STUDENTS' PERFORMANCE IN FLIPPED AND TRADITIONAL CLASSROOM SETTINGS: A COMPARATIVE STUDY

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ABSTRACT

This study compared the learning outcomes for undergraduate students taking an introductory managerial accounting course in a flipped class (N = 77) and students who took the same course in a traditional class (N = 78). Student learning outcomes were measured using scores from twelve weekly online assignments, midterm and final examinations held on campus, and overall course performance. The results showed that students registered in the flipped class were not as successful as students enrolled in the traditional class. The findings suggest that Flipped-class pedagogy is not merely a change in the delivery mode. To be successful, it needs intense preparation. The heart of the Flipped Classroom is student engagement, including his/her realization of the responsibility for self-learning. No pedagogical approach, of course, fits all students alike. Students should not, therefore, be in any doubt about what to expect before registering for the class. Since the acquisition of critical reasoning skills is not a single-step process, but is a continuum, future researchers need to focus on senior students with exposure to this pedagogical approach from the beginning of their university studies.

INTRODUCTION

The university is often considered a place for the acquisition of knowledge. It is true that knowledge is a prerequisite for learning. But, knowledge acquired by rote memory, knowledge that is specific to a situation, or that which one cannot generalize is no learning, since it is short-lived and tends to be forgotten as soon as the purpose in view, e.g., an examination, is over. Therefore, it is claimed that a mere passive transmission of knowledge from the instructor to students, for example, in a traditional lecture form, adds little, if any, to students' learning process (Coates, 2006; Barkley, 2010). That defeats the very objective of a university, which is the development of intellectual competence "capable of being applied in any field whatsoever" (Flexner, 1930). The capability to apply knowledge open-mindedly to novel situations being crucial to learning (Pluta, Richards, & Mutnick, 2013), it must involve "reflective abstraction." The student must initiate the activity himself and exert reflective thought in the understanding of the subject matter (Ginsburg & Opper, 1979).

The phenomenal advancement in information technology has led to an exponential growth of information available in every field of study over the last few decades. Unfortunately, there has been little change in the way knowledge is imparted to students and in-class lectures continue to be the medium of instruction (Prober & Heath, 2012). There has been concern over the years that the current structure of education caters only to lower levels of learning, as postulated in Bloom's taxonomy (2001). That fails to instill critical thinking skills essential to prepare better students for the 21st century (Accounting Education Change Commission, 1990; Albrecht & Sack, 2000; Christensen & Eyring, 2011). Perhaps, partly because of inertia, the ease in covering the ever-increasing course content and a lack of proper evidence of proficiency of any alternative mode of delivery, the traditional venerable method of the in-class lecture has held sway.

A recent innovative approach to teaching is the Flipped or the Inverted classroom setting. It reverses the general order in which instruction is handled, that is, a professor-led lecture in class, followed by the assignment of exercises, problems, essays, etc. to a student as homework. In the Flipped classroom setting, students are furnished with multimedia lectures recorded out of class and studied by them independently at their pace as homework. Students are expected to come to class prepared, equipped with the course content. The Flipped model thus frees in-class time for the professor to engage in those instructional activities requiring students to practice higher-order thinking skills of application, analysis, synthesis and evaluation of Bloom's revised taxonomy (Anderson & Krathwohl, 2001). As defined by the Flipped Learning Network (2014), "Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter." This pedagogical approach changes the class environment dramatically from the passive teacher-centered ("sage on the stage") to the student or learner-centered, where the student plays an active role throughout in his/her quest for knowledge, and the instructor acts only as a "guide on the side" (King, 1993). Active learning activities involve in-class problem solving, case studies, "clicker" questions, collaborative group work, etc., resulting in a dynamic learning environment.

The concept of the Flipped or Inverted classroom is indeed promising in the quest for a methodology to produce better-educated individuals equipped with advanced analytical and diagnostic skills to face the challenges posed by the global economy. Research on the effectiveness of this novel approach to teaching in the higher institutes of learning is limited (Pierce & Fox, 2012; Asef-Vaziri, 2015; Gilboy, Heinerichs, & Pazzaglia, 2015; Chen, Wang, Kinshuk, & Chen, 2014). Bishop and Verleger (2013) suggest that "additional research is needed to examine the influence of flipped classroom instruction on objective learning outcomes." The purpose of this study was to contribute to this field of research by comparing students' performance in an accounting course in flipped and traditional classroom settings.

The rest of the paper is organized as follows. Section one provides a brief review of the literature. Section two discusses the theoretical underpinnings of the concept of cognitive development. Section three describes the methodology, i.e., research design, measures of student learning, hypotheses, and data collection. Section four provides the analysis and results. Finally, Section five presents a discussion, conclusion, and limitations of the study.

LITERATURE REVIEW

Academia has over the years used various methods to involve students actively in the learning process. (Kasl, Marsick, & Dechant, 1997; Novak, 1999; Lage, Platt, & Treglia, 2000; Crouch & Mazur, 2001). The Flipped classroom has become a buzzword in the media over the last decade and a half. The lure of this new educational model should be inescapable to both students and teachers: It affords students freedom and responsibility to acquire knowledge at their pace, thus motivating them to be active participants in the learning process, whereas instructors, cognizant of students' difficulties based on their in-class performance, can make better use of class time by judiciously selecting activities catering to students' higher-level learning skills.

Most studies focusing on the flipped-classroom experience show that attitudes and perceptions of a majority of students were consistently positive. Some concerns, expressed only by a significant minority, related to the need for more support from teachers, their non-availability to answer questions during the traditional component of the model and the possibility of some students being unprepared during the face-to-face activities in class (Gilboy et al., 2014; Kim, Kim, Khera, & Getman, 2014; Mok, (2014). In their scoping review, O'Flaherty and Phillips (2015) identified three research studies that focused on educational outcomes of using the model: One of nursing students reported improved learning outcomes, whereas, in the other studies of pharmacy and mechanical engineering students, the results were unchanged and equal or better, respectively (Missidine, Fountain, Summers, & Gosselin, 2013; McLaughlin et al., 2014; Mason et al. 2013, as cited in O'Flaherty & Phillips, 2015). Pierce and Fox (2012) used a flipped classroom model in their study of a renal pharmacotherapy topic module and concluded that "students' performance in the final examination significantly improved compared to the performance of students the previous year who completed the same module in a traditional classroom setting." When Albert and Beatty (2014) redesigned an Introduction to Managerial Course based on the flipped class model, they found that students performed better than those taught earlier by the same instructor in a traditional lecture class setting using the same text and tests. They also discussed four other comparative research studies focusing on the business, pharmacy, and electrical engineering students. The results showed that while the use of the flipped-classroom approach made no difference to the business students' performance, pharmacy and electrical engineering students benefited by scoring significantly higher on the exams.

Haughton and Kelly (2014) conducted a comparative study of approximately 600 students in an Introductory Business Statistics course taught in 22 sections at Suffolk University in Boston in one of the two learning environments and concluded that there were no significant differences in the performance of students in the two environments. They opined that "It is possible to argue that shortly the flipped format may outperform the traditional form as faculty gain experience in this type of environment, and as further technological advances improve mode efficiency." Herreid and Schiller (2013) described a course redesign project for a college- preparatory chemistry course using the flipped model and a comparison of the exam scores of students attending the flipped and traditional lecture classes. The results of the study showed that students attending the flipped classes were overall more successful scoring higher on the final exam (Ruddick, 2012, as cited in Herreid & Schiller, 2013).

Estes, Ingram, and Liu (2014) reported on a number of research studies of the flipped classroom: Deslauriers et al. (2011) used the flipped classroom model in a large physics class and "found that students in the flipped course scored more than twice as well as students in the control group in multiple-choice test measuring comprehension of the content in the final week. The students also enjoyed the flipped experiment: 90% agreed that they enjoyed the interactive learning methods". In another study, Berrett (2012) implemented the flipped classroom approach in an introductory calculus course and found that as compared to students in the traditional class setting, those in the flipped class "were able to make gains twice the rate." Similarly, Lizer and Wesner (2013) as cited in Estes et al. (2014) reported improved performance of students attending a flipped pharmacy course class.

It is interesting to note that though overall findings of the studies on learning outcomes of students attending the Flipped classes over those attending the traditional lectures were mixed, the learning theory of cognitive development fully supports the Flipped-class pedagogical approach.

THEORY OF COGNITIVE DEVELOPMENT

Inhelder and Piaget (1958) explained the intellectual growth in human beings as a developmental process occurring in stages. From childhood to adolescence, in an individual's life, there are four levels of growth, viz., sensory-motor, pre-operational, concrete operational and formal operational. The later levels display a more sophisticated and efficient pattern of thought and reasoning. The last two are relevant to students' readiness for undergraduate study. Formal operational thought, the highest level attainable by human beings, is characterized by the abilities to reason abstractly.

Piaget's research evidence shows that formal operational skills are not universal and that many adolescents fail to acquire the formal-operational thought (Ginsburg & Opper, 1979). The transition between the concrete operational and formal operational stages is not an abrupt or a single-step change but is a continuum. A fundamental idea underlying Piaget's work is that of mental structures. From infancy to adulthood, intellectual development is explained by the construction and reconstruction of mental structures within the brain. This process of constructing new mental structures is called equilibration or self-regulation.

The developmental process primarily involves three steps, viz., assimilation, cognitive conflict, and accommodation. Assimilation occurs when the individual confronts an unfamiliar problem situation and tries to solve it with the help of existing reasoning patterns. When the attempt fails, and he/she realizes the inadequacy of the reasoning pattern used, it results in "disequilibrium, cognitive conflict," or "contradiction," and the next phase, i.e., accommodation, takes place. Now the individual makes an effort to alter his/her reasoning pattern to deal with the problem situation adequately, that is, the individual accommodates to the new situation, or self-regulates, and acquires new mental structures (Lawson & Benner, 1976). According to Piaget (1964), this process of equilibration or self-regulation is a "fundamental factor in development." However, Furth (1977) cautions that in the equilibration process, assimilation could be followed directly by

accommodation. In that case, the individual will retain his/her current state of equilibrium without further accretion to mental development.

It is noteworthy that "cognitive conflict," which is said to be fundamental in mental development, is deliberately built into the schema underlying the flipped class model: Students are expected to experience it while assimilating the contents of video lectures at home and if not, they may find it almost impossible to escape while facing carefully planned active-learning activities in class.

METHODOLOGY

Research Design

A quasi-experimental research design was applied to students registered into two sections of an introductory managerial accounting course for an undergraduate business degree taught by one instructor during a single semester. One section (93 students) was prepared using the flipped class model, where students were asked to perform certain activities at their pace at home before coming to the class, such as watching lecture videos, PowerPoint presentations provided for the purpose and studying relevant portions of the text. They were also required to complete weekly assignments consisting of true/false statements, multiple choice and problem-solving questions, which involved calculations, analysis, or short answers. In class, students were involved in collaborative work and concept engagement, including exercises, brief cases, and problems to illustrate concepts and principles of the subject matter. In the regular class section (102 students), the instructor explained concepts and principles of the subject matter in lecture form, including PowerPoint presentations and some exercises/problems in class. After that, students were asked to complete the weekly assignment before the due date.

This study used the method of self-selection by students in each section. It was assumed that students would enroll in a section offering the teaching mode that they thought would best maximize their performance and access to content. This self-selection was not expected to affect the robustness of the study because students were all from the same school and taking a core course required of all undergraduate business major students. Therefore, the students' profiles will be comparable in both teaching modes. The vast majority of prior studies also employed, self selection. To achieve a high degree of internal validity and as close a comparison as possible between the flipped-class and traditional class models, the same instructor taught the two sections, eliminating differences in such confounding factors as grading standards and instructor teaching style across sections. Furthermore, efforts were made to ensure that students in the two learning environments had access to the same textbook and supplementary learning aids, such as assignment solutions, PowerPoint slides, and solutions to previous examinations.

Measures of Student Learning

Student performance was compared using four different measures of learning, consisting of twelve weekly assignments, midterm, a final examination (held on campus), and total marks in the course. Students in both the flipped class and traditional class were required to register at WileyPlus Course Management Systems to perform the twelve weekly assignments.

The twelve weekly assignments corresponded to the twelve chapters required for the course and consisted of true/false statements, multiple choice and problem-solving questions involving calculations, analysis, or short answers. Each assignment was graded on 100 marks with two attempts for each question. These twelve weekly assignments carried 10% of the total marks in the course. After the due date for each assignment, students were able to review the solutions and link to the textbook. These weekly assignments were essential in maintaining student activity while providing learners with timely, meaningful feedback and assessment. These tasks created an element of motivation and an educational design that promoted a more active, collaborative, and participatory form of learning.

Statement of Hypotheses

The null hypotheses for this study were:

1. Ho: There was no statistically significant difference in students' performance between the flipped section and the traditional section in the twelve weekly assignments.
2. Ho: There was no statistically significant difference in students' performance between the flipped section and the traditional section on the midterm examination.
3. Ho: There was no statistically significant difference in students' performance between the flipped section and the traditional section in the final examination.
4. Ho: There was no statistically significant difference in the students' overall performance between the flipped section and the traditional section based on total marks.

Data Collection Procedures

There were 93 students enrolled in the flipped class section and 102 registered in the traditional section. The results presented below included data only from students who completed all requirements for the course. In the flipped class section, 16 students either withdrew from the course or deferred the final examination for personal reasons, leaving 77 students who completed the course and received a final grade. It was equal to 83% retention rate. In the traditional section, 24 students either withdrew from the course or deferred the final examination, leaving 78 students who completed the course and received a final grade. It was equal to 76% retention rate, which was comparable to the typical retention rate found in traditional classroom settings in previous semesters.

STATISTICAL ANALYSIS AND RESULTS

For each hypothesis, an independent samples t-test comparing the respective variables of the two teaching modes was used to test the hypothesis—this method was employed by a majority of prior research studies in comparing the effectiveness of the traditional classroom with that of the flipped class delivery. This test is appropriate because the independent or grouping variable is nominal (approach = flipped vs. traditional) and the dependent variable in each case is ratio scale. Summary performance measures for students in both the flipped and traditional sections are presented in Table 1.

TABLE 1: SUMMARY STATISTICS AND T-TESTS OF STUDENTS' PERFORMANCE

Section	Number of Students	Mean Score	Standard Deviation	Standard Error of the Mean	F-Value	Significance Level
PANEL A: Students' Performances in 12 Weekly Assignments						
Traditional	78	84.05	14.79	1.68	1.79	0.182
Flipped	77	77.45	17.20	1.96		
PANEL B: Students' Performances in the Midterm Examination						
Traditional	78	50.37	15.65	1.77	1.40	0.239
Flipped	77	43.81	17.45	1.99		
PANEL C: Students' Performances in the Final Examination						
Traditional	78	73.97	15.61	1.77	5.25	.023
Flipped	77	66.91	19.99	2.28		
PANEL D: Students' Overall Performance in the Course						
Traditional	78	67.90	12.81	1.45	6.83	.010
Flipped	77	61.05	16.70	1.90		

The average scores on weekly assignments reported in Table 1, (Panel A) correspond to the number of points awarded out of 100%. These figures were used to test whether the mean scores on the twelve weekly assignments differed between the flipped and traditional sections. The results indicate that the average score on weekly assignments in the flipped section (77.45%) was not significantly lower than that in the traditional section (84.05) at F-Value 1.79, which measured the difference between flipped and traditional variances at the 0.182 significance level. The higher scores found in the traditional section may be the result of understanding the subject matter from the instructor before the due date, whereas the flipped section was required to complete the assignment before coming to class. These findings support the first null hypothesis.

The results of the midterm examination, presented in Panel B of Table 1, indicate that the average performance of students in the flipped sections was not significantly different from that of students in the traditional section at F-Value 1.40, which indicated that variances between flipped and traditional sections were not different at the 0.239 significance level. However, students in the flipped section achieved a lower average score (43.81%) on this midterm examination than those in the traditional section (50.37%). The low performance of students in the flipped section on the twelve weekly assignments did carry through to the midterm examination. This low performance of students in the flipped section could be because of the constraints on the flipped class requiring students to learn the subject matter on their own and to complete the weekly assignment before coming to the class. The results presented in Panel B support the second null hypothesis.

The students' performance on the final examination, Table 1 (Panel C), were statistically different at F-value 5.25, which indicated that variances between the flipped and traditional sections were different at the 0.023 significance level. These results indicate that students in the flipped section performed significantly lower than those in the traditional section. The low performance of students in the flipped section (66.91% VS 73.97%) is consistent with their lower performance on the twelve weekly assignments and midterm examination. It seems that they did not avail themselves of the opportunity to learn independently and from their experience with the weekly assignments and the midterm examination. These results do not support the third null hypothesis.

Given that student in the flipped sections achieved lower scores, on average, than students in the traditional section across all three components of the course, Table 1 (Panel D), accordingly demonstrates that students in the flipped section underperformed (61.05%) hose in the traditional section (67.90%). This difference in scores was statistically significant at F-Value 6.83, which indicates that variances between the flipped and traditional sections were different at the conventional level of significance at 0.010. This significant difference in the mean total marks was not surprising because the results of the final examination, worth 60% of the total, were significantly different between the flipped and traditional sections. Hence, these results do not support the null hypothesis of Students' Overall Performance in the Course.

DISCUSSION

The findings of the study contrary to the theoretical evidence in support of the flipped class model are indeed surprising. But, one should not interpret these as a negation of the model itself. Education at all levels has taken different approaches over the years to address successfully the changing needs of students, and to incorporate the evolution of technology over the years. A major objective of the "Flipped Learning" pedagogical approach is to stimulate a behavioral response from students in a dynamic classroom environment, allowing them to engage fully in their learning and enhancing their cognitive abilities. Students are expected to listen to the lectures on their own time (time which traditionally would have been used for homework) and use the classroom time for the problem- solving and fundamental concept development lending

itself to improvement in their critical thinking skills, clarification of any confusion and a more in-depth understanding of the course material.

Though the overall idea is simple, it is crucial to underline a few key determinants of success of such an approach. The heart of the Flipped model is in somehow engaging and motivating students to take on the responsibility for learning. The results thus could be explained by the seeming lack of enthusiasm. Primarily, the student needs to be enthused to become an active participant in learning and thus it is imperative that quality and diligence be put in the design and delivery of course materials. The educator needs to provide adequate guidance and a structured layout. This is accomplished by providing thorough explanations of the material in the online lectures exploring the topics from different angles and at different levels of difficulty. It needs to be supplemented by problem-solving activities in class challenging their critical-thinking skills and allowing them to express and identify their areas of concern.

This study was conducted on first-year undergraduate students taking one of the core courses in introductory managerial accounting. The students had no previous experience of a Flipped class. Their failure to avail themselves of the opportunity of self-learning offered by the Flipped class could be attributed partly to their immaturity as well as a lack of proper communication of what was expected of them in a Flipped class.

Also, according to Piaget's theory of cognitive development, discussed earlier, accretion to mental development, or acquisition of critical reasoning skills should not be viewed as a single-step change, but as a continuum. The results of this study are thus revealing and would hopefully encourage future researchers to focus on senior students at the undergraduate level or graduate level who have had experience with the Flipped model from the beginning of their university studies.

The Flipped Class pedagogy thus involves much more than a change in the delivery mode. Its successful implementation requires the instructor to focus on encouraging students to interact with each other and with the instructor to develop an active learning environment. It is important that the instructor quickly adapts from a teaching role to that of a coach and facilitator. The instructor's role will naturally continue to shift over time. It will move from one of a facilitator encouraging student-faculty interactions and promoting cooperation among students to one of a motivator supporting active learning, emphasizing time management through assessment, and prompt feedback.

CONCLUSION

In just over a decade, flipped learning has become a buzzword in higher education. However, educators continue to face challenges as they strive to apply this great learning technique. A primary focus of educators involved in flipped instruction is the learning outcome. This study compared the learning outcomes of students in flipped and traditional classroom settings. Four different learning outcomes were designed to better assess and demonstrate the effectiveness of the two types of course delivery in an introductory managerial accounting course. Students were

required to complete twelve weekly flipped assignments, a midterm and a final examination held on campus. The results of this study showed that students registered in the flipped section were not as successful as students enrolled in the traditional section.

These findings are revealing: Flipped-class pedagogy is not merely a change in the delivery mode. To be successful, it needs intense preparation. The heart of the Flipped classroom is student engagement, including his/her realization of responsibility for self-learning. No pedagogy, of course, fits all students alike. Students should not, therefore, be left in any doubt about what is expected from them before registering for the class. Since the acquisition of critical reasoning skills is not a single-step process, but is a continuum, future research needs to focus on senior undergraduate and graduate students, who have been exposed to this pedagogical approach from the beginning of their university studies.

LIMITATIONS OF THE STUDY

The study had some limitations: It was conducted at a single university and for a single course taught by one instructor. Furthermore, data were collected for only one semester, and the assignment of students to each group was not random, as the students had the choice of enrolling in any group. Although the results of this study are informative, the study does not promote one medium of delivery (flipped or traditional) over another, nor does it attempt to measure the effect of teacher/student and student/student interaction on learning outcomes.

This study concentrated on the form of delivery as the primary factor influencing student performance in the course. Nevertheless, other factors such as previous flipped course experience, proficiency with a particular classroom web page (WileyPlus), work experience, and other student demographics could have influenced the results. The study, however, did benefit from internal validity resulting from one instructor teaching all flipped and traditional sections. This allowed for differentiation in factors such as institutional milieu, grading standards, and instructor teaching style, to be eliminated. Regardless, further research needs to be conducted to provide information to support the robustness and reliability of this study's findings. A question that should be addressed in future research is whether flipped formats applied to upper-level courses of various degree programs will result in better learning outcomes. One thing is sure: As future studies elaborate on the effectiveness of flipped learning, educators will continue to face challenges in their effort to embrace new teaching protocols and methodologies.

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