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Perception of Biology Students to Flipped Classroom Approach in Biological Control and Environment Conservation

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ABSTRACT

Flipped classroom (FC) approach is an active, student-centered learning approach that consists of two parts - online-based individual instruction outside the classroom and active learning activities inside the classroom. This project aims at investigating the effectiveness of flipped classroom approach as a teaching and learning method (TnL) and to elicit the perception of 26 students in their 3rd year in Biology who enroll in the Biological Control and Environment Conservation course. At the end of flipped classroom sessions, written feedback was obtained from the students who underwent FC activity regarding their perception of FC activity using a 5-point Likert scale in the form of the questionnaire, with the respondents' anonymity are maintained. The results confirmed that flipped classrooms increased student knowledge attainment with an average of 77% of the students are confident in their ability to address the course topics when they sit for the final examination. We also found that students were showing favorable perceptions and demonstrating positive reactions to the flipped-classroom approach compared to the traditional classroom with 31% strongly agreed, and 46% agreed. Consequently, the students are ready to take more courses that implement flipped-classroom approach. The results achieved in this study show a promising tendency in the performance, perceptions, and emotions of students towards the flipped classroom approach.

Keywords:

flipped classroom, perception, biology
students, active learning

1. Introduction

Flipped classroom (FC) is one of the approaches that are in line with the IR 4.0 initiatives that suggested the development of lifelong learners, enhanced engagement with the lesson material, and increased interaction between students and faculty. As most of the undergraduate students are millennials, teaching and learning should no longer be teacher-centered but should cater to the learning styles of the millennials. In the biology course, a large proportion of teaching and learning time is occupied by didactic teaching sessions. Traditional teaching methods are definitely basic ways of imparting knowledge. In the 21st-century learning environment, students are constantly challenged by the digital world characterized by the rapidly growing global knowledge and continually advancing information and communication technology. The attempts to put the available teaching and learning

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time to better use led to the evolution of the "flipped classroom" introduced by Bergmann and Sams [1].

The implementation of the FC model in teaching science, technology, engineering, and mathematics (STEM) subjects has encouraged teachers to create a challenging environment that helps learners link knowledge by engaging learners in problem-solving skills. Particularly, Jeong *et al.* [2] indicated that the FC showed that the success of students' performance significantly improved in science subjects compared to classes not applying the FC model. Moreover, the passing rate of students who followed the FC model was improved by more than 10% and their final exam scores were notably higher than students in the previous year. In addition, Al-Samarraie *et al.* [3] concluded that FC in seven disciplines of natural sciences potentially promoted certain learning outcomes especially supporting students to transfer their knowledge between contexts.

Biology is one of the natural sciences that focuses on living organisms. Biology has a great position in the curriculum, however, is known for its fact-laden content and could be the least favourite subject to students who do not like reading. Therefore, in developing an effective learning environment for Biology subjects, an instructor should consider the implementation of active learning such as flipped classrooms to maintain students' interest and focus. Impactful learning can be accomplished with the adoption of blended learning strategies such as the usage of the latest technologies and digital applications, the application of appropriate materials that can be visualized to boost student's interests such as fieldwork and laboratory practicals, and the development of online learning materials and topics [4-5]. Malto *et al.* [6] demonstrated a significant difference result in the gained interest in Biology between the FC group and the traditional group which was in favor of the FC group.

According to Pearson's School Achievement Services [7], there are four pillars that instructors must incorporate into their teaching method to engage with FC which are flexible environment (F), learning culture (L), intentional content (I), and professional educator (P). Successful implementation of FC could be accomplished using a three-stage model proposed by Estes *et al.* [8]: the pre-class (modeling, pre-assessment), in-class (clarifying concepts, solving problems), and post-class (assessment, application, transfer) stages. In the intact age of coronavirus disease 2019 (COVID19), FC can be a worthwhile alternative to the existing conventional teaching approaches. Students could improve their concentration in the classroom, be more motivated for classes, and shift from passive to active learning in terms of self-participation in the learning activities [9-10]. Given the significance of FC, therefore, this study investigates the effectiveness of the flipped classroom approach on students' academic achievement and attitude, particularly their interest and confidence in the Biological Control and Environment Conservation course (SSCG 3213) in Semester 1, 2021/2022. Data on teachers' perspectives in the implementation of flipped classrooms were also elicited to support the findings.

1.2 Research Question

Our research aims to explore the perception of biology students on flipped classroom approach in the Biological Control and Environment Conservation course and FC effectiveness on the students who enrolled in this subject. Hence, we attempt at answering two research questions namely:

RQ 1: What are Biology students' perceptions of the Flipped Classroom approach used in the course?

RQ 2: Do Biology students perceive that the Flipped Classroom approach supports their learning?

1.3 Research Objectives

The goals of this research are to investigate the effectiveness of flipped classes as a teaching and learning method (TnL) and to elicit the perception of 26 students of 3rd year in Biology who enrol in the Biological Control and Environment Conservation course.

2. Methodology

This study employed both quantitative and qualitative designs. For the quantitative design, we used descriptive analysis to measure the effectiveness of flipped classroom intervention applied in the Biological Control and Environment Conservation course. In particular, the investigation was designed in the model of a posttest single group, and data was collected after applying the flipped classroom approach. This project was conducted to investigate the effectiveness of flipped classes as a teaching and learning method (TnL) and to elicit the perception of 3rd-year biology students on FC. The study was conducted over a period of 7 weeks from the end of October 2021 until early December 2021. The third-year cohort consists of 26 biology students who enrolled in Biological Control and Environment Conservation course participated in this study. The flipped classroom approach was conducted for six consecutive lessons on the topic “Biological Control Agent”. The student’s academic achievement in Biology was assessed through descriptive statistics and their interest and confidence levels in biology will be measured as well. At the end of FC sessions, written feedback was obtained from the students who underwent FC activity regarding their perception of FC activity using a 5-point Likert scale in the form of questionnaires. The questionnaire on the FC activity was adapted from a validated questionnaire developed by Pierce and Fox [11]. This questionnaire was modified and revalidated appropriately to suit the needs and context of the study. The number and percentage of students responding to each item were identified. The mean rating for each item was calculated.

For qualitative design, the questionnaire contained open-ended questions in order to elicit freewheeling comments from the students and to gain students’ suggestions and remarks. The open-ended section was analyzed using content analysis.

3. Results and Discussion

Sample Description

All students who participated in the FC activity responded to the questionnaire in which we aimed at exploring their perception of flipped classrooms. 85% of the participants are females and 15% are males with an average age between 20 and 21 years old.

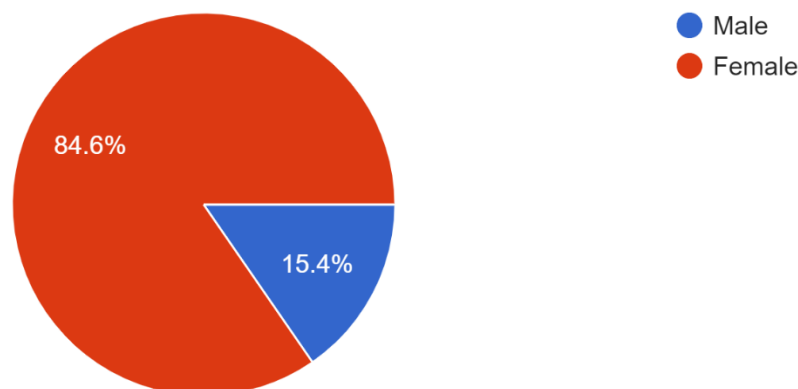


Fig. 1. Gender of the participants

Perception analysis and evaluation

The result shows that there is a positive perception of flipped classroom approach used in the course. All students (100%) strongly agree and agree that watching video lessons before attending class is very meaningful in order to accomplish the proposed learning goals (Q1). This finding confirms that students in the FC displayed a long-term impact of the lessons' basic concepts at the very beginning of the course due to the availability of recorded materials outside the class, as well as a dynamic in-class session [12]. Q2 elicited their views on pre-recorded lecture videos. The data shows that only 31% of the participants did not watch pre-recorded lectures at all. It is interesting to discover that more than half of the biology students strongly agree that learning the key foundational content prior to coming to class greatly enhanced the understanding and comprehension of the course material in class. This finding echoes Rai *et al.* [13] and Nwosisi *et al.* [14] who discovered that majority of biology students believed that the FC greatly aided in background knowledge before class and offered the flexibility of time for studying.

In Q3, 93% of the students strongly agree and agree that the pre-recorded lecture helps them to become more engaged in the class activity. FC helps to improve students' self-directed learning skills by participating in various activities in the classroom. The participants also agree (23%) and strongly agree (77%) that the instructors are able to relate the pre-recorded video with class activity to overcome the students' difficulties and optimize the class time efficiently. Most students preferred to view the video presentation and the experimental video because they appear to give a huge advantage over a static image in terms of information insight as well as imprinted in memory for a longer period than a static image [15].

In particular, Q6 and Q8 identify students' emotions and confidence during a class activity. 85% of the participants felt that the FC approach assisted them to be more attentive and active in the class activity and it helped them to understand the concepts clearly (Q6). The FC approach provides an opportunity for students to become active learners during class since they learn the basic content knowledge prior to class [16]. FC may provide more interactions between the instructor and learners during in-class activities where learners can build up higher-order cognitive skills and engage in meaningful learning [17]. It is surprising to learn that 77% of the participants were confident in their ability to address the topics when they sit for the final examination (Q8).

Q10 and Q11 explore the general perception of students about how effective and useful the FC approach is used in the course.

From the content analysis, we elicited some of the opinions expressed by the students on flipped classroom approach:

The flipped classroom allowed us as students to gain more insight and explore more before the actual class itself, allowing us to be more attracted, engaged and interested in the class topic. Students are able to be actually invested in the lectures instead of dreading the lecture itself if it were one-way delivered. (Student 10)

I think that I am more engaged with the lecture on that particular day with the conduction of flipped classroom. I enjoyed the last 7 weeks so so much & I hope this type of lecture can be conducted again with every other courses. Thank you for a very fun teaching & learning session. (Student 23)

It gives time for students to digest the information rather than having a traditional classroom where sometimes its hard to catch up. (Student 12)

Table 1
Perception of Biology students to flipped classroom model (n=26)

Q	Content and structure	Response on Likert Scale				
		1	2	3	4	5
Q1	Viewing the lecture before the scheduled class prepares me for the class activity	15(58)	11(42)	0	0	0
Q2	I did not view the lecture before class although I was supposed to.	0	3(11)	8(31)	8(31)	7(27)
Q3	Viewing the pre-recorded lecture was essential to successfully participating in the class activity.	15(58)	9(35)	2(7)	0	0
Q4	The instructor made meaningful connections between the topics in the pre-recorded lecture and the class activity.	20(77)	6(23)	0	0	0
Q5	The flipped classroom conducted in this course was similar to other courses at the Department of Biosciences, UTM	2(8)	16(61)	7(27)	0	1(4)
Q6	I enjoyed being able to view the lecture prior to schedule class as opposed to live class lecture.	13(50)	9(35)	4(15)	0	0
Q7	The instructor required student participation in the in-class activity	18(69)	7(27)	1(4)	0	0
Q8	I am confident about my ability to address these topics on the final examination.	4(15)	16(62)	6(23)	0	0
Q9	I want more interaction between students and faculty members in class.	7(26)	9(35)	9(35)	1(4)	0
Q10	I wish more instructors use the "flipped classroom" model	5(19)	12(46)	7(26)	2(8)	0
Q11	The Flipped classroom is more engaging than traditional classroom instruction.	8(31)	12(46)	4(15)	2(8)	0
Q12	I would rather watch a traditional teacher led lesson than a lesson video	0	7(26)	14(54)	3(11)	2(8)
Q13	I like watching the lessons on video.	9(35)	14(54)	2(8)	1(3)	0

Values are presented as number of responses to each statement (%) Response Likert scale. Q=Question, 5=Strongly agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly disagree

I totally agree with the flipped classroom activity in group because it is possible for the students to gain more knowledge, input and control over their own learning. They also can compare their notes and add some other point from the other group. (Student 8)

I think the flipped classroom method is fun and it requires student to participate more in the class session. I also think that flipped classroom method is a good approach to build student's softskilled. (Student 1)

Honestly, this method is quite new to me. I strongly agree that this method is useful in this online situation because it provide step-by-step exposure and guidance instead of bomb us with the whole lecture. It will be good if lecturer use this model instead of traditional teaching method like one way teaching especially in online classes. Overall flipped classroom has it potential and benefits. (Student 3)

From the excerpts here, it is evident that Flipped Classroom approach is perceived positively among the participants of our study (RQ 1). The data also exhibits that FC approach is effective in facilitating students' learning experience for a theory and concept-laden course as the Biological Control and Environment Conservation course (RQ 2).

4. Conclusion

This research aims to investigate students' perceptions when a Flipped Classroom approach was used as an instructional methodology in a biology subject. The findings of our study are of significance to biology courses instructors as they can plan and use the FC approach when teaching any theory and concept-laden biology courses. Our study postulates that better learning outcomes are achieved when Flipped Classroom approach is applied as a teaching approach to increase students' learning experience and understanding, especially in a theory and concept-laden course. We recommend that future research may consider including other theory and concept-laden Biology courses in different contexts and participants.

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