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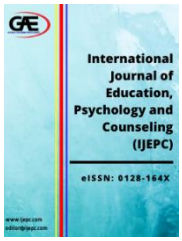

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STUDENTS' LEARNING EXPERIENCE IN A WEB DESIGN COURSE USING FLIPPED CLASSROOM APPROACH IN HIGHER EDUCATION

Usha Vellappan[1*], Lim Liyen[2]

[1] Faculty of Business, Multimedia University, Malaysia
Email: usha.vellappan@mmu.edu.my
[2] Faculty of Information Science And Technology, Multimedia University, Malaysia
Email: lim.liyen@mmu.edu.my
[*] Corresponding Author

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Abstract:

The incorporation of information technology in education has benefitted learning institutions, instructors as well as students in coping with how knowledge can be transferred, absorbed, and used in the context of teaching and learning. The flipped classroom has been used to maximize the in-class time with discussions and critical thinking activities and leaves the learning to the students prior to the in-class sessions which were considered difficult to be implemented in a traditional classroom setting. The aim of this study is to explore students' learning experiences with the implementation of flipped classroom approach. This study presents 96 business program students' experiences of incorporating flipped classroom approach in a web designing course at the university level. Both quantitative and qualitative questionnaire was used to collect data for this study. The findings of the study showed that students responded positively to this approach. Students expressed that they are able to learn better and be more prepared to attend face-to-face classes. They appreciated that they were given the freedom to take charge of their individual learning. The hands-on nature of the course made flipped classroom favorable because students are able to apply their knowledge immediately by using the self-check questions after viewing the videos and progress to more complex applications during the in-class sessions. Students welcomed such an approach to be used in other hands-on or practical courses. However, there are still areas of concern and challenges for both students and instructors that need to be looked into when incorporating the flipped classroom model.

Keywords:

Flipped Classroom, Online Learning, Blended Learning, Higher Education, Active Learning, Digital Learning Environments

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Introduction

The speed of change in the areas of information technology has created tremendous amount of new approaches in the current education environment. The availability of multiple devices ranging from the humble personal computer to the multi-function smartphones with the varieties of learning platforms has created many ways for a student to get information and knowledge. This new era of technology advancement has also created new ways of how employers recruit employees where they look for candidates with mature thinking, having a forte for problem solving, responsible, capable to execute tasks at their own pace without much supervision and most importantly being able to join forces and communicate their ideas effectively in a team. This new paradigm indirectly forces the learning institutions to adapt to the new technology as well in order to prepare their students well to join the competitive and challenging job market. As a result, the educators have to enrich the students by incorporating new ways and tools in their daily teaching and learning activities. This new approach in learning also has become a new trend for students who need a certain amount of flexibility in order to fulfil other obligations such as work and family.

In a traditional classroom setting, both the instructors and the students sit in a room and the process of teaching and learning begins. In this method, the students are forced to absorb the given information within a stipulated time frame which usually will be a two-hour class session per week. It also assumes that all students have the same absorption and understanding rate of the subject matter. Missing classes results in students not being able to understand the content of the current lectures and it also makes it difficult for the students to understand and follow the subsequent topics. A traditional classroom also does not give the freedom to use varieties of resources and learning methods such as group discussions, animations and videos to teach the students who have different levels of learning abilities and preferences because the in-class time is so limited and precious that most of it will be used by the instructor to give out information. The problems that arise from the traditional classroom method of teaching and learning are now slowly being eliminated with the use of the flipped classroom model. The flipped classroom model has been around for some time now. This method is not new as many studies had been conducted but with different terms such as inverted classroom (Lage & Plat, 2000) and the usage has grown tremendously due to the wide spread of digital devices, Internet infrastructure and technologies available. In this flipped classroom model, the classroom environment is reversed where learning materials of a topic are given earlier to students to study at home. The discussion and practice of the materials will be done in the classroom setting. The availability of digital resources such as computers, tablets and smartphones together with Internet connectivity has rapidly made this a chosen method used in educational institutions (Sun et al., 2018). These digital resources are incorporated into the learning process to create a better method of how instructors communicate with students (Adam & Nel, 2009). Flipped classroom teaching and learning model is said to be a good approach that can prepare the students with the skills needed in the new digital age. The use of flipped classroom model is effective in improving the problem solving, critical thinking as well as decision making skills of a student compared to the traditional way of learning (Park & Han, 2018). Flipped classroom model can be explained as a classwork which is done at home (Ash, 2012). In this method, the learning process is done at home individually by utilizing the available technology. Materials for each topic in the form of videos, slides, podcasts, quizzes and exercises are uploaded at a learning management portal. The students will then access and learn these materials prior to the next class. This will give them a basic idea of the content of the topics and prepare them before the actual lecture classes begin. This teaching and learning approach has created a whole

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new way of looking at the relationship between a student and the instructor and the entire learning environment. There is no doubt that the traditional way of teaching and learning is very effective. Each student has a different way and rate of absorbing contents taught to them. Some take lesser time and some may take a longer time to understand the materials. This becomes worse when students miss classes and find difficulties in catching up especially when they are pressured to hand in homework and assignments related to the lecture (Goodwin & Miller, 2013). This leads to students not concentrating in the classroom and start focusing on other things such as texting and viewing Internet contents (Mok, 2014).

In the flipped classroom method, the traditional mode of learning where the instructor teaches the content of the topic entirely in the classroom has been shifted to the student's individual space (McLean et al., 2016). The flipped classroom model gives more room and flexibility to the students in choosing how, where and the time that they want to learn. The rigid class schedule in a conventional classroom environment can be taxing for students and this may affect the student's concentration and learning ability. Flipping the class makes learning less strenuous as students may choose their preferred time to learn so that they can put their maximum focus on the content of the topics (O'Flaherty & Phillips, 2015). During the in-class lecture sessions, the students will have discussions, debates, problem solving exercises and presentations based on the topics that they have learnt at home. Flipped classroom learning is all about providing classwork through the available technologies and doing homework in the classroom (Kara, 2015). It is very important to understand that flipped classroom or learning is not all about watching videos. The main point to note is that this type of learning includes the interactive activities done during the actual face-to-face class session with the guidance of the instructor. Reversing the teaching and learning environment increases the in-class time for more activities and interactions where it was not possible by using the conventional way of learning. A study by Jungic et al. (2015) supports this as the flipped classroom method was highly applauded and welcomed by students who enrolled in a calculus course. In another work by Wilson (2013) reported that the anxiety of undergraduate students decreased with their participation in the flipped classroom activities. The interactions come in variety of ways such as discussions, presentations, debates or problem solving activities. It must be clear that flipped learning is not about the student studying alone and only with the computer or smart devices.

In a nutshell, the studies done by the researchers indirectly states that students will have more control and flexibility to complete their lessons. They may choose the method, time and the place that they are most comfortable with to learn. They will not be forced to learn in a specific place or given a specific time duration to complete their lessons. This will make the actual lecture classes to be more interactive and fun where students can work and collaborate with their peers in solving problems and discussing the topic contents. This will also improve the student and instructor's relationship as more communication is being made between them during the in-class time.

Literature Review

Flipped Classroom

The education system has seen a lot of changes with the use of computer technologies. It has allowed learning materials to be made available 24/7 which are mostly delivered through the Internet. Students are no longer confined to the classroom or even the 9 to 5 timetable schedule

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in order to learn. Placing materials in advance on online learning platforms saves precious in-class time so that more focus can be done on the key skills and competencies that students need.

In a conventional teaching and learning environment, the instructor takes on an active role and teaches the content of the course. Students are required to attend classes at a specific time and day based on their schedule. Once a lecture class begins, students were bombarded with loads of information and they were required to understand the materials in order to proceed to the next topic. The student lack control over their own learning. The instructor controls how the information is presented and expects the students to follow them. The students will take a passive role by just listening and taking down notes based on the lectures. Students will try to make sense of what is being taught to them while the instructor is teaching. Students have no time to pause and reflect on the topics being taught because it may result in them missing crucial points as they have to take note of the instructor's lecture. The instructor has the responsibility to teach the list of topics as per the syllabi in a stipulated amount of time. As a result, the instructor will have insufficient time to closely interact with their students and know the level of understanding (Hamdan et al., 2013). The overwhelming work load is one of the main challenges face by instructors in most learning institutions. They have to prepare and teach the contents of a syllabi within the allocated time frame which depend on the weeks of a term. Students are also burdened with too much of homework in a short period of time which results in the loss of motivation and interest in the course (Prober & Khan, 2013). The time constraint as well as the number of students in a class makes it difficult for an instructor to focus and interact with each individual student (Hamdan et al., 2013), making the weaker students feel neglected and demotivated with the lessons.

The main objective of a flipped classroom is to create an active learning environment, to let students learn at their own pace and to create a more personalized learning relationship between the instructor and the student. Active learning can be described as a way to dynamically engage students with the course content. These engagements can be in the form of debates, role plays, discussions, critical thinking and problem solving activities. As compared to the conventional or passive approach of teaching and learning where the instructor takes on full responsibility on the transfer of knowledge, active learning places a much greater degree of responsibility on the students. In a flipped classroom environment, the emphasis will be in the instructor's role to guide the students to think, ask and give feedback on a given problem. The flipped classroom approach provides the instructors opportunities to guide students more closely (Keengwe, 2014). This method also maximizes the two-way interaction between students and instructors while reducing the one-way instructor instruction (Johnson, 2013). In the traditional method of teaching and learning, the class time is used to teach the contents of the topic which sometimes leaves no room for conducting interactive activities. By means of the flipped classroom method, due to the learning being done by the students at home, that leaves more time for activities and interactions between the students with their peers as well as the instructor as stated by Goodwin and Miller (2013). In other words, the instructors become the facilitators. This process of learning molds the students to be more interactive and become active learners.

A simple observation made by Bergmann and Sams (2012) proved that students showed a better understanding of the given material when using flipped learning where they used recorded videos to present the topics which the students viewed at home. Based on the videos that they have viewed, the students had to complete assignments, labs, quizzes and tests. The flipped learning focuses a lot on self-learning where the students do learning independently by

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using materials given by the instructors before the actual in-class sessions. The materials used can be in any form as long as it contains the proper learning contents and fulfils the learning objectives of the course and not limited to only videos or the Internet (Kim et al., 2014). Toto and Nguyen (2009) in their research expressed that by using the flipped learning method, the students were given more opportunities to apply their knowledge during the in-class session with the guidance of their instructor. This study also showed that flipped classroom model caused an increase in student achievement in the Financial Mathematics course. An investigation done by Lopes and Soares (2018), also showed an encouraging result on students' overall achievement when flipped classroom was implemented into a Financial Mathematics class.

A research done by Zainuddin and Attaran (2016) established a significant result when flipped classrooms were introduced especially to those students who were introverts and quiet as well as to those who have lower level of English proficiency. This enables the students to have more opportunities to have discussions with their peers and instructors which is rarely possible in the traditional way of teaching and learning. This was also mentioned by Bergmann and Sams (2012) where flipped learning is not interpreted as learning using only recorded videos. Viewing pre-recorded videos is just one part of the process of flipped learning. It must be followed by communication and interaction with the addition of activities related to the video topics conducted within the actual face-to-face class sessions with the presence of the instructors as facilitators. Another reason to convert to the flipped classroom method is the ability of the students to study the materials at their own pace A study by Mok (2014) stated that weaker but hardworking students are able to study at their own pace. This enables them to be more prepared when attending classes. It also identified that flipped classroom improved the attitudes of students and improved their scores. Meyer (2013) has also reported that by using flipped classroom in a pharmaceutics course, there was a 51% increase in the performance of the students. As a result, it helps to build their confidence and enjoy the subject content more.

The flipped classroom approach also helps students become more confident and increase the ability to learn independently. This is a much needed skill where the ever changing job market requires employees that can learn new things fast and work independently. Students who performed well in a flipped classroom had strong engagement to the materials that was uploaded prior to the actual class (Jovanovic et al., 2017). An increase in student performance has been proved by many studies when the classes use the flipped learning method. Nasrullah et al. (2019) in their study for pre-university chemistry course using the inverted classroom learning model have also noticed a substantial improvement in students' test results for students who learnt using the flipped learning model. A study done by Abdullah and Azizan (2017) investigated the association between flipped classroom and students grade. The results showed that there were improvements in test marks, assignments as well as quizzes. Students understanding on topics increased and they enjoyed the new way of leaning. In an undergraduate medical course flipped classroom research by Angadi et al. (2019), students revealed that the flipped classroom approach was more interesting and engaging which results in a significant difference between the pre-test and post-test scores. Even though some studies have mentioned that students found flipped learning to be over powering and daunting at times, they still perform better compared to the tradition method of learning as stated by Velegol et al. (2015). A quantitative study conducted by Schwarzenberg et al. (2017) also found a better

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achievement with flipped classroom as compared to the conventional classes provided that much importance is given to the design of the flipped classroom.

There are also many studies that shows some undesirable aspects of adopting flipped learning in a classroom. The uncontrollable network and Internet connection problems. Computer devices related problems such as old hardware and software. Unresponsive students who do not view the uploaded videos and claimed that they did not understand the topic by just watching the videos and lack participation and feedback in classroom discussions as stated by Darinka et al. (2014). Flipped learning is not all about students. It is also a challenge to the instructors who face the same technological problems and also the need to create materials which requires time consuming preparation as mentioned by Ansori and Nafi' (2019). There are a lot of resources nowadays from different websites and learning platforms where one can register and use the contents. They offer pre-made videos, tutorials and quizzes on the topics. Using materials from another platform may not always reflect the instructor's assigned syllabus. There might be segments in the pre-made videos which are not related to the topics in a course syllabus. There is also the issue of language, slang and speed of speaking as compared to the students' native language. Students coming unprepared for the face-to-face class due to their lack of self-regulatory skills in learning the topic contents on their own which leads to the disruption of the in-class activities.

Even though flipped classroom approach has been around for some time, many institutions are still not fully using this method widely when it comes to teaching and learning. There are reports that states that even with the availability of new technologies, students still preferred a traditional way of learning. Students tend to show resistance and frustrations when asked to embark on the flipped classroom environment and this was shown in the reduction of students' satisfaction (Gilboy et al., 2015). This may be due to the lack of knowledge to use the new technologies or lack of clear step by step instructions for the students to follow which may lead to undesirable outcomes. Many students still need the presence of the instructor during the learning process to guide them even though many experts have shown the positive impacts of student-centered learning. A recent study by Wu et al. (2020) where the flipped classroom model was used in a radiology class in China revealed that students were unhappy that the pre-class work was time consuming and that it had too many questions for the student to complete.

Lack of discipline on the part of students is also a challenge. Some students do not view and learn the uploaded materials due to the lack of knowledge and exposure to flipped learning and the platforms that are being used for it. This method will be pointless if students attend classes without having learnt the lessons. Disengagement during self-learning is also a challenge. As reported by Guo et al. (2014), shorter videos increase the students' concentration on the topic. There is also an issue where shorter videos will require multiple videos to be uploaded to complete a specific topic. This will result in students losing interest to see more materials. The instructor's failure to encourage and monitor students' development or involvement is also a challenge for the instructors especially for the pre-class activities. It is very important for the instructors to give feedback to students during the pre-class work. Instructors need to continuously give feedback to the students in order to maintain the level of momentum and engagement towards the lessons (Avdic & Åkerblom, 2015). Giving feedback may not always be possible in real-time due to the students' learning time which might be different from the instructor's time of availability.

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Methodology

This study involved descriptive study which aims to explore the students' experience when learning using the flipped classroom method. The study is guided by the following research questions:

1. What are the students' experience when using the flipped classroom approach?
2. What are the challenges that the students faced when using the flipped classroom approach?

In this study, the researcher implemented flipped classroom for a Web Design course at a private university. There were two lecture sections which consist of 46 and 50 students respectively. Both lecture sections were taught using flipped classroom approaches correspondingly. Both groups of students were provided with the same course outline as well as identical pre-class and in-class activities. At the end of the semester, an online questionnaire was distributed to gain understanding on students' experience in the flipped classroom. All 96 students responded to the online survey.

For data collection purpose, an online questionnaire which includes quantitative as well as qualitative questions and the descriptive analysis technique was applied on the collected data. A five point Likert scale which includes "Strongly Disagree" (1), "Disagree" (2), "Neutral" (3), "Agree" (4) and "Strongly Agree" (5) was adopted for the questionnaire used in this study. The questionnaire also includes some open ended question on the problems that the students faced throughout the execution of this flipped classroom learning method.

Sample Group And Implementation

Two lecture sections of Web Design course were taught using flipped classroom method. The flipped course was a mandatory subject taught to business program students at the diploma level. This course covers the basic programming concepts and coding techniques on web designing which includes topics on HTML, Cascading Style Sheet and basic JavaScript. A total of 96 students participated in this study. As they are students from the business program, they have no prior experience and knowledge about the world of coding. In the past, this subject was taught purely through the face-to-face classroom. The instructor teaches the concepts, gives examples, answers the students' queries and proceeds to give exercises and solve the exercises together with the students to further improve their understanding on the topic. This was all done within a 2-hour class session per week which was sometimes an impossible feat. Figure 1 shows how different the previous traditional classroom were with the current flipped classroom approach used for this course. In a conventional way of classroom teaching, in most cases, after a concept has been taught to the students, only basic problem solving or critical thinking exercises can be conducted in the classroom due to the time constraint. Using the flipped classroom approach, the basic exercises can be done during the self-learning phase. That leaves a lot of time in the face-to-face meetings to try more intermediate or challenging problem solving questions.

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	Before face-to-face class	During face-to-face class	After face-to-face class
Traditional Classroom Environment		Lectures Basic coding exercises	Homework (Intermediate coding exercises)
Flipped Classroom Environment	Video lecture. Short reading materials. Self-check quiz Basic coding exercises	Topic review Intermediate coding exercises (General or group discussions)	Homework (Advance coding exercises)

Figure 1: The Traditional Method Verses The Flipped Learning Method

Due to the hands-on or practical nature of the course, most of the materials were designed in video format where the content focuses on the writing of the programming codes, execution of the program and viewing the output. Using videos was a good option as the students are able to see how the codes are written, executed and corrected if there are errors and with the addition of instructor's simultaneous explanation makes the topics easier to understand. Secondary materials are also uploaded in the form of short notes given in PDF documents format. The materials for this course were placed in Google Classroom (GC). GC was the chosen platform as there was no concerns on the amount of storage used as the institution has a registered account with Google. Storage is very important because there were many different varieties of materials being used and uploaded and this requires more storage. The instructor for this course recorded all the topics using a basic computer laptop and a free version of Screencast-O-Matic desktop recording software. This free version of Screencast-O-Matic recording software allows very basic recording functions and only allows a 15-minute video recording time limit. A research by Guo et al. (2014) reported that the average viewing time for a 6-minute video was 100%. A 12 to 15-minute video duration gets an average engagement time of 50%. As the length of the video increases the engagement of the students towards the lesson drops. It is good to have shorter videos to engage the student more. The instructor records the introduction, concepts and basic step by step programs which was divided into multiple short videos. The contents were made in such a way that it starts with a very basic explanation and slowly progresses to a higher level of difficulty. All of the video recordings were made by the instructor and none were taken from other online learning platforms or the Internet. Even though there are abundance of pre-made videos available online that instructors can use (Herreid & Schiller, 2013), self recorded videos were made to comply to the course syllabus and to create a more personalized approach. The videos were made to imitate the normal way of how an instructor teaches in a face-to-face classroom and not to be too formal. It will indirectly give the students a sense of being in an actual classroom. This videos were then uploaded at GC. The instructor also created self-check quizzes using Google Form as well as simple coding exercises for the students to try after they have viewed the videos. The questions posted were related to the topics presented in the videos. This will give feedback to the students as well as the instructor on the students' understanding on the topics. This quizzes and coding exercises are included in the pre-class activity merely to check the understanding of the student

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and are not included as grading in the actual coursework marks calculation for the course. A screenshot of the video and self-check quiz is shown in Figure 2 and Figure 3.

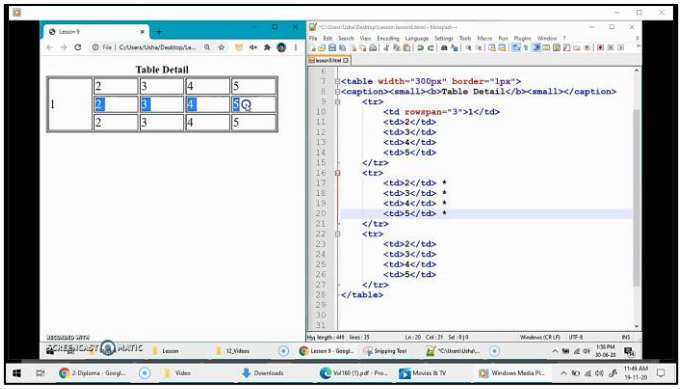
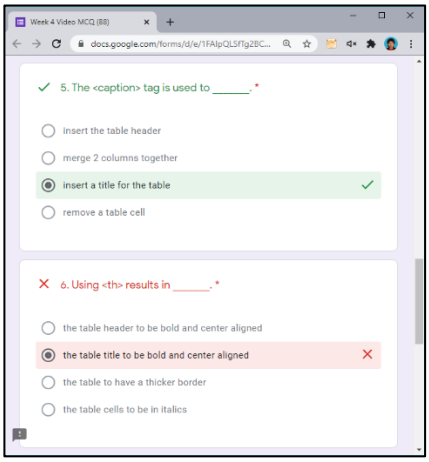
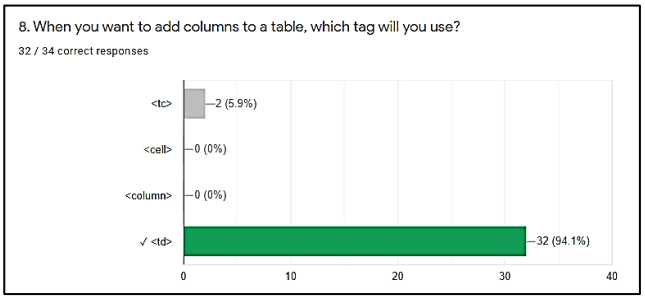


Figure 2: Video Demonstration With Audio Narration





(a) Self-Check Quiz Example **(b) Overall Self-Check Quiz Responses**

Figure 3: Self-Check Quiz Gives Feedback To Students And Instructors

During the actual in-class lecture session, the first 30 minutes were used to review and discuss the topics from the videos. Students will have an opportunity to seek for explanation on the wrongly answered self-check quiz questions that they had attempted. The remaining time were used to give more complex exercises for the students to try. This will be followed by discussions on the answers to each exercise. During the lab sessions, students were divided into smaller groups so that they could do mini discussion among themselves. The groups were divided by the instructor in a way that each group comprised of good, average and weak students. This group formation was made in such a way so that the better students can teach the weaker students. This improves communications as well as learning because not all students are comfortable to ask the instructor for clarification due to lack of confidence or understanding on the topic.

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Observations and Findings

Students' Experience of Flipped Classroom

A total of 96 students responded to the questionnaire. The most profound observation was the change in the learning culture. Students showed more responsibility towards their own learning. Majority were very well prepared for the class with their short notes taken from the pre-class activities all ready to assist them with the extra knowledge and exercises given during the face-to-face class. In previous terms, the students did not pay much attention to the notes that were uploaded in the learning management system which were in either PowerPoint or PDF format. Majority of the students in previous terms attended classes without knowing what was going to be taught to them on that day. The instructor had to start from scratch to make the students understand. Some students learnt faster than others. When the instructor slows down to focus on the weaker students, the good students feel bored. If the instructor was too fast, the weaker students feel lost and often feel that they are being neglected and finally lose focus in the course. Another obvious observation is that the instructor does not have to repeat contents of the lecture unnecessarily. Unlike in previous terms, a lot of repeating had to be done due to students taking breaks in between lectures and due to students being absent for class. With flipped classroom, this issue was extremely minimized. Those students who were absent for classes were able catch-up fast and attempt the exercises without much difficulties with the help of the pre-class materials.

The results of the survey clearly show a positive response that students are ready to accept the flipped learning method for this course. Majority of the students (91.67%, n=33 *agree* and n=55 *strongly agree*) agreed that they are more prepared for the face-to-face class after viewing the videos at home. They also stated that due to this, they are able to concentrate more in class. As all the videos were self-made, the language used in the videos was easy to comprehend making it easy for the students to grasp the content of the topics. It makes the lesson more personalized with the use of the instructor's own voice or even to show their face. Another benefit is avoiding different accent that students might find difficult to understand especially when using pre-made videos. Students agreed that the video contents were easy to understand (93.75%, n=30 *agree* and n=60 *strongly agree*). This course is practical in nature and it is important for students to see and try writing programming codes. Demonstrating these in the form of videos have a better impact on students understanding rather than just reading the text version. Since these students were business program students and that this course is a web designing course, they had no prior coding experience. The videos provided them the ability to pause, rewind and replay sections which students found very helpful whenever the need arises. Many students managed to watch all the videos uploaded by the instructor before the start of the face-to-face class (89.58%, n=38 *agree* and n=48 *strongly agree*), with majority of those students being able to complete viewing them in a very short amount of time (77.08%). Many students used the video extensively by pausing and repeating segments of the video to increase or to satisfy their understanding (92.71%, n=36 *agree* and n=53 *strongly agree*). This was done especially when they made mistakes in the self check quiz as well as when answering the short coding questions.

The flipped classroom approach has given the student the flexibility to learn the materials at their own convenience (87.50%, n=31 *agree* and n=53 *strongly agree*). The responses from students were encouraging and concurred with previous researches done which stated that flipped classroom give the students freedom to work at their own pace. Students also expressed

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satisfaction where they are able to assess their understanding by using the self check quiz as well as the basic coding exercises made available together with the videos. This gives a sense of achievement and motivation when attending the face-to-face class as stated by Andrade and Du (2007) where their research findings concluded that students acquired positive attitude and improves motivation and learning. Students enjoyed the practical way of studying where they learn and apply their knowledge in practicing questions and responded that they would like future practical based course to use similar flipped classroom approach (83.33%, n=35 *agree* and n=45 *strongly agree*).

In previous terms, there were problems whenever group discussions were done. Students tend to be uninterested maybe due to the lack of understanding or preparation. However, with the introduction of flipped classroom, students were ready and enjoy doing group discussions (72.92%, n=33 *agree* and n=37 *strongly agree*) as they have understood the topic and are more prepared for class. It is also revealed that students are more open to receiving and giving feedbacks to other students as well to the instructors (85.42%, n=34 *agree* and n=48 *strongly agree*). Students feel more comfortable and more confident to ask questions when in doubt (88.54%, n=37 *agree* and n=48 *strongly agree*) because they have already done the groundwork when viewing the pre-class materials. Students do not feel ashamed or nervous when repeatedly asking questions to their peers because they feel that it is easier to understand the feedback and explanations given by them (Kim et al., 2014). The survey questionnaire and the mean and standard deviation results are presented below in Table 1.

Table 1: Descriptive Statistics

	Mean	Standard Deviation
I am able to understand the content and language of the video	4.542	0.695
The duration/length of each video is acceptable	4.313	0.799
I am able to complete watching the videos is a short amount of time	4.083	0.816
I like the way the videos were made with the addition of quizzes and exercises to increase my understanding	4.458	0.710
I can learn the materials at my own pace and free time	4.406	0.776
I am willing to spend more time to watch and understand the content of the videos	4.302	0.742
I often pause or repeat parts of the videos in order to increase my understanding of the topic	4.458	0.710
I watched all the videos that is uploaded	4.354	0.794
I am able to complete the exercises and the quiz based on the content of the video	4.333	0.790
I enjoy doing discussions with my team members during the lab sessions	4.042	0.962
I am more prepared for lecture classes after watching the videos	4.458	0.753
The video contents reflect the topics discussed in the lecture classes	4.490	0.711
I am able to concentrate more in class after watching the videos	4.427	0.707

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I am able to complete the exercises given in the classroom better after watching the videos	4.396	0.732
I would like future practical courses like this to use a flipped classroom approach	4.271	0.827
Getting feedback and giving feedback in discussions helps me to understand the topics better	4.333	0.790
I feel comfortable asking questions and receiving help from the lecturer as well as other students.	4.365	0.756

In the open ended question asking about the usage of videos in the flipped classroom, students mentioned that they appreciated the effort made by the instructor to record self made videos instead of using pre-made videos from the Internet or other platforms. The videos were also made in such a way that make them feel as though they are in a face-to-face classroom environment. The use of the videos as a tool to introduce the topics which will be discussed in subsequent face-to-face classes received a positive feedback because the video content did not stray away from the in-class topics. The inclusion of quizzes and coding exercises further increased the students understanding on the topic (92.71%, n=36 *agree* and n=53 *strongly agree*) as they can self evaluate themselves and re-view the videos if necessary. The content of the video also sets a foundation and it continues seamlessly to the topics and exercises that are discussed in the face-to-face classroom. It is very important for the pre-class materials to reflect the content of the face-to-face classroom so that the students can relate and stay engaged to the lesson.

Challenges of Flipped Classroom

The common challenge when dealing with technology is the unavailability of resources. Resources can be in the form of hardware such as computers, tablets or smartphones, software as well as the Internet access. Many students have given this as a problem when applying the flipped classroom approach. Due to the lack of Internet coverage at their respective areas, students have difficulties in downloading materials or even to view the contents online (Chen, 2016; Wang, 2016). On average the length of the videos is 10 minutes with the shortest video being 3:28 minutes and the longest was 14:45 minutes. Even though most students (84.38%, n=34 *agree* and n=47 *strongly agree*) stated that the duration of the videos were acceptable, they still insisted that the videos should be made shorter. This is a point to be considered as mentioned by Guo et al. (2014), shorter videos increase the students' engagement on the topic. The videos can be broken up into shorter segments to improve the duration for each video. The creation of the videos and materials is also a challenge for the instructors. The availability of software and the time taken to learn and use them is a problem for some instructors. The time taken to plan and properly layout how each topic needs to be presented is also a burden for instructors. The issues of copyright when using pre-made videos is also a concern.

The success of implementing the flipped classroom approach depends heavily on the students' own motivation to learn. Highly motivated students will view the videos and try out the quizzes and exercises while the less motivated will get less done or none at all. Flipped classroom approach creates more room for discussions, communication and collaboration between students as well as the instructor. In the survey, the results reveal a lower percentage of happiness when it comes to group discussions with team members. This might be due to students who did not watch the videos at home and therefore are lost during the class discussions. Previous studies have reported that students who skipped going through the pre-

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class activities had trouble concentrating and contributing to the in-class activities (Sun et al., 2018). The overwhelming amount of preparation a student needs to do prior to the actual class might cause some students to reject the flipped classroom approach. Even though students are able to learn at their own pace, some still struggle to understand the materials as they are slow learners and still require a guide to be present. The non availability of basic but extremely important infrastructure such as computers and digital devices, software and Internet connection are also other reasons why some students are not able to contribute during discussions.

There were less than 10% of students who did not attempt the given self check quiz and short coding questions. When asked the reason for this, they revealed that they forgot or after watching the videos, they were too tired to attempt the quiz and coding questions. The design of the materials was made in such a way that the quiz and the coding exercises were not directly embedded into the videos. So this might be a reason for them to leave the exercises for later and at the end forget to complete them. To overcome this problem, the design of the video can be improved by embedding the quizzes and short coding questions into the videos directly. This can be done by using free third party platforms such as Edpuzzle. Edpuzzle allows videos to be paused and students are forced to answer some questions before the video resumes. This is an affective way of checking the student's understanding before continuing the lesson. But of course it comes with a limitation on how many videos that are allowed to be embedded with the quizzes and questions when using a free account. Another reason to why students tend to leave out the self-check quizzes and extra exercise given is due to the fact that no marks were taken from them to be included as part of the students' coursework marks. This may be improved if some percentage of marks in the quizzes and coding exercises were to be included in the coursework marks in future.

A minority of students stated that even though they attempted the pre-class materials, it took too much of their personal time at home. This decreases the other activities that they often do with their family and friends. Students also mentioned that it was difficult to get timely feedback from the instructor. This is encountered especially when the students try the pre-class coding exercises. As a result, they could not complete the work given to them. This is a challenge as the students learn at a time which the instructor is not available. Table 2 shows the summary of the challenges faced by students throughout the implementation of flipped classroom for the entire trimester.

Table 2: Summary Of Challenges Faced By Students In Flipped Classroom

– Unavailability of resource such as computers, laptops or smartphones and Internet access.
– Long video duration.
– The overall pre-class learning is taking a lot of their personal time.
– It takes time to learn the available functions and features of the learning platforms.
– Not able to receive real-time feedback from the instructors when attempting the pre-class work.
– Uncooperative or unresponsive team members during in-class discussions.
– Pressured to learn too many materials on their own without guidance.

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Conclusions and Suggestions

This study has exposed the flipped classroom approach to the student continuously for 14 weeks which is one complete term. It was a new learning experience where flipped classroom was implemented throughout the term and not just for certain topics of the course. The result of this study shows a great change in the way students learn. They take ownership of their own learning. The students were more vocal in asking questions and willing to apply their knowledge into practice. The classroom environment became more dynamic with discussion in groups as well as with the instructor. The students help each other out by teaching those who were having trouble with the topic. The pre-class materials such as the videos give the student the power to pace their learning and to easily take notes by pausing the videos. In a real classroom setting, this was in most cases impossible to do. Students were more attentive in the classroom with flipped classroom approach. They are willing to try out exercises given in the face-to-face class unlike in previous terms where students were too tired to do the exercises after the instructor conducted the lecture. Even though the students were willing to watch the videos completely, they would prefer shorter video duration of less than 10 minutes. Shorter video allows better student engagement and lesser time for the students to download from the platform into their computer if there is a need.

Of course it cannot be denied that there were a minority of students who were reluctant to learn using the pre-class materials. This also results in some students being free-riders during the in-class discussion. The use of flipped learning has had a very big impact on how students learn throughout the term in this course. Students showed a positive response when asked whether they would like to incorporate flipped classroom in other course, especially those which requires hands-on or practical work. Due to the nature of the course which uses a hands-on approach, flipping the class was a good decision and has worked well for the students as well as the instructor and should be incrementally introduces to other course with similar structure.

Based on the study done, some suggestions are proposed for future flipped classroom implementation:

1. The course materials uploaded for the pre-class lessons should start from basic and slowly progress to more advanced levels with clear instructions. This is to ensure that students can follow each lesson on their own without guidance.
2. It is advisable to include some portions of marks from the pre-class quizzes or exercises into the course grading marks. This is to encourage students to attempt and complete the pre-class work. This will also ensure students are well prepared when attending the face-to-face classes.
3. The instructor's feedback must be given priority. Due to the absence of the instructor during the pre-class lessons, students will post questions when they have difficulties understanding the lessons. The instructor must be able to provide quick and adequate response to the students' queries.

Implications for practice or policy:

- Instructors can apply flipped classroom approach to increase the engagement towards the lessons.
- The challenges for both students and instructors needs to be considered for better flipped classroom learning experience.
- Instructors must focus on giving quick and adequate feedback when implementing flipped classroom approach.

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This research has brought forward the benefits as well as challenges when implementing flipped classroom for the first time to diploma level students. A better understanding was gained on how students reacted to the application of this method into the classroom. The study was implemented to a course which is hands-on or practical in nature. The positive results received in this study cannot be generalized to other theoretical courses. Future studies should be done to other theoretical courses to have better knowledge on how to tackle different challenges in other genre of courses.

The study focuses more on whether the students can accept the new mode of study and to identify the problems that they face rather than to identify the effects of this model on the students' grades or performance. More quantitative studies should be done with much larger sample size with multiple instructors. This survey study was done with a small number of students (n=96) and with only one instructor. This is the first course that implemented the flipped classroom approach. So students might not be too familiar with the online platforms and the new way of learning as they are too comfortable with the conventional way of learning.

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