Harnessing the power of cutting-edge technologies in flipped learning: A paradigm shift in university education after post-COVID-19 era

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Abstract

Flipped learning is an instructional approach that reverses the traditional classroom model, delivering instructional content outside of class and utilizing in-class time for interactive activities and discussions. In our university, the implementation of flipped learning has gained momentum, particularly due to the shift towards remote and online education during the COVID-19 pandemic. However, the level of experience and familiarity with flipped learning varies among students and teachers. This study investigates enhancements and methods to transform university education and enhance learning experiences in the post-COVID-19 era through flipped learning. Questionnaires are utilized to collect exemplary flipped learning experiences from students, while interviews are conducted with teachers nominated by their students for effective flipped teaching approaches. These findings contribute to the development of best practices and professional development opportunities for educators. Embracing these enhancements enables universities to create a transformative educational environment for fulfilling learning experiences.

Keywords: *Flipped learning; Post-COVID-19 era; AI-driven video production and automated narration; Online collaboration learning platforms; Flexibility in learning.*

1. Introduction

Flipped learning is an instructional approach in which the traditional model of classroom instruction is reversed (Al-Samarraie et al., 2020). In this approach, students are first exposed to instructional content, such as pre-recorded videos or online modules, outside of the traditional classroom setting. They engage with these materials independently and at their own pace, typically before attending in-person or synchronous virtual class sessions. By accessing the

instructional content beforehand, students can acquire foundational knowledge and grasp key concepts independently. This pre-learning phase allows them to come to class prepared, ready to engage in higher-level activities and discussions facilitated by the teacher. During the in-person or synchronous sessions, the focus shifts from content delivery to active learning, collaborative problem-solving, and application of knowledge.

Flipped learning has proven to be a valuable approach as it has enabled educational institutions to adapt to remote and hybrid learning environments (Bredow et al., 2021; Låg & Sæle, 2019). In response to the challenges posed by the COVID-19 pandemic, teachers and educators worldwide have developed a wealth of instructional videos and online resources to support flipped learning (Divjak et al., 2022; Linling & Abdullah, 2023). During the pandemic, educators quickly shifted their focus to creating engaging and informative videos and online assignments that could be accessed by students outside of the traditional classroom setting (Deng et al., 2023).

In general, these videos served as primary instructional materials, covering a wide range of topics and subjects. Teachers embraced various video creation tools and platforms, including screen recording software, online video platforms, and video editing software to deliver content. The use of such tools allowed teachers to maintain a connection with their students, ensuring that learning continued even in remote settings. Students could access the learning materials at their own pace and review the content as needed. Furthermore, the abundance of instructional videos and online teaching materials created during the pandemic has resulted in a vast repository of valuable resources that can be utilized even in the post-COVID-19 era (Ibrahem et al., 2023). These resources can be repurposed and integrated into future flipped learning experiences. Educators can organize and curate videos based on subject matter, difficulty level, or learning objectives, making it easier for students to access relevant content.

To make the most of these valuable resources in the post-COVID-19 landscape, educators can leverage technology tools to categorize and tag the videos, making them easily searchable. They can also create playlists or modules that align with specific units or topics, providing a structured learning experience for students. Additionally, educators can encourage students to contribute to the resource pool by creating their own instructional videos or sharing external resources that they found helpful.

In this study, we aimed to gather insights into the experiences of both our students and teachers with flipped learning and teaching. To achieve this, we conducted university-wide surveys with teachers to explore how they made use of technology in their teaching practices. In addition to the surveys, we conducted interviews with teachers to gain deeper insights into their use of technology in flipped learning. These interviews allowed us to explore how teachers integrated technology tools, including GenAI, into their instructional strategies. In this paper, we discussed

their experiences with curating and delivering instructional materials, adapting resources for different learning environments.

2. Methods

The study involved a retrospective analysis of questionnaires that were distributed to all students and teachers in our university through mass email invitations in November of last year. The purpose of the survey was to explore which courses were implementing effective flipped learning approaches with the assistance of advanced technologies to support the learning and teaching processes. We received a total of 649 responses from students, including 90 postgraduates and 559 undergraduates. Additionally, 89 teachers also participated in the survey. The survey was conducted using the Qualtrics platform. The response rate for students was approximately 2.4%, while the response rate for teachers was approximately 4.5%. Interviews were also conducted with teachers nominated by their students for effective flipped teaching approaches.

3. Results and Discussion

The majority of teachers (approximately 57.3%) reported not using flipped approaches in their teaching. However, interestingly, 59.6% of students indicated that they have experienced flipped approaches. According to the results, it is evident that a significant portion of teachers (48.6%) use flipped teaching approaches for 0-25% of their courses, while only a small percentage (22.8%) employ flipped approaches for over 50% of their teaching content.

The table below displays the responses from students who have had flipped learning experience. Overall, students' opinions regarding their experience with flipped learning were very positive, with a strong agreement and agreement percentage of nearly 60% for most of the questions (Table 1). Notably, postgraduate students had even higher levels of satisfaction than undergraduate students (Table 2).

Unveiling the Positive Aspects: Students Embrace the Flipped Classroom

In addition to the rating questions, the student survey also featured several open-ended questions aimed at gathering insights into the strengths and weaknesses of the flipped learning approaches. Upon careful analysis of the feedback received, it is evident that students have expressed several positive aspects of the flipped classroom approach. They greatly appreciated the flexibility it offers for self-paced learning, allowing them to study at their own convenience and have access to course materials anytime and anywhere. As reported previously, this flexibility enhances comprehension and reinforces concepts, leading to a deeper understanding.

Table 1. Student responses on flipped classroom approach - undergraduate (UG) students

UG (n = 224)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Flipped classroom approach can improve my learning experience.	19%	58%	17%	3%	3%
Flipped classroom approach can improve my learning outcomes (e.g. achieve better grade).	16%	48%	29%	4%	3%
Flipped classroom approach can make me more engaged in learning.	22%	48%	23%	4%	4%
Flipped classroom approach can promote active learning/make me actively engage in learning.	19%	59%	17%	3%	3%
I personally like the flipped classroom approach better than a traditional classroom setup.	17%	47%	23%	10%	4%
General speaking, I think flipped classroom approach is effective for my learning.	16%	56%	21%	5%	3%

Table 2. Student responses on flipped classroom approach - postgraduate (PG) students

PG (n = 90)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Flipped classroom approach can improve my learning experience.	30%	44%	21%	2%	2%
Flipped classroom approach can improve my learning outcomes (e.g. achieve better grade).	22%	47%	21%	6%	3%
Flipped classroom approach can make me more engaged in learning.	32%	36%	24%	4%	2%
Flipped classroom approach can promote active learning/make me actively engage in learning.	27%	51%	14%	6%	2%
I personally like the flipped classroom approach better than a traditional classroom setup.	19%	40%	27%	10%	4%
General speaking, I think flipped classroom approach is effective for my learning.	23%	49%	21%	4%	2%

Moreover, students found value in the active and interactive learning facilitated by the pre-class materials, such as lectures, readings, and videos. These resources enabled them to familiarize themselves with the content prior to class, contributing to more meaningful and engaging in-class discussions. The flipped classroom approach encourages active participation, peer interaction, and collaboration on class activities, creating a dynamic and stimulating learning environment.

Students also expressed that the flipped classroom approach enhances their overall learning experience by reducing cognitive load, increasing involvement, accuracy, and motivation. They appreciated the opportunity to delve deeper into topics and gain a comprehensive understanding of the subject matter, leading to a more fulfilling educational journey.

Students' Concerns: Addressing the Flaws

Previous studies suggested that flipped learning is not fit for everyone (Gannon, 2016) , it is important to acknowledge the concerns raised by some students regarding low-quality materials and technical issues. They expressed dissatisfaction with poorly shot videos and lengthy, challenging-to-engage materials. Additionally, they encounter slow loading times and face specific device and environment requirements, hindering their learning experience. Unstable connections and difficulties in accessing and downloading materials further compound their frustrations.

Furthermore, students highlighted the lack of guidance and inconsistent teaching as areas of concern. The use of different platforms to present material led to variations in the quality of instruction, leaving students feeling uncertain and confused. The lack of clarity in materials added to their struggle, as they found it difficult to understand and question if they were studying correctly. Inconsistent teaching arrangements, where there are discrepancies between provided materials and class content, only exacerbate their confusion. Students also found that some contents were irrelevant or repeated, impeding their progress. In addition, students expressed a desire for more timely feedback and detailed explanations from their instructors, as well as increased opportunities for peer discussion and teacher-student interaction. They seek guidance and support to deepen their understanding and enhance their learning experience.

Lastly, students reported challenges with time management and distractions. The flipped classroom approach requires students to develop better time management skills and allocate more time for preparation. However, they felt a lack of sufficient guidance from teachers and peers, making it challenging to navigate the course effectively. Moreover, they find themselves easily distracted by other information or applications on their devices, compromising their ability to concentrate and fully engage with the class.

Strategies for Addressing Student Concerns: A Teacher's Perspective

To ensure the effective implementation of flipped learning approaches, we conducted interviews with experienced teachers who were highly regarded by their students for providing exceptional learning experiences. After summarizing the interview data, we have identified the following strategies to address the concerns raised by students:

To enhance the quality of materials, teachers can capitalize on AI tools to streamline video production (Sanchez-Gonzalez & Terrell, 2023). By utilizing automated narration, teachers can

save time and eliminate the need to personally read out content, and adding transcripts to videos improves accessibility and comprehension for students. Expanding the range of materials is also beneficial. Teachers can incorporate shared resources, such as YouTube videos, TED Talks, or reputable online sources, that align with the learning objectives. As an alternative to videos, teachers can also consider using conventional reading materials, like concise descriptions of case studies, to provide flexibility (Talbert, 2017).

Clear guidance and timely feedback are crucial for students navigating the flipped classroom approach. Teachers should communicate instructions and guidelines that outline the objectives and expectations of each class, providing students with a roadmap to follow. Additionally, offering prompt feedback on assignments and assessments, complete with detailed explanations and guidance, helps address any misconceptions or questions. Teachers should also make themselves available for one-on-one consultations or virtual office hours to provide further support and clarification.

Teaching time management skills is instrumental in helping students succeed in the flipped classroom model. Teachers can impart effective techniques and strategies, such as task prioritization and the creation of study schedules. By developing strong time management skills, students can effectively engage with the flipped classroom approach (Talbert, 2019). It's important to note that flipping the entire course may not be suitable in all cases, so both students and teachers should adapt the pace accordingly.

Promoting peer interaction and collaboration is essential within the flipped classroom environment. Teachers can create opportunities for peer discussion and collaboration through online forums, group activities, or virtual breakout sessions. By fostering a collaborative learning environment, students can actively engage with their peers, exchange insights, and learn from one another. Additionally, the use of AI-based chatbots can enhance the learning experience by providing personalized support and guidance to students, answering their questions, and facilitating discussions (Lo & Hew, 2023) . Incorporating AI-based chatbots into the flipped learning approach can further enhance student engagement and promote a deeper understanding of the course material.

This study has several limitations. Firstly, the findings are limited to our university and may not be generalizable to other institutions or educational settings. Additionally, the study faced a low response rate, which raises concerns about potential response bias and limits the representativeness of the findings. Furthermore, the analysis did not include a breakdown of sociodemographic characteristics, such as age, gender, or academic discipline. This lack of information hinders our understanding of potential variations and the impact of these characteristics on the effectiveness of flipped learning approaches. Future research with larger and more diverse samples, as well as follow-up studies involving teachers and students who have actively used the flipped approach to validate their experiences, is needed to address these

limitations, and provide a more robust understanding of flipped learning in different educational contexts.

4. Conclusion

Flipped learning has emerged as a valuable approach for educational institutions during the COVID-19 pandemic. Teachers have created instructional videos and online resources to support remote and hybrid learning. These videos have allowed for continued learning at students' own pace and have complemented in-class activities. The abundance of instructional videos and online teaching materials created during the pandemic can be repurposed and integrated into future flipped learning experiences. Technology tools can enhance searchability and provide a structured learning experience for students. Students can also contribute to the resource pool by creating their own videos or sharing external resources.

While students have a positive perception of the flipped classroom approach, they have raised concerns about the quality of materials, technical issues, lack of guidance, and inconsistent teaching. Addressing these concerns and providing timely feedback, detailed explanations, and increased opportunities for interaction can enhance the flipped learning experience. Flipped learning has proven to be a valuable tool in adapting to remote and hybrid learning environments. By leveraging the resources created during the pandemic and addressing student concerns, educators can continue to enhance the effectiveness of flipped learning beyond the COVID-19 era.

Acknowledgments

References

Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: A review of the evidence across disciplines. *Educational Technology Research and Development*, *68*(3), 1017-1051.https://doi.org/10.1007/s11423-019-09718-8

Bredow, C. A., Roehling, P. V., Knorp, A. J., & Sweet, A. M. (2021). To flip or not to flip? A meta-analysis of the efficacy of flipped learning in higher education. *Review of educational research*, *91*(6), 878-918. https://doi.org/10.3102/00346543211019122

Deng, R., Feng, S., & Shen, S. (2023). Improving the effectiveness of video-based flipped classrooms with question-embedding. *Education and Information Technologies*, 1-26. https://doi.org/10.1007/s10639-023-12303-5

Divjak, B., Rienties, B., Iniesto, F., Vondra, P., & Žižak, M. (2022). Flipped classrooms in higher education during the COVID-19 pandemic: Findings and future research

recommendations. *International journal of educational technology in higher education*, *19*(1), 9. https://doi.org/10.1186/s41239-021-00316-4

Gannon, K. (2016). Flipped Learning: A Philosophy, Not a Fad *Teaching Unitied States History* http://www.teachingushistory.co/2016/05/flipped-learning-a-philosophy-not-a-fad.html

Ibrahem, U. M., Abdelfatah, H. M., Kedwany, D. M., AlMankory, A. Z., Diab, I. M., & Abdul Kader, R. A. (2023). The drivers of change for future learning: How teachers were taught in the COVID-19 crisis and what will come next? *Sustainability*, *15*(20), 14766. https://doi.org/10.3390/su152014766

Låg, T., & Sæle, R. G. (2019). Does the flipped classroom improve student learning and satisfaction? A systematic review and meta-analysis. *AERA open*, *5*(3), 2332858419870489. https://doi.org/10.1177/2332858419870489

Linling, Z., & Abdullah, R. (2023). The impact of COVID-19 pandemic on flipped classroom for EFL courses: A systematic literature review. *SAGE open*, *13*(1), 21582440221148149. https://doi.org/10.1177/21582440221148149

Lo, C. K., & Hew, K. F. (2023). A review of integrating AI-based chatbots into flipped learning: New possibilities and challenges [Mini Review]. *Frontiers in Education*, *8*. https://doi.org/10.3389/feduc.2023.1175715

Sanchez-Gonzalez, M., & Terrell, M. (2023). Flipped classroom with artificial intelligence: Educational effectiveness of combining voice-over presentations and AI. *Cureus*, *15*(11). https://doi.org/10.7759/cureus.48354

Talbert, R. (2017). No, you do not need to use video in flipped learning (and five alternatives) https://rtalbert.org/flipped-learning-without-video/

Talbert, R. (2019). Time Management Strategies for the Flipped Classroom. *Faculty Focus*. https://www.facultyfocus.com/articles/blended-flipped-learning/time-management-strategies-for-the-flipped-classroom/