

The effective learning process in 5E flipped learning environment: A case study of medical assistant students

Bala Krishnian Muniandy ^{a,1,*}, Por Fei Ping ^{b,2}, Rames Prasath Mahatan Rai ^{c,3}

^a Department of Emergency Medicine, Hospital Canselor Tuanku Muhriz UKM, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Wilayah Persekutuan Kuala Lumpur, Malaysia

^b School of Education, Humanities and Social Sciences, Wawasan Open University; 54, Jalan Sultan Ahmad Shah, 10050 George Town, Penang, Malaysia

^c Department of Biomedical, Faculty of Allied Health Science, City University, U No, Menara City, 8, Jalan 51a/223, 46100 Petaling Jaya, Selangor Darul Ehsan, Malaysia

¹blrmsh@yahoo.com*; ²fppor@wou.edu.my; ³rames.prasath@city.edu.my

*For correspondence:

blrmsh@yahoo.com

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Abstract: Different studies have addressed different aspects of flipped learning but its practices and issues with integrated 5E learning cycles in higher education in Malaysia context still need to be explored. This case study is an attempt to explore medical assistant undergraduate students' learning experiences in the 5E flipped learning environment (5EFL). Varied forms of data were collected, including (1) semi-structured individual interviews with students, (2) student focus discussions, (3) participant learning journals, and (4) classroom observations. Thematic analyses were conducted to analyze qualitative data respectively. Multiple methods were employed to establish the trustworthiness of the study. The findings indicated that students valued real-time interactions with peers and the instructor. In addition, five themes emerged from the study a) Supportive Learning Process, b) Organized and Well-Structured Method, c) Enhance Teacher's Supportive Role, d) Facilitate Students' Role, and e) Enhance Perceived Competence Level in Learning. This study found learners improved their quality of work in 5EFL. Thus, this 5EFL environment played an important role in enriching learners' cognitive load in the learning process.

Keywords: 5E flipped learning environment; effective learning process; medical assistant student; student learning experience

Introduction

Flipped learning is generally aligned with the instructional needs of learners and allows them to have access to the latest sources of knowledge and best practices in instruction and pedagogy according to their pace and convenience (Rodríguez *et al.*, 2019). Flipped learning as an innovation in pedagogy seems to widen the academic horizon of students having more opportunities for innovative learning experiences. It also enhances their learning and learning achievement (Zhao & Su, 2021). Hence, it as a form of online or e-learning can be used at different levels of education (Rahmelina *et al.*, 2019). However, as university students are adults; they are self and socially motivated with their own choice and pace of study and can use it in a better way (Eccles & Wigfield, 2020). The study of Martínez-Jiménez and Ruiz-Jiménez, (2020) compared learning performance and satisfaction of students in a flipped course delivery and traditional classroom teaching in health education. The results demonstrated a

significant difference ($p < 0.01$) between scores of satisfactions with flipped and classroom teaching. Overall, the study indicated flipped course delivery to be the preferred choice of students over lecturing in the classroom merely. Similarly, the study of [Garcia-Vedrenne et. al \(2020\)](#) reported a successful transformation in teaching an undergraduate medical course by using flipped and team learning that emerged as an innovation in instructional strategy. Even so, [Morin et. al \(2020\)](#) at the University of Central Florida, examined the perspective of institutions, faculty, and students in adopting flipped learning. The study reported the overall satisfaction of students to be high along with high levels of their interactions with faculty and fellows. Convenience and flexibility appeared to be the reasons for getting into flipped learning courses and for many students it appeared to be a platform of active learning. However, a downward trend in satisfaction levels among younger students was reported accompanied by problems with technology, time management, and course organization.

As flipped learning combines traditional classroom with online instruction; there emerges a complexity in terms of the variety and diversity of learning environments, learning design(s) and as well as learning styles of the students ([Dantas & Cunha, 2020](#)) and narrow awareness. Similarly, cultural and technological diversity and the Net-Generation experiences create problems for flipped learning and its success ([Åhman & Nguyen, 2020](#)). Likewise, after reviewing research experiences of university students in flipped learning, [Chen et. al \(2019\)](#) suggested that it needs to be focused on the interrelationships of various learning modes, traditional, online, etc. The study of [Yeh \(2022\)](#), demonstrated students' satisfaction with flipped learning due to its flexibility. However, they reported their problems and wished their tutors to be trained in using technology in the instructional process

Although different studies ([Cevikbas & Kaiser, 2020](#); [Mitsiou, 2019](#); [Soon Tan et al., 2022](#)) have regarded flipped learning as a paradigm shift in the teaching-learning process and described its use, benefits, and potential according to [Lawson et. al., \(2019\)](#) unknowingly incorporate ineffective pedagogical strategies that do not promote creative and critical higher-order thinking skills. Furthermore, they questioned the ability of teachers, availability of students-centered classrooms, instructional planning, coping with individual differences, diverse learning experiences and learning styles, and purposeful interactions of students. Even so, [Stone \(2019\)](#) highlighted issues in online learning education regarding the retention of students, the readiness of colleges or universities to embrace it, and problems of developmental education pedagogy. Also, [Gonzales et. al., \(2020\)](#) reported in their study a lower level of satisfaction among younger students due to problems with technology, time management, and course organization. Besides, the innovations in information and communication technologies (ICTs) seemingly brought about a revolution in the field of education and training ([Foutsitzi & Caridakis, 2019](#)) like other areas of social sciences. It seems to have opened new avenues of imparting education by facilitating instructional delivery. Therefore, new methods and techniques of instruction and instructional delivery are emerging with the emergence of new technologies and technological tools. A 5E-flipped learning environment is an innovation in instructional delivery on account of ICTs particularly, the Internet and its related technological tools or application (apps) with the integration of 5E learning cycles. Flipped learning seems to be an emerging concept in developing countries with greater instructional potential. Different studies have addressed different aspects of flipped learning but its practices and issues with integrated 5E learning cycles in higher education in Malaysia context still need to be explored. This study is an attempt in this area. Thus, a research question was posed; How does the 5EFL environment enrich the learning environment for an effective learning process?

Method

Research Design

A case study can provide an in-depth and detailed examination of the situation and its contextual conditions ([Paparini et. al., 2020](#); [Yin, 1994](#)). Thus, a single case study was designed to explore learners' experiences in 5EFL within the authentic context.

Context and Participants

The study was conducted in an undergraduate-level 5EFL course at a private university in Kuala Lumpur of Malaysia in 2022. This course introduced the foundations of prehospital trauma care. Participants were in the year 2 medical assistant students diploma program, including both males ($n = 4$) and females ($n = 8$). The learning activities in this 5EFL course included video lectures, paper analyses, online reading, reflection journals or discussions, online forums, presentations, classroom discussions, and continuous and final evaluation with topics related to prehospital trauma care. The 5EFL course included seven-week durations arranged in terms of seven weeks of online sessions and the end weekly of F2F sessions. All the F2F classroom sessions were arranged in the evening to accommodate students' free schedules. In all seven weeks of online sessions, students were required to go through weekly related activities at their own pace, a course learning management system (LMS) Moodle has been used. They were also encouraged to participate and comment on peers' weekly discussion forums. In addition, to

provide feedback on students' online discussions and assignments, the instructor used asynchronous participating access. The instructor created a role as a participant and was involved in the discussion forum. In the classroom sessions, the instructor facilitates the students' participation in learning activities.

Data Sources

Data sources in this study included: (1) semi-structured interviews with four students (IV), (2) focus group discussion (FG) with two groups and each of the groups has six students, (3) 12 participant learning journals, and (4) seven classroom observations. The researcher first obtained approval from the university administration and the course leader. Follow by this, a meeting was arranged in week 1 with the students. This meeting was held to introduce the researcher and explained the study. The researcher explained the study process and their task throughout the course. The researcher also clarified any questions from the students. In addition, during the meeting, students' consent was obtained through a consent form. In week 2 the first part of the course was started with online and classroom sessions. The first round of participant learning diaries was collected from week 2 to week 4. Then at week 5, the second part course was continued with online and classroom sessions. In week 9, the second round of participant learning diaries was collected. At week 10, 2 focus group discussions were conducted, followed by individual student individual at week 11. All the interviews session was conducted via F2F. The interview protocol for both FG and IV included eight questions, such as background information of interviewees, the activities that students thought effective or ineffective, and the role of this approach to enrich their learning experiences. The focus group discussion lasted for 45-60 min and the individual interview lasted approximately 30 min and all these sessions were audio-recorded.

Data Analyses

All qualitative data were analyzed by researchers. The researcher used thematic analysis (Braun & Clarke, 2014) to analyze the individual interviews, focus group discussions, classroom observations, and qualitative data from the participant learning journals. The interviews were transcribed by the researcher, and first-level member checking was conducted with the interviewees. Once the researcher transcribed the data verbatim (Eaton *et al.*, 2019), and confirmed the transcripts, a thematic analysis was conducted. One of the external scholars with a Ph.D. in the qualitative background was asked to read the interview transcripts and suggested initial codes, categories, and themes, and the researcher and this scholar then discussed them, resolved any disagreements, and finalized the coding. The same protocol was followed to analyze the focus group discussions, classroom observation, and participant learning journals.

Results and Discussion

The effectiveness of the learning process in the 5E flipped learning environment was categorized under five themes, which are a) Supportive Learning Process, b) Organised and Well-Structured Method, c) Enhance Teacher's Supportive Role, d) Facilitate Students' Role, and e) Enhance Perceived Competence Level in Learning as shown in Figure 1; all the themes' findings are explained below.

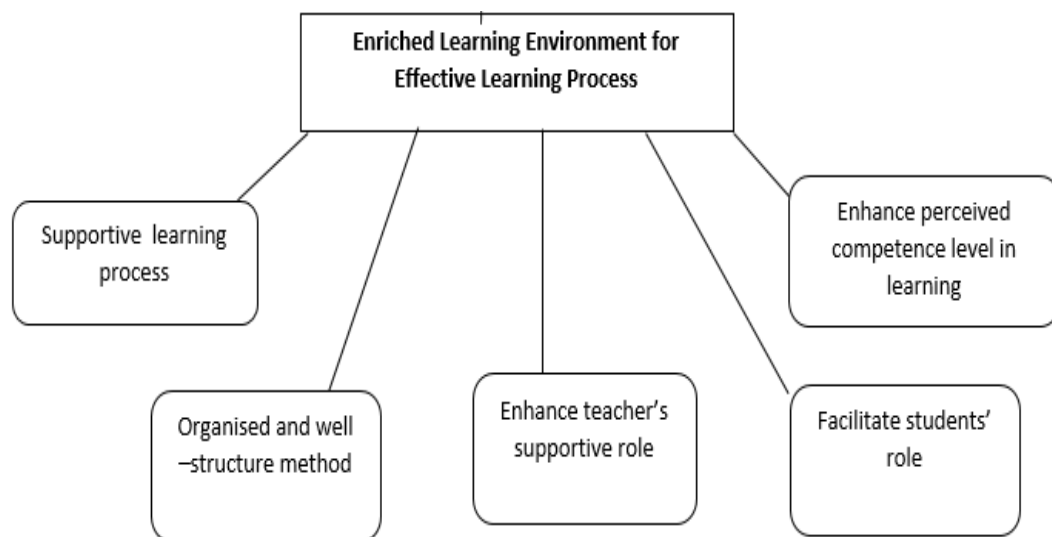


Figure 1. Themes explored on the effectiveness of the learning process in the 5EFL environment

Supportive learning process

The students described this teaching approach as a good and supportive learning process, they felt this because they found the learning materials such as video lectures and notes were good at providing information.

“Sources used such as pictures, online videos, and online reading materials were very good. It resonates with me because I like to study with pictures and online videos. After all, I don't feel bored. I am also happy to understand the topic with the picture. I also think I can learn almost half of the information from the online explanation and the method used is organized and easy to understand” (FG2 S2).

Besides that, some students explained how the video lectures provided step-by-step information for them. Student 5 stated:

“It's a method of using video, the video was interesting and descriptive so we were able to get information and we can learn easily. We were also able to follow because the content was arranged in an orderly manner and step-by-step so it was easy for us to understand and follow the lesson” (FG1 S5).

The online observation of student 8 also noted:

“Student is continuously involved in the online activities, especially watching video lectures; this is evidenced by the total watching video lecture time for student 8 which was 160 minutes” (OBS8).

Moreover, student 1 in his interview mentioned that the video lectures provided information from basic to complex which helped him to understand the lesson better. He said:

“This is because the online session provides materials and explanations and each individual has to go through it himself” (IS1).

The 5E flipped learning environment also provided the students with thinking ability by focusing on learning step-by-step. As student 6 stated:

“The videos are prepared in such a way from basic to deep explanations. The steps are really interesting for me because it engages me in the lesson. The way it was designed well and for me, as a student, it made me interested because it provides me with information on how I am going to continue my learning” (IS6).

Besides the interview, online observation also found that student 6:

“Student 6 was actively involved in the online activities, and he was really focused on following the step-by-step process of the learning activities and completing the task” (OBS6).

The student in his learning diary also wrote that this learning environment made him thrilled to learn by previewing information and eager to continue with online learning activities. Student 3 wrote:

“I felt thrilled to experience the contents of the 5E learning environment. The preview was awesome and I was eager to start online learning activities” (LDS3).

This learning environment also provided this student with opportunities to re-watch the video to increase her understanding. Student 3 wrote in her reflection:

“I have opportunities to re-watch the video lecture to increase my understanding. I can follow the lesson well. I felt it was well arranged which made me interested to follow” (RES3).

The online observation noted that student 3:

“Student 3 reviews the video frequently” (OBS3).

The students also had the excitement to continue online and classroom sessions; this is because the arrangement at the beginning of both lessons made the students excited to continue with the subsequent

lesson. Student 9 reflected:

"I was ecstatic to be able to interact with the subject in the 5E learning environment. I was excited to begin online learning activities after seeing the preview" (LDS9).

"Students freely discussed the topics with their peers in the classroom" (CO2).

The learning process in a flipped classroom is characterised by a variety of learning modes being introduced including group work, independent study, research, performance, and project work that optimize learners' learning capacity. By participating in different learning environments, the learners themselves have the flexibility to choose when and where to learn which can gradually and constantly increase their autonomy level as mentioned by Brau (2020). This study aimed to explore the enriching constructive alignment that influences the student's learning process in the 5E flipped learning. The positive learning conditions in this approach to learning, as well as factors that contributed to the adoption of different approaches to learning, were identified. It was evident that different elements of constructive alignment had a clear role in guiding student learning and studying. The teaching and assessment-related factors appeared to play a big role in student learning. In the course that applied active teaching and learning activities, almost all the students described adopting a deep approach (McEnroe-Petitte & Farris, 2020). It appears that teaching that provides enough challenges for students requires active involvement from the students throughout the course, provides chances for peer support, and uses high-quality teaching materials to support students to adopt deep learning (Li *et al.*, 2022). On the other hand, traditionally organised courses with lectures and final examinations, and with no engaging activities had significantly more students adopting the unreflective or mixed approach learning outcomes (Hailikari *et al.*, 2021). Furthermore, according to Wang *et al.* (2021), a constructive learning environment with an active learning design and implementation which is focused on this study will provide students with a positive learning environment. Therefore, it appears that teaching that does not require active involvement on the part of the students also provides more options for students not to engage. Hence, the way the teaching is organised seems to play a crucial role in guiding what the students do. As suggested by Uiboleht and Karm (2020), a student-centered approach to teaching appears to support students' learning towards the adoption of a deep approach. The above explanation was in line with the finding of this study whereby most students experience a positive learning process with a 5E flipped learning environment.

Organized and well-structured method

The 5E flipped learning environment was arranged in a systematic approach. Some of the students expressed their concern regarding their learning experiences with the lesson arrangement of the course content. They liked how the content was arranged, especially the method of delivery of content. They expressed their perception of the knowledge that was passed to the students through a step-by-step approach. They liked to focus on the course because the approach enabled them to follow the context well. This was shared by student 6:

"I also like to learn with this method because this method was structured in providing information. The online video first reveals the content and the follow-up video then explains the content. The video explained in more depth and there was also reading material that gave me a more in-depth explanation" (FG2 S6).

The online non-participant observation also noted that student 6 was more engaged with this approach as described:

"Students participated in the step-by-step activities provided in an online learning environment" (OBS6).

This well-organized instructional method supported students in learning because the method provided the students with learning details and facilitated them to understand the lesson. This has been explained by the students with the following data:

"Yes, I feel I can learn detail through this approach. This was because I felt the method used to provide me with the information step-by-step. I can follow lessons step-by-step the online session starts with an introduction on what we understand in the following lesson" (IS9).

"The classroom was well-planned steps-by-steps for easy understanding. I felt it was a method" (LDS2).

"This session allowed me to connect what I had learned in class to what I was expecting in the

upcoming classes” (LDS7).

The student also described the 5E flipped learning environment as providing integration between online and classroom sessions. Student 10 wrote:

“What I value during my preparation for the classes is the ability to relate what I've been taught to what I already know” (LDS10).

In recent years, numerous researchers have already discussed and verified the effects of flipped learning, the advantages of flipped learning, and their benefits for students' learning performances (Marshall & Kostka, 2020; Özdögrü, 2022). Nevertheless, researchers have specified that providing multimedia and adequate learning guidance is important for supporting students' extracurricular activities (Suartama *et al.*, 2020). To reach this goal, this study proposed a contextual 5E flipped learning approach. It provided medical assistant students with concepts relevant to prehospital trauma care, integrated the 5E learning cycle stages into a flipped learning environment with multiple learning activities, and designed a case study to explore students' learning experiences. Hence, this study's findings indicated that students have a positive learning environment with this approach to enhance their learning ability in prehospital trauma care.

Chiou *et al.* (2020) believed that a well-organized and structured method stimulated students' internal motivation. With the improvement in internal motivation, participants can thoroughly take part in learning activities (Chaudhuri, 2020). That is why the 5E flipped learning environment has great potential for promoting students' learning engagement, which could be the reason why the students learning with the 5E flipped learning approach showed better attitudes and learning performance than those learning with the conventional flipped learning environment. Additionally, the study findings regarding learning tendency with the well-structured method were in line with the hypothesis proposed by Sulaiman *et al.* (2020), who suggested that students' recognition could benefit from 5E learning cycle activities. Other researchers in a systematic review have also pointed out that contextual learning activities with a learning model can successfully instruct students to engage in higher-order thinking, and thus improve their learning efficiency (Zou *et al.*, 2020). Therefore, the 5E flipped learning approach was developed in the present study to assist students in obtaining knowledge through sound, videos, and pictures with contextual questions when they observe and deal with problems. These applications enabled students to exhibit higher-order thinking and to understand how to apply knowledge in clinical environments, which is also a conducive effort to enhance their learning ability. This study finding showed that a 5E flipped learning environment can promote students' in-depth motivation, and thus increase their in-depth understanding and application of knowledge.

In addition, the findings of the present study revealed that the students encountered a manageable learning environment with this approach. The interview results showed that the students thought adopting the 5E flipped learning environment has promoted their knowledge of making correct decisions as well as reduced their learning anxiety. The result specified that providing an organised and well-structured method with a suitable time for situating learners in learning contexts is an effective method in medical education.

Enhance the teacher's supportive role

The role of a teacher in delivering courses is very important to make sure their students are able to understand and gain knowledge. The teacher could use various approaches in order to impart knowledge to their students. Therefore, a teacher plays an important role in conducting teaching and learning activities. Teachers are usually considered facilitators in teaching and learning. They need to guide the students in the learning process. This 5E flipped learning environment provided the ability to enhance the supportive role of the teacher in teaching and learning. Student 8 shared her experiences:

“The instructor gave a key point for me to answer. This was great so I can recall what I have learned online. Next, the instructor discussed the questions so that all students understood what they should understand while studying face-to-face. This allowed me and my friends to concentrate on the session” (FG2 S8).

Moreover, student 6 explained that providing immediate feedback to the students' questions helped them to learn and this enhanced the teacher's role in the 5E flipped learning environment. As student 6 described:

“The support provided by the teacher was very good, the teacher helps and guides students to understand the content of the topic. They gave immediate feedback and this made the students clarify any doubt about the topic” (IS6).

The 5E flipped learning environment is one of the platforms which enabled more interaction with the

teacher. Student 1 in his learning diary mentioned:

“This is a platform where we get to interact with the teacher and I used it to have some questions answered” (LDS1).

Furthermore, in the classroom observation, it was found that the teacher facilitates student learning by providing learning materials and taking control of their learning.

“The teacher relaxes and assumes facilitating, supporting and resource person roles” (CO2).

“The teacher employs a precise teaching technique and provides the content to the students” (CO3).

It is ultimately undeniable that opportunities and challenges are seen by both teachers and learners when introducing the flipped learning approach in teaching and learning (Turan & Akdag-Cimen, 2020). In addition, the flipped learning approach helps 21st century learners to develop 21st century skills. The flipped learning approach provides more time for learners during the teaching procedures through various learning tasks and activities such as role plays, simulations, games, discussions, and presentations. Consequently, learners engage more in the learning environment and become active learners (Galindo-Dominguez, 2021). Moreover, learners can expand their knowledge and broaden their horizons via content-based activities through flipped instruction. In terms of teachers and instructors, the flipped learning approach allows them to develop or choose materials related to real-world situations or current issues with the integration of technology. Therefore, learners can utilize technology as a tool to access learning materials and gain more knowledge by themselves anytime and anywhere. More importantly, the flipped learning approach also develops information, media, and technology skills for learners as one of the required skills in the 21st century.

Apart from providing opportunities for learners to be more engaged in the lessons and become active learners, the flipped learning approach also supports teachers to become active facilitators. Teachers in the flipped learning environment or classrooms need to prepare the learning materials in advance and update the materials with current situations, especially in medical education (Blair *et al.*, 2020). Consequently, in the flipped classroom, teachers will not only teach and prepare all learning materials, but also facilitate their professional learning and development, link the flipped learning approach with suitable practices, introduce innovations to the classroom, and conduct research to help improve their students. Therefore, the teachers will enhance their eagerness to challenge themselves to make their teaching more efficient, turn themselves from passive teachers to active teachers and develop 21st-century skills. Thus, the benefits of implementing the flipped learning approach need to be promoted to all teachers in terms of supporting active learning, enhancing learners' engagement, and practical assessment. Similarly, the practice of the 5E flipped learning environment in this study has a positive outcome with the supportive role of the teacher. In this study, students who have experienced the design and implementation of the 5E flipped learning environment have emphasized the role of the teacher as an active facilitator; they experienced the teacher playing an active facilitating role, especially in the classroom session to engage students in learning. This study is consistent with the findings of Blair *et al.* (2020). Thus, a good instruction design can promote a supportive role of teachers in teaching and learning.

Facilitate students' role

The students also experienced this 5E flipped learning environment that facilitated the student's role in learning. This approach has focused on student-centered learning environments. There were two learning environments set in this 5E flipped learning environment; online and physical. The students had the opportunity to learn self-directed online with instructions and in the classroom teacher-guided, they were also allowed to discuss with their peers and enhance their understanding. The classroom and online non-participant observation identified:

“The learners work extra hard here. The learning session is controlled by learners through observation work investigation and drawing shock and fluid resuscitation inferences” (CO1).

“The students took part in the group discussions with the desire to understand the topic further” (CO3).

“The student also takes part actively in the online learning activities” (OBS9).

In the 5E flipped learning approach, learners are encouraged to take charge of their learning. Although it may challenge those learners who are used to sitting down to listen to lectures, learners in the 5E flipped classroom are expected to be able to support themselves and work collaboratively with their colleagues in learning. In addition, learners in this flipped classroom are required to explore the content

in greater depth by themselves. They are also expected to be able to increase higher-order thinking capacity according to the learning opportunities provided by the teachers. Furthermore, learners in flipped classrooms are also actively involved in building knowledge through increased opportunities from participating in a meaningful learning environment (Say & Yildirim, 2020). In this study, students have mentioned that the use of the 5E learning cycles in the flipped classroom approach has facilitated their role as students in learning. They felt that in this learning environment, they were more involved in the learning activities in both online and classroom. They were able to engage with the learning activities, especially with the 5E step-by-step stages of activities. This learning environment was designed to guide the students to follow the activities with scaffolding focused on the constructivist model. The students were guided with step-by-step instructions in their learning process. Thus, the finding of this study is concurrent with the suggestion by Özbay and Çınar (2021) which focused on a systematic teaching design approach that can facilitate students' role in the learning process.

Enhance perceived competence level in learning

All students reported positively about the 5E flipped learning environment pre-class element, especially basic to complex lecture video information viewing, as it enabled them to develop an understanding of the course content before class. Having the basic knowledge enhanced students' perceived competence and confidence in learning in class and motivated them to pay more attention during class time. As the students stated:

"After watching the step-by-step video lecture, I have more confidence in class ... confident to look at the teacher and feel more confident to answer questions" (IS1).

"As I have the basic concept in my mind ... during the discussion in class, I could quickly understand the views of others. This gives us more opportunities to interact and I have more opportunities to express my views. Without preparation, I do not have the nerve to talk" (RE S2).

"I felt very confident and knowledgeable after going through the step-by-step online session, it made me well prepared before the classroom session" (FG1 S5).

The results from focus groups, individual interviews, and learning diary feedback also gave an insight into the students' learning approaches towards in-class learning activities. Students had a high preference for the 5E flipped learning environment and were more engaged in becoming active learners in both learning environments: pre-class and in-class sessions. In this study, the students expressed their enriched learning experiences by saying they have improved their understanding and application of knowledge in the clinical practice which promoted a deeper and wider thinking for them. They also perceived a positive learning outcome with the use of the 5E flipped learning approach that combined e-Lecture prior to the class with face-to-face interaction in the classroom. As mentioned by Bloomberg (2022), learner empowerment, social learning, and emancipating flexible, lifelong learning are some of the key features focusing on future pedagogical ideas, where the learner applies knowledge through intellectual inquiry in professional and applied contexts. These features were considered within the 5E flipped learning environment design and implementation for this study. In addition, another way to explain students' enhanced learning outcomes in the 5E flipped learning environment is that this new model provides an opportunity for students to become active learners.

In this learning environment, students learn the basic content knowledge before the classroom and they come to class to explore more opportunities to work on problem sets and engage with the classroom activities. Hence, an innovative flipped learning approach can provide opportunities for students to have more interactions with the instructor and peers during in-class activities (Cho *et al.*, 2021). Therefore, while students actively engage in interactive sessions for in-class tasks followed by face-to-face instruction, they can build up higher-order cognitive skills and engage in meaningful learning (Lu *et al.*, 2021). For these reasons, the 5E flipped learning approach is useful when teaching students in large enrollment introductory sections. In addition to becoming active learners in the 5E flipped learning environment, students are more likely to manage their time, learning strategies and approaches, and pace, which may be associated with self-regulation (Park & Kim, 2021). From this, the students gain basic knowledge and learn at their own pace. Moreover, the low-stakes formative assessments in the 5E flipped learning environment allowed students to keep track of their learning process. These opportunities in the 5E flipped learning environment have the potential to encourage students to equip themselves with self-regulation skills that improve their competence level in learning.

Limitations and suggestions for future research

A few limitations are noteworthy in this study. First, the study context was limited to a small-sized undergraduate class in learning design and technology, and thus the findings may not be applicable in other disciplines or at other educational levels. Future research could expand the study in diverse educational settings. Second, the number of interviewees was limited. Thus, instructors and instructional

designers should be cautious when applying the findings of this study to larger classes. Third, the interviewer and interviewees had a strong rapport, which must have influenced the research in various ways. To establish trustworthiness, the researchers worked collaboratively to address possible biases and conducted interviews one week after the course had concluded. Fourth, even though the research involved multiple data sources, it did not examine students' learning outcomes. Future studies could investigate more closely the effect of strategies and technologies on students' learning outcomes in 5EFL.Ss

Conclusion

In conclusion, an overwhelming number of students reported that they were more confident in their ability to understand lessons after attending the 5E flipped learning environment. They believed that they had made good progress in the development of knowledge and practice with this 5E flipped learning environment. In addition, the improvements in self-efficacy concerning independent learning showed that the 5E flipped classroom approach may be appropriate for preparing students for tertiary studies. As a result, being active learners and taking responsibility for their learning can help them leverage the resources provided in face-to-face and online sessions in 5EFL.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

B. K. Muniandy: data analysis; methodology, and writing original draft preparation. **P. F. Ping:** analysis; writing original draft preparation. **R. P. M. Rai:** review and editing.

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