted themes and sub-themes were retained as they directly aligned with the research questions on formative assessment practices in the implementation of flipped classrooms at higher education institutions. The extracted themes include technology-enhanced formative assessment, collaborative learning and peer assessment, and self-regulated learning strategies, with sub-themes such as online quizzes, real-time feedback, project-based learning, peer assessment, self-reflection, and instructional alignment. These themes highlight the diverse approaches to formative assessment in flipped classrooms, emphasizing the integration of digital tools, active learning methods, and structured feedback mechanisms to enhance student engagement and learning outcomes.

Among the 13 studies, various research methodologies were employed to examine formative assessment practices in flipped learning environments. Studies from WOS journals (e.g., WOS Journal 1, WOS Journal 3, WOS Journal 4, WOS Journal 5, and WOS Journal 6) primarily used quantitative methods, such as pre/post-test surveys, statistical analysis (SPSS), and LMS learning analytics, to measure student performance, engagement, and feedback effectiveness. For instance, WOS Journal 1 used a quantitative survey to assess students' perceptions of flipped learning, while WOS Journal 5 conducted a mean difference analysis of mock test scores to evaluate the effectiveness of LMS-integrated formative assessments.

In contrast, SC studies (e.g., SC3, SC5, and SC6) employed qualitative approaches, such as reflective analysis, thematic coding, and case study evaluations, to explore students' perceptions and experiences with formative assessments. SC3, for instance, examined students' engagement and intellectual stimulation through research-oriented learning, while SC5 analyzed reflective diaries and mid-module feedback to assess student engagement, attendance, and plagiarism reduction.

Additionally, several studies adopted a mixed-methods approach, including WOS Journal 2, SC1, SC2, SC4, and SC7. These studies combined quantitative survey data with qualitative reflections to provide a comprehensive understanding of formative assessment strategies. For example, WOS Journal 2 incorporated progressive assessment with digital rubrics and used both numerical analysis and qualitative feedback from students and teachers. Similarly, SC1 and SC2 used pre/post surveys and structured peer feedback to evaluate the effectiveness of experiential learning in flipped classrooms. SC7 focused on LMS analytics and self-regulated learning strategies, demonstrating how learning management systems can help tailor assessments based on students' progress.

These diverse methodological approaches reinforce the importance of formative assessment in flipped classroom implementation, particularly in enhancing student-centered learning, continuous feedback, and active participation in higher education settings. The combination of quantitative, qualitative, and mixed-methods studies provides a well-rounded perspective on how formative assessments contribute to student learning experiences, motivation, and academic performance in flipped classrooms.

Research Findings

Study	Teaching Methods	Type of Assessment	Assessment Tools	Findings
WOS Journal 1 [40]	Pre-recorded video lectures, Micro-reading/research, Online presentations/sample applications, Collaborative learning, Role-play, Project-based learning, Concept mapping, Simulations, Group discussions, Group presentations	Rubrics, Pre-established criteria, Continuous or real-time feedback	Online tools (Kahoot!, Socrative, Quizizz)	This study found that proper planning of formative tasks and feedback helped students assimilate content better, leading to meaningful learning.
WOS Journal 2 [41]	Project-based learning, Digital rubric	E-assessment, Peer assessment, Self-assessment, Teacher assessment, Progressive assessment (Initial, Intermediate, Final)	Digital rubric, Feedback mechanisms	This study found that progressive assessment with digital rubrics and feedback enhanced teachers' and students' understanding of assessment criteria.
WOS Journal 3 [42]	Team-based learning approach, Interactive videos, Collaborative activities, LMS-based structured learning	MCQs, Mapping activities, Practice-based self-reflection, Group assignments	EdPuzzle, PlayPosit	This study found that interactive sessions with timely feedback improved student achievement.
WOS Journal 4 [43]	Inquiry-based learning (IBL), Instructional videos, Group/pair work, Short presentations	Technology-enhanced formative assessment (TEFA), Online quizzes, Q&A activities, Open-ended reflection	Padlet, Rubrics	This study found that inquiry-based learning combined with TEFA in flipped classrooms increased students' writing quality.
WOS Journal 5 [44]	Pre-recorded lectures, Review drills, Interactive quizzes	Pre-test, Post-test, In-class quizzes	LMS-integrated assessments, ICT tools	This study found that integrating LMS and ICT tools in formative assessment fostered an interactive and engaging learning environment, improving outcomes compared to traditional lectures.

WOS Journal 6 [45]	Pre-recorded videos with embedded questions, Interactive activities, Self-correction, Peer assessment	Automated feedback, Rubrics	EdPuzzle, Self-assessment tools	This study found that web-based learning tools in flipped teaching enhanced student engagement and provided meaningful learning experiences.
SC1 Journal 7 [46]	Pre-class: Review articles, Mock patient counseling; In-class: Think-Pair-Share, PowerPoint presentations, Peer assessment, Group presentation	Pre/Post assessment survey, Self-reflection	Constructive feedback, Q&A sessions	This study found that flipped learning increased students' confidence and enhanced their learning.
SC2 Journal 8 [47]	Pre-class: Online videos; In-class: PowerPoint presentations, Peer assessment, Role-play, Experiential learning	Checklist assessments, Pre/Post survey	Feedback rubrics, Online assessment tools	This study found that after implementation, students' confidence in examining pediatric patients increased, and the curriculum was well received.
SC3 Journal 9 [48]	Self-study (Books, journal articles, short videos, case studies), Research-oriented teaching, Action learning	Reflective analysis, Research-led assignments	Reflective diaries, Research discussions, LMS	This study found that flipped learning increased student engagement, stimulated intellectual excitement, and enhanced learning.
SC4 Journal 10 [49]	Embedded videos, Peer assessment, Project-based learning, Self-assessment	Peer feedback, Review, Assessment criteria design	Learning groups, Digital rubrics	This study found that the findings can serve as a guideline for planning and designing innovative teaching methods, but additional training is required for successful implementation.
SC5 Journal 11 [50]	Active learning, Weekly reflections, Case study analysis	Reflective work, Mid-module feedback	Padlet (anonymous feedback), Case study evaluations	This study found that flipped learning increased student attendance, engagement, and overall performance, with a significant reduction in plagiarism cases.
SC6 Journal 12 [51]	YouTube videos, Participatory design approach, Self-evaluation	Continuous feedback loop, Formative assessment tools	Online tasks, Video-based formative assessments	This study found that the findings can be used as a design and delivery guideline focusing on instructional principles in flipped classrooms.
SC7 Journal 13 [52]	Pre-class: Online content, Lecture videos; In-class: Problem-solving, Scaffolding questions, Group work; Post-class: Reflection reports, Self-assessment quizzes	Formative quizzes, Self-assessment surveys, Teacher feedback	LMS-integrated tools	This study found that LMS can serve as a key tool to track student learning performance, allowing teachers to tailor assessments based on students' self-regulated learning strategies.

RESULTS AND DISCUSSION

The results of this study provide a comprehensive analysis of formative assessment practices in the flipped classroom model within higher education. The findings are discussed based on the three key phases of flipped learning: before class, during class, and after class. This highlights the integration of various formative assessment strategies across these stages. Additionally, the study examines the types of formative assessments implemented and the technological tools used to facilitate these assessments. By exploring these aspects, the discussion aims to provide insights into how formative assessment enhances student engagement, supports self-regulated learning, and improves academic outcomes in a technology-enhanced flipped learning environment.

Flipped Classroom	Main Theme	Sub-Themes
		1. Pre-Class Online Quizzes & Self-Assessments: Use of Google Forms, Kahoot!, Socrative, Quizziz, and EdPuzzle to assess prior knowledge and prepare students for class.

Before Class	Technology-Enhanced Pre-Class Formative Assessment	**2.** Embedded Assessments in Learning Materials: Interactive videos with embedded questions, digital rubrics, and in-video quizzes to provide instant feedback and reinforce learning.
		3. Collaborative & Peer-Assisted Pre-Class Assessments: Discussion forums (Padlet, Flipgrid), peer review, and pre-class reflections to facilitate knowledge sharing.
		4. Readiness Checks & Self-Regulated Learning: Encouraging students to engage in self-assessment checklists, pre-reading activities, and self-paced learning tasks to ensure they are prepared for in-class learning.
During Class	Active & Real-Time Formative Assessment	**1.** In-Class Interactive Quizzes & Polls: Use of scaffolding questions, live polling (Mentimeter, Socrative), and group quizzes to assess comprehension and adapt teaching strategies in real time.
		2. Collaborative Learning & Peer Assessments: Implementation of Think-Pair-Share, role-playing, peer feedback, and group-based assessments to reinforce learning through social interactions.
		3. Immediate Instructor Feedback & Scaffolding: Providing verbal feedback, real-time formative assessments, and structured guidance to address misconceptions and facilitate deeper learning.
		4. Project-Based & Problem-Based Learning Assessment: Using case studies, simulations, and real-world problem-solving tasks to assess student engagement and knowledge application during class.
After Class	Post-Class Reflection & Continuous Assessment	**1.** Metacognitive & Reflective Assessment: Use of reflective journals, diaries, and self-assessment tools (Google Sites, Mahara e-portfolios) to reinforce learning and self-regulated development.
		2. Summative Project-Based Learning with Formative Feedback: Ongoing assessment of student projects, research-oriented tasks, and problem-solving activities with constructive feedback.
		3. Integration of Learning Analytics & Continuous Feedback: Leveraging LMS tracking, performance analytics, and self-regulated learning data to tailor instruction based on student progress.
		4. Cumulative & Long-Term Formative Assessments: Using weekly formative tasks, mid-course feedback (Padlet, anonymous reflections), and self-evaluation surveys to ensure continuous student engagement and improvement.

RO1: To analyze formative assessment practices in the flipped classroom model within higher education

The findings reveal that formative assessment in the flipped classroom model occurs across three phases: before class, during class, and after class. In the before-class phase, students engage in technology-enhanced pre-class formative assessments, including online quizzes (Google Forms, Kahoot!, Quizziz), embedded assessments in learning materials (interactive videos with in-video quizzes), and collaborative peer-assisted activities (Padlet, Flipgrid discussions). Readiness checks such as self-assessment checklists and pre-reading tasks further help students prepare for in-class learning.

During the in-class phase, active and real-time formative assessments are implemented through interactive quizzes and polls (Mentimeter, Socrative), peer assessments, and collaborative learning strategies like Think-Pair-Share and group-based assessments. Immediate instructor feedback, scaffolding, and problem-based learning activities (case studies, simulations) are also key components, ensuring students apply their knowledge effectively. In the after-class phase, formative assessments focus on reflection and continuous assessment, including metacognitive tools (reflective journals, self-assessment diaries), project-based learning with formative feedback, and learning analytics that track student progress for continuous improvement.

RO2: To analyze the types of formative assessment and the tools used in formative assessment practices in flipped classrooms in higher education

The study identifies various types of formative assessments used in flipped classrooms, described by phase. In the before-class phase, pre-class assessments mainly include diagnostic quizzes, interactive videos, and discussion-based peer reviews, which utilize tools like Google Forms, EdPuzzle, and Flipgrid. The during-class phase focuses on real-time assessments such as live polls, peer feedback activities, and group-based problem-solving tasks, with tools like Socrative, Mentimeter, and in-class scaffolding strategies. The after-class phase

integrates reflective and cumulative assessments, such as e-portfolios, self-regulated learning analytics, and summative project-based assessments, facilitated by platforms like Google Sites, Mahara, and learning management system (LMS) tracking.

Overall, the findings highlight a technology-enhanced, structured approach to formative assessment in flipped classrooms, where diverse tools support different assessment types at each stage of learning, ensuring student engagement and continuous feedback.

Theoretical Interpretation of Findings

The findings of this review can be interpreted using formative assessment theory and self-regulated learning theory. Formative assessment theory emphasizes the importance of timely feedback, learner involvement, and continuous monitoring of students' learning progress, which align well with the structure of flipped classrooms. Similarly, self-regulated learning theory highlights learners' active role in planning, monitoring, and evaluating their own learning, which is supported through pre-class preparation activities, in-class formative feedback, and post-class reflection in flipped learning environments. This alignment between theory and practice indicates that the integration of formative assessment in flipped classrooms supports learner autonomy and continuous learning improvement.

CONCLUSION

This study examined formative assessment practices in the flipped classroom model within higher education, focusing on their implementation across three key phases: before class, during class, and after class. The findings highlight how technology-enhanced formative assessments, such as online quizzes, embedded interactive assessments, and peer discussions, help prepare students before class. During class, real-time assessments, collaborative learning strategies, and immediate instructor feedback foster active engagement and deeper understanding. After class, reflective assessments, project-based learning with formative feedback, and continuous performance tracking support long-term learning and self-regulation. These findings suggest that structured formative assessment practices within a flipped learning environment enhance student engagement, motivation, and academic performance. Additionally, the study identified the types of formative assessments used and the digital tools that facilitate them. Platforms like Google Forms, Kahoot!, Socrative, Padlet, Mentimeter, and e-portfolios were widely used to support assessments at different learning stages. The integration of these tools allows for real-time feedback, personalized learning experiences, and continuous improvement.

Overall, the study emphasizes that well-designed formative assessments in flipped classrooms not only enhance student learning but also encourage active participation and self-directed learning, thus serve as a valuable approach in higher education. By synthesising assessment strategies, tools, and implementation practices across existing studies, this review contributes a structured conceptual understanding of how formative assessment functions within flipped classrooms in higher education, offering both theoretical insights and practical implications for educators and researchers.

Despite these contributions, this study has several limitations that should be acknowledged. The review was limited to selected academic databases, which may have resulted in the exclusion of relevant studies published elsewhere. In addition, the application of specific inclusion and exclusion criteria and the relatively small number of studies included may limit the generalisation of the findings. Future research may address these limitations by expanding database coverage, broadening selection criteria, and incorporating a larger body of empirical studies to further strengthen understanding of formative assessment practices in flipped classrooms.

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