

# Innovations in the Flipped Classroom Method and Interactive Digital Media to Address Post-Pandemic Learning Loss

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## Abstract

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The COVID-19 pandemic has caused widespread learning loss across the globe, highlighting the urgent need for innovation in teaching and learning strategies. Among the emerging solutions, the flipped classroom model and the use of interactive digital media have gained increasing attention as relevant and effective approaches to enhance student engagement and learning outcomes in the post-pandemic context. This literature-based study aims to examine the effectiveness of integrating these two approaches as a response to learning loss. The flipped classroom shifts content delivery outside the classroom while optimizing in-class time for interactive, collaborative activities. Meanwhile, interactive digital media such as videos, simulations, and gamified content offer engaging, multisensory learning experiences. Findings from the reviewed literature reveal that the integration of flipped classroom strategies and interactive digital technologies significantly mitigates the negative effects of learning loss by promoting learner autonomy, flexibility, and collaboration. These findings suggest that such pedagogical innovation has the potential to transform the post-pandemic educational landscape.

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## 1. Introduction

The COVID-19 pandemic has drastically and comprehensively shaken the global education system. In a very short time, educational institutions worldwide were forced to shift teaching and learning activities from traditional physical classrooms to technology-based digital platforms. This sudden transition posed various complex challenges, one of which is the phenomenon known as learning loss, a condition where students experience a significant decline in academic achievement due to several interrelated factors. These factors include unequal access to devices and internet connections, a drastic decrease in learning motivation due to isolation, and low active student engagement in prolonged online learning processes. According to research conducted by Backes et al. (2021), learning loss indeed occurred significantly during the pandemic and has shown long-term impacts that affect not only students' cognitive but also their non-cognitive skills.

This condition is very worrying and poses a serious challenge to the sustainability of the global education system. Therefore, to overcome this problem, innovation in learning methods is greatly needed and even becomes a necessity. New approaches need to be adopted to adapt to the evolving post-pandemic situation and conditions. One approach that has received widespread attention from education practitioners and researchers is the flipped classroom. This model fundamentally reverses the traditional teaching structure by placing material delivery activities outside the classroom. Typically, material is delivered through instructional videos or other digital media that students can access independently before class sessions.

Meanwhile, face-to-face time is used for in-depth discussions, concept application, and collaborative problem-solving. The flipped classroom can increase interactivity among students and facilitate more student-centered learning compared to traditional methods. This creates opportunities to build more active, reflective, and individually tailored learning. In addition to the flipped classroom method, the use of interactive digital media such as interactive instructional videos that present quizzes, gamification that makes learning more enjoyable, and technology-based simulations also enriches the learning experience of students. These digital media allow for a more engaging, varied, and adaptive presentation of lesson material to diverse student learning styles. In research by Munir et al. (2021), the use of interactive digital media proved to be very important in maintaining the continuity of the learning process and helping to reduce boredom and saturation experienced by students during online learning. In the context of post-pandemic education, the synergy between the flipped classroom and interactive digital media becomes highly relevant and strategic.

This combined approach is not only capable of overcoming various limitations that arose in online learning during the pandemic but also opens up great opportunities for creating more flexible, personalized, and collaborative learning experiences (Sing et al., 2021). Learning becomes unrestricted by space and time, and students have greater control over their own learning process. Bakar (2021) emphasizes that technology-based pedagogical innovations such as the flipped classroom and interactive media should be seen as part of a long-term transformation in education, not just a temporary solution or an immediate response

to a crisis. Based on these considerations, this study aims to explore and review various scientific literatures related to the application of the flipped classroom and interactive digital media in the context of learning loss post-pandemic. This study will examine relevant academic to provide a comprehensive overview of the effectiveness, implementation challenges, and potential uses of both approaches in current and future educational scenarios. The results of this study are expected to make an important contribution to the development of learning strategies capable of meeting the needs of students in the challenging and uncertain post-pandemic era.

## **2. Literature Review**

### **2.1. The Concept of Flipped Classroom and Its Advantages**

The flipped classroom is an innovative learning model that places initial exploration of learning material outside the classroom, usually done independently by students through various digital media such as instructional videos, online modules, or electronic reading materials. Meanwhile, face-to-face class time is shifted to active learning activities, such as group discussions, contextual problem-solving, student presentations, and collaborative work that allows direct interaction between students and teachers, as well as among students. This approach is oriented towards deeper and more student-centered learning. According to Subramaniam and Muniady (2019), the flipped classroom approach significantly increases students' active engagement in the learning process. This model also allows teachers to focus

their attention and guidance more on the specific difficulties faced by individual students, so that the interventions provided are more targeted and personalized.

In research conducted by Nerantzi (2020), students who participated in learning through the flipped classroom approach showed a significant improvement in academic results compared to students who learned using a conventional, one-way learning approach. In addition, the flipped classroom also fosters a sense of responsibility and self-directed learning in students, as they are required to prepare independently before face-to-face learning begins. The success of this method highly depends on the availability of high-quality digital content, as well as the teacher's ability to design engaging, meaningful, and student-needs-aligned classroom activities.

## **2.2. Interactive Digital Media and Increased Learning Motivation**

Interactive digital media refers to the use of various forms of technology in learning that allow students to interact directly with the presented content. Some examples of these media include interactive instructional videos, digital quizzes that provide immediate feedback, web-based simulations that resemble real situations, and educational games designed to arouse learning interest through game elements. Interactive digital media not only presents information in a one-way manner but also provides opportunities for students to actively participate, choose responses, and explore material at their own learning pace. Munir et al. (2021) notes that the use of interactive digital media significantly increases students' active participation in the learning process.

Furthermore, this approach also strengthens concept comprehension through multisensory learning experiences, i.e., through a combination of visual, audio, and kinesthetic elements, which helps accelerate and deepen the internalization of teaching material. In a study conducted by Koeswati (2021), the implementation of digital media in the context of post-pandemic learning proved to help overcome the limitations of social interaction that students experienced during online learning. Interactive instructional videos allow students to re-access material anytime and as much as needed, providing flexibility in understanding the lesson content. Meanwhile, gamification features in digital media strengthen students' intrinsic motivation by providing rewards, challenges, and a sense of achievement that encourages them to continue learning actively and consistently.

### **2.3. Synergy of Flipped Classroom and Digital Media to Overcome Learning Loss**

Combining the flipped classroom with interactive digital media creates a dynamic, flexible, and adaptive learning environment for diverse student needs. This approach offers a more participatory and contextual learning experience by combining the strengths of self-directed learning with the support of interactive digital technology. Business learning shows that the integration of these two approaches can effectively bridge the gaps due to learning loss that emerged during the pandemic. On the one hand, the flipped classroom strongly encourages students' self-learning responsibility, as they must understand the material before the face-to-face session. On the other hand, interactive digital media provides visual and audio

aids, and gamification elements that enrich concept understanding through a more enjoyable and engaging learning process (Rozman & Donath, 2019).

Backes et al. (2021) conclude that this combined strategy significantly reduces the impact of learning loss by creating an optimal balance between self-directed learning and active guidance from the teacher. This approach allows teachers to focus more on guiding students during class, as time is no longer spent on delivering basic material. Bakar (2021) adds that the integration between the flipped classroom and interactive digital media opens opportunities for creating more differentiated learning designs, capable of adjusting approaches and materials to individual student needs in the ever-changing post-pandemic education context that demands continuous adaptation from all parties.

### **3. Methods**

This research uses a literature review or library research method with a descriptive qualitative approach that aims to provide a comprehensive overview of the learning innovations of the flipped classroom and the utilization of interactive digital media in responding to learning loss in post-pandemic education. The main focus of this study is on scientific publications, specifically discussing the application of flipped classroom, the effectiveness of interactive digital media, and the phenomenon of learning loss in the context of formal education in the post-pandemic era. The analyzed literature was selected from credible and reputable sources, with priority given to indexed international journal articles relevant to the discussed topic. Secondary data was collected through the Google Scholar database,

using keywords such as “Flipped Classroom”, “Interactive Digital Media”, and “Learning Loss Post-pandemic” to ensure search results align with the study's scope. In the selection process, inclusion criteria were used to filter articles deemed suitable for further analysis. Articles considered must be officially indexed international journal publications, focus on formal education, and be relevant to learning issues in the post-pandemic era.

In addition, articles included in the analysis must present strong empirical data or in-depth theoretical studies, so as to contribute significantly to the understanding of the issue under study. Articles that were merely opinion-based, unscientific, or did not present substantial data were excluded from the analysis process. From the initial screening, 20 relevant articles were obtained, and then re-selected to 12 articles deemed most representative based on methodological quality and depth of findings. The analysis was conducted with a thematic content approach, where each article was reviewed to identify key themes related to the main research topic. The main themes analyzed included the benefits of applying the flipped classroom in the context of post-pandemic learning, the role of interactive digital media in reducing the impact of learning loss, and the effectiveness of integrating both in creating innovative and adaptive learning. To increase the internal validity of the research, theoretical triangulation and cross-literature comparison techniques were used. The results of the entire analysis process are compiled and presented in the results and discussion section to provide a comprehensive understanding of the potential implementation of the learning strategies studied to address the challenges of future education.



## **4. Results and Discussion**

The results of the in-depth literature review show that the flipped classroom approach combined with the use of interactive digital media can be an effective, relevant, and adaptive solution in responding to the impact of learning loss that emerged due to educational disruption during and after the pandemic. Based on the analysis of some selected international journal articles that met strict selection criteria, a number of key findings illustrate how these two approaches work synergistically to overcome the learning challenges faced by students in the post-pandemic era. First, the implementation of the flipped classroom model consistently shows positive and constructive results on students' active engagement in the learning process and on the improvement of their academic achievement. In research conducted by Nerantzi (2020), it was found that students experienced a significant improvement in their understanding of learning material, and also showed higher active participation during in-class learning activities, especially when they had been given access to learning material before the face-to-face meeting.

This allows class time to be utilized for more meaningful activities, such as strengthening the understanding of concepts that have been learned, and developing critical thinking skills through discussions, questions and answers, or collaborative problem-solving activities. The flipped classroom approach provides more space for teachers to guide and facilitate students' learning processes individually, according to the needs and challenges they face, making this an important aspect in efforts to recover from learning loss (Yildiz Durak, 2018). Second, the use of interactive digital media such as adaptive instructional videos that can adjust to student abilities,

interactive simulations resembling real situations, and game-based learning applications or gamification has proven to significantly increase student learning motivation and strengthen retention of taught material. Research by Munir et al. (2021) shows that students tend to understand and remember learning material more easily when it is delivered using visual and interactive approaches compared to delivery through static text which tends to be boring. This is very crucial, especially since many students experienced demotivation, fatigue, and boredom during prolonged online learning during the pandemic. Interactive digital media can create a more engaging, enjoyable, and relevant learning atmosphere for the current digital generation (Mustapha & Kashefian-Naeeni, 2017).

Furthermore, the synergy built between the flipped classroom and interactive digital media creates a learning ecosystem that is not only more inclusive and friendly to student diversity but also more adaptive to changes and future needs of education. Focusing on business learning show that the integration of these two approaches significantly facilitates stronger self-directed learning, increases student learning autonomy, and encourages more active, productive, and meaningful collaboration among students. In this combination, the flipped classroom acts as a methodological framework that directs teaching strategies, while interactive digital media acts as a visual and interactive aid that enriches content, enhances understanding, and encourages student engagement in the learning process.

In another study conducted by Backes et al. (2021), it was found that traditional learning models are no longer relevant and adequate to answer the challenges that arise in the context of post-pandemic education, especially due to

unequal access to technology and declining student motivation in participating in the learning process. They emphasize that digital transformation in education is a necessity, and this not only involves the utilization of technology as a tool but also demands a change in the pedagogical approach itself. In other words, the flipped classroom is not just “watching videos at home and discussing in class,” but a paradigm shift in learning that places students as active subjects in the learning process, no longer passive objects who merely receive information.

Several other studies also identified a number of key factors determining the success of implementing the flipped classroom model combined with interactive digital media. These include teacher readiness in designing engaging learning content, aligned with student characteristics and learning objectives; readiness of technology infrastructure such as stable internet access and adequate digital devices; and institutional support from schools or educational institutions. Subramaniam and Muniady (2019) state that the teacher's role is crucial in the successful implementation of this model, as the teacher is the main designer of meaningful interactions between students and learning material. Without appropriate and contextual instructional design, the flipped classroom risks losing its essence and becoming merely a passive substitute for conventional lectures packaged in digital format.

The importance of creating a “digital learning space” that is safe, supportive, and conducive to student growth. Students need learning platforms that allow them to interact actively, receive direct and personalized feedback from teachers or peers, and access learning material anytime according to their rhythm and learning style. In

this context, interactive digital media is an ideal tool because it provides high flexibility, accommodates individual differences in learning, and creates an exploratory and participatory learning experience. While the flipped classroom encourages student independence and responsibility for their learning process, interactive media creates an interesting context, stimulates curiosity, and helps internalize material more effectively (Zainuddin & Perera, 2019).

A study by Koeswati (2021) shows that students who learn using a combination of flipped classroom and social media like WhatsApp for group discussion activities experienced a significant increase in concept understanding, and also showed an improvement in the quality of collaboration in learning groups. Although not all students have equal levels of technology access, this approach provides a greater opportunity to reach previously lagging students, provided it is supported by inclusive and equitable policies and interventions. However, not all findings in this study are positive. Some studies noted serious challenges in implementing this combined learning model, especially for students who do not have stable internet access or are not yet accustomed to self-directed learning that demands high personal responsibility. Nerantzi (2020) highlight that the digital divide remains a major obstacle and can exacerbate learning loss if not addressed with systemic and planned strategies. Therefore, inclusive implementation strategies are highly needed, including comprehensive teacher training, provision of adequate digital access and devices for all students, and technical and emotional support for students facing difficulties.

From a pedagogical point of view, the flipped classroom also demands a shift in learning culture, both from teachers and students. Teachers are required to be able to design engaging and meaningful content, and to facilitate active and participatory learning processes. On the other hand, students are required to be more independent, disciplined, and responsible for their own learning process. Unpreparedness or resistance to these new roles can be an obstacle that disrupts the effectiveness of the learning strategy. Therefore, as suggested by Subramaniam and Muniady (2019), continuous training and guidance are needed for all stakeholders in the education system so that this paradigm shift can proceed optimally. The integration between the flipped classroom and interactive digital media also opens up great opportunities for implementing differentiated learning approaches more widely and effectively (Reyna et al., 2018).

By providing learning materials in digital format that can be accessed anytime and anywhere, students can learn at their own pace. This is very important for addressing learning loss, as students come to school post-pandemic with highly varied levels of learning readiness and concept understanding. This strategy allows for more personalized, adaptive, and responsive learning to individual student needs. Finally, based on a thematic analysis of all reviewed articles, the combined approach of the flipped classroom and interactive digital media provides three main contributions to post-pandemic education recovery. The first is an increase in student engagement in the learning process. Second, there is a strengthening of self-directed learning competencies as well as students' collaborative abilities. And third, the ability to adapt to new learning contexts that demand high flexibility, pedagogical

innovation, and the resilience of the education system to future disruptions. Thus, this approach is not just a temporary solution to overcome the impact of the crisis, but can be a foundation for redesigning future education to be more resilient, inclusive, and transformative.

## 5. Conclusion

The COVID-19 pandemic has pushed the world of education to a critical point, demanding major changes in learning methods. One of the most felt impacts is learning loss, especially due to a lack of interaction, engagement, and access to effective learning. This study shows that the flipped classroom approach and interactive digital media can be a relevant and effective solution in overcoming this impact. The flipped classroom offers a learning structure that allows students to be more active in managing their learning process, while interactive digital media provides visual and cognitive support capable of increasing concept understanding and learning motivation. The combination of the two creates a flexible, engaging, and adaptive learning environment for student needs.

However, the implementation of this strategy is not without challenges, such as technological readiness, digital literacy, and institutional support. Therefore, the success of this innovation highly depends on the readiness of all parties in the education system to adapt and innovate. The flipped classroom and interactive digital media are not only short-term solutions to address learning loss but also serve as a foundation for redesigning a more resilient and transformative education system. Going forward, this approach needs to be systematically integrated into education

policies and practices to be able to shape a generation of adaptive, independent, and collaborative learners.

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