Reinventing flipped learning: An exploratory study on the use of *online flipped learning* in the new normal

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Abstract: Blended learning remained relevant amidst the pandemic as it continued to offer flexible solutions for optimizing teachers' instruction, students' learning, and the use of available technologies. School closures and pandemic-related educational disruptions have opened possibilities for the reinvention of blended learning models such as flipped learning. From the conventional combining of *online and face-to-face learning,* a possible reconceptualization of flipped learning includes the combination of *asynchronous and synchronous learning in a fully online setup.* This study explored the viability of implementing an online flipped course, its effect on student performance, and the perceptions of students about their learning experience. An online flipped course was implemented for an entire semester in a college mathematics course. Results obtained from tests, survey, and focus group discussions revealed that a) the online flipped course had a positive effect on student performance and b) students were largely positive about their online flipped learning experience; they also favored the online flipped learning over other flexible learning modalities. This study has provided evidence on the potential of online flipped learning to provide a sustainable approach in supporting learning continuity in times of educational disruptions. Results and limitations of the findings are further discussed.

Key Words: flipped classroom; blended learning; flexible learning; educational disruptions; next normal

1. INTRODUCTION

The growth of technological innovations in recent years has fuelled the rise of technology-enhanced, student-centered pedagogies. With the affordances of information and communication technologies, blended learning approaches have gained traction in schools and universities as evidenced by the growing number of published studies on the topic in recent years (Talbert, 2017). One of the specific types of blended learning is flipped or inverted learning, characterized by the moving of content delivery outside of the classroom to allow for students' active learning inside the classroom (Bergmann & Sams, 2012). According to Flipped Learning Network (2014), four pillars constitute flipped learning: a) flexible learning environment, b) learning culture that fosters self-regulation, c) intentional content that caters to students' needs, and d) professional teaching.

The mixing of asynchronous online learning and synchronous face-to-face learning in blended learning approaches, such as in flipped learning, is argued to offer smart solutions to bridging gaps between the traditional and digital forms of learning

(Clark & Mayer, 2016). Before the pandemic forced school closures, flipped learning was typically conceptualized by combining pre-class asynchronous online learning and synchronous face-to-face learning. In a scoping review by O'Flaherty and Phillips (2015), it was revealed that wide-ranging technologies and activities were implemented by faculty in the delivery of flipped learning in higher education. Pre-recorded lecture videos, podcasts, screencasts, readings, and other interactive resources commonly formed part of asynchronous pre-class learning, whereas, active learning strategies such as presentations, discussions, and debates, typically formed part of the face-to-face learning. Similar patterns were observed in flipped K-12 classes. In a systematic review by Satparam and Apps (2022), K-12 teachers typically deliver pre-class learning activities through video watching, readings, online tests, and other learning activities such as discussion, reflection, and annotations. On the other hand, face-to-face learning typically included individual and group activities, scaffolded instruction, mini-lectures, and presentations.

Evidence on the benefits of flipped learning to students are widely documented in the literature. Among these are increased student satisfaction, increased academic performance, and the promotion of student empowerment and engagement (O'Flaherty & Phillips, 2015; Talbert, 2017). However, current studies on the effectiveness of flipped learning on student learning are not conclusive as contradicting results continue to populate the flipped learning discourse. For example, in school education, findings on the effectiveness of the flipped learning in K-12 contexts are equivocal as there is a mixture of studies that have reported flipped learning being effective and studies that have reported contradicting results (Satparam & Apps, 2022). Moreover, challenges impede teachers and students from reaping the most from flipped learning. These challenges generally include students' lack of motivation in performing pre-class activities, increased teachers' workload, and the lack of access to technologies (Satparam & Apps, 2022).

Blended learning approaches and flipped learning remained relevant when the COVID-19 pandemic forced school closures. Educational institutions implemented various learning modalities for learning to continue. The Philippine Department of Education, for instance, directed schools to primarily consider modular distance learning, online distance learning, TV- and radio-based instruction, blended learning, and homeschooling. On the other hand, the Philippine Commission on Higher Education directed higher education institutions to adopt flexible learning modalities that will cater to students given their access to devices and connectivity.

As challenges overwhelmed teachers and students in the early implementation of learning modalities in the new normal, balancing offline, online, asynchronous, and synchronous learning seemed to have provided a practical option. Flipped learning appeared to have offered smart ways for optimizing teachers' instruction, students' learning, and the use of available technologies. This necessitated, however, to reinvent the conventional idea of flipped learning, from combining *online and face-to-face learning* to combining *asynchronous and synchronous activities in a fully online setup.* With this apparent need for reinvention, studies exploring the viability of online flipped courses, their effect on student performance, and the perceptions of learners must be conducted to provide foundational evidence on the effectiveness of the reinvented approach. This study was an attempt to address these needs. Specifically, this study sought answers to the following questions:

RQ1. What is the effect of online flipped learning on student performance in a mathematics course?

RQ2. What are the students' perceptions of their online flipped learning experience?

2. METHODOLOGY

2.1 Locale of the study, participants and overview of the course

The locale of the study is the Bicol University College of Education, a teacher education institution in the province of Albay, Philippines established in 1969. It caters to pre-service teachers' training and has integrated schools for basic education (K to 12).

The targeted course for the flipped learning implementation was College and Advanced Algebra (3 units; 54 hours/semester). The students-participants in this study were first-year students (n = 34) enrolled during the 1st Semester, School Year 2021-2022 (August to December 2021). The students had been undergoing pandemic-caused home-based instruction

for three semesters already when they took up the online flipped course. The online flipped course was implemented in a completely online setup with the aid of a learning management system, a video conferencing app, a teacher-owned pen-tool enabled tablet, video materials, e-books, and students' owned devices. Weekly pre-class activities were made available starting Saturday and in-class sessions were held every Tuesday and Friday. Table 1 briefly outlines the structure of the online flipped course that guided the implementation of the study.

Table 1. Overview of the online flipped course

Wk	Focus Content	Pre-Class Activities	In-Class Activities
1	*Course Orientation*		
2-4	Review Topics in Algebra Equations, Inequalities, and Mathematical Modeling	Video watching Readings Compre-hension checks	Question and answer Mini-lecture Individual/ Group exercises Next-day preparation
5-8			
9	*Midterm Examination*		
10-17	Functions and Their Graphs	Video watching Readings Compre-hension checks	Question and answer Mini-lecture Individual/ Group exercises Next-day preparation
18	*Final Examination*		

2.2 Instruments and Data Collection Process

In gathering the data, the study employed the use of the following: a) pre-test and post-test; b) a perception survey questionnaire on flipped learning experience; and c) focus group discussions. The pre-test and post-test construction followed the standard procedures in developing and validating a test beginning with the development of test specifications up to establishment of the validity of the test. The pre-test was administered in Week 1, whereas the post-test was given in Week 18. Thirty-one out of 34 students completed both tests. Connectivity issues hindered three from taking either or both of the tests.

The perception survey questionnaire on flipped learning experience was modelled from a similar perception survey questionnaire by Graziano

and Hall (2017). The survey questionnaire is a five-point Likert checklist which surveyed students' perceptions of their online flipped learning experience along motivation, effectiveness, engagement, and enjoyment. The questionnaire's structure and content were subjected to peer evaluation to establish validity. Students were invited to respond to the survey after their final examination. Lastly, focus group discussions were conducted to further understand how the students perceived their online flipped learning experience. These were held two weeks after the semester ended. All participants were fully aware of their participation in the study and signed a consent form for the survey and focus group discussions.

3. RESULTS AND DISCUSSION

The total score of both the pre-test and post-test was 50. The set of questions in the two assessments was the same, covering the identified scope for the course and targeting the solving of algebra problems as applied in real-world situations. A paired t-test showed a significant difference between the pre-test mean (n = 31, M = 6.45, SD = 4.96) and the post-test mean (n = 31, M = 22.10, SD = 10.42), t(30) = -7.58, p < 0.001 (see Table 2). The Cohen's d value was 1.89 indicating a very large effect size.

Table 2. Student performance in pre-test and post-test

	Mean	SD	Skewness	Kurtosis
Pre-Test	6.45	4.96	0.92	-0.01
Post-Test	22.10	10.42	0.65	-0.36

Table 3 presents the summary of the quantitative data collected from the survey on students' perceptions of their online flipped learning experience in terms of motivation, effectiveness, engagement, and enjoyment. Data from the focus group discussions were coded, analyzed, and organized into thematic categories and are discussed in the succeeding sections.

Pre-class learning and in-class learning.

The design of the learning activities and tasks implemented in the pre-class aspect of the course was perceived by almost all of the students to have provided sufficient information and skills needed for them to perform well in the in-class sessions. The

comprehension tests have also allowed them to check their foundational understanding of the topics before learning them further.

Table 3. Students' perceptions of their online flipped learning experience

Items by Dimension	Mean	SD
Motivation (α = 0.67)		
The use of pre-class learning videos influenced my motivation to learn.	4.85	0.36
The use of pre-class comprehension checks influenced my motivation to watch the videos.	4.73	0.51
The use of question and answer to check my understanding at the beginning of the in-class learning influenced my motivation to watch the videos.	4.73	0.45
The active learning activities in the in-class sessions influenced my motivation to learn.	4.97	0.17
Effectiveness (α = 0.93)		
The pre-class learning videos were stimulating in learning.	4.64	0.77
The pre-class learning videos were helpful in learning.	4.79	0.73
The in-class sessions were stimulating in learning.	4.79	0.73
The in-class sessions were helpful in learning.	4.85	0.70
Answering the questions in pre-class comprehension checks while watching the videos was helpful in learning.	4.67	0.80
I learned more in flipped learning than I would have in full asynchronous or full synchronous learning.	4.15	1.10
Engagement (α = 0.98)		
The pre-class learning activities were engaging in learning.	4.76	0.74
The in-class session activities were engaging in learning.	4.73	0.75
Enjoyment		
I enjoyed flipped learning more than I would have enjoyed being in a full asynchronous or full synchronous class.	4.18	1.11

One student said,

"*Yung sa pre-class activities po, ang benefit is natutulungan po kami magkaron ng prior knowledge sa ituturo sa in-class, kaya mas nagiging prepared po kami for in-class dahil sa binibigay na pre-class activities.*" (The benefit of pre-class learning is it helps us acquire prior knowledge of what will be taught in the in-class learning, so we become well-prepared for the in-class session because of those activities.)

The in-class activities carried out in the course were found by almost all of the students to have provided opportunities to discuss the concepts deeper and clarify misconceptions. Almost all of the students were one in saying that the in-class sessions facilitated motivation, deeper discussion of concepts, and have allowed for the much-needed scaffolding to take place. One issue, however, was the erratic Internet connectivity which affected the participation of some students during in-class sessions. This, however, was addressed by uploading the session recording to the learning management system immediately after a session was finished. The perceptions of the students on the in-class learning activities and design were succinctly captured in the sharing of one student:

"*Yung practice exercises na pinapasagutan [sa in-class session] kahit di compulsory, ito po talaga nagbigay ng excitement kasi may part na matatawag, may part na hindi. Mas nabigyan kami ng opportunity na sagutan kasi di po alam sang number matatawag. Challenge nga lang po yung internet connectivity kasi may times na mahina, minsan mahirap intindihin yung lesson kasi putol putol po, naglileave meeting po. Yung process po sa paglelesson, okay din po, mas madali po intindihin kasi nakakaapproach po kami sayo directly po.*" (The practice exercises being given [during the in-class sessions] although not compulsory gave excitement because there are times that we are called and times that we are not. We were given enough opportunity to explore the problems as we do not know whether we will be called or not. The only challenge, however, was the internet connectivity, because there were times that connectivity was weak; it was challenging to understand the lesson because of erratic connection, we get disconnected. The overall process [during the in-class sessions] was facilitative of understanding as we can approach you directly.)

The uploading of the session recording suggests that the scaffolding provided to students

during the actual in-class sessions was extended beyond the in-class hours when students were further learning on their own. One student said,

> "Yung recording po is a big help din po. Kapag may nakakalimutan on a certain topic, we can watch it again and yung mga hindi po nakapag attend, pwede nila pa din po mapanood and makasabay sa topic. And minsan po kasi kahit nakaattend ng meeting po, nawawala bigla internet so pwede pa din po mapanood yun." (The recordings are a big help as well. When we forgot something about a certain topic, we can watch it again. Also, those who were not able to attend [the in-class session] can still watch it and catch up. Even when students were able to start the session but sometime in the middle got disconnected, they can opt to watch the recording.)

Online flipped learning as a preferred learning modality.

All students expressed their preference for flipped learning over other flexible learning modalities (e.g. full online synchronous, fully asynchronous, printed modular). Based on the interview data, the major factors that influenced their preference are the affordances that flipped learning offers in terms of: self-regulation, flexibility, scaffolding, and cost-effectiveness. In terms of self-regulation, one student shared,

> "Ang flipped learning parang mas better po sya sa distance learning, for example, printed module, kasi parang gagawa ka lang ng module just to comply. Sa flipped learning, it is flexible sa students kung pano sya magadapt at magstrategize sa situations, pano nya pagaaralan both asynchronous and synchronous activities." (Flipped learning is better than the other forms of distance learning like printed modular because the latter encourages compliance while in the former, students will think of strategies on how they will learn the asynchronous and synchronous activities.)

Students appreciated the flexibility in online flipped learning and the opportunity it offers to catch up whenever they missed a lesson due to weak connectivity. A student maintains *"Pag flipped learning po sir may chance ka pa po sir balikan yung mga lesson na namiss"* (In flipped learning, Sir, there is a chance for you to revisit the lessons that you

missed). The online flipped learning setup appears to have mitigated the impact of weak connectivity on students' learning. Students were one in sharing that they felt not left behind whenever they missed a lesson because recorded and curated materials are available for them to access.

For the majority of the students, flipped learning is preferable because the much-needed scaffolding in their learning is afforded. One student said,

> "Sakin sir, okay po yung flipped learning kasi unlike sa printed modular type, yung iba may key to correction na, tinitignan na lang, di naman students yung sumasagot. Sa flipped learning, iintindihin mo talaga, at kung may questions, nadidiscuss talaga at natatanong kung may questions." (For me, Sir, flipped learning is better than printed modular type because some have a key to correction attached to them, students just refer to them, they do not answer it themselves. In flipped learning, you need to understand the concepts, and if there are questions, there is an opportunity to discuss and ask.)

A couple of students, interestingly, cited the better cost-effectiveness of the approach as compared to printed modular and fully online synchronous modes of instruction, citing that the former typically entails transportation expenses and the latter requires costly subscriptions. Printed modular mode of instruction typically requires picking up physical copies of modules, while the full online synchronous mode of instruction is carried out via video conferencing sessions.

The data obtained from the focus group discussions underscored the idea that online flipped learning may offer similar benefits as that of conventional flipped learning. The findings on the perceived benefits of students exposed to online flipped learning in this study parallel with those with the reviews done on the effectiveness of conventional flipped learning (e.g. O'Flaherty & Phillips, 2015; Satparam & Apps, 2022) highlighting self-regulation, flexibility, and scaffolding as primary benefits. One interesting finding, however, in the present study is the perceived benefit on cost-effectiveness which may be lacking in conventional flipped courses.

The notable effect on student performance in the online flipped course matches those in some studies contextualized in conventional flipped

learning (e.g. O'Flaherty & Phillips, 2015; Satparam & Apps, 2022). Nevertheless, more studies and continuous discussions on online flipped learning should be conducted to strengthen this early idea, in the same way as research on conventional flipped learning should be further investigated since mixed and contradictory results on its effectiveness continue to populate the flipped learning discourse (Satparam & Apps, 2022).

Overall, the positive insights shared by the students highlighted that the online flipped learning has afforded the four key characteristics of an ideal flipped learning setup: a) flexible learning environment, b) learning culture that fosters self-regulation, c) intentional content that caters to students' needs, and d) professional teaching (Flipped Learning Network, 2014). The design of pre-class and in-class learning allowed for flexible course engagement. Furthermore, the materials provided at pre-class and in-class sessions have provided tailored and scaffolded content to students. Lastly, continued evaluation and scaffolding of students' learning characterized a professional and informed approach to the instructional design process.

4. CONCLUSIONS

School closures have allowed for the reinvention of the conventional structuring of flipped learning. This exploratory study aimed at providing foundational insights on the viability of an online flipped course, its effect on student performance, and the students' perceptions of their learning experience. Two key insights were drawn from this study: a) the online flipped course greatly contributed to the learning of students as evidenced by the students' improved test scores; and b) students were largely positive about their online flipped learning experience and favored flipped learning over other flexible learning modalities.

The design, sample, and context of this study, however, presented certain limitations, hence, caution in interpreting the results is advised. Future research endeavors may consider using experimental or quasi-experimental designs to draw more comparable data. Further, students from different year levels may be examined and the possibility of designing and implementing other online flipped courses may be

considered. Nonetheless, despite the limitations, this study provided evidence on the potential of online flipped learning to provide a sustainable approach to support learning continuity in times of educational disruptions.

5. ACKNOWLEDGMENTS

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