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5E Flipped Learning Environment Enriched Learning Experience of Medical Assistant Students by Increased Online Learning Ability: A Case Study

(Kaedah Pembelajaran 5E Kelas Terbalik Meningkatkan Keupayaan Pembelajaran dalam Talian bagi Pelajar Pembantu Perubatan: Satu Kajian Kes)

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Abstract

Engagement with learning activities is very important for adult students, especially in the online learning environment. This research is an exploration of the learning experiences of medical assistant students in a 5E flipped learning environment of the Pre-Hospital Trauma Care course at a private university in Malaysia. In this study, students were required to participate in a 5E-flipped learning environment involving online and face-to-face learning activities. A case study research approach was adopted, involving 12 undergraduate students enrolled in a 7-week PHTC 5E flipped classroom course. Qualitative data were generated through participants' learning diaries, classroom observations, online non-participant observations, the student focuses group discussions, and individual student interviews. Thematic analysis was used to code, identify patterns, and develop themes within the data. The findings showed that students can improve their online learning ability with this 5E flipped learning environment. This focused on the aspect of a) Providing a Self-Checking Approach b) Increased Students' Preparation Time c) Providing a Self-Directed Learning Environment, and d) Improve Self-Efficacy in Learning. Thus, the 5E flipped learning environment enriches students' learning ability in an online learning environment.

Keywords: 5E flipped learning, learning experiences, online learning ability, medical assistant students, 5E flipped case study

INTRODUCTION

Over the past decade, educational standards have emphasized the value of student-centred learning, where students are responsible for their learning and actively participate in higher-level tasks and cognitive standards (Islam, Sarker & Islam, 2022; Mubarak, Wibowo, Rahamathulla, Yang, & Schönert, 2022; Nerland, 2020). This requires the use of active learning approaches that encourage students to engage in an online learning environment and to present their work, problem-solve and engage in self and peer assessment, group work and discussion in classroom sessions (Bond, 2020). Contemporary instructional strategies, which typically use technology as the main tool of delivery, aim to relieve this tension and enable effective student-centred strategies. A majority of faculty strives to use innovative methods to encourage learner autonomy while ensuring content coverage within the period of the curriculum (Zheng & Zhang, 2020). Now that educational technologies are increasingly being made available online, faculty in various disciplines have enabled students to access various course content (usually via video lectures) outside of the classroom and hands-on activities within the classroom; namely, classroom flip (Kang & Kim, 2021). Flipped classroom (FC) models have attempted to address these issues by dedicating more classroom time to active and student-led learning and using advanced technology to support a blended learning approach. A typical FC methodology provides students with access to online video lectures/tutorials (flips) before in-person sessions so that they are prepared to engage in more interactive, collaborative, and cross-cutting activities such as research, debate, problem-solving, discussion, engaging-based learning methodology (Al-Samarraie, Shamsuddin & Alzahrani, 2020; Kang & Kim, 2021; Marshall & Kostka, 2020; Zhao & Su, 2021). Students benefit from this pre-class exposure to materials and events outside of the classroom, as they can adjust their pace of study to suit their learning styles and understanding. During class hours, students can engage in class activities through group work, rather than passively listening (i.e., lecturing) to the instructor. In turn, instructors can spend class time facilitating and monitoring student performance and providing adaptive feedback to individual students or groups of students (Marshall & Kostka, 2020; Zhao & Su, 2021).

This approach has attracted the attention of scholars as research shows that this type of instruction creates a more dynamic learning environment (Halasa et al., 2020; Kang & Kim, 2021; Martnez-Jimnez & Ruiz-Jimnez, 2020). However, the implementation of this approach in medical education, especially in the setting of medical assistants, is sparse. Briefly, a novel flipped learning environment approach with a detailed lesson design was developed and implemented in a medical assistant program with the expectation of achieving a more engaging and interactive learning environment.

Many proponents of active, student-centred learning suggest that activities in the flipped learning environment should be well designed to maximize opportunities for students to build meaningful personal knowledge and develop higher levels of cognitive skills (such as application, analysis, and assessment) (Diningrat, Setyosari, Ulfa & Widiati, 2020) or higher-order thinking skills (Hwang, Chang, Song & Hsieh, 2021). In this way, students can determine whether they have understood the course content and relate it to their prior knowledge and make it their own by being able to question it in their own words (Zheng & Zhang, 2020). Systematically designed activities are an effective approach that could stimulate students to think higher and incorporate conceptual understanding into the learning process (SyaRoni, Inawati, & Guswanto, 2020). When students actively engage and participate in the learning process, they can better understand the subject matter (Hoshang, Hilal, & Hilal, 2021). Syaroni et al. (2020) also noted that students need to be actively involved in learning activities; They need to participate in the learning environment, whether there are parts of the activities that seem important but that they don't understand, and how to understand the core concepts. This process triggers many metacognitive processes, thus supporting learning, whereby students become more intellectually active and engaged in the learning process (SyaRoni et al., 2020).

Furthermore, Baptist, Utami, Subali, & Aloysius (2020) pointed out that step-by-step learning cycles engage students in the subject of study, thereby increasing their understanding and enhancing their interactions.

Rafon and Mistades (2020) posit that the regular and systematic use of the 5E instructional model could make the flipped learning environment unique. Some instants, learning cycles, such as 5E instructional cycles, can be regarded as educational facilitators because it provides not only a step-by-step learning approach for students, but the activities made also support stronger communication, sharing and socializing (Gillies & Rafter,2020; Rafon & Mistades,2020; Siwawetkul & Koraneekij,2020). The 5E instructional model can increase students' participation in the learning process, which can be summarized simultaneously as engagement with the learning environment (Siwawetkul & Koraneekij,2020). This means, every student in the 5E instructional learning environment can interact and participate actively, and the teacher can get a rough picture of student learning progress (Lam, Hew & Jia, 2022). In recent years, numerous studies have examined the effects of the 5E instructional model in education and have reported positive learning outcomes (Bahtaji, 2021; Gillies & Rafter,2020; Lam et al., 2022; Rafon & Mistades, 2020).

Tasks and activities integrated into higher education classes are based on pedagogies and assisted technologies that can increase student engagement and improve their attitudes towards learning. Based on the work cited above, this study chooses flipped learning and the 5E instructional model as the main pedagogical approaches. This paper suggests that when university students have more opportunities to engage in a flipped learning environment and are encouraged to improve their study skills and engage in deep thought and discussion supported using 5E lesson cycles, curricula could be constructed differently. As Lo and Hew (2020) have pointed out, few conceptual frameworks can evoke a how-to-list-associated approach to designing an effective flipped learning environment and detail how that approach contributes to learning. Solutions to the problem require an understanding of which design approach inspires student engagement in the flipped classroom environment. Therefore, this study created an innovative flipped learning environment that included 5E instruction cycles to improve the engagement of the medical assistant students in the learning process; thereby contributing to the growing body of research literature in this area.

LITERATURE REVIEW

<u>FLIPPED CLASSROOM</u>

Two components include the FC approach; The first is the independent learning process that takes place outside of the classroom and the second is active and collaborative teaching in the classroom (Bergmann & Sams, 2012). The FC approach uses various technological means to provide students with instructional materials and associated exercises. These technological resources allow students to learn the content outside of the classroom (Dori, Kohen, & Rizowy, 2020), thus providing teachers with plenty of time in the classroom to provide deeper explanations and practice together with the students (Bergmann & Sams, 2012). In the online component of FC, teachers provide video lectures, presentations, online assignments, and more, and expect students to independently study the content provided before coming to class. According to Lo and Hew (2017), this approach thus promotes a student-centred learning experience. In addition, it allows for smarter management and use of lesson time by allowing teachers to wander around the classroom, identify different individual difficulties, discern different challenges and misunderstandings among students, and finally respond accordingly by providing those students with support and encouragement (Lo & Hew, 2017). A key benefit of the classroom component of the FC approach is that students are provided with sufficient class time to work extensively and collaboratively with their teacher on exercises, which is considered essential to mastering skills and achieving a full understanding of the lesson (Kaiser & Vollstedt, 2007). A key advantage of the online component of the FC approach

is that the instructional content is available to students outside of the classroom anytime, anywhere, allowing them to revisit it countless times until they reach a full understanding (Lo & Hew, 2017). In addition, the traditional flipped classroom, where students meet face-to-face with the teacher, has been almost impossible to adopt. Instead, many institutions have integrated online teaching into the FC. Research has shown that this combination resulted in positive effects for students, including increased learning, understanding and attention, and positive evaluations of a variety of courses taught (Tang et al., 2020).

5E INSTRUCTIONAL CYCLES

According to the 5E model (Bybee et al., 2006; Bybee, 2009), learning through 5E cycles follows five phases identified as follows: (i) engagement, (ii) exploration, (iii) explanation, (iv) elaboration, and (v) evaluation. These phases can be implemented at different levels when planning and creating different curriculum materials, lesson plans and instructional strategies (Bybee et al., 2006). The first feature is to engage the learner in scientific questions. This trait is found in the first phase of the 5E model, namely engagement, which enables students to engage in learning activities. At this stage, teachers need to motivate and engage students by presenting a specific problem that requires students' attention. The next phase is exploration. Once students are engaged and motivated in a particular activity, they should be able to explore their thoughts and abilities. At this stage, the instructional approach is characterized by prioritizing evidence in response to questions and formulating explanations based on evidence. The next phase of the 5E model is Explanation, where concepts, ideas, processes, and capabilities become clear and understandable. This phase relates to another feature of inquiry, involving explanations associated with scientific knowledge and the communication and justification of explanations. the explanation phase describes these characteristics and offers the students the opportunity to relate their explanations to scientific findings and justify them further. The next phase is the elaboration of the problem and its solution(s). At this stage, teachers provide students with more experiences, assignments, and challenges to expose them to new but similar situations. The final phase of the 5E model is evaluation, students are required to take part in the assessment of learning and the teachers are expected to provide students with appropriate feedback on the quality of their performance.

METHODOLOGY

RESEARCH DESIGN

A qualitative study was conducted to explore the learning experiences of university medical assistant students about practices of the 5E flipped learning environment in one of their emergency course modules. Its character was exploratory about learning experiences among medical assistant students. In other words, it was case study research exploring individuals' online learning experiences using the 5E approach to flip learning environments.

RESEARCH SUBJECTS

This study was limited to medical education students, specifically medical assistant subjects at one of the private universities in Malaysia. University students (Diploma in Medical Assistant Studies Programs) were selected to participate in this study. Appropriate sampling procedures have been introduced. 12 students took part in this study. These students were required to attend a 7-week prehospital trauma course designed with a 5E flipped approach to learning.

TYPES OF INSTRUMENTS

A total of 12 learning diaries, two focus group discussions and four individual interviews were used as research instruments for data collection. All these research tools were created after reviewing the literature and in light of the nature and research questions of the study. Expert opinions helped the researcher finalize the tools. The main question was to explore the learning experiences of medical assistant students in a flipped 5E learning environment. In this study, a pilot study was conducted to test the data generation tools, specifically the participant learning diary, the focus group discussion questions, and the individual interview questions. Two students from the second-year medical assistant program were selected to provide feedback on the quality and understanding of the content of the participant learning diary, focus group discussion questions, and individual interview questions. The feedback from them was used to make improvements to the data collection tools.

DATA COLLECTION TECHNIQUES

The researcher first obtained the approval of the university administration and the course director. A meeting with the students was then arranged in week 1. This meeting was held to introduce the researcher and explain the study. The researcher explained the study process and their role throughout the course. The researcher also clarified all the students' questions. In addition, consent was obtained from the students through a consent form during the meeting. In week 2, the first part of the course started with online and face-to-face sessions. The first round of participants' learning diaries was collected from week 2 to week 4. Then, in week 5, the second sub-course continued with online and face-to-face sessions. In week 9, the second round of participants' learning diaries was collected. Two focus group discussions were conducted in week 10, followed by four individual student interviews in week 11.

DATA MANAGEMENT TECHNIQUES

The data collected from the participants' learning diaries were transferred in the form of documents and focus group discussions and individual interviews in the form of interview transcripts. To answer the purpose of this study, the researcher used a thematic analysis approach to the data analysis. In this study, participants learning diaries, focus group discussions, and individual interview transcripts were analyzed by following the six-level thematic analysis of Braun and Clarkes (2020). Thematic analysis is a versatile method that can be used in a variety of theoretical and epistemological contexts (Braun & Clarke, 2006). In other words, this analytical method does not prescribe any specific data collection methods, theoretical positions, or epistemological or ontological frameworks (Braun & Clarke, 2006). Themes or patterns in thematic analysis can be identified in an inductive or bottom-up or deductive or top-down manner. In the inductive approach, data is analyzed with little or no predetermined theory or framework, resulting in data-driven analysis. The deductive approach, on the other hand, involves fitting the data into a given framework or the researchers' analytical biases to examine specific theoretical concepts (Braun & Clarke, 2006; Burnard, Gil, Stewart, Treasure & Chadwick, 2008). An inductive thematic analysis method was used in this study (Braun & Clarke, 2013). More specifically, topics are identified based on what is contained in the data. In addition, the data will be used to examine specific theoretical concepts (Braun & Clarke, 2013).

RESULTS

DEMOGRAPHIC PROFILES OF THE PARTICIPANTS

There were 12 students involved in this study. Out of the 12 students, 8 were females while 4 were males, aged between 20 and 22 years. In terms of ethnicity, only one student was Malay, four were local ethnics from Sabah while the other seven were local ethnics

from Sarawak. Table 1 provides data on the demographic profiles of the participants involved in this study related to student code, gender, age and ethnicity.

Table 1. Category of participants

Student	Student Code	Gender	Age	Ethnicity
S1	S1	Male	21	Iban
S2	S2	Female	20	Malay
S3	S3	Female	22	Iban
S4	S4	Male	21	Kadazan
S5	S5	Male	21	Kadazan
S6	S6	Male	21	Dusun
S7	S7	Female	20	Bidayuh
S8	S8	Female	22	Bidayuh
S9	S9	Female	21	Dusun
S10	S10	Female	21	Bidayuh
S11	S11	Female	21	Iban
S12	S12	Female	20	Iban

Note: S= Student

The responses of students collected through learning diaries, focused group discussions, and individual interviews were grouped thematically according to the purpose of the study. The results were extracted from thematic analyses individually for students respectively. Table 2 shows the summary of data collection sources.

Table 2. Summary of data collection sources

Research Method	Description	No. of Sources Collected
Learning Diary	Collecting students' learning diary	12 (Learning Diary)
Student Focus Group Discussions	Conducting focus group discussions with students divided into 2 groups with each group consisting of 6 students.	2 (Focus group)
Student Individual Interviews	Interviewing selected students	4 (Individual interview)

The responses to the question on how students experience learning in 5E flipped learning environment and the finding focused on one of the main themes emerged: Increased online learning ability. In general, this theme was organised into 4 sub-themes. Table 3 shows the summary of the findings. All the themes and their sub-themes are explained below.

THEME: INCREASED ONLINE LEARNING ABILITY

This theme has four sub-themes, which are (a) Provide a Self-Checking Approach, (b) Increased students' preparation time, (c) Provide a self-directed learning environment and (d) Improve self-efficacy in learning; all the sub-themes findings are explained.

a.   *Provide a Self-Checking Approach*

Students explained that this 5E flipped learning environment has provided them with the ability to perform a self-checking assessment. Students felt that they have an opportunity to perform a self-check on the learning aspect and it made them understand better in this learning environment. This was expressed by student 6 in the focus group two interview:

"Not only that, I like the last activity which was self-assessment. I like the activities because I can assess my understanding and, I can understand what the important points in the topic taught were. This was also a guide for me to focus on my learning" (FG2 S6).

Table 3. Summary of findings

Themes	Subthemes	Codes	Frequency (f)	Total Frequency (f_t)
Increased Online Learning Ability	Provide Self-checking Approach	- Provide an online quiz on self-assessment for each lesson.	7	
		- Provide an online self-evaluation approach.	5	
		- Students answer online tasks after watching the video.	4	19
		- Post-classroom online review	3	
	Increased Students Preparation Time	- Knowledge was given before entering the class.	6	
		- Method allows to re-watch online pre-class videos at much time.	4	
		- Understand basic knowledge before attending the classroom session.	4	14
	Provide a Self-Directed Learning Environment	- Provide online step-by-step learning approach.	5	
		- Provide an approach to learning by own	4	
		- Allow me to learn without a teacher	2	11
	Improve Self-Efficacy in Learning	- Understand the lesson better after reviewing the online video post-classroom session.	5	
		- Able to answer the online questions post-classroom session.	4	
		- Able to explain concepts to peers post-lesson.	3	
		- Better self-reflection on learning outcomes and achievement	3	15
Total			59	59

Furthermore, this learning environment has a pre-quiz assessment which allowed them to recall information before starting the classroom session. This also allowed students to test their knowledge and understanding of the lesson before the classroom session. As Student 1 stated:

"This is because the online session provides materials and explanations; each individual must go through it himself. They also need to do self-evaluation by answering the questions provided. They learn individually" (IS1).

This was supported by the online observation of Student 1:

"Student actively participated in an online quiz; he likes the online quiz" (OBS1).

In addition, there was a student who also shared that this learning environment enabled them to identify their weaknesses and improve their learning. Student 1 wrote:

"The quiz is good. I can identify my weakness. I can evaluate myself. I refer back to the learning materials again" (LD S1).

This learning approach also made the students evaluate their learning progress by doing self-checking assessments. Student 4 wrote in her learning diary:

"Through the self-reflection assessment technique, I was able to evaluate my progress towards achieving educational goals" (LD S4).

During the learning process, the teaching approach needs to design and implement a recall ability of the learning information. Students' experiences in the 5E flipped learning environment have the potential to cater to these elements. Students found that they were provided with an avenue to recall information on the previous learning materials. This situation happened in both learning environments; online, they were required to answer the questions at the end of each topic, and in the classroom, the teacher began the lesson with a pre-quiz. Student 9 said:

"The classroom session began with a pre-quiz discussion; it was very good because the session allows me to recall back what I have studied online" (IS9).
Moreover, classroom observation also supported this feedback.
"Students are involved in the quiz at the beginning of the class" (CO 1).
Furthermore, online observation of student 9 found:
"Student 9 is actively involved in the online activities; he completed the chapter quiz actively" (OBS9).

b. Increased Student Preparation Time

One of the main advantages highlighted during the interviews was that the students believed they had a better understanding and more preparation for the lesson by watching the online video lectures. Low-proficient students especially valued the opportunity to watch the lecture videos before class as they needed more time to understand the lecture by checking the meaning of new words they heard in lessons. Student 1 stated that *"It was my first time learning through the 5E flipped classroom. I think it's very useful and helpful to us. Sometimes, if I cannot understand something in the classroom, I can go home and watch the videos again and again until I understand. I watched some videos more than six times sometimes. I understand more after watching the same video again and again. Sometimes, when I don't understand, I just stop the video and take notes in my own words. I think it is helpful because not only can I know the content but it also helps me in understanding the topic well; I also can learn how to improve my learning skills. I prepared well before I went to class. For example, I may watch videos three times if I don't understand. I paused the video and then I screenshot it and then need to understand it slowly. I can't do this when I am in the classroom during class"* (IS1).

Some students also commented that they interacted with the course materials in a timelier and more accurate manner as the 5E flipped learning environment approach allowed them to review learning materials step-by-step earlier than a traditional note-taking-based lecture. Student 5 in focus group 1 stated that *"In the 5E flipped classroom, we watch the video before class so the second day when I am in the class, I have learned some concepts. I know what I will do today so when the teacher is teaching in front of me, I can quickly absorb the knowledge and use it in the discussion"* (FG1 S5). The students believed that being able to prepare for their understanding earlier led to better knowledge acquisition and performance than they did in a lecture-based classroom. Student 9 in focus group 1 said *"I think in my high school, I learned in a traditional classroom. Before class, I don't know what I am going to do today, and I don't know what to prepare. I don't prepare for myself. I just sit in the classroom. Maybe after 10 minutes or 20 minutes of the class, then I just start to know what I am going to do today. I think it is too slow. And sometimes it is not effective but this 5E flipped classroom gives me enough preparation"* (FG1 S9).

The 5E flipped learning environment was reported to be beneficial as the step-by-step lecture videos allowed them to watch multiple times, pause to take notes, rewind, or fast-forward based on their own pace of learning. Some students felt this learning was more focused and strategic as they knew what to anticipate in the classroom. Students shared that being able to watch the recordings more than once increased their control over the course and made their prior learning more effective. Student 4 in his interview added later *"When I re-watch the step-by-step videos, it helps me to revise and learn again. So that is a kind of preparation for me. I think that it is important to prepare before class. This is effective" (IS4).* Student 5 also expressed concern about this in his learning diary *"I learned before the classroom; I got some knowledge before the class session, and this improves my understanding" (LDS5).* Thus, watching step-by-step lecture videos before lessons were considered an effective way of revising their understanding of lesson concepts so that they have the necessary knowledge during their case study practices in the classroom.

c. Provide a Self-Directed Learning Environment

Compared to the traditional teaching approach, the use of educational videos for pre-class preparation in the 5E flipped learning environment was generally welcomed as it allowed flexibility for students to learn at their own pace by having the option to access the videos at their own time. A student stated that such flexibility *"gives me more time to understand and learn"* at home, and *"speeds up the train of thought in class" (FG1S7).* Also, the arrangement of the online lesson with the 5E approach in terms of video watching was an easy way to learn, and could even ignite a spark of interest in students to self-learn, as student 9 shared in the following quotes:

"I think watching the video lecture by following the sequence of 5E is quite relaxing. I could stay home, choose a leisure time, and have a comfortable place to watch the video lecture voluntarily. If I am interested in it, I will watch it again. Watching it doesn't feel like learning in class. It's good for easy learning" (IS9).

"Those 5E flipped classroom video lectures are interesting, and I want to learn more after watching the video. I mean I'd probably watch more relevant videos, do a bit more, and watch other video clips that have not been recommended" (IS9).
"I learned through myself on the online session, it is guided with step-by-steps" (LD S6).

Students generally voiced that being able to access all pre-class materials at the start of the course could be more helpful for their learning and preparation, especially when it is arranged accordingly such as the 5E approach.

d. Improve Self-efficacy in Learning.

The final sub-theme focussed on students perceived self-efficacy due to the accessibility of the video lectures. Regarding their learning, the students perceived that a *"5E flipped classroom helps improve many areas. I learn how to structure my learning and think critically"* and have become *"more confident and have the more critical thinking, more independent and more active in learning" (FG1 S7).* Others elaborated on how the 5E flipped learning environment helped them to learn more confidently as they now *"know how to understand information and how to use the video lecture; how to read the article in the link and take note for further understanding" (FG2 S10).*

"During the out-of-class session, we were encouraged to share ideas during the discussion with peers to clear any misconceptions we had" (FG1 S5).
"The tutor's presence made me feel comfortable as he helped to discuss our questions to understand the topic better" (FG2 S8).
"We were able to discuss our problems we did not understand with the teacher who explained to us and sometimes corrected our misconceptions" (IS4).

Another learning outcome the students mentioned was meeting their course expectations through active collaboration activities. Some of the students felt more comfortable working with peers in the group to build their confidence to learn. In addition, the engagement enhanced interpersonal interaction, and the group activities helped students become more open-minded as they shared ideas, discussed, reflected, and came to common conclusions. Consequently, students were of the view that the 5E flipped learning environment fosters effective peer teaching as they were able to share ideas. The students preferred this approach since it promoted their interaction and their communication skills. Student 5 in the focus group interview stated:

"Working with other students helped us learn the concepts. Through the discussions, we can ask our peers for clarification and communication to better understand the concept" *(FG1 S5).*

Another participant reiterated that:
"Because the interactions with our teacher and other students are cordial such to an extent, we don't feel unwilling to answer and ask questions in the class" (IS1).

Furthermore, student 4 in his interview noted that:
"The 5E flipped classroom creates opportunities for us to be more interactive as we collaborate and discuss to bring out different ideas and views to be shared. Through the collaboration, we understand the concept well" (IS4).

Student 4 again in his learning diary added:
"Our expectations increased when collaborating with peers through the class discussion. We could come to a common agreement regarding presenting results in our group project" (LD S4).

DISCUSSION

The flipped classroom incorporated both face-to-face and online learning environments. The online learning approach was carried out using learning videos, which students can easily access and download from anywhere and anytime which allowed them to learn whenever and wherever they want. After studying independently, students can use the videos to assess their understanding by working on some questions and practising questions. Students were also aided by media platforms, which can be used outside of the classroom to ask teachers and other students online if any content has not been understood. Face-to-face learning was accomplished by assigning tasks discussed in groups, and some games were played that can make learning more enjoyable. At the end of the lesson, the teacher can administer a written test/quiz to determine how well students understood the flipped classroom material. In this study, the assessment activities were designed accordingly with the 5E learning cycle stages. The engagement and evaluation stages of the 5E flipped learning environment focused on self-assessment for an understanding of the lesson. The students have shared their learning experiences by mentioning that the 5E flipped learning approach has provided them with self-checking ability. This finding is in line with the constructive learning theory, which focused on self-evaluation ability in a constructive learning design (Banihashem, Farrokhnia Badali, & Noroozi, 2022). Furthermore, this study's findings are supported by Deneen and Hoo (2021), whereby they included an assessment component in the instructional approach which can let the learners have self-check opportunities. Thus, self-checking ability is very important in designing and implementing an instructional approach to engage the students in the learning process.

Several conditions and instructional materials can help increase student engagement and preparation for pre-class learning activities, as reported by Jiang et al. (2020). One of these is videos, which are the most widely used resource for learning outside of the classroom because they are easier to understand than their text-based counterparts (Kim,

So & Joo, 2020). They also mentioned that online videos combined with an internet connection are valued by students for convenient learning at a selected time and pace, which is a significant benefit of pre-class learning and the main reason for students' satisfaction with learning (Zou, Luo, Xie & Hwang, 2020). The result of this study extends 5E flipped learning to include the design of formative feedback mechanisms that support individualized learning. This teaching approach also contemplates the integration of videos with low-stakes quizzes to encourage engagement and preparation before class learning. This brings an understanding of the benefits of learning incentives and also the consideration of encouraging student engagement by assessing the entire pre-class learning component and motivating students to complete the course. Furthermore, in this study, the conditions of the pedagogical aspect of the 5E approaches, such as time-effective learning strategies, an adequate explanation of learning objectives and the importance of pre-class learning activities, provide better support for students' preparation time. This is particularly beneficial for students with low metacognitive self-regulation ability, who are prone to non-compliance when preparing for classroom sessions (Wongwandee & Paritakul, 2020). The results of this study also indicate that contextualising the pre-class learning design with 5E cycles helped students make a better connection between online and face-to-face classes knowledge transfer, so students are more motivated to prepare for in-class activities (Busebaia & John, 2020). In addition, the 5E strategies also enable students to plan, monitor and assess their learning progress for better self-preparation. Therefore, the designs are aimed at a given time frame and allow the students to create an appropriate learning environment to consciously achieve the learning goal and develop resilience and attention in learning.

This study confirmed that the use of 5E learning cycles in flipped learning environment promoted students' self-directed learning skills and improved their learning performance. It can be suggested that flipping the medical classroom and using a videotaped lecture in Learning Management System (LMS), particularly in the prehospital trauma treatment course, will save instructors' time on printing paper materials and more time for peer-to-peer or student-to-instructor interaction. In addition, it supports students in preparing outside of class, participating in activities, and following discussions during class activities. Students come to class prepared and ready to engage with the material. They can understand their prehospital trauma skills through a presentation, conversation, discussion, asking and answering questions, and solving case study problems. In other words, this flipped 5E learning environment can be viewed to improve student pre-class preparation, which in turn allows for more efficient use of classroom time. This study result is consistent with a statement by Robinson and Persky (2020) that students with the ability to self-directed learning can collaborate with their peers, solve problems independently, and work autonomously through intrinsic motivation. In the interviews, the general perception of the students was positive, especially regarding the receipt and distribution of information about the LMS outside of class time and the monitoring of learning activities. The students rated it positively that they were able to repeat the pre-class learning contents, especially with online sessions by self-study the outside-of-the-classroom learning materials. They could pause, rewind, and play the video lectures as needed (Hoshang et al., 2021).

The 5E flipped learning environment used in this study was designed to allow students to monitor their progress on the teaching-learning activities for at least two hours a day. In addition, students were able to read their peers' comments on the forum posted and their self-assessment in trauma care. Furthermore, the researcher stated that the LMS has become a crucial device for university students to monitor and update all information related to teaching-learning activities and receive instant notifications from their teachers (Ge, Chen, Yan, Chen, & Liu, 2020). Another positive side of this report is that a similar style of instruction allocates students more time to interact and practice course content with peers and teachers in both learning settings: online and in the classroom. Therefore, it helped students to share knowledge among themselves and helped low-ability students to study and ask questions with their peers. Similarly, the finding from Debacco (2020)

indicates that the online learning platform enables students to form social connections and personalities, especially outside of class time for an asynchronous way of teaching and learning a foreign language. In addition, regarding self-assessment of learning skills, all respondents indicated that the 5E flipped learning environment allowed them to assess their own and their peers' achievements. This allowed the students to prepare well for the lesson.

This study finding on the role of a 5E flipped learning environment in promoting understanding and application of key concepts and boosting student confidence was similar to study findings by Abdullah, Hussin, Hammad and Ismail (2021). Their study results showed the ANOVA and MANOVA tests significant differences ($p<0.001$) in students' confidence before and during the implementation of the flipped classroom method (FCM). It was found that the use of FCM contributed significantly to incrementally increasing students' self-efficacy in English language achievement. The students agreed that the learning materials and resources in FCM were very helpful, and the teaching method enhanced their learning. In contrast, classroom use of FCM among medical students in India has yielded mixed results, partly because the students failed to complete the reading or suggested activities (Prabhu & Jyothi, 2022). Like these results, inappropriate use of the reversed methodology was identified as one of the factors for its low acceptance during its introduction in pharmacy courses among undergraduate students in Malaysia (Tan, Zakuan, & Abd Aziz, 2022). Thus, designing an appropriate instructional approach can influence students' learning ability.

This research aimed at exploring students' enriching learning experiences in a 5E flipped learning environment, particularly in the online session. The qualitative finding of this research concluded that the students' self-efficacy levels were at a high level. As expressed in the qualitative data of the research, the students achieved high levels of self-efficacy in the 5E flipped learning process. In the literature, within the knowledge of the researcher, there is no other study examining the effect of the university-level medical education program on the perception of self-efficacy of students in a 5E flipped learning environment. Moreover, it can be also said that the perceptions of students in 5E flipped learning self-efficacy are at a medium level in technology guidance and lecture video preparation. It was observed that the lecturer considered the student's interests, needs, attention, suitability of the material to the goals of the course, and its quality while preparing technology-supported material. Youhasan, Chen, Lyndon, and Henning (2021) also emphasised that it is very important to design the platform while implementing flipped classroom applications according to student and teaching needs and this situation directly affects the success of the learning process. Furthermore, Doo and Bonk (2020) in their study with university students stated that student-centred approaches are an important factor in increasing self-efficacy when choosing a strategy, method, and technique for the realisation and evaluation of a teaching process in line with the objectives. It is suggested that content, assessment tools, and individual characteristics of students should be analysed. Similarly, the lecturers applying the model organise the teaching process by considering the individual differences between the content and students. Confirmatory similar findings were also reached by other researchers who investigated the flipped classroom model (Algarni & Lortie-Forgues, 2022; Doo & Bonk,2020). On the other hand, it was concluded that the lecturers used digital materials for different purposes. These purposes can be listed as drawing attention, creating real-life situations, entertainment, assessment and evaluation, and feedback. This result is in line with Latorre-Cosculluela et al., (2022) findings. Additionally, considering that the self-efficacy beliefs and attitudes developed by the lecturer influence students' acts and teaching performances (Doo & Bonk, 2020), it can be seen that the 5E flipped learning environment could make positive contributions to the development of students' self-efficacy level. As the self-efficacy perceptions of students improve, they can practice their activities more confidently, organise what they can do, communicate efficiently, and strive to be successful in academic achievement (Jin & Harp, 2020).

CONCLUSION

In summary, an overwhelming number of students reported that after attending 5E's flipped learning environment, they felt more confident in their ability to understand the lesson, especially in the online session. They believed they had made good progress in developing knowledge and practice. The improvements in self-efficacy related to independent learning indicated that the 5E flipped learning approach may be appropriate to prepare students for tertiary studies, particularly for online learning sessions. With the development of information technology, online learning has become a part of the daily life of tertiary students, and they can use information technology to search for what they need. The study shows that medical assistant students believe 5E flipped learning helps them access study-related information and can facilitate comprehensive learning. In addition, the 5E flipped learning environment allows students to better communicate with their teachers. Due to the high frequency of online pedagogy, students have more channels to access learning information. By integrating the 5E cycles with flipped classroom students' perceptions of the use of online education is better. It was concluded that the impact of the 5E flipped learning environment in educational applications is beneficial and its use is essential.

However, caution should be exercised when reading the results of this study. The participants were college students from a Malaysian university. Almost all participants were background from East Malaysia. The results should not be directly generalized to participants from a different geopolitical culture. It is not certain how the results might be affected if the study were conducted using graduate students as the study sample. To broaden our understanding of the 5E flipped learning environment in higher education contexts, we make the following recommendations for future research. First, future research should consider replicating the present study to include participants from a different geopolitical culture as well as participants from a different level of study (e.g., graduate, high school). Second, future research should include student engagement within a 5E flipped learning environment. Knowing which technological tools can better encourage student participation enables a teacher to choose the right tool for their 5E flipped learning activities. Third, future research should explore the use of different video styles in the 5E flipped classroom. Future studies could consider answering questions such as watching their online teacher's video or other teachers' videos; and what type of video styles do students find most engaging in online sessions. Finally, a quantitative study involving a big sample size could explore the effect of a 5E flipped learning environment on students' learning experiences.

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