Evaluation of Students' Dependency on Out-Of-Class Learning: A Flipped Classroom Approach

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Abstract—**The flipped classroom method enables the provision of reference material for students' out-of-class learning prior to the in-class teaching and learning process. In this work-in-progress paper, a study is reported that the findings of the study on students' dependency on five entities, namely, peers, Internet, books, exercises and subject teachers, during out-of-class learning in the absence of teachers. The study was conducted on a total of 31 students which focused on Mathematics subject. Results obtained from the study revealed that, the students relied on their peers, initially but turned to the Internet once they had mastered their learning.**

Keywords—flipped classroom, active learning, secondary mathematics

I. Introduction

Flipped classroom is one of the student-centred teaching methods which helps create an active learning environment [1,2]. It has two phases, namely, in-class and out-of-class learning, which provide students the opportunities to learn independently and to learn to develop knowledge through experience and guidance of teachers and peers [3]. Previous studies related to flipped classroom have proven the method to be effective in improving students' achievement [4] at both the school and university levels. At the school level, flipped classroom has also been proven to be effective when implemented on gifted and talented students [3], besides the mainstream or normal students.

Fig. 1 shows that the flipped classroom method is the opposite of the traditional method. In this method, schools are venues for students to do their assignments, where any problem solving will be done by the students with the help of teachers. In the traditional method, assignments are done out-of-class, causing the students problems if they cannot understand the task given or assignments

This caused the students' misunderstanding of the existing topic to worsen [6]. The dependency of students through out-of-classroom learning which cannot be resolved completely through the traditional method has opened up space and opportunities for the researcher to examine this dependency through the flipped classroom method.

Based on the flipped classroom method, students are given the material to be learned before the actual classes take place the following day, and this is known as the out-of-class learning phase.
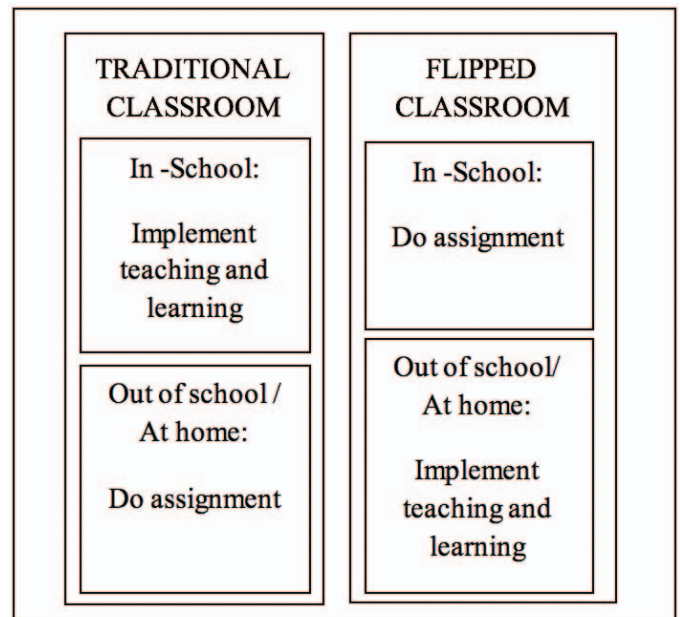

Fig. 1. Flipped classroom method.

Obviously, the need to optimize technological applications for learning and teaching is paramount in the out-of-class learning in the flipped classroom method [5]. An appropriate and systematic use of technological applications in the flipped classroom method will not only assist teachers in their teaching, but also help increase students' understanding in difficult subjects [6]. In addition, the flipped classroom method is seen to improve students' performance, communication and teamwork [7]. However, the method has its drawbacks, as it requires access of materials during out-of-class hours and students' dedication to complete their work prior to the in-classroom session on the following day.

Originally, the flipped classroom method was implemented at the university level in Engineering and Technology teaching before it became widely used at the school level in Science, Technology, Engineering and Mathematics [7][8]. However, questions arise whether the flipped classroom method causes a great impact on improving students' performance at the school level.

As such, among factors which need to be emphasized are, the way students adapt to the method and the type of entities

they rely on once they encounter problems while using reference materials outside the classroom. Out-of-class learning takes place in the absence of teachers.

Since this study was conducted on fully-residential secondary school students, their dependency was limited and subject to school management and environmental factors. A fully-residential secondary school refers a school system to nurture outstanding students to excel in academic and extracurricular activities. Hence, the dependency on entities in this study took those two factors into account.

II. METHODOLOGY

A. Participants

A total of 31 fully-residential-school students, aged 13–14 years old were assigned as the intervention group, who underwent the flipped classroom method.

B. Research Question

This study sought to answer the following question:

What is the students' dependency during the out-of-class learning of the flipped classroom method?

C. Research Procedure

Each student was to use the material provided during the out-of-class flipped classroom learning. Each of them was provided with a laptop to access the learning materials uploaded into a Google Drive. They were required to download the provided material, namely, Digital Statistic (DigitSTAT), a day ahead of the in-class Mathematics lesson and to manipulate the material for 5-10 minutes, before answering the questions on a hardcopy worksheet provided. The purpose of this exercise was to ensure that students had some understanding about the contents of the Digital Statistic (DigitSTAT) material provided, prior to the in-class learning on the following day.

III. DATA ANALYSIS

The implementation of the flipped classroom method comprises two phases, namely, out-of-class learning and in-class learning. However, this paper only discussed activities in the former, where each student was exposed with a material resource known as Digital Statistic (DigitSTAT). Each DigitSTAT package contains a set of activities and a set of questions by series. In this study, a total of six DigitSTAT series were provided. Through the out-of-class flipped classrooms learning, the students stated the resources they relied on, based on the following entities: 1) Internet; 2) Peers; 3) Books; 4) Exercises; 5) Teachers.

A descriptive analysis was carried out by obtaining the percentage of each entity through a questionnaire about entity dependency on out-of-classroom learning. The questionnaire was distributed to every student at the end of a series of flipped classroom learning.

Fig. 2 shows an analysis of students' dependency through the first activity in the out-of-class flipped classroom learning while using Digital Statistic (DigitSTAT).
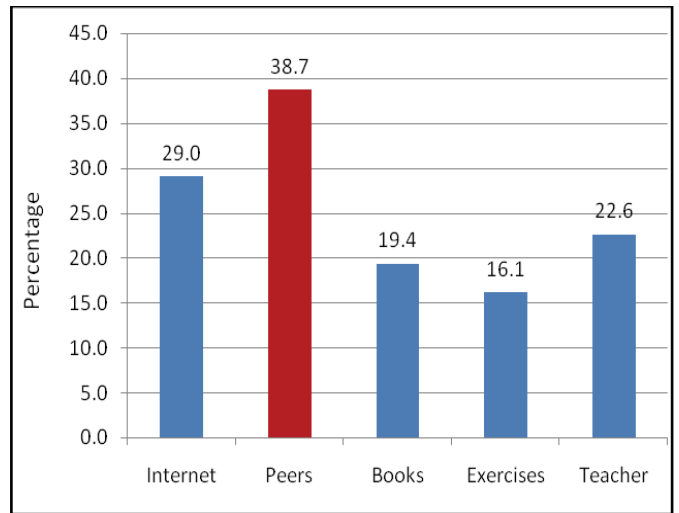
Fig. 2. Students' dependency on Digital Statistic 1.

Based on Fig. 2, the highest students' dependency during out-of-class learning through DigitSTAT activity 1 was on their peers (38.7%). Of the total percentage, 16% were male students and 84% were female students. In addition, the lowest 16.1% dependency was on exercises, comprising 40% male students and 60% female students. However the percentages of male students' dependency on all entities were lower than those of female students.

This was followed by an analysis on the students' dependency on the 5 entities in the subsequent activity, namely, activity 2. After using DigitSTAT, 35.1% students were found to be still dependent on their peers once they encountered problems while using the DigitSTAT materials. Of the total percentage, 27% were male students and 73% were female students.

The students also relied on their peers once they did not understand things they were learning, as shown in Fig. 3. The percentages of male students' dependency on all entities were also lower than those of female students.
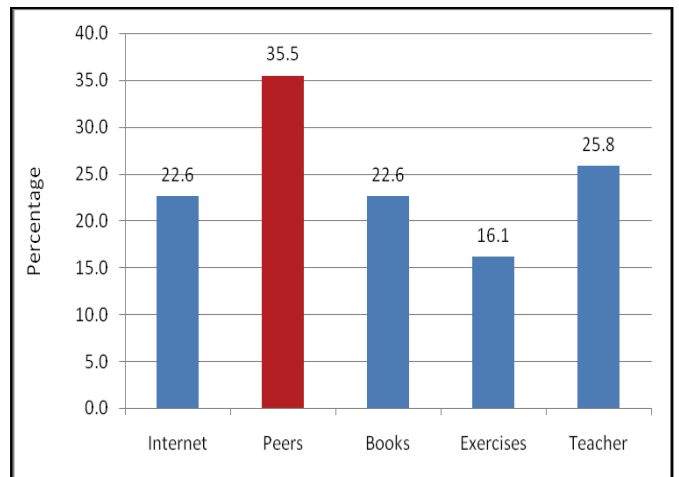
Fig. 3. Students' dependency on Digital Statistic 2.

Next, as shown in Fig. 4, activity 3 proved peers, at 48.4% to be the dominant entity in students' dependency during the

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out-of-class flipped classroom learning. The highest dependency percentage of 48.4% was due to the difficulty level of the questions included at the end of the out-of-class flipped classroom learning. Fig. 4 also shows that exercises as the lowest dependency entity. Interestingly, the percentage of male students' dependency in activity 3 changed, where a higher percentage of them (57%) depended on exercise entity, compared to female students.
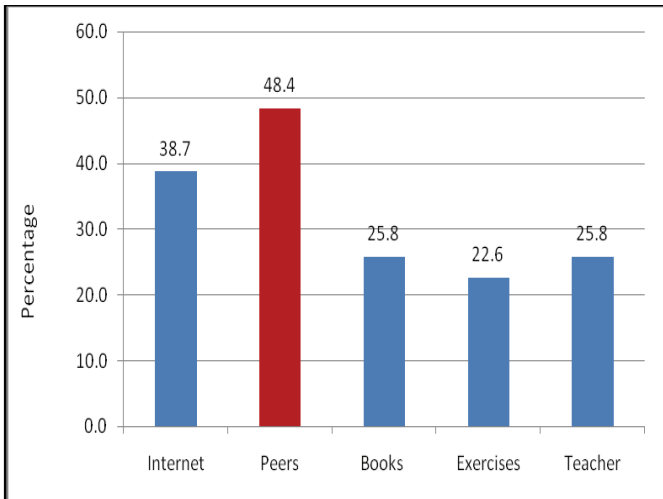

Fig. 4. Students' dependency on Digital Statistic 3.

Meanwhile, Fig. 5 shows students' dependency on entities during activity 4. As in the previous activity, students' dependency was still dominant on their peers (29%), once they encountered problems while using the DigitSTAT materials. However, as per the entities in activity 1, 2 and 3, the percentages of female students' dependency on each entity were still higher than those of male students.
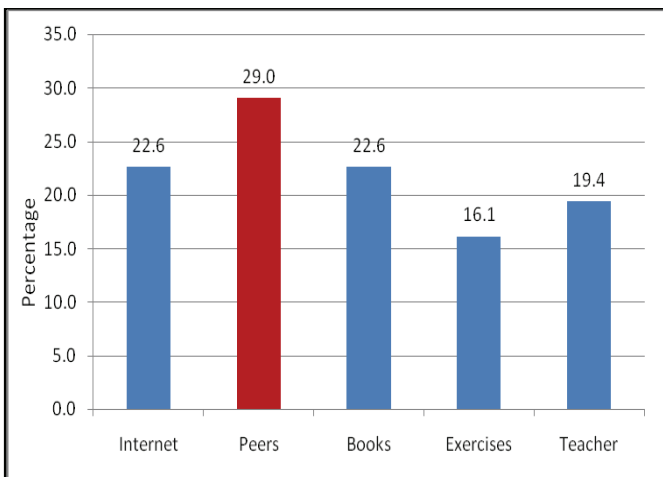

Fig. 5. Students' dependency on Digital Statistic 4.

Based on Fig. 5, although the percentage of dependency on peers was the highest, its value was slightly lower, compared to the percentages of dependencies shown in Fig. 1, Fig. 2 and Fig. 3. This was likely because the students have started mastering self-learning and become less dependent on their peers.

Further on, Fig. 6 indicates students' dependency on DigitSTAT in activity 5 was the highest for peers entity, at 35.3%, although the percentage of dependence was seen decreasing.
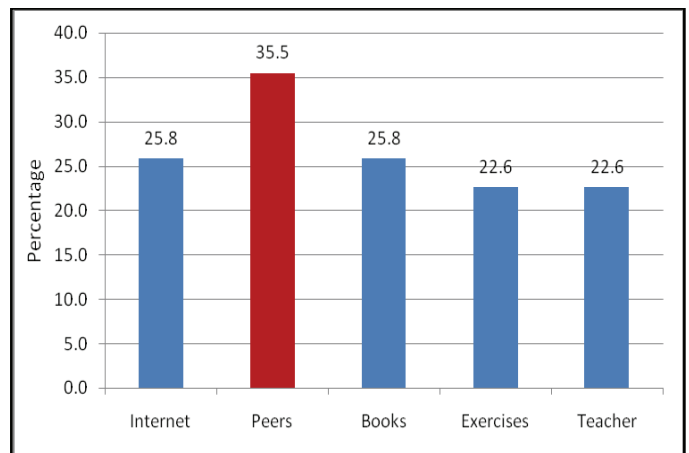

Fig. 6. Students' dependency on Digital Statistic 5.

The percentage of female students' dependency on each entity remained high as in the previous activities, but as in activity 3, the percentage of male students' dependency at 57% was higher than that of female students on the exercises entity.

Activity 6 (Fig. 7) was the last one where the DigitSTAT material was used. During this activity, it was found that, students' dependency on their peers was also high. However, there was a significant change in the result found in activity 6, compared with activities 1-5, where the highest percentage at 77.4% was for the Internet entity.

In activity 6 also, the training provided at the end of the application of DigitSTAT materials was the most difficult. Although students' dependency on the Internet entity was the highest, their dependency percentage on the peers entity at 54.8% was also the highest compared to activities 1 to 5. The needs for the students to refer questions to their peers and to find additional materials online resulted in the increased percentage of their dependency on peers and the Internet.
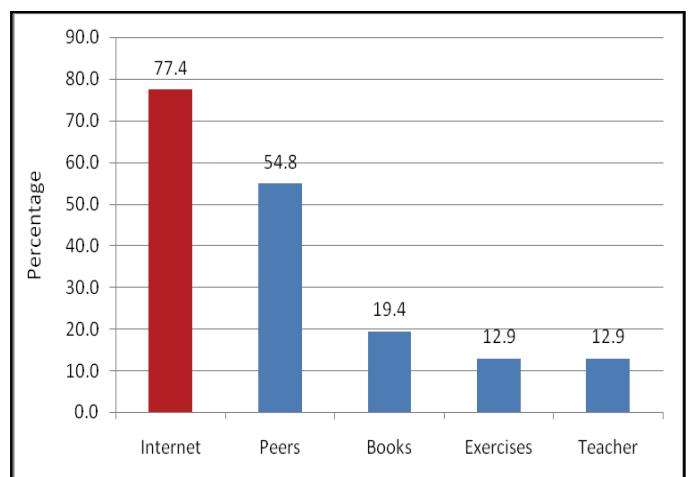

Fig. 7. Students' dependency on Digital Statistic 6.

Fig. 7 shows that students' dependency on the entities of peers, books, exercises and subject teachers was increasingly declining when compared to the 5 entities in the previous activities.

However, out of the total percentage, female students were still ahead of male students in the dependency on each entity except exercises. The percentage of male students' dependency on exercises increased to become 75%, compared to female students (35%).

Generally, in activities 1 to 5 as shown in Fig. 8, during the use of DigitSTAT, students' dependency on peers was high. It was only in activity 6 that, the dependency on Internet prevailed over all the other entities.
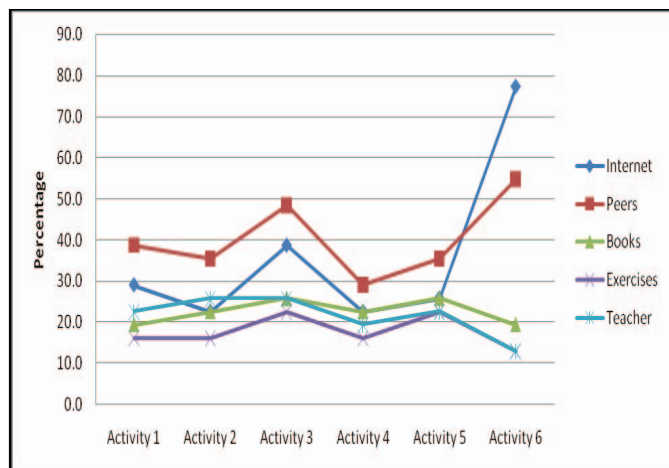

Fig. 8. Overall students' dependency on Digital Statistic.

IV. DISCUSSION AND CONCLUSION

The findings of the study showed that, throughout the out-of-class flipped classroom learning, students' dependency on their peers was high, compared to the other four entities (Internet, books, exercises and subject teacher), during the early stage of the flipped classroom implementation. However, once they had increasingly gained the mastery of their learning process, they would look for more in-depth information from the Internet, compared to that obtained from their peers.

It can be concluded from the study that, in the out-of-class learning of the flipped classroom method, a self-learning approach, and students' dependency on peers was the highest, followed by the use of the Internet as a reference. Only a small percentage of them chose subject teachers, books and exercises as their references and guidance to solve problems

while using Digital Statistic (DigitSTAT). This proved that, peers were the entity preferred by fully-residential-school students for their reference and guidance once they encountered problems in their learning, until they had mastered the learning, after which period, they would turn to the Internet as their source of reference. This finding was consistent with that of [3,4], which stated that, academically excellent students required an extraordinary learning. Accordingly, the Internet is a resource which needs to be provided to give students the opportunities to explore for information more effectively [9].

Furthermore, the students' high dependency on peers and the Internet through the flipped classroom method proved their ability to learn more independently, compared to the traditional methods, where they rely only on subject teachers.

This study will be extended to other students in the same age range to see if this finding will provide the same or even better results.

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