A Quantitative Investigation of Student Performance in a Peer Assisted Flipped Classroom Model

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Abstract: In the current educational scenario existing at the higher education institutions, where the academic schedules are packed with lot of student activities and other skill development training activities, the faculties are facing difficulties in completing the syllabus, which is the bare minimum requirement expected of them. This leads to faculty resorting to the traditional lecturing techniques even though the scope of implementing active and co-operative learning strategies in the today's classroom scenario is higher. Many past studies have indicated that the traditional lecturing techniques do not help in the improvement of student performance and satisfaction. This article reports on a study which employed a peer assisted flipped classroom technique to improve the performance of students in an engineering course offered in the final year of B.E Civil engineering program. The flipped classroom strategy involved in this study consisted of 28 students watching recorded lectures along with their peer pairs before attending the regular class hours. The regular class time was split between completing a handout based on the recorded lecture, group discussion and doubt clearing by the course instructor. The statistical analysis on the pre-test and post-test scores of the students obtained before and after the implementation of the research technique revealed that there is a significant improvement in the performance of the students compared to the traditional teaching techniques. The research technique is found to have a positive effect on the performance of students based on the results concluded in the study. The research revealed that the peer assisted flipped classroom technique can be implemented as one of the active learning strategy to increase the performance level of students.

Keywords: Peer assisted flipped classroom, Active learning, Traditional teaching, Recorded lectures, Peer pairs, Performance

1. Introduction

The present engineering education system is facing the problems of tightly packed curriculum and vast syllabus for the courses. The faculty teaching engineering courses find it difficult to complete the syllabus within the prescribed lecture hours. In order to complete the courses within the stipulated lecture hours, the faculties stick on to the traditional lecturing methods. On the other hand, the traditional lecturing methods have had a deterrent effect on the motivation and performance of the students. The past studies have stressed on the need to shift from the teacher centric traditional teaching methods to more student centric active teaching methodologies by bringing in major pedagogical reforms in order to improve the quality of engineering education (National Academies, 2005; Prince, 2004; Terenzini et.al, 2001). Many researchers in the past have proposed Flipped Classroom as one of the student centered teaching strategy, due to the major advancements in the field of educational technology (Lage & Platt, 2000; Lage et.al, 2000; Baker, 2000; Bishop & Verleger, 2013). Flipped classroom is an instructional strategy and a type of blended learning that reverses the traditional learning environment by delivering instructional content, often online, outside of the classroom. It moves activities, including those that may have traditionally been considered homework, into the classroom (Wikipedia, 2020). The peer assisted learning is another student centric teaching style in which the students are partnered with their classmates. The paired students mutually address their academic needs, apart from actively collaborating in completing the assignments and projects (Fuchs et.al, 2000). In the current research work, the author has implemented the peer assisted flipped learning strategy in an engineering course to assess the influence of the technique on the performance of the students. The technique implemented combines the advantages of both the flipped classroom technique and the peer assisted learning technique.

2. Literature Review

The flipped classroom methodology refers to the active and blended learning style of teaching in which the students are provided with the content and learning materials prior to the handling of the classes. This technique leads to the integration of face-to-face and online teaching techniques enabling students to engage in meaningful and communicative learning and critical problem-solving (Bergmann & Sams, 2012; Kim et.al, 2017; Zarrinabadi & Ebrahimi, 2018). The importance of the flipped classroom

lies in the fact that the content is delivered before class time, and the actual class time is spent in the form of discussion, integration, and application of that content. The course instructors act as a facilitator, guiding students in discussion either individually or in groups during the class time. The implementation of flipped learning in a higher education course had resulted in the improvement of the student's achievement along with the improvement in the student's attitudes towards learning (Garrison & Akyol, 2009; Alrowais, 2014). The transfer of information out of the classroom and the process of information assimilation inside the classroom allowed the instructors to coach students in their learning instead of delivering lectures. The interaction of instructors with the students in a flipped classroom is found to be more personalized. The students are found to be actively involved in the knowledge acquisition and participate in the evaluation of their learning (Crouch & Mazur, 2001; Alvarez, 2011; Zhang et.al, 2016). In the peer learning style of learning methodology, the students learn and master the content by joining together with their peers and classmates into small, structured and heterogeneous groups. The students through peer learning are not only responsible for their self-learning, but also help their group-mates in learning (Antil et.al, 1998, Singh & Abrham, 2015). In students, peer learning is found to promote teamwork, critical enquiry, reflection, communication skills and also the development of learning outcomes. Peer learning helps in motivation of students to review, learn, and comprehend the material when they are put into a teaching role. This helps students in regulating their work process, support their peers ensuring in the fulfillment of the learning goals of the peers (Boud et.al, 2013; Cavallaro & Tan, 2006; Liaw et.al, 2008; Razak & See, 2010). The implementation of a flipped classroom model with an online discussion component resulted in the improvement of student's academic performance since it maximized the outside-the-classroom learning and inside-the-classroom hands-on practice. The team work and collaboration among students was also found to be improved through the online and in classroom discussions (Haddad & Kalaani, 2015). The review of previous research works revealed that the flipped classroom and peer learning techniques have been tried independently, but a combined peer assisted flipped learning technique has not been tried as an active learning technique. The peer assisted flipped learning technique can combine the advantages of both the flipped learning and peer learning techniques. The major advantages of flipped learning like self-paced learning, deeper understanding of the subject, better preparedness for the next day's class and student-centered learning can combine effectively with the benefits of adopting peer learning like more personalized learning experience, higher interaction between students resulting in active learning, peer students getting a deeper understanding of the subject and higher interaction between the students and teachers. This technique also helps the course instructors in the way that the lessons are completed on-time, instructors can use the class time effectively for doubts clarification, reinforcing important contents and focus on slow-learners.

A. Research Question

Based on the review of the previous research works, the author has focused on the current research to find if there is any significant improvement in the performance of students treated to the two types of teaching techniques namely the Traditional Lecturing techniques and the Peer-assisted Flipped Classroom technique. This lead to the framing of the research question and its relevant hypothesis:

Research Question: Is there a significant difference in the performance of students when peer assisted flipped learning is implemented compared to the traditional lecturing?

Hypothesis: There is no significant difference in the performance of students when peer assisted flipped learning is implemented compared to the traditional lecturing.

3. Methodology

A. Participants

The present research work carried out was related to the elective course CE6006 Traffic Engineering and Management. The course was taught to the 7th semester B.E Civil Engineering students at PSG Institute of Technology and Applied Research, Coimbatore, India. The institution being affiliated to Anna University, Chennai, the syllabus of the course was as per the Anna University Regulations 2013. The total no. of students registered for the course was 28. All the 28 students participated in the research work, with their consent of participation acquired. For the purpose of appointing peers, the pre-test scores of all 28 participants were considered. The pre-test scores conform to the test scores of participants in the test conducted before the implementation of the peer assisted flipped learning technique. Based on the pre-test scores, 14 pairs of peers were identified. The peers were paired in such a way that the student with high score in the pre-test is paired with a student with low score in the pre-test.

B. Procedure

The research involved the implementation of the traditional lecturing method and the peer assisted flipped learning method of teaching. The Unit 2 of the prescribed syllabus in the course was taught to the students using the traditional lecturing method. This involved using the traditional methods of lecturing such as the chalk and talk lecturing and power point presentations. An assessment test at the conclusion of Unit 2 was conducted, the scores of which were considered as the pre-test scores for the current research, based on which the peer pairs were identified. The peer assisted flipped learning technique was implemented for the teaching of Unit 3 of the prescribed syllabus. A total of 12 classes were handled by the flipped class methodology to complete the Unit 3. The methodology involved in providing the recorded videos of the lecture one-week prior to the classes for the participants. The videos along with necessary study materials and texts were

uploaded in MOODLE platform, which the students had access to. Each recorded lectures runs for about 30 to 40 minutes. The participants were instructed to watch the recorded lectures along with their peer pair. The peer pairs watched the recorded videos and took notes wherever necessary. During the course classes, the participants were made to sit along with their peer pairs. The participants were provided with a scaffolding handout based on the recorded lecture they watched prior to attending the class. The first 15 minutes of the class is spent by the peer pairs in completing the handout. The handout consisted of questions related to the recorded videos they watched prior to the class and the distribution of questions with respect to Revised Bloom's Taxonomy (Anderson et.al, 2001) were in the order of 20% remembering type, 30% understanding type and 50% application type questions. The next 15 minutes of the class involved the group discussions, where in all the participants reflect on the recorded video lecture. The last 15 minutes of the class involved the interaction and doubts clearing by the course instructor with the participants. At the completion of Unit 3 of the course, an assessment test was conducted, the scores of which were
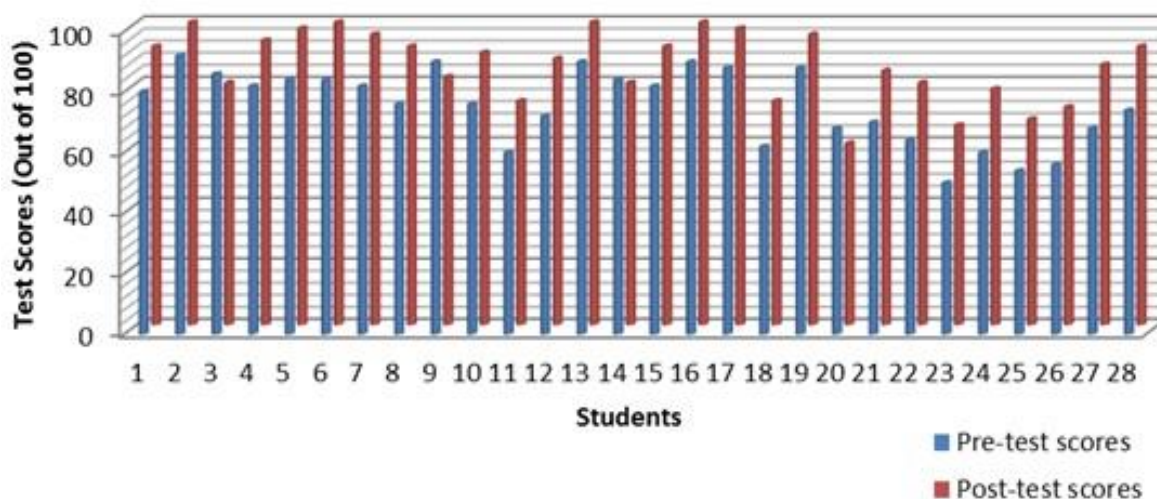

Fig. 1 Research method wise distribution of articles

considered as the post-test scores of the research. The assessment tests consisted of 20% remembering, 40% understanding and 40% application type questions.

C. Statistical Analysis

In order to quantify the effect of the peer assisted flipped learning technique adopted in this research, the performance of the participants were directly assessed using a pre-test and post-test analysis. A total of 28 participants took part in the assessment tests conducted in the pre- and post-implementation of the peer assisted flipped learning technique. The pre-test and post-test scores of all the participants are represented in the Figure 1. The pre-test scores had a mean value of 75.4 and standard deviation of 12.38, while the post-test scores had an average of 86.1 and standard deviation of 11.51. A paired samples t-test was conducted on the pre-test and post-test scores at the 95% significance level to test the hypothesis, the results of which are tabulated in Table 1. The t-value obtained from the test was 7.3 with a standard error mean of 1.46. The calculated t-value of 7.3 is greater than the p-value of 2.052.

Table 1 Paired samples t-test results

| | Paired Differences | | | | | | | |
| | μ | σ | Std. Error Mean | 95% Confidence Interval of the Difference | | t | df | Sig. 2-tailed |
				Lower	Upper			
Pair 1	10.7	7.7	1.46	7.72	13.71	7.3	27	.000

4. Results and Discussion

The statistical analysis of the pre-test and post-test scores clearly indicate that the mean of the post-test scores after the implementation of the peer assisted flipped learning technique is higher than the pre-test scores where the traditional teaching methodology was adopted. The difference between the means of pre-test and post-test scores being 10.7 supports the fact that the peer assisted flipped learning technique adopted as the teaching methodology in the proposed research improves the student performance. The significant value obtained from the paired samples t-test (7.3) is less than the significant value (2.052) of 0.05 alpha level (p<0.05). Based on this result, the stated hypothesis that there is no significant difference in the performance of students when peer assisted flipped learning is implemented compared to the traditional lecturing is rejected. The result implies that there is a significant difference in the means of pre-test and post-test scores. The findings indicate that the implementation of the peer assisted flipped learning technique has increased the performance of the students compared to the performance of the students in traditional teaching technique. This can be attributed to the fact that all the relevant text materials related to the content in the recorded lectures were provided beforehand to the students which has made the learning process easy for the students. Due to the implementation of flipped learning technique, most of the time inside the class room was spent on discussion and doubt clearing by the

course instructor which has helped the students in improving their performance in the course.

5. Conclusion

In this paper, a novel peer assisted flipped learning technique was presented. The technique involved an interaction among the students outside the classroom. The interaction was enhanced by the fact that the students watched the recorded lectures of the course along with their peer pairs, which helped them in understanding the course more effectively in the way of peer discussions as and when they watched the recorded lectures. This technique seems to be more closely identified with the learning style of the engineering education students, where students enjoy studying among and along with their peers. This has been clearly concluded by the results of the t-test conducted on the pre-test and post-test scores of the students. The results have been inferred using the statistical analysis with 95% confidence level. The technique presented in the current research work has also enabled a higher collaboration among the students based on the discussions carried both outside and inside the classroom. The results of this research reinforce the importance of the implementation of collaborative learning for increasing the performance level of students.

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