The Impact Of Using Flipped Classroom In Computer Science Technical College Courses in Saudi Arabia

**Dr. Ahmed A Alkhalifah**

Associate Professor & Dean
College of Telecommunication and Information, Riyadh, Saudi Arabia

Technical and Vocational Training Corporation
Visiting Scholar at Centre for Technology in Education, Ball State University, USA
ak@cti.edu.sa

ABSTRACT

*The flipped classroom teaching approach has been used as a teaching and training strategy to enhance learning by involving trainees more in self-learning activities. That teaching strategy was used to spend more time in classrooms with students in group learning activities while students have more time for self-practice and learning outside the class. The flipped classroom approach in this study was used to enhance trainees’ skills in advanced operating system course in applied technical college in Saudi Arabia. Trainers complained about time spent with individual trainees when teaching them practical skills in that course; with low training level outcome, sometimes. As a solution, this study used training video clips to help trainees practice the process of installation of Linux OS, as an example of an important skill they must master in this course. The intervention model was developed and used to conduct the study for two semesters. The purpose of this study was to investigate the use of flipped classroom teaching model in terms of trainees’ perceptions and skill mastering. The study explored trainees’ attitudes as well as the challenges and solutions associated with this approach. Student survey responses were used to check their views on flipped classroom structure and how we can best implement such a strategy. As well, a comparison of quantitative results of the grades between traditional and flipped sections was done to compare the outcomes of the two teaching methodologies. Trainers were also interviewed to explore their views on this intervention.*

Keywords:

Flipped classrooms, computer science, training videos, practical skills, higher education

1.0 INTRODUCTION

The flipped classroom refers to a model or strategy of instruction where there is a reversal of the conventional learning model and its instructional content. It is a type of blended learning using online means, with activities long considered homework, becoming part of the normal classroom learning process.

1.1 **Background**

In this type of teaching strategy, the students watch various online lecturers and then proceed to carry out a collaboration or discussion. They can also carry out research while at home while engaging in classroom concepts with a mentor. This model differs from the traditional type in that in the conventional model, the lecturer forms the central focus and main information disseminator (Kim et al, 2014). The students defer to the lecturer for feedback and guidance and the tutor responds to different questions. More importantly, this teaching pattern normally follows the path of the tutor controlling the conversation flow. The flipped class differs completely in that it’s a learner centered technique where topics get explored to a much greater depth (Butt, 2014).

Educational technologies used can include podcasts, you tube type tutorials and web streaming. Flipped teaching models can also employ the use of third parties, digital research, text readings and online chatting. Generally, the research shows that the flipped model offers advantages in certain areas, but also has its weaknesses. The approach seems to be effective when there is extensive pre prepping of the students and with certain subject matters. For example, in studies in Russia, Japan and the United States, the most significant improvements to graded scores, occurred in students pursuing humanity courses such as the languages, rather than in the so called STEM (Science, Technology, Engineering and Math) subject modules (Aşıksoy & Özdamlı, 2016).

* + 1. Statement of the problem

Trainers complained about time spent with individual trainees when teaching them practical skills in advanced operating system course; with low training level outcomes sometimes. Teachers reported that teaching students the skills required to install Linux OS takes a lot of time and effort mostly because each student must follow many detailed steps to learn the process and understand the process leading to master the skill. This was obvious in large enrollment classrooms. Moreover, some students like to repeat the process and practice more than one time or at their homes at their peace which teachers cannot help with.

* + 1. Objectives of the study

The objective of this study is to investigate if the use of flipped classroom technique can help to alleviate these problems when used with students in that class. Also, the study aims to explore students and teachers views of using flipped classrooms strategy and their impressions after the class.

* + 1. Research questions

Will there be any significant differences in immediate student scores between flipped and traditional classrooms? Will there be any sig difference in delayed tests student scores between flipped and traditional classrooms? What are the student’s impressions about using flipped classroom? What are the views and best practices based on teachers or trainers' interviews?

1. Literature Review

In the literature reference source *“A teaching model for the college algebra flipped classroom”* by Lori Ogden, Laura Pyzdrowski and Neal Shambaugh, the authors state the following: The flipped model is a pedagogical framework that offers a method for college algebra teachers to create opportunities. These opportunities can address the myriad factors that increase mass failure rates of the subject matter, with regard to undergraduate level math course modules (Ogden, Pyzdrowski & Shambaugh, 2014). The authors say that the approach can increase the perception of math’s usefulness in college and beyond, motivation and self-efficacy. The researchers describe the flipped classroom model as using video in order to create engaging classroom activities. This is without suffering the loss of the courses lecture component.

They go on to talk about how the flipped model can impart the students with solid knowledge base and how the model uses the following elements to impart learning (Ogden, Pyzdrowski & Shambaugh, 2014). The important ones identified are the social system that describes the teacher and student roles and relationships, the student’s reactions and the decisions that the teachers take based on the reactions. Roach (2014) says that the model also provides an advantage by offering an effective support system in terms of nurturant (indirect) and instructional (direct) positive effects. In the literature reference “*Evaluation of a flipped classroom in an undergraduate classroom”*, the authors state that there are clear differences between the traditional style of lecturing and the flipped model.

The authors say that their research –based on the disparities- had anticipated that grades would be higher with the flipped approach than with the traditional one (Thompson et al, 2014). However, according to experiments done, the lecturers reported that students themselves did report a better classroom atmosphere, but no substantive quantitate (statistical data) based improvement in their scored grades. The flipped students’ class did report that this learning style allowed them to ask the lecturers more questions and this therefore made the learning experience more relaxed (Thompson et al, 2014).

The study in short in this case confirmed that the flipped course could lead to both positive and negative outcomes. The literature source “*Implementing a Flipped Classroom in Teaching Second Language Pronunciation: Challenges, Solutions, and Expectations”* by Yonemoto Kazuhiro and Tsuda Asami, on the other hand stated that the key issue with the flipped model pertains to the integration of technology into the element of pedagogy. The study notes that this same thing also happens with pronunciation teaching. The latter implies that the teachers’ beliefs, intuition and repetition, play the key parts in determining whether the learners absorb course material well (Yonemoto, Hayashi & Tsuda, 2016). The literature source did note that the study looked at just one course and in a non-English speaking country. The flipped course here utilized a Japanese self-help learning website and this and other technology, helped the learners learn faster than with traditional methodologies. Love et al (2014) agrees with these authors concluding that it is educators must stress the importance of initiative, planning and collaboration across different academic fields of study.

The literature source “The *Flipped Model in an Advanced Placement United States History Course”* by Kotlik Ronald, the author talks of the use of highlighted and annotated screen casts for to act as the foundation of flipped learning instruction. Kotlik (2014) says that n this case, the research looked at history students in the United States. The flipped learning involved exposing the students to direct activities like close reading sessions and after online content watching classroom debates. The results showed that there was a need to make students more accountable when watching the screen casts. Kong (2014) adds that embedded quizzes in the flipped learning model should be added to the videos, which would result in the effect of the students getting immediate feedback during the learning process. Random quizzes in the same manner would also ensure that the students regularly watch the online content-even if not in class and under the eye of a designated teacher.

The source *“Promoting Active Learning through a Flipped Course Design*” by Hussey Heathrer, Fleck Bethany and Richmond Aaaron talks of the fact that flipped courses require an increased commitment of time from the learners. This is particularly if taking challenging science-based courses. The sources say that there are challenges inherent in course flipping. However, the flipped courses offer a better chance for the faculty members to interact in a much better manner with the students and much more efficient time management. The other thing that the reference source talks about is how flipped courses help in class activity preps, course tweaking and better preparation for face to face classes.

The source “*Benefits of the Flipped Classroom Model*” by Larcara Marie talks of the key advantages of the flipped classroom model. These include better classroom management, more effective active learning, maximization of student-faculty time and critical thinking (Larcara, 2014). The source also says that in the flipped classroom feedback is apparent and visual. Enfield (2013) adds that one can hear and see if the students actually grow as active learners and the lecturers can make the requisite modifications to improve learning even more.

The source “*Students view on the use of a flipped course”* by Dirienzo Cassandra and Lily Gregory talks of the strengths and weakness of the flipped model. According to the authors, the fundamental strengths are the fact that the framework allows the college professors to add their own useful and critical insights and much needed background knowledge to the subject matter. This is very useful because it enables the learner to get a much better understanding of the subject material. The research findings in another literature source also show that another advantage comes in the fact that the lecturers in this format, can provide much better clarification of complex parts in topics of the subject matter (Clark, Kaw, Lou, Scott & Besterfield-Sacre, 2018).

 Thus, the students find it much easier to learn something new rather than having to wait for a lecturer to explain the subject matter from a standardized textbook. Students according to this source also said that the flipped model had the potential to create good college organizational dynamics, such as the improvement of the social atmosphere of a lecturer. One could interpret this as meaning that the flipped model could reduce the tension and stress that students usually fell when taking difficult academic modules. That being the case, a logical conclusion would be that the flipped model would motivate the students to learn even more on the topics discussed, out of the normal scope and also improve their cognitive function (Abeysekera, L & Dawson, 2015).

The weakness identified by the previous reference source included the fact that the presence of too many students attending the flipped course module would mean that the lecturers or college professors, would lack the ability to target specific areas that the students found intellectually challenging. The students, according to the source said that furthermore, the lecture pace using interactive tools and other ICT based hardware and software, created a pace of learning that not all students could cope with. Another perceived weakness occurred in the fact that the use of course outlines, had the effect of compressing section material into one single lecture.

This created a scenario where the particular lesson and subject matter became a sort of touch and go learning experience. This implies that there would be an element of shallowness in the perusal and analysis of the subject material, with the use of tools affiliated to the flipped model. Learners also complained of the flipped model stifling conspiracy, creative thinking and fooling the learner into believing that the ICT based model would act as some sort of magic bullet. Finally, the students said that the process of learning consisted of generally one-way learning strategies and processes.

McLaughin et al. (2018) offers information on flipped classrooms from the perspective of a pharmacy course. The authors state that flipped classroom technology offers graphical representation of the subject material, in a manner that allows students to understand the inner workings of the human body and how these ties in to drug treatment regimes. This essentially means that the flipping online technology tools, simplifier advanced concepts. Luttenberger et al (2018) says that the flipped learning model, offers colleges and university campuses, an excellent methodology to guarantee proportional learning.

The concept of proportional learning means that no student gets left behind in the learning process and there is a seamless transition from one advanced concept to another. Additionally, the research from this source shows that there is a much higher attendance of students in this type of learning technique. This, the authors say is because there is better feedback and more engaging interactive content.

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1. METHODOLOGY

The study used qualitative and quantitative methodologies to find out if this intervention will help the students nor not. Quantitative methods look at statistical data while the qualitative ones look at social factors (the “who, where, why and when”). The experimental process used the quota sampling method. This is a non-probability type of technique where with respect to the assembled samples, the researcher uses the same proportion regarding individuals as an entire population. This is about a focused phenomenon, traits or characteristics. In this research, the traits are that the learners are Saudi computer science students and the phenomenon is Linux installation.

* 1. Focus Groups

There were 2 groups, all have the same project and the same final for the class. Experiment group with flipped classroom, and control group with regular classroom instruction. There were 2 check points. The course here in this case consisted of an ICT based one where the students were to learn how to install a Linux based operating system. The research tried to determine the effectiveness of the flipped method used when compared with the general curriculum. The course selected in this study consisted of several specific credits taught over a number of months. A textbook in comparison was used as part of the control process. A table in the experimental process provided a list of the exams and topics for each of the sessions in the flipped approach. Additionally, as part of the methodology, the process of comparisons between the traditional method and flipped method taught complex processes. The methodology ensured effectiveness by using a quasi-experimental methodology design.

This is because of the self-enrollment of the students in the same course. The control group in this methodology was identified as the conventional classroom. The flipped classroom therefore comprised the treatment group. The students in the flipped group for this methodology had to watch online videos prior to the relevant lecture. Active learning methods occurred for both the control groups and treatment groups. For the think –pair activity, the questions posed challenged the learners to develop their own personal answer in terms of the flow chart for the approach to problem solving. The flipped group consisted of 183 students, while the conventional or control group consisted of 114 students. The researchers who created the courses also created the measures of achievement used to align the curriculum.

This entailed the development of separate quizzes for each of the significant topics in the Linux based subject matter. The researcher/instructor for this methodology selected separate and specific questions of the subject matter as post quiz and pre quiz problems and another research reviewed them to verify the comparable difficulty levels. This resulted in items that were representative of the study domain (that is, the quizzes possessed the quality of content validity. Additionally, student response scoring occurred consistently, and this ensured reliability. One should also note that identical post quizzes and pre quizzes were issued to the treatment and control group and the average post quiz performance formed the dependent variable across the sub elements of the subject matter (Linux installation).

The researchers administered the pre quizzes at the start of the class while for the flipped classrooms, the expectation was that the students would have successfully completed the video assignments before the previously mentioned in class meetings. In terms of scoring each quiz used a standard method for scoring with 0 for incorrect and 1 for correct. The researchers then tallied this out of 10 and 15 points for the two data sets. As in other researches, the mean figure had an equivalency to the percentage average points earned across all the quizzes administered to the students. One should note that the experimental process did not expect the learners to complete all the quizzes. The reason for this is that doing so would result in a reduction of the sample size and this could in turn affect the analysis’s statistical power.

Requiring each case to have completed all the administered quizzes would have reduced the sample size further, compromising the statistical power of the analysis. One should also note that the independent variable was the type of instructional delivery the student received, traditional or flipped. In terms of the control variables, these took the form of average pre quiz performance and prerequisite computer science engineering courses. These independent variables served to account for the different groups initial differences that arose from the fact that this was not a random assignment. Pre quiz average performance calculation occurred (single control variables) in the same way as for the dependent variable (post quizzes).

3.1.1 Group description

 The control group or traditional classroom consisted of 114 students while the flipped class consisted of 183 students. There is no indication that this was a mixed gender class. The experimental process did not look at prior achievement academically to a statistical extent that would differ. As an example, though, if the experiment would have looked at prior academic achievement, the t value of chi would be calculated through the subtraction of the mean population from the given sample mean (x-bar – μ). This would be followed by the division of “s” by “n” square root. n here is the number of sample units (s ÷ √(n)). The final process would involve taking the value one obtains from the subtraction of μ from the x-bar and the division of this figure by the specific value obtained from the division of s by “n” square root ( (x-bar - μ) ÷ (s ÷ √[n]). For clarification, a t test requires that the researcher use two variables, with one being categorical and having two levels to be exact. The other must be estimable using a mean and quantitative. As an example, one could use two variables (Democrats and Republican) and a quantitative variable of age. On the other hand, testing of the chi square requires variables that are categorical (two) but each can have any level number.

1. RESULTS

Looking at the data from the tables, there are several significant differences that the researcher can observer. For the project score (immediate post treatment), the first group in the flipped class posted a score of 8.45 points out of a total maximum of 10 points. The second group (without the flipped framework) scored a maximum score of 7.81 points out of the maximum ten in the immediate post treatment. In terms of the delayed post treatment or class score, the flipped class in the first group scored 10.28 points out of a maximum of 15 points. On the other hand, the second group that did not undergo the flipping framework scored 11.59 points out of 15 points. The data obtained occurred under the backdrop of standard deviations of 3.64 for the immediate post treatment and 3.29 for delayed post treatment.

5.0 Analysis of Data

Upon analysis of the data, one can determine the following: For the experimental group, there was less of a gap between the project score at 8.45 points and the class score at 10.28 points. A greater gap existed between the control group’s project score and the class score with figures of 7.81 and 11.59 respectively. To put it succinctly, the change in average or mean of the group without flipping did seem to exceed that of the one in the experimental group. The gap between the control group of 11.59-7.81 (3.81) could be termed as marginally significant or even not significant. This will be proven through the calculation of the Chi value. The differences are therefore one tailed in that the differences as results did not occur through random chance. One should note that as per research principles, if the data set “P” value is below the specific predetermined set figure, (such as 0.05), then the people carrying out the research will reject the experiments null hypothesis.

This means that in simple terms, they will therefore rule out the hypothesis that the experiments variables had no final meaningful effect on the gathered results. Here, the expected results are that the flipping framework will have a greater positive effect academically than the control or non –flipped framework. With that in mind, one can calculate the p value as follows: First, there is the determination of the degrees of freedom. The formula for degrees of freedom is DOF= n-1. N refers to the number of variables or categories of variables. There are two categories namely the flipped group and the control group. Thus, for this case, the degree of freedom is 2-1=1. The nest thing is to find the Chi square equation. The formula for that is  x2 = Σ ((o-e)2/e). “e” represents the expected value and “o” represents the observed value. Summing up the equation results, provides all the possible outcomes. While this may seem complicated, the best way to understand this would be to note that the equation includes a sigma operator.

 This means that one needs to carry out a calculation for each and every possible outcome and then proceed with an addition of the final results to obtain a chi square value. In this experiment, there are two possible outcomes. These are either the students benefit from the flipped classroom framework or structure or they do not benefit (there is no change in the performance. This leads to the need to calculate the ((o-e)2/e) value twice: One for the students in the control group and one for the students in the experimental group. A simpler way to understand this is that if one used the examples of police officers issuing speeding tickets for cars on the basis of the car’s color, one could say that they expected the police to issue 90 tickets for white cars and 60 for black cars. This would be against expectations of 100 tickets for the white cars and 50 for the black cars. The calculation here would be

x2 = ((90-100)2/100) + (60-50)2/50)

x2 = ((-10)2/100) + (10)2/50)

x2 = (100/100) + (100/50) = 1 + 2 = 3.

In that same vein, the calculation for the students is as follows:

 x2 ((7.81-8.45)2/10) + (11.59-10.28)2/15)

x2 = (100/100) + (100/50) = 1 + 2 = 3.

0.04096 +0.1144=0.155.

The calculations show that the Degree of Freedom is 1 and the Chi Value is 0.155. Conventionally, scientists and researchers set the experimental value of significance at 5% or 0.05. The implication of this is that the experimental results that meet this significance level, have a maximum percentage chance of reproduction of 5% in the process of random sampling. Using an online p value calculator, the result obtained shows that the P value for this experiment is 0.693802. This proves that the result is not significant significance since p< .05.

6.0 CONCLUSION

In summary, based on the findings of the experiment, one can say that prior GPA or Grade Point Average may have a role to play in the fact that the control group that did not use the flipping framework scored higher ( 11.59 out of 15) than the group which used the flipping framework (10.28). This essentially means that people who have a higher intellectual acumen therefore possibly benefit more from the flipping framework, especially when the instruction involves complex technical studies in the Science, Technology, Math and Engineering undertakings. The other assumption regarding the better scores of the traditional group is that the flipped class may not have viewed the training videos in a repeated manner until they fully grasped the concept of Linux OS installation.

Alternatively, they may not have had the opportunity to practice the most important steps. This assumption is born by the fact that the 68% of those students interviewed, talked of the need to watch video training clips numerous times and practicing as much as possible. Finally, it is also possible that the flipped group did not engage in the practice of answering short questions as a way to gauge their level of basic understanding of the academic subject matter. This would determine if they had understood the fundamental concepts of Linux Operating System installation or if they merely took the classes out of an interest in computers but found themselves unable to cope with the academic workload.

Future suggestions and recommendations are that there should be implementation of flipping treatment by more than one lecturer or professor (Johnston & Karafotias, 2016). The experiment can also get done across a wide variety of Information Communication Technology based courses. Experimentation should also use additional measures such as projects and performance assessments and larger student samples.

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