Student Perspectives of Engagement in a 5E Instructional Model Applied in a Virtual Learning Environment

Ibrahim Adam[1]

Abstract

As an effort to retain the continuity of student's learning during the COVID-19 pandemic, a subject called "Multimedia Technologies for Teachers (CPT237)", offered to students studying for Bachelor of Arts in Teaching English as a Foreign Language (BATEFL), at the Maldives National University, was re-designed, to be delivered using a 5E instructional model in a virtual learning environment. The re-designed subject was then taught, during the first term of 2020. A mix of asynchronous activities through Google Classroom and synchronous virtual sessions through Google Meet were conducted to achieve the learning outcomes of the course. The ASPECT instrument which assesses student perspective of engagement in an active learning classroom was administered at the end of the semester. The results of the response from the class of 10 students show that they were highly engaged within such a learning environment. This suggests that the 5E instructional approach can be an effective strategy to improve students learning experience, in online learning environments.

Keywords: Student Engagement; 5E Instructional Model; Virtual Learning; Flipped classrooms

1 Ibrahim Adam is currently working as a lecturer/instructional designer at the Centre for Educational Technology and Excellence of The Maldives National University. He holds a Master's in Multimedia (e-learning technologies) from Multimedia University, Malaysia. Correspondence concerning this article should be addressed to Ibrahim Adam, mail: ibrahim.adam@mnu.edu.mv

Introduction

Enhancing student engagement, and transformation of students into active learners are essential for improving quality of higher education provision at all levels (Tanaka, 2019). Active learning is a process in which students participate in activities which engage them to think about what they are learning. This has been mainly driven by evidence from research in Science, Technology, Engineering and Mathematics Education showing that passive learning through listening to lectures or watching demonstrations do not change students' existing misconceptions (Duit, Tregaust & Widodo, 2008). While attending a lecture, reading a textbook, or watching a video can be active forms of learning when reading or listening is for a purpose, they can easily become passive activities where students are not actively thinking about what they are learning. Research shows that instructional methods through which students actively engage in obtaining, sharing, discussing, creating, and applying knowledge, has a greater impact on students' mastery of higher-level cognitive skills such as reflection, analysis, synthesis, and evaluation of their own learning (Freeman, et al., 2014, Hsieh, 2013).

With advances in technology, active learning approaches are mostly used in flipped classroom settings. In traditional flipped classrooms, learners are expected to read text material, watch different types of videos or do prior knowledge assessments online, before attending classroom sessions for face-to-face, active, group learning activities including games, simulations, experiments, debates, or case studies. These activities are mainly problem based or inquiry-based activities designed to challenge, extend, or revise students' prior knowledge, with staff and students working together in partnership. Designing such activities can be challenging in normal flipped classroom teaching. However, teaching using active learning strategies become more problematic when teaching is fully online, as it was during the COVID-19 Pandemic (Sa'adah & Anjarwat, 2021).

In compliance with the Maldivian Government's efforts to reduce the spread of COVID-19, The Maldives National University (MNU) also ceased all face-to-face teaching, effective from March 19, 2020. E-learning was identified and accepted as the most appropriate solution to this issue. However, the biggest challenge was the lack of familiarity among the academic staff at MNU towards the use of technology enabled virtual learning to engage students in active learning. MNU lecturers including myself, started to explore the possibilities for effective strategies to continue teaching and learning in a fully online, e-learning environment.

Therefore, the main aim of the project presented in this paper was to identify an instructional model to continue teaching and learning online keeping the students actively engaged. Research was conducted to investigate the level of student engagement by implementing delivery of instruction within a 5E (Engage, Explore, Explain, Elaborate, Evaluate) instructional model (Bybee, 2009), implemented in a virtual learning environment, with pre-and post-class activities.

Student engagement in learning using technology, can be beneficial for not only during emergency crisis but for providing education for many students at dispersed locations, and for those who balance studies with employment or caring responsibilities. Gaining a better understanding of students' level of engagement will help inform instructor best practices and provide an additional measure for comprehensively assessing the impact of different active-learning strategies (Wiggins et al., 2017). Therefore, the outcomes of this study, focusing on student engagement with the learning process in a virtual learning environment, can be a guide for instructors in designing courses for active learning.

Literature Review

Student engagement and active learning

Since an active learning classroom has been shown to benefit student learning, educators are advocating for a shift away from the traditional "sage on a stage" mode of lecturing toward the use of student-centered, evidence-based instructional approaches (King, 1993; Wiggins, et al., 2017). This is particularly relevant, when podcasts and videos on any subject are widely available for free, online, and often delivered by world renowned authorities on the subject, which can be accessed by students from the comfort of their homes (Freeman & Schiller, 2013). In an active-learning environment, students spend more time co-constructing knowledge in partnership with their peers and lecturers (Wylie & Chi, 2014). Ultimately students become actively engaged, increasing their level of grasping the gist of the lesson (Rafon & Mistades, 2020), through a range of activities designed for peer reciprocal questioning, teaching, and team collaboration (King, 1993).

Engagement is a multifaceted concept and includes dimensions ranging from behavioral (being on task), to cognitive (exerting effort), to affective (being invested in a task) (Reeve & Lee, 2014). Considering how students engage with active-learning exercises, Chapman (2003, p.1) uses the term

"engagement" to mean "learning task engagement". Chapman explains that learning task engagement encompasses, "students' cognitive investment, active participation, and emotional engagement with specific learning tasks." Engagement can be referred to as the level of attention, curiosity, interest, optimism, and passion shown by students when they are learning; their ability to use cognitive and metacognitive strategies to engage in difficult tasks; and by their willingness to ask questions, to participate in discussions with tutors and peers, to make progress in learning (Sa'adah & Anjarwat, 2021; Chapman, 2003). Exploring students' perception toward their engagement in the learning process is important to identify their role as active learners so that the teacher or lecturer can evaluate and adapt the instruction to increase active engagement in the learning task, and in the learning process (Sai, 2020).

Measuring the extent to which students do or do not engage is important for comprehensive assessment of the effectiveness of active-learning strategies while the underlying motivations driving engagement may vary (Wiggins et al., 2017). Many studies have been conducted to investigate the correlation between students' engagement and their achievement where many of these studies has shown a positive correlation between the two variables. Similarly, many theoretical frameworks also have been formulated to explain the relationship (Wiggins, et al., 2017). Educators face a bigger challenge to maximize students' involvement in the learning process through online lectures (Sa'adah & Anjarwat, 2021).

5E instructional learning cycle model

The 5E instructional model is based on the constructivist learning approach and can be used to develop 21st century skills of self-management, self-development, systems thinking, complex communication and social skills, non-routine problem solving, and skills of adaptability to cope with uncertainty, novelty, and change (Bybee, 2009). The model is designed to support students to be active participants in constructing their own learning through making sense of something themselves, whilst engaging in student-student and student-teacher dialogue and debate. The instructor takes the role of a guide to scaffold the learning process where students can integrate prior knowledge and experiences with new ideas and concepts (Rafon & Mistades, 2020).

The 5E model is considered as an inquiry-based learning model providing opportunities for students to develop their own understanding of concepts over time, with a minimum of 3 to 5 phases in an instructional sequence (Bybee, 2009; Dodge, 2017). According to Omotayo and Adeleke (2017), 5E model is one of the most widely used approaches in curriculum, and instruction design,

based on contemporary research on student learning and development. The 5E model consists of five stages of learning that comprise *engage*, *explore*, *explain*, *elaborate*, and *evaluate*. Dodge (2017) compares direct teaching model with the 5E instructional model and concludes that the latter allowed for more student engagement in the classroom. He summarises the comparison with the stages as in the Table 1 below.

Table 1. Comparison of Direct Teach and 5E Instructional Model

Direct Instruction Teaching Model	5E Instructional Model
Anticipatory Set: activates student interest	Engage: students engage in a simple, short problem-solving activity which prompts them to question what they think they know
Link: connection to what has been previously learned	Explore: students must test a question or problem using own ideas in collaboration with others, in new situations, use new technologies and learn new procedures. They must adapt to the new communication style, new concept, or new way of thinking and communicate solutions, based on evidence
Presentation: teacher presents and explains lesson concepts	Explain: students are given the opportunity to learn a new concept or skill with direct teacher intervention, linking students' previous explanations to the new idea. Students communicate and try to justify explanations based on the new knowledge gained
Guided Practice: students are given the opportunity to demonstrate knowledge under teacher's guidance	Elaborate: students apply the new concept or skill to a new situation. Elaboration activities give students additional time and experiences to apply, extend and elaborate on their learning
Independent Practice: students practice concept or skill individually	Evaluate: Teachers assess the learning outcomes from the beginning of the instructional sequence and give formative feedback. Students evaluate their skills, abilities and knowledge and communicate their solutions for the summative assessment of their learning.

Virtual Learning

A Virtual Classroom (VC) is an online learning environment (Wang & Newlin, 2001). The delivery format goes by several names: e-learning, Internet learning, distributed learning, networked learning, tele-learning, virtual learning, or web-based learning (Mupinga, 2005). Online synchronous learning is, in many ways, like a physical classroom. For example, both physical and virtual classrooms allow for immediate feedback, interactions with instructor and peers, and guided exercises to motivate and increase student learning (Yilmaz, 2015). With the significant growth of e-learning, teachers and students explore new ways of constructing knowledge and enhancing teaching and learning experiences outside the four walls of the classroom. Despite the significant growth and interest in e-learning, positive outcomes are not ensured in all contexts (Bell & Federman, 2013). In view of this, some researchers have shown uncertainties about technology transforming teaching and learning and the pedagogic values of online learning (Gedera, 2014). Additionally, the integration of educational technologies presents challenges and concerns in relation to students' learning.

Concerns like teachers being unable to pace around the room to glance at student work and check progress, technical issues like lagging of videos (Terada, 2020), checking whether students are engaged, and teachers' difficulty to let go of control are among challenges that are put forward regarding online education. Furthermore, there are claims that subjects that require analysis, conversation, feedback, and give and take are difficult to teach online (Stevens & Tucke, 2020).

Technology does not offer a complete solution for a transformative education; rather the practitioners should concentrate on the potential, educational technologies offer individuals to enhance their performance whilst been knowledgeable about the limitations of these technologies and know how to utilise the technologies for maximum impact (Gedera, 2014). These potentials and limitations are known as affordances and constraints of technologies in education, and they should be thoroughly considered for a successful implementation of e-learning. What is required is an effective pedagogical approach to be used with the help of technologies to mitigate the shortcoming of online instruction (Gedera, 2014).

Flipped classroom is a form of blended learning modality whereby combinations of asynchronous learning through online medium and synchronous learning within classrooms are integrated. Content is delivered to students outside of the classroom using taped lectures, videos, or other pieces or technology (Sajid

et al., 2016). Class becomes the place to work through problems, advance concepts, and engage in collaborative learning (Keengwe, Onchwar, & Oigara, 2014).

Ismail and Abdulla (2019) presented an approach of Virtual Flipped Classroom (VFC) (see Figure 1) that can be implemented in cases where stage two of the FC cannot be achieved in a physical environment. It provides a virtual blended learning environment, combining the concepts of both Flipped Classroom and Virtual Classroom.

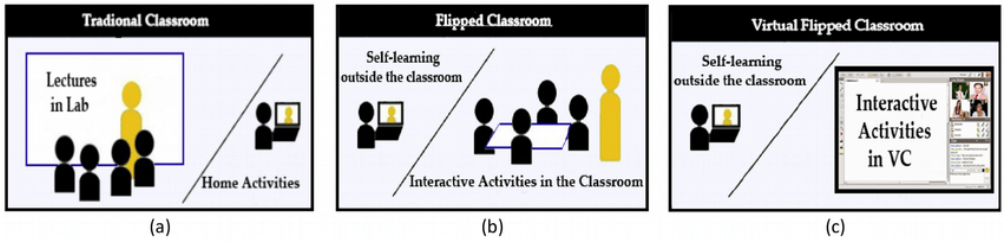


Figure 1. Traditional classroom, flipped classroom, virtual flipped classroom as illustrated by Ismail and Abdulla (2019)

The VFC allows the students to watch and listen to lectures at home and then perform their interactive activities and apply their knowledge in a virtual synchronized classroom in a similar way to the real classroom environment.

Challenges and barriers to virtual flipped classroom instruction

Flipped learning becomes a challenge for those applying it the first time, since it takes time to adapt teaching materials, to become familiar with the technology, time that could be spent on research or services to the university, which can give lecturers more recognition. Often, they sacrifice their free time in the evenings and weekends, to learn and adapt to innovative practices. Staff who are willing to try new approaches to instruction using technology need a supportive technology design team to work with them (Kim, Speed, & Macauly, 2019). Once, the teacher is ready to begin to use the flipped class approach to teaching, more time and resources are required to design or look for the best audio-visual resources to be shared with students, which are meaningful to the students and can actively engage and hold the interest of the students (Bergmann & Sams, 2014).

Teachers can also experience resistance from students who may not be ready for the change. Students may not have the time or be willing to make time to complete pre-and post-class activities. Some students may have the belief

that they do not have the confidence, capacity, or competence in the required pre-requisite knowledge. Some may not have the complex communication and social skills required for collaborative learning. While most of the students may have the necessary technology skills, already underprivileged groups of students may not have adequate access to online resources and can have difficulty in creating a learning environment at their homes (Zainuddin & Halili (2015). All these factors, together with student feedback on relevance of the learning activities, their perceived value of these activities, group composition, and the time available to students need to be considered in creating a suitable learning environment for the students (Wiggins, et al., 2017)

Since the teacher acts as a facilitator and as a guide, they need to be skilled in questioning, probing, and challenging the students' thinking, in an online learning environment. They need to establish mutual trust and rapport by getting to know the students at a more personal level, for collaborative interaction to happen. If students do not have the skills to ask for help, to be creative, to support other students in their academic work, to work as a team or to work independently, these factors can act as deterrents to successful online collaboration. For successful learning to happen, scaffolding by tutors and peers within the range of the student's capabilities is essential (Vygotsky, 1978).

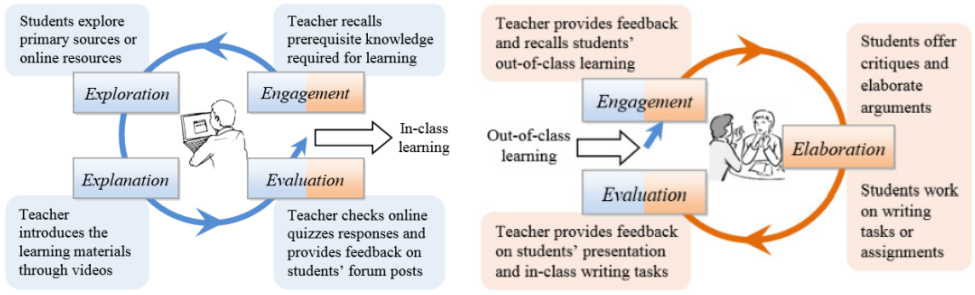
Methodology

Designing process of instruction for 5E in a virtual blended learning environment

The suspension of physical classes at MNU in response to COVID-19 meant that there was no possibility for the implementation of stage two of FC where the teacher organises individual and group activities to deepen the students learning within a physical classroom. However, considering FC as a potential approach to continue the teaching and learning in this situation, the researcher decided to adopt VFC model that combines the concepts of FC and VC, proposed by Ismail and Abdulla (2019), to create a fully virtual learning environment, which did not require any physical face-to-face interaction.

To ensure that the learning environment elicits student engagement, the 5E instructional model was applied within this study, in a virtual learning environment based on the cyclic model proposed by Lo (2017) as shown in Figure 2. The model relates the phases of 5E instructional model for both in-class and out-of-class learning component within the asynchronous, synchronous virtual learning environment. As per the model (see Figure 2a), the

engagement, exploration, explanation, and evaluation phase should be focused outside the classroom and the in-class learning should focus on the *elaboration phase*. However, the *engagement* and *evaluation phase* are still considered necessary inside the classroom. Figure 2b further details the activities within the phases.



(a) (b)

Figure 2: 5E blended learning instructional model proposed by Lo (2017).

To adapt the model to a virtual flipped learning environment, the out-of-class learning component was further classified into before and after class instructional strategies. In this manner, the learning can be related to past experiences and future practice to establish relevance in learning (Portillo & Gallimore, 2020). Keeping this framework as the backbone of the design process, the subject "Multimedia Technologies for Teachers (CPT237)" offered to students enrolled in Bachelor of Arts in Teaching English as a Foreign Language (BATEFL) course during Term One of 2020, for 14 weeks; was re-designed to be delivered in a 5E instructional model applied in a virtual flipped learning environment.

Methodological approach and implementation

While the out-of-class learning was carried out through the asynchronous learning activities assigned on the Google Classroom, in-class learning was carried out in a synchronous virtual class using Google Meet video conferencing platform. The Google Classroom was structured week wise (Figure 3a) with detailed instructions providing students a learning path to complete weekly required learning (Figure 3b).

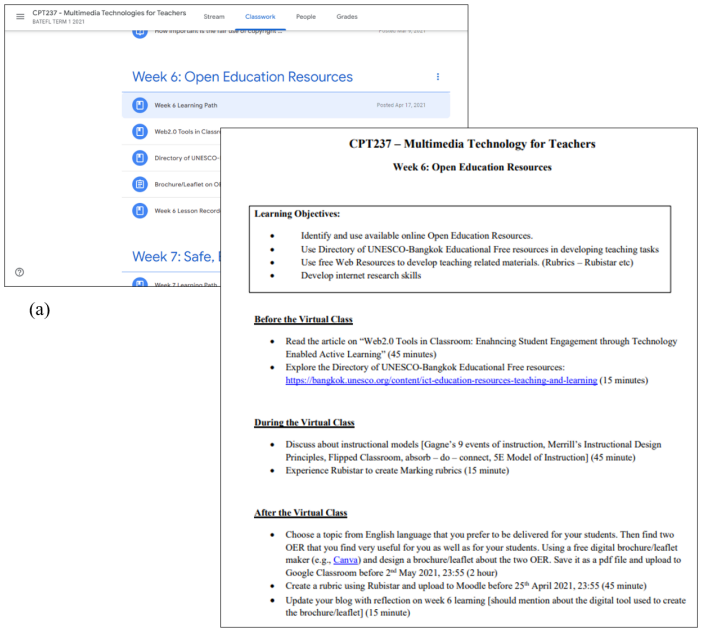


Figure 3: Structure of Lessons in Google Classroom.

Lesson structure for the 14 weeks consisted of learning activities for the phases within the model. An example for Week 6 is shown below.

Week 6

Topic: Open Education Resources (OER)

Learning Outcomes:

1. Discuss application of instructional strategies to design teaching and learning practices.
2. Identify and use available online Open Education Resources.
3. Use directory of UNESCO-Bangkok Educational Free resources in teaching tasks.
4. Use free web resources to develop teaching resources.
5. Develop internet search skills.

Before virtual class (out of class learning):

Explore the UNESCO library of OER

Explanation: Read article on designing learning activities using web 2 tools to promote active learning at multiple levels

During Virtual Class (In-class learning)

Elaborate: Demonstrate and explain the concept of OER, instructional strategies and step-by-step instructions to create resources using tools.

Engage: Students follow discussion and practice along with the instructor

Evaluate: Students present their work through screen sharing option in Google Meet

After Virtual Class (Out-of-class learning)

Engage: Students independently choose an OER related to their field.

Use digital tool to create infographic about the chosen OER.

Review about learning in their reflective blog journal.

Evaluate: Provide feedback to student's submission and journal reflections

Out-of-class learning activities for both before (Figure 4) and after class (Figure 5) were implemented through discussion forums, readings, watching videos, and participating in interactive activities designed using different web tools.

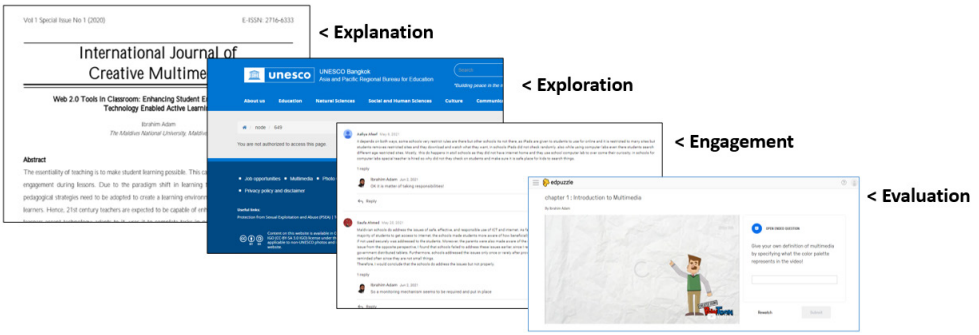


Figure 4: Implementation example of before class activities in Google Classroom.

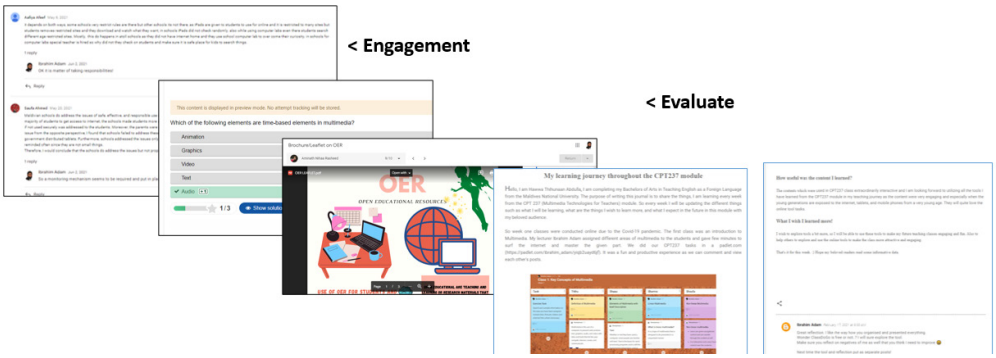


Figure 5: Implementation example of after class activities in Google Classroom.

The in-class learning activities through Google Meet covered elaboration using Google Slides, live demonstrations and interactive activities that could be carried out in real-time using different Web tools (Figure 6).

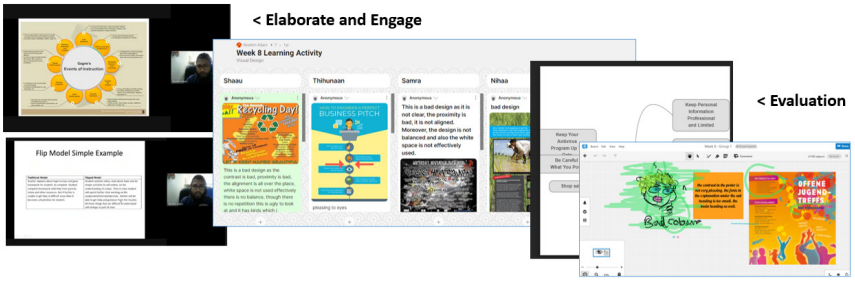


Figure 6: Implementation example of in-class activities through Google Meet.

Instrument, data collection and analysis

Assessing Student Perspective of Engagement in Class Tool (ASPECT) designed by Wiggins, *et al*. (2017) was used to collect data. This validated instrument was adopted as a means to gain a more holistic view of the student experience in an active-learning classroom. The tool has 16 items covering three factors: 1) value of activity, 2) personal effort, and 3) instructor contribution where each student has to provide their perception level. In addition to these items, an open-ended question to write an overall comment of the students was included. The instrument was administered as an online survey questionnaire at the end of the semester, to the 10 students enrolled in this course, during Term 1 of 2020, at MNU. The analysis was carried out descriptively to identify overall agreement level for the three factors.

Results and discussion

Results for the engagement level for the "Value of Activity" factor shows that 90% of the students had a positive perception and 10% had a negative perception towards the group learning activities (Figure 7). The findings relate to the description of it by Wylie and Chi (2014) where they state that in an active-learning environment, students spend more time co-constructing knowledge with their peers. The "Value of Activity" measures the perceptions of the activity's value for learning, and these activities were mainly group-based activities.

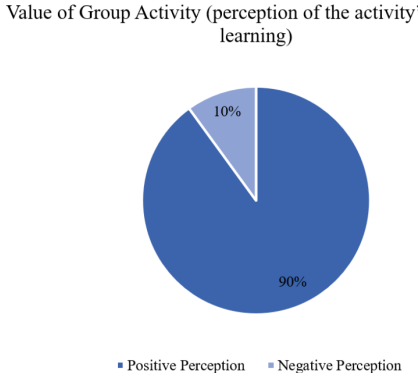


Figure 7: Student's perception on Value of Activity factor.

Result for the engagement factor of "Personal effort" measuring the level of individual effort a student put into the activity states that 100% of the participants had a positive perception (Figure 8). This depicts the motivation of students which is a driving factor for student engagement as stated by Sa'adah and Anjarwat (2021).

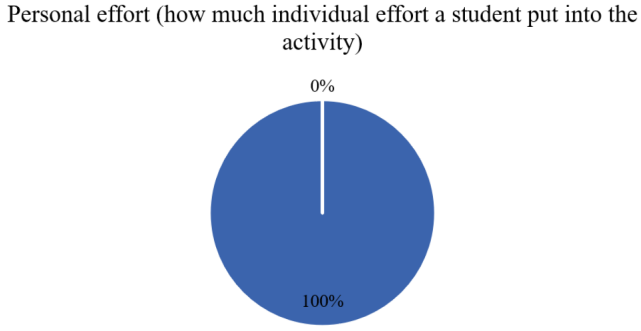


Figure 8: Student's perception on Personal Effort factor.

Results showed for "Instructor Contribution" factor depicts 90% of positive perception and 10% negative perception (Figure 9). In a student-centered, active learning environment, the teacher's role is as a guide or facilitator and the guidance becomes a factor for student engagement (Bergmann & Sams, 2014). This tells us that the proposed learning environment enforces student-centered, activity-based learning strategies.

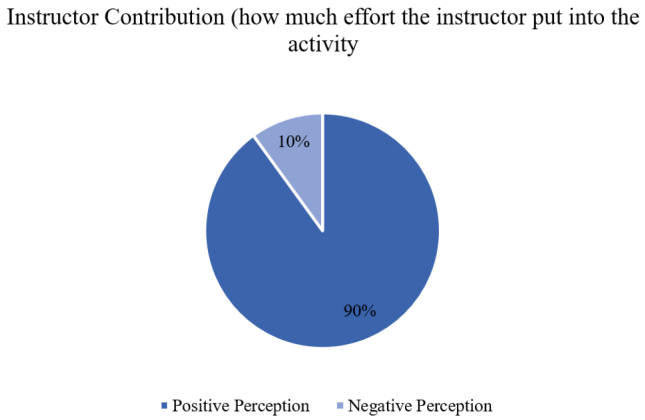


Figure 9: Student's perception on Instructor Contribution factor.

Since 9 out of the 10 students had a positive perception for all the three factors, this indicates that curriculum and instruction designed using the 5E instructional model and applied in a virtual flipped learning environment is a highly engaging environment that fosters active learning practices.

Conclusion

For this study, a 5E instructional learning cycle model was used to design delivery of instructions in a virtual flipped learning environment. The main purpose was to address the significant issue of enhancing student engagement in an online environment through effective active-learning exercises. The result of the engagement measures of students concludes that this approach improved students' engagement during their learning process. Therefore, it is evident that by combining best practices of instructional designing, an engaging learning environment can be created even in an online learning environment to deliver demonstrative subjects. It can not only be applied in e-learning but also in normal face-to-face delivery, using a flipped classroom model.

Since the number of the students enrolled in the class was very few, and the focus of the subject was highly relevant to the context of teachers teaching during COVID-19, the level of student engagement may have been higher for this cohort of students. The application of this model needs to be investigated for experiential learning in other subjects, for multidisciplinary learning and for service learning (Bowen, 2005). Therefore, further research is required to implement it in different disciplines of subjects and for classes with a larger number of students. Also, its applicability can be tested within a context of physical classes by replacing the virtual contact learning with face-to-face component, and using different data collection methods (Mandernach, 2015; Chapman, 2003).

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