Implementing Flipped Classroom in the Digital Learning Environment

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Abstract
At the beginning of the COVID-19 pandemic in spring 2020, all schools faced unpredictable challenges, and alternative solutions were needed to optimize the functioning of the educational process. One of these was the implementation of the "flipped classroom" in teaching practice. This idea gave rise to the concept of the online flipped classroom, which allows students to continue their educational work in a high-quality, engaging, and attractive way, even outside the physical classroom. Furthermore, the online flipped classroom has proven to be as effective as the traditional one, mainly because it promotes students' self-directed learning, activity, motivation, collaboration, and successful interactions due to its flexible structure. The study provides a theoretical insight into the application of this teaching method in the period of distance learning and analyzes its advantages and challenges. The most common challenges were found to be difficult access to the Internet and thus to learning materials, the lack of digital skills of teachers, the time and effort required to create videos, the design of a creative learning environment, and the facilitation of different types of activities and teaching materials, which contribute significantly to students' motivation to learn under exceptional circumstances. Students' free access to computer equipment and internet connections from home played a key role. Therefore, the flipped classroom approach requires government investment in building/upgrading appropriate information and communication infrastructure, additional teacher commitment, and investment in teachers' professional development.
Keywords: challenges, online teaching, online flipped classroom, teacher.

Применение технологии перевернутого класса в цифровой образовательной среде

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Аннотация
С начала пандемии коронавируса, объявленной весной 2020 года, все школы столкнулись с непредвиденными сложностями. Для оптимизации учебного процесса необходимы были альтернативные решения. Одним из таких решений стало внедрение в педагогическую практику технологии перевернутого класса. Это привело к созданию понятия «перевернутый онлайн-класс», которое позволило осуществлять образовательный процесс в качественной и увлекательной форме вне классной аудитории. Перевернутый онлайн-класс доказал свою эффективность, главным образом, потому, что эта форма работы способствует самостоятельности обучения, активной деятельности, положительной мотивации, развивает сотрудничество и успешное взаимодействие студентов благодаря гибкой структуре технологии. Проведенное исследование дает представление о применении данного метода в период дистанционного обучения, анализирует преимущества и трудности, возникающие при реализации перевернутого онлайн-класса. Выявлены наиболее распространенные проблемы: ограниченный доступ к Интернету и учебным материалам, недостаточно развитые цифровые навыки преподавателей, слишком много времени и усилий, затрачиваемых на создание видео и учебных материалов, создание творческой обучающей среды, которая призвана обеспечить различные виды деятельности и которая в значительной степени способствуют повышению мотивации студентов к обучению в непривычных обстоятельствах. Свободный доступ к компьютерной технике и стабильное Интернет-соединение играют важную роль в обучении студентов. Для успешной реализации технологии перевернутого класса требуется финансовая поддержка государства в целях создания и модернизации соответствующей информационно-коммуникационной инфраструктуры, заинтересованность преподавателей, а также инвестиции в профессиональное развитие педагогов.
Ключевые слова: проблемы, онлайн-обучение, перевернутый онлайн-класс, педагог.

Introduction

The outbreak and the spread of the COVID-19 pandemic have significantly changed education systems worldwide. Such a global crisis has required students and teachers to take active responsibility and be flexible in employing educational methods adaptable to specific and changing circumstances. A technology-based approach to active learning has become a viable option in an emergency. With the pandemic outbreak, the concept of distance learning arose, but majority of teachers did not have sufficient knowledge of computer technologies. Issues such as how to organize distance learning, how to implement it according to the established plan, which platform to use for teaching, and how to monitor the impact and quality of teaching may be the causes of lower satisfaction among teachers faced with the sudden introduction of distance learning (Yadav et al., 2021). Under these circumstances, an idea such as the flipped classroom method seemed

to be a suitable solution since it has recently attracted growing attention in educational circles, particularly in higher education and increasingly in secondary and primary education.

The concept of the flipped classroom is more or less well-known. In most cases, students listen to the teacher's lectures and instructions in the classroom and get assignments in school to complete at home. It is followed by studying the course content by reading literature. The teaching material is initially provided as a video, which students must watch comprehensively and write down what they did not understand in the video. However, the material can also be made available to students in written form (asynchronous learning). By absorbing the material through the video, in the next class students actively deepen their knowledge of problem situations through analysis and discussion (Marina & Ridlo, 2021; Nouri, 2016). However, moving teaching to the virtual world also creates other solutions adapted to the new circumstances. Hung (2022) advocates an online flipped classroom during a pandemic. Unlike the traditional flipped classroom, where students must prepare their assignments by watching videos or reading materials before participating in class activities, teachers and students meet virtually rather than physically, which lends itself to maintaining physical distancing protocols. This new pedagogical approach has the potential to promote active and collaborative learning. However, the flipped classroom is only effective if students are actively involved in the assigned tasks through activities before, during, and after the class. The teaching material should be selected or created according to a learning environment that requires a certain degree of autonomy. Above all, teachers should be aware of their changing role: from delivering teaching content in the traditional classroom to leading/coordinating the teaching process in the flipped classroom.

Methodology

This article provides an overview of the literature on the application of the flipped classroom teaching method in the online learning environment. The aim was to examine the significance and applicability of the innovative pedagogical approach, the flipped classroom, under the changed conditions of the educational process. In addition, we analyzed its possibilities, advantages, and challenges in the digital learning environment. The paper provides an overview of online flipped classroom, students' attitudes, changes and challenges in teaching. We analyzed the research on flipped classroom that has been conducted in the last seven years, specifically concentrating on the following three questions:

1. What are the main characteristics of the flipped classroom?
2. How does flipped classroom effect on students?
3. What are challenges of flipped classroom?

We searched the following scientific databases: EBSCOhost, ERIC, Google Scholar, J-Store, SAGE, and ScienceDirect. In the first phase, initial keywords were identified from the researchers' knowledge of the field. These included: *the teacher*, *the online flipped classroom*, *challenges and changes in the teaching process during online teaching*. The free application Zotero (https://www.zotero.org/) was used to store the selected list of references. The free web application Rayyan (Ouzzani et al., 2016) was used to select the articles to be used in this review. In the next stage, both authors independently chose the relevant list of references. Eligibility of review was assessed using the following inclusion criteria for the studies included in their samples: a) publication year from 2016 to 2023; b) research methodologies: quantitative, qualitative, mixed-method, a systematic literature review articles and review articles; c) school-based studies; d) studies in English language. There were 27 articles selected for more in-depth analysis. We organized the

flipped classroom literature into three dimensions relevant to the aim of the study: online flipped classroom, students' attitudes, changes and challenges in teaching (Table 1).

Table 1. *Teaching dimensions affected by flipped classroom*

Dimensions of educational practice	*References*
Online flipped classroom	Heiss and Oxley (2021) Lo and Hew (2022) Rindaningsih et al. (2021) Santhanasamy and Yunus (2022) Veldthuis et al. (2020)
Students' attitudes	Campillo-Ferrer and Miralles-Martínez (2021) Cevikbas and Kaiser (2023) Hew et al. (2020) Jia et al. (2021) Kien and Hong (2022) Latorre-Cosculluela et al. (2021) Ma (2020) Marina and Ridlo (2021) Mursyidah et al. (2021) Ocktalia et al. (2023) Sakti and Sukardi (2021) Shim and Inti (2022) Tang et al. (2020) Tian (2023) Umar and Ko (2022) Yurniwati and Utomo (2020)
Changes and challenges in teaching	Aidoo et al. (2022) Akçayır and Akçayır (2018) Linling and Abdullah (2023) Khan and Abdou (2021) Md Desa and Abd Halim (2022) Yadav et al. (2021)

Results and Discussion

In this section, we critically discuss in detail the flipped classroom literature based on dimensions that have been identified, namely online flipped classroom, students' attitudes and changes and challenges in teaching. The review provides a concise summary of the flipped classroom content, which includes a relevant description of the flipped classroom as well as its overall perspective, argument, or purpose.

Online flipped classroom

By abandoning the framework of the physical classroom, teachers can choose technologies that allow easy interaction and engage students in learning activities. Most commonly, they use digital media such as Microsoft Teams, Google Meet, Zoom, WhatsApp, and Facebook. Such virtual spaces enable posting video lessons, adding interactive content such as digital quizzes, giving and collecting feedback (Reflianto et al., 2021).

Based on the research conducted, Santhanasamy and Yunus (2022) state that the online flipped classroom teaching approach has proven to be a flexible teaching and learning method that teachers should use to improve student motivation and engagement in learning. Similarly, Linling and Abdullah (2023) find that the flipped classroom can improve student engagement, autonomy, and responsibility for learning,

which in the 21ˢᵗ century is a crucial component for developing students' technological competencies and long-term ambitions and can help students develop responsibility for lifelong learning. Furthermore, Zainuddin and Halili (2016) demonstrate that the flipped classroom positively affects student achievement, motivation, engagement, and interaction. It is because students can learn at their own pace, which helps them feel confident during interactive learning activities in class. Although video and digital platforms are crucial tools in flipped classroom practice, the teacher must not ignore other important factors influencing student learning. In other words, they can develop different teaching strategies by adapting to students' learning styles without neglecting the teaching content and curriculum. For example, students can learn through hands-on and project-based learning activities. It leads to active and effective learning and a higher cognitive level of thinking. In this way, implementing a flipped classroom changes the approach to student learning from a teacher-centered approach to a student-centered approach.

The teacher commences flipped learning by summarizing the learning topic and briefly introducing the design of the activity, providing examples, and describing the model of the activity carried out by the students. In such a learning model, the teacher plays a significant role in teaching. Due to the need to use modern technology, the teacher's lack of mastery of technology affects the design of synchronous and asynchronous learning. Therefore, the primary solution is government support to improve the internet network. The challenge and, at the same time, the need for teachers in the flipped learning model is to create a learning environment with learning resources through virtual platforms (Rindaningsih et al., 2021). In this way, teachers can reach students more effectively through group discussions, video meetings, and sharing of materials (Sakti & Sukardi, 2021). However, the use of technology for distance learning should not be pretentious. Therefore, teachers should resort to platforms commonly used in everyday life and optimize them to become familiar and close to students (Anugrah et al., 2020).

According to the recommendations for implementing the flipped classroom in teaching practice (Hartyányi et al., 2018), it is desirable to provide students with various teaching material, give them feedback, conduct frequent group tasks, encourage discussions, debates, and similar forms of collaboration, and allow independent activities as well as time to ask questions, clarify, or check students' understanding. A study by Veldthuis, Alers, Malinowska, and Peng (2020) suggests that the flipped classroom method can initiate and provide effective teaching models in crises. Preparing and enabling high-quality materials for video lessons and planning collaborative tasks, discussions, and other activities for students can successfully meet the criteria of this model.

Heiss and Oxley (2021) provide several guidelines for successful online flipped classrooms. They believe that when creating videos, teachers should use familiar technologies and tools that can be easily integrated into the educational system. Videos should preferably be kept short, ideally 10–13 minutes long. Anything beyond that could be long and boring for students. It is necessary to encourage and develop collaboration with other colleagues. It is important to adapt the existing teaching material to the students and to design tasks or develop teaching strategies that increase their motivation. Furthermore, it is essential to explain this mode of teaching at the beginning and to make the results clear to the students. In addition, it is crucial that students independently look for and find the learning materials and thus solutions to the challenges or problems they encounter while learning. In this way, they can see and understand that their own responsibility is important for independent learning and the application of what they have learned in practice. After independent learning at home, lessons should be designed so that students apply higher-level cognitive processes (application, analysis, evaluation and

creation). Students need to learn not only to assess their own knowledge and skills, but also to plan their learning strategies, monitor their progress and modify these strategies if necessary to become as independent as possible.

In addition, Lo and Hew (2022) set out the following nine principles for the effective practice of online flipped learning: make the transition to online flipped learning with teacher support, allow students enough time to complete activities before and during class, use a learning management system and discussion platforms that facilitate learning, use instructional videos to support student learning, use interactive online tools to facilitate synchronous learning activities, provide in-class time for teacher lectures and explanations, give students assignments with real-world problems that require them to apply their knowledge and skills, organize small group activities that encourage peer interaction, and allow for formative assessment with teacher feedback. Such activities promote social interaction and can encourage the development of critical thinking skills and self-efficacy in students. Collaboration, communication, numeracy, and creativity as 21st century skills can be developed at different levels through a flipped classroom.

Students' attitudes towards the flipped classroom

Hashim and Shaari (2020) point out that flipped classroom pedagogy is suitable for 21st-century learning and Generation Z due to the immediate learning responses and feedback. The flipped classroom learning design is overwhelmingly viewed positively by students as they discover its benefits and effectiveness in developing skills that will benefit them in their personal and professional development (Kien & Hong, 2022; Latorre-Cosculluela et al., 2021). These skills include character-building, collaboration, communication, critical thinking, and creativity. Accordingly, Yurniwati and Utomo (2020) consider the flipped classroom grounded on problem-based learning suitable because it improves students' thinking at a higher cognitive level and enables them to improve independent learning and collaboration. In addition, online learning in the flipped classroom has been shown to effectively improve students' cognitive, affective, and psychomotor abilities (Sakti & Sukardi, 2021). The flipped classroom provides students with more opportunities for independent research. As they complete tasks at their own pace, they can combine existing and new knowledge more effectively (Tian, 2023). In addition, it is important to introduce students to techniques that match their learning patterns and allow them greater learning control. In this way, a deeper understanding of the content is facilitated, the internalization of knowledge is promoted, and the achievements of learning goals, as well as the use of strategies that correspond to their learning styles are improved. In this approach, however, learning is seen as a shared activity between all participants, both the teacher and all students in the class. To achieve this, it is necessary that the activities include agreement, implementation, and assessment.

Most students seem to view the flipped classroom positively, seeing the benefits of hands-on activities as well as greater autonomy in learning. More frequent interactions (especially with peers) and new ways of applying knowledge and delivering content contribute to this (Campillo-Ferrer & Miralles-Martínez, 2021). In addition, students with higher levels of e-literacy find classroom activities intrinsically motivating compared to their peers. Students express satisfaction about building knowledge and correcting mistakes through interactive teaching because such activities allow them to engage in self-directed learning. Constructive feedback to improve work also contributes to satisfaction and leads to students' positive attitudes towards learning (Rehman & Fatima, 2021). Research findings (Mursyidah et al., 2021) show that using this method can increase students' learning outcomes by 70% and motivation to learn by 34%.

When analyzing the effectiveness of flipped classrooms in online teaching, Marina and Ridlo (2021) found that students' understanding of concepts and their self-efficacy improved after applying the flipped classroom method. Students' self-efficacy increases due to the encouragement in the classroom and their emotional state. Due to the increase the students discuss in groups to better master the teaching content by sharing their opinions. The flipped classroom increases their desire to succeed because they realize that other groups have understood the material, while also encouraging students to ask questions. A study by Ocktalia, Sujinah, and Omar (2023) points to the success of learning with a flipped classroom supported by information and communication technology (ICT), in which they point to the enthusiastic attitude of students in asking questions and expressing opinions, as well as the diverse interaction of teachers with students. Kien and Hong (2022) also found that students enjoy asking questions in class and collaborating with their classmates. They believe the flipped classroom helps students to master the teaching content more effectively than traditional teaching methods. They also greatly appreciate the availability of materials, the organization of lessons in Google Classroom, and the teacher's instructions on how to work in the flipped classroom.

Although other research suggests that flipped learning positively affects students' learning efficiency (Ma, 2020; Umar & Ko, 2022), Tang et al. (2020) find that the effectiveness of online teaching is not satisfactory for students. However, the combination of online teaching with the flipped classroom has a positive impact on learning, student engagement, and assessment. Cevikbas and Kaiser (2022) claim that this pedagogical approach enables the effective use of technology and combines the benefits of live and online teaching to guide students toward active learning. One year later, based on a systematic literature review, the authors concluded that the online flipped classroom approach can facilitate teaching due to its flexible structure. In particular, the use of instructional videos, the creation of dynamics and interactions in the learning environment, and collaborative group work are significant elements of flipped classroom implementation that can positively impact students' learning success. However, the results show that the positive impact of the flipped classroom method on students' academic success largely depends on their self-discipline and responsibility in learning, i.e., their preparation (watching videos, using reading materials, taking notes), otherwise, they cannot actively participate in discussions and group work (Cevikbas & Kaiser, 2023).

Although the online flipped classroom was introduced as an immediate solution during the pandemic, it proved to be just as effective as the traditional one, mainly because students were equally successful in both approaches and their attention was maintained equally (Hew et al., 2020; Jia et al., 2021). But unlike the usual flipped classroom approach, students do not meet face-to-face, but rather online. Although Shim and Inti (2022) find that most students find the online flipped classroom method appropriate, they still prefer the traditional classroom. It is probably due to the lethargy caused by constant online learning during the COVID-19 pandemic and school closures.

Changes and challenges in teaching

Lo and Hew (2017), who studied flipped classrooms before the pandemic, conclude that this approach promotes active learning in which students solve problems by applying previously acquired knowledge. On the other hand, they point out challenges such as insufficient knowledge of this teaching method, workload, time required for preparing, problems with technology, inadequate student preparation, and monitoring of students' learning activities outside the classroom. During the COVID-19 pandemic, this model is still relevant and functional in distance learning. However, it faces particular difficulties in implementation. Insufficient network connectivity during distance learning proved to

be one of the biggest challenges for 60% of teachers, as it affects the quality of teaching. It is followed by technological issues (53%) (Yadav et al., 2021).

When it comes to difficulties in implementing the online flipped classroom, teachers cite a lack of internet capacity, poor network connections that hinder access to learning materials, and insufficient mastery of digital competencies and skills. The flipped classroom method requires adequate ICT infrastructure, engagement, and teacher training to be able to design and implement this approach. The latter largely depends on their ICT literacy and competencies to improve students' activity by providing feedback and responding to their needs (Aidoo et al., 2022). Cevikbas and Kaiser (2023) also note similar shortcomings and point to the need to use technological devices and software to create teaching materials such as educational videos. There are also problems related to workload, time, and difficulties with individual learning before teaching. The results of a systematic literature review (Linling & Abdullah, 2023) also confirm the advantages and challenges of the flipped classroom. Mostly, the advantages are greater student engagement, better peer interaction, and greater student autonomy. The biggest challenges seem to be technological and internet-related issues and the additional workload for teachers and students. Other challenges include students' lack of interest in the given content or difficulties in understanding it, as well as students' lack of self-discipline, parental resistance, and the lack of time needed to study the online learning materials. Students often do not realize that they do not understand a concept until they actually start analyzing and solving problems. Parents can help some students if they are struggling with learning challenges at home, but most parents do not have sufficient knowledge in a particular area to help them. Since the teacher's role in this model is more of a facilitator and mediator, teachers should allow more time for controlling the students.

One of the main limitations of this approach is that students sometimes deliberately do not prepare for class, i.e., they attend class without completing the previously assigned task. In addition, some students cannot understand certain teaching content before class, which makes it difficult for them to be active and complete tasks during the class. The time dimension proved to be another major limitation of this method, requiring additional time for preparation, recording videos (Khan & Abdou, 2021). Teachers will spend more time designing quality learning materials to engage students in learning outside the classroom. Heiss and Oxley (2021) also believe that the biggest challenge in implementing the online flipped classroom method is the time required to prepare the videos. It can be reduced if several teachers share the recording tasks (by topic). Collaboration and teamwork are crucial prerequisites of this endeavor. It is therefore necessary to study and prepare this learning model carefully before carrying out learning.

In addition to the lengthy preparation of teaching materials, the teachers' lack of digital skills to create videos, the students' lack of motivation to watch videos before class, and the students' difficulties in understanding the teaching content shown in the video are often highlighted (Md Desa & Abd Halim, 2022). However, Akçayır and Akçayır (2018) suggest solutions for the effective implementation of flipped classrooms. First and foremost, teachers should pay more attention to the quality of instructional videos (e.g., brief and interesting) when designing flipped classroom activities. It would be desirable for teachers to use more interaction/communication tools so that students can receive feedback when completing tasks/homework outside of class. As technological competence seems to be a challenge, it is necessary to question the availability of technology and the competence of students before implementing the model. Although video is an important tool in the flipped classroom, teachers should not neglect other important activities and should use integrated approaches to make flipped learning as accessible as possible.

It is also important to focus on how teachers communicate with students in and out of classroom.

Despite the challenges and shortcomings mentioned above, the flipped classroom offers various opportunities and benefits that contribute to the quality of teaching. It is considered an essential pedagogical model due to its numerous advantages ranging from popularity among students to supporting teachers through active learning (Khan & Abdou, 2021). The benefits of the flipped classroom include improving students' motivation during the learning process, promoting active learning, changing perceptions of learning, improving engagement in learning, improving knowledge, improving students' positive attitudes, promoting active and collaborative learning, improving teacher-student and peer interaction, enhancing creativity, and improving student performance (Akçayır & Akçayır, 2018; Md Desa & Abd Halim, 2022).

Based on the above and the importance of this teaching method for classroom and especially online teaching, it is instrumental to make suggestions for its further use. It is necessary to prepare recorded videos of lectures and quizzes for students' self-assessment in advance. Providing different types of activities and teaching materials creates a stimulating learning environment that contributes to students' motivation to learn. Teachers should be aware of the learning purpose and characteristics of the flipped classroom method, as well as their information literacy. Teacher collaboration is essential in implementing a flipped classroom, especially in finding or creating suitable video lessons (Kien & Hong, 2022). However, an indispensable factor for the further use of the online flipped classroom is the support of the state in providing an Internet network for all students and improving it where it already exists.

Conclusion

The online flipped classroom method is becoming a reliable option for the learning and teaching process. It is just as effective as the standard method. This pedagogical approach can potentially enhance active and collaborative learning among students and their teamwork, motivate them during the learning process, and improve teacher-student and peer interaction. The success of distance learning is even higher when combined with other teaching methods. However, its adaptability to the context and specific circumstances in which it is applied is only possible if students and teachers take an active role and the responsibility that comes with it. The teacher's main task is to carefully plan the lesson and create new content or adapt existing content to prepare students for the lesson.

The online flipped classroom method is a relatively new pedagogical approach that offers students a richer educational experience. In addition, its application changes the culture of student learning from a teacher-centered to a student-centered approach with more teaching activities for students. Although it offers many of the above advantages for teaching and learning, it still faces challenges. Problems with the Internet availability and quality, insufficient mastery of digital competencies and skills, additional workload for teachers and students, monitoring of students' learning activities, and the (in)ability of platforms to stream videos are some of the obstacles. Making videos in particular is a time- and labor-consuming intensive activity. However, this time can be reduced by dividing the workload among teachers. The challenge for teachers in the online flipped classroom method is to create a learning environment with learning resources via virtual platforms. As each learning platform offers different learning tools, features, and possibilities, teachers can use different platforms or combine them to facilitate their students' learning. The flipped classroom approach requires an appropriate ICT infrastructure, teachers' perseverance and commitment, and monitoring educational

trends concerning this approach as part of their professional development. Students must have open access to computer equipment and the Internet connection from home. Therefore, we hope this study will encourage researchers and educational policymakers to broaden their contemporary perspectives and theoretical considerations for further development of the flipped classroom approach. Ultimately, our findings may stimulate future research in the field of flipped classrooms.

Acknowledgements

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