

EDITORIAL

# The past, the present, and the future of flipped teaching

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## INTRODUCTION

The didactic lecture has been the traditional teaching approach to transfer information from the teacher to the students, where students experience little interaction (1). It was effective when the resources were limited, technology was scarce, and students had no independent access to knowledge; they depended on their professors to acquire information. Flipped learning, on the other hand, is built on the notion that students would review the content first in their own individual learning spaces and the application and analysis of the concepts occur under the guidance of the instructor as described in Bloom's taxonomy (2). In the flipped teaching method, the instructor provides learning tools such as guided readings, lecture videos, lecture slides, and practice problems to ensure that students learn the concepts on their own (3, 4). Intentional student-engaging activities are designed for the group sessions that follow next, where the content is revisited in the presence of the instructor and peers multiple times to master, apply, and understand the assigned content at a deeper level. The flipped instructional design is practical in the current situation where technology and resources are plentiful and when the pandemic forced courses to be held in the remote format (5–8).

The flipped teaching method became prominent throughout the COVID-19 pandemic, especially in easing the transition from face-to-face to remote teaching and learning (8–10). More institutions have adapted flipped teaching as the method of the future, such as the University of Miami (11); MEF University in Istanbul, Turkey (12); and Anahuac University in Mexico City, Mexico (13), to mention a few. Others have been following this trend. Almaarefa University in Saudi Arabia offers department-wide flipped teaching training to its faculty. In the following sections, we reflect on the origin of flipped teaching, how it is utilized today, and the role of flipped teaching in the future of higher education.

## HISTORY OF FLIPPED TEACHING

The flipped teaching method has been used throughout history, although no specific name was given to it. Professors assigned readings, especially in the literature-based courses, as homework and discussed the topic during class. In the

late 1990s, several educators were independently attempting to find student-centered active learning teaching methods. Dr. Erik Mazur (14), known for peer instruction, is one of the earliest educators to have adapted flipped teaching. Lage et al. (15) identified a gap between the various learning styles of students, such as group work, project-based learning, experiential learning, and the traditional lecture method that the educators used. However, there were limitations in incorporating alternate instructional approaches to meet the different learning styles among students while balancing the course content because it required increased class time to meet all the learning preferences of students (15). Dr. J. W. Baker (16) designed a teaching approach assigning lecture content as homework and class time to master the information. Advances in educational technology that were taking place at the time, such as access to multimedia and the ease of multimedia development by the faculty, allowed the birth of a new teaching method. Lage et al. (15) and Baker (16) coined the term “Inverted Classroom,” and Baker called it “Classroom Flip.” In this newly found teaching method, lectures were shifted from the classroom and, during the in-class session, the students applied their knowledge in activities to strengthen their understanding of the topics (3).

Integration of educational technology, although not solely dependent on, complemented this teaching strategy. The introduction of computers in the 1980s, the development of the internet in the 1990s, and the growth of multimedia technology soon after were some of the key players that offered an excellent promise for engaging students in learning and promoting pedagogical changes. One specific tool that played a critical part in the late 1990s was the learning management system such as Blackboard and WebCT.

In the mid-2000s, Jonathan Bergmann and Aaron Sams (17) recorded their chemistry lectures, uploaded them to YouTube, and required their students to watch the videos before class to reach and develop concepts further for their students. By doing so, students were better prepared and had interactions that led to greater discussions. The overall classroom experience improved for both students and instructors. Around the same time, Salman Khan (18) taught math remotely to his young family members by uploading YouTube videos. These videos were reaching tens of thousands of students per month. The popularity of his teaching

strategy led to the origin of Khan Academy, a nonprofit organization that provides free lessons to all students (18). Although resources are freely available through Khan Academy and similar platforms, students typically lean toward instructor-generated resources that appear to enhance their learning (19).

## FLIPPED TEACHING DESIGN

The Academy of Active Learning Arts and Sciences is a nonprofit organization dedicated to establishing the Global Standards framework for Flipped Learning (20). These standards were built on widely acknowledged norms and best practices worldwide. Based on these principles, the flipped teaching design consists of two major components: preclass and in-class activities. Students are introduced to the content individually in the preclass coursework. The application of knowledge, where students learn, practice, and master the material, occurs during the in-class session (3). The flipped teaching design revolves around a shift in the role of the instructor from “sage” to “guide,” where there is less lecturing during class and instead more active learning and application. Students become responsible for their learning, and it also allows opportunities to learn from peers. Thus flipped teaching offers many benefits.

Content-heavy courses often cannot build many active learning sessions to protect class time for lecture delivery. However, with flipped teaching, since lectures are shifted outside the classroom, one can build a wealth of student engagement activities. Flipped instruction allows time during class to interact with students at the individual or the small group levels and helps manage the course schedule without deviating from the syllabus since it follows a highly structured plan. It is the student engagement, both at the individual capacity outside, and during class time, that makes flipped instruction more effective. Although it seems daunting to flip a large class size, many studies have demonstrated successful implementation by remodeling large classes into active-learning sessions (21–25).

Convincing educators to adapt to flipped teaching is a challenge since not everyone is familiar with the new teaching method, and it is often uncomfortable to switch from the teacher to the facilitator role. The instructors may also be concerned about the time commitment to revise their teaching materials. Faculty typically assume teaching responsibilities for which they have received no formal training and therefore tend to follow the structure that has been previously established or the format they have experienced as a student, which is often the lecture method (26). Although faculty may find flipped teaching time consuming at the beginning of their transition, the teaching resources they can reuse could help them gain confidence in their new teaching method.

Students, in general, prefer the traditional method of receiving lectures passively. Therefore, they often resist the new teaching method, especially since it requires preparation for class upfront. They may not devote the necessary time and effort to the flipped course. However, research suggests that students who perceive the lecture method as the best approach to learning tend to perform better with flipped teaching (27, 28).

Due to the benefits of flipped teaching, there has been a steady increase in the number of publications related to this pedagogy over a decade (Fig. 1). Since flipped teaching was generally referred to as blended learning in the early years, the graph specifically notes the number of publications in this category. However, it must be noted that blended teaching may include a variety of active learning strategies in addition to flipped teaching. On the other hand, flipped teaching is described as flipped instruction, inverted classroom, and flipped classroom. Figure 1 captured citations from all these different terminologies. The publication numbers are expected to grow exponentially, given the successful application of this instructional strategy during the pandemic.

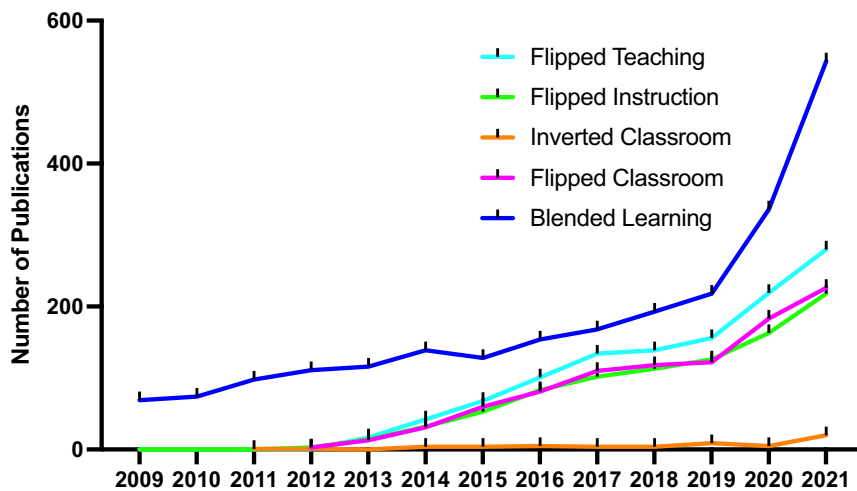
## FLIPPED TEACHING DURING THE PANDEMIC

The pandemic forced a shift in how we think about teaching. The lecture method was not the most suitable during the pandemic, especially when it occurred online to students whose videos were typically turned off. Those who used flipped teaching continued to use this strategy with minimal changes in the online modality (6, 8–10). New terminologies were introduced, such as e-flip, when flipped teaching was employed for online teaching. The preclass portion was now referred to as asynchronous activities and the in-class component became synchronous sessions. Although the preclass (asynchronous) design remained the same, some activities for the course’s in-class (synchronous) portion were modified. For example, student response activities such as polling helped engage students at the individual level, whereas the Breakout Rooms helped facilitate peer engagement and deeper understanding (6).

Overall, students were kept engaged during the synchronous sessions. They were able to interact with the instructor by asking pertinent questions, which also suggested that they were adequately prepared. Thus the flipped teaching method during the pandemic positively impacted student success. Studies examining students’ perceptions and performance suggested that they embraced the virtual flipped teaching method, which maintained the same strong outcome as before (6, 8–10). Educators who were resistant to using a new teaching method were more open to implementing flipped teaching. Similarly, students quickly became accustomed to the alternate teaching technique (29).

## FUTURE OF FLIPPED TEACHING

The recent COVID-19 pandemic offered technological adaptation among both educators and students. Therefore, it is the best time to fully adopt flipped teaching since it fits all the emerging assumptions and fulfills the overarching needs of higher education and steers clear of the outdated lecture models. Universities are embracing flipped teaching since the pandemic popularized this instructional strategy, and there will be an even larger surge in interest and an increase in faculty development programs for adapting flipped instruction. For example, a National Science Foundation-funded Innovative Flipped Learning Instruction Project (IFLIP) involved 24 science, technology, engineering, and



**Figure 1.** Publications as obtained from PubMed between 2009 to 2021 on the Flipped Teaching, Flipped Instruction, Inverted Classroom, Flipped Classroom, and Blended Learning. It must be noted that Blended Learning category was not limited to Flipped Teaching.

mathematics faculty, 12 from a 2-yr community college, and the other 12 from a 4-yr university received training. While they were testing flipped teaching techniques in their classrooms, the COVID-19 pandemic disrupted the study. Instead of delaying progress, the pandemic was used as an opportunity to examine flipped teaching capabilities further. IFLIP cohort members were better prepared to transition into a virtual mode when compared to their peers who were not participating in the cohort; they had the opportunity to flip their courses and work with remote-teaching technology ultimately. As a result, those faculty reported that their flipped classroom was the most effortless transition to a remote format when COVID-19 stay-at-home orders were in place (8). Students who participated in flipped classrooms also found it easier to navigate it online because they had already experienced the technology before moving completely remote (30).

Furthermore, the global flipped classroom market reached a value of US \$1.35 billion in 2020 as it provides flexibility for the students to access the content from anywhere at anytime and learn at their own pace. It also encourages the student to practice self-study. The effectiveness of this teaching method has driven the market positively (31). This strong growth is expected to continue throughout the next 5 yr for various reasons, including digitization, favoritism for personalized learning, and incorporation of programs in educational institutions.

Thus far, flipped learning has been successfully tested in combination with retrieval practice, team-based learning, and case-based learning (23, 32, 33). The latest adaptation has been synchronous online flipped teaching, which is a remote approach to the in-person setting of the classroom (6). At present, flipped teaching is being tested in the hyflex format, which combines on-site and remote learning in a flexible manner and massive open online course modality that requires some synchronous interaction for the students and the instructor (34).

Given the commitment to flipped teaching and buy-in from the educators, students, and institutions, we are now at the inflection point. More innovations would soon expand flipped teaching methodology into secondary education, including rural populations. Returning to the

traditional teaching method when the pandemic ends will be a mistake; we should allow further advances in engaging students in learning by capturing the moment to reshape education for the better. As Robert Talbert (35) claims, flipped learning can be a key to transforming teaching and learning postpandemic.

## DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

## AUTHOR CONTRIBUTIONS

C.G. conceived and designed research; C.G. performed experiments; C.G. analyzed data; C.G. interpreted results of experiments; C.G. prepared figures; C.G., S.D., and E.H. drafted manuscript; C.G., S.D., and E.H. edited and revised manuscript; C.G., S.D., and E.H. approved final version of manuscript.

## REFERENCES

1. DiCarlo SE. Too much content, not enough thinking, and too little FUN! *Adv Physiol Educ* 33: 257–264, 2009. doi:10.1152/advan.00075.2009.
2. Bloom B, Englehart MD, Furst EJ, Hill WH, Krathwohl D. The classification of educational goals. In: *Taxonomy of Educational Objectives Handbook I: The Cognitive Domain*. New York: Longmans, 1956.
3. Al-Samarraie H, Shamsuddin A, Alzahrani AI. A flipped classroom model in higher education: a review of the evidence across disciplines. *Educ Tech Res Dev* 68: 1017–1051, 2020. doi:10.1007/s11423-019-09718-8.
4. Han E, Klein KC. Pre-class learning methods for flipped classrooms. *Am J Pharm Educ* 83: 6922, 2019. doi:10.5688/ajpe6922.
5. Campillo-Ferrer JM, Miralles-Martínez P. Effectiveness of the flipped classroom model on students' self-reported motivation and learning during the COVID-19 pandemic. *Humanit Soc Sci Commun* 8: 1–9, 2021. doi:10.1057/s41599-020-00684-8.
6. Gopalan C, Butts-Wilmsmeyer C, Moran V. Virtual flipped teaching during the COVID-19 pandemic. *Adv Physiol Educ* 45: 670–678, 2021. doi:10.1152/advan.00061.2021.
7. Rehman R, Fatima SS. An innovation in Flipped Class Room: a teaching model to facilitate synchronous and asynchronous learning during a pandemic. *Pak J Med Sci* 37: 131–136. 2020. doi:10.12669/pjms.37.1.3096.



8. **Beason-Abmayr B, Caprette DR, Gopalan C.** Flipped teaching eased the transition from face-to-face teaching to online instruction during the COVID-19 pandemic. *Adv Physiol Educ* 45: 384–389, 2021. doi:10.1152/advan.00248.2020.
9. **Bryson JR, Andres L.** Covid-19 and rapid adoption and improvisation of online teaching: curating resources for extensive versus intensive online learning experiences. *J Geogr High Educ* 44: 608–623, 2020. doi:10.1080/03098265.2020.1807478.
10. **Fogg KC, Maki SJ.** A remote flipped classroom approach to teaching introductory biomedical engineering during COVID-19. *Biomed Eng Educ* 1: 3–9, 2021. doi:10.1007/s43683-020-00001-4.
11. **University of Miami.** Flipped Learning (Online). Academic Technologies. <https://academictechnologies.it.miami.edu/explore-technologies/technology-summaries/flipped-learning/index.html> [2021 Oct 1].
12. **MEF University.** Flipped Learning (Online). <https://www.mef.edu.tr/en/flipped-learning/#gsc.tab=0> [2021 Oct 1].
13. **Flipped Learning Global Initiative.** How Anahuac University Built a Flipped Learning Dream Team (Online). *Flipped Learning Review*. <https://flr.flglobal.org/how-anahuac-university-built-an-innovative-teaching-strategies-dream-team/> [2021 Oct 1].
14. **Harvard University.** The Flipped Classroom Will Redefine the Role of Educators (Online). <https://www.seas.harvard.edu/news/2013/03/flipped-classroom-will-define-role-educators> [2021 Oct 1].
15. **Lage MJ, Platt GJ, Treglia M.** Inverting the classroom: a gateway to creating an inclusive learning environment. *J Econ Educ* 31: 30–43, 2000. doi:10.1080/00220480009596759.
16. **Baker JW.** The origins of “the classroom flip.” In: *Proceedings of the 1st Annual Higher Education Flipped Learning Conference*, Greeley, Colorado, edited by Overmyer J, Yestness N. Greeley, CO: The Flipped Learning Academy Innovation at UNC Project and the MAST Institute at UNC, 2016.
17. **Bergmann J, Sams A.** *Flip Your Classroom: Reach Every Student in Every Class Every Day*. Washington, DC: International Society for Technology in Education, 2012.
18. **Khan Academy.** Free Online Courses, Lessons & Practice (Online). [https://www.khanacademy.org/\\_render](https://www.khanacademy.org/_render) [2021 Oct 1].
19. **McGovern E, Baruca A.** Want to Enroll in a MOOC? No Thanks, My Professors Have Their Own Videos (Online). [https://digitalcommons.sacredheart.edu/wcob\\_fac/233](https://digitalcommons.sacredheart.edu/wcob_fac/233) [2021 Oct 1].
20. **AALAS.** *Academy of Active Learning Arts and Sciences* (Online). <https://aalasinternational.org/> [2021 Oct 1].
21. **Danker B.** Using flipped classroom approach to explore deep learning in large classrooms. *IAFOR J Educ* 3: 171–186, 2015. doi:10.22492/ije.3.1.10.
22. **Gopalan C.** Effect of flipped teaching on student performance and perceptions in an Introductory Physiology course. *Adv Physiol Educ* 43: 28–33, 2019. doi:10.1152/advan.00051.2018.
23. **Gopalan C, Klann MC.** The effect of flipped teaching combined with modified team-based learning on student performance in physiology. *Adv Physiol Educ* 41: 363–367, 2017. doi:10.1152/advan.00179.2016.
24. **Hernández-Guerra M, Quintero E, Morales-Arráez DE, Carrillo-Pallarés A, Nicolás-Pérez D, Carrillo-Palau M, Gimeno-García A, González-Alayón C, Alarcón O, Otón-Nieto E, Díaz-Luis H, Hernández-Siverio N, Martín-Malagón A, Arteaga-González I, Bravo-Gutiérrez A, Lorenzo-Rocha MN, Jordán-Balanza J, Sánchez-González JM, Barrera-Gómez M, Reid A, Marina N.** Comparison of flipped learning and traditional lecture method for teaching digestive system diseases in undergraduate medicine: A prospective non-randomized controlled trial. *Med Teach* 43: 463–471, 2021. doi:10.1080/0142159X.2020.1867312.
25. **Herbert C, Velan GM, Pryor WM, Kumar RK.** A model for the use of blended learning in large group teaching sessions. *BMC Med Educ* 17: 197, 2017. doi:10.1186/s12909-017-1057-2.
26. **Robinson TE, Hope WC.** Teaching in higher education: is there a need for training in pedagogy in graduate degree programs? (Online). *Res High Educ J*: 1, 2013. <https://eric.ed.gov/?id=EJ1064657> [2022 Jan 17].
27. **Deslauriers L, McCarty L, Miller K, Callaghan K, Kestin G.** Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom (Online). *PNAS*, 2022. <https://www.pnas.org/content/116/39/19251?cid=nwsltrtn&source=ams&sourceid=5078450> [2022 Jan 17].
28. **Gopalan C, Fentem A, Rever AL.** The refinement of flipped teaching implementation to include retrieval practice. *Adv Physiol Educ* 44: 131–137, 2020. doi:10.1152/advan.00143.2019.
29. **Education World.** The Rise of Flipped Classroom Learning During Covid-19 (Online). <https://www.educationworld.com/teachers/rise-flipped-classroom-learning-during-covid-19> [2022 Jan 20].
30. **Gopalan C, Serrano C, Dickey P, Bracey G, Fickas J, Bartels L, Locke S.** Flipped teaching eased the transition of faculty to remote teaching during the COVID-19 pandemic. *FASEB J* 35, 2021. doi:10.1096/fasebj.2021.35.S1.04624.
31. **Business Wire.** \$1.35 Billion Flip Classroom Market—Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026—ResearchAndMarkets.com (Online). 2021. <https://www.businesswire.com/news/home/20210422005606/en/1.35-Billion-Flip-Classroom-Market—Global-Industry-Trends-Share-Size-Growth-Opportunity-and-Forecast-2021-2026—ResearchAndMarkets.com> [2022 Oct 1].
32. **Dobson J, Linderholm T, Perez J.** Retrieval practice enhances the ability to evaluate complex physiology information. *Med Educ* 52: 513–525, 2018. doi:10.1111/medu.13503.
33. **Yang F, Lin W, Wang Y.** Flipped classroom combined with case-based learning is an effective teaching modality in nephrology clerkship. *BMC Med Educ* 21: 276, 2021. doi:10.1186/s12909-021-02723-7.
34. **Halpin PA, Golden L, Hagins KZ, Waller S, Gopalan C.** Symposium report on “Examining the Changing Landscape of Course Delivery and Student Learning”: Experimental Biology 2017. *Adv Physiol Educ* 42: 610–614, 2018. doi:10.1152/advan.00096.2018.
35. **Talbert R.** Flipped Learning Can Be a Key to Transforming Teaching and Learning Post-Pandemic—EdSurge News (Online). EdSurge, 2021. <https://www.edsurge.com/news/2021-04-02-flipped-learning-can-be-a-key-to-transforming-teaching-and-learning-post-pandemic> [2022 Jan 20].