

LEVELS OF FLIPPING THE CLASS ROOM: STUDY OF AFRICAN-AMERICAN COLLEGE STUDENTS

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Abstract

This study is an analysis of mean exam scores of three groups of African-American Undergraduate business students to determine the effects of different levels of flipping the classroom. For the highest level of flipping, the results showed positive and significant effects of flipping compared to the control group. However, a second moderately flipped group did not have a significantly greater mean exam score compared to the control group. Thus consideration of flipping a threshold may be needed in some instances to cause the flipping effect.

INTRODUCTION

The present paper is a study that examines changes in the test performance of a sample of African-American college students using the recent pedagogical model of “flipping the class room”. Jim Bergman and Aaron Sams (2012), in their recent book, describe principles of how having students actively participating in classroom activities and exercises, instead of passively listening to a lecture, creates more student interest, engagement and learning. Bergman and Sams argue that student interest is driven by immediate feedback, a key benefit of the flipping concept. In their particular flipping approach, they encouraged students to use Google Drive because of the software’s collaborative technology enabling access group and student- instructor collaboration regarding various research and creative activities to improve their academic performance. Other researchers have also reported studies on how effectively flipping technology has been in their college class rooms. For example, Lage, Platt and Tregelia, (2000) conducted a study in which economics was taught using a variety of teaching styles. They found that the variety of styles increase the student performance in the economics classes. They concluded that students learn in different ways or have different learning styles and that the teacher must present different teaching styles to accommodate the variety of student learning styles. Reichmann and Grasha (1974) designed a questionnaire in which they determined that students learn in one of three different ways, including a) being a dependent learner, b) a collaborative learner or c) independent learner. They concluded that the effectiveness of the teaching style was dependent upon the learning

style of the student, and the style-match with the teacher. They concluded that the teacher should vary their style, especially using styles other than the traditional lecture format. Reichman and Grasha used a variety of learning aids including video-lectures, exercises, discussion, problem assignments, power points, bulletin boards, and individual meetings with the economics students in their study. Dwortzan, (2012) also flipped the classroom for his engineering students in a course involving computational fluid dynamics at Boston University. Students watched videos of lectures online which was done outside of class time for collaborative student problem-solving. These meetings had the effect of helping students better understand the course core concepts. He found that this resulted in self-paced learning, which was a more effective way for his students to learn the concepts. Mark Gerstein (2012) reported that his various classroom flipping techniques were effective in increasing the understanding of basic math techniques in his classes. At Harvard, Crouch and Mazur (2000), reported gains in student performance over several years in math and engineering classes, and concluded that the flipping approach greatly improved performance over traditional methods of teaching. Deslaurier et. al. (2011) found significant learning gains in his physical science classes. Novak (1999) found that in having students do practice quizzes on-line before class, his students were able to benefit from “just-in-time” teaching, because their class was flipped. Flipping the class allowed students to use the collaborative technology to discover their weak knowledge areas before class, and then make adjustments just in time for the on-line quizzes. He reported that grades were much better with flipping and helped to improve the “just-in-time” performances on the quizzes. Carl Wieman et.al. (2011) reported significant learning gains in reading assignments and quiz scores by his physics students when they experienced the class room flip in the second semester, after being in the traditional mode the first semester. They reported that the scores from multiple choice questions increased for the experimental groups an average of 41% more than the control groups. In fact, Wieman refers to this increase as “dramatic” as the average increase was 2.5 standard deviations. Wieman, a Nobel Prize Winner in Physics, says, “The human brain accepts new concepts largely through constant recall, while interacting socially, so we must de-emphasize lecture in teaching and emphasize active problem-solving.” Richard Hake (1998) also found large increases using “integrative engagement” methods, creating gains of almost 2 standard deviations in student performance. Although the articles reviewed here is not exhaustive, a significant number of empirical studies have demonstrated the effectiveness of the flipping method with certain samples of college students compared to the traditional lecture. There seems to be significant agreement among important academic researchers as Carl Wieman and policy makers such as The President’s Council of Advisors on Science and Technology, who concluded in a recent report that “flipping the classroom, active learning and other dynamic teaching methods are essential to produce good students. The challenge here is to choose appropriate classroom activities in which students are led to discover the important concepts, and explain them to each other”

At this point in the literature, researchers are exploring the relationships between a variety of techniques that can be classified as active and dynamic, especially for independent learning, in addition to effective student demonstration of basic concepts learned. Cynthia J. Brame, (2012) in an article reported in the *Journal Of Higher Education*, while defining Flipping the Classroom, said “students first get exposure to new material independently, usually done through reading or lecture videos. But then they use the class time to do the harder work of assimilating that knowledge, perhaps through problem-solving, discussion or debates”. The source of new material outside the classroom varies as does the way the material is assimilated. Brame indicates that students can select which sources such as video lectures, read textbook or other means, would be best for them as an individual, since people learn best in different ways. She asked this question in the article:” Why lecture when students can do for themselves “? At Vanderbilt, Brame reports of using video lectures prior to class, so students can use as much active listening to the video before class as they choose to. They may view the resource material for the purpose of initial learning the material, or for review before class. Video lectures are taken from YouTube, Khan Academy, MIT’s Open Course, Coursera, or the textbook, among other sources. Charles Prober and Chip Heath (2012) of the Stanford Medical School used short on-line faculty presentations. Lage, Platt and Tegalía (2000) has required readings, lecture videos, printable power points, voice-over presentations and worksheets; Mazur and Crouch (2001) used quizzes and clickers requiring responses to questions before class. Novac (1999) required before-class writing assignments and problems assignments. Variety in the way information has been presented is a key part of the flipping model.

Assuming the attainment of the basic concepts and theories are attained, before class by the student, assimilation in class is enabled. The types of demonstrations of in-class learning are as varied as the ways of providing out-of-classroom learning. The in-class assimilation techniques often depend on the nature of the task being done, which can differ greatly from physical jobs to strategic, etc. A list of such ways to demonstrate this knowledge reported in the literature include: writing assignments, multiple choice questions, case discussions, role playing, debates, quizzes, effort, completion of assignment, processing feedback, etc. This assimilation period is the time when the teachers get to interact with students while they were learning and processing feedback. Providing active dynamic teaching and immediate feedback and encouragement helps to promote effective learning.

Brame (2011), though noting that though most studies found the “flipping effect” in science, math, engineering and economics classes, argued that nonetheless, the flipping approach has “broad applicability” to history and other social science subjects. The present paper is an example of Brame’s idea as it will venture outside the science areas to business management. It will also venture into what may also be different in terms of

having all African-American Students. Few, if any, of the studies have been done with a population of African-American college students in a Historically Black University.

Specifically, this paper does report of an experience with flipping the classroom in business courses. The model for the study follows those already reported on earlier in this paper. There are, however, some design variations in the model that are different in terms of the source and range of resources and aids available to students in the experimental groups. The particular resources helped students in the treatment groups to understand the concepts and theories of the course outside the classroom. These before-class resources go beyond the video of the lecture, to include an on-line lab of content designed both by the professor and the textbook publisher. Among the resources available in the lab were power-point presentations, videos of lectures, e-textbooks, flash cards, quizzes, summaries, cases and exercises. These aids were all available for students' access and use to help students prepare on their schedule. The aids were specifically designed to help the student understand class subject matter before coming to class.

The research models thus far in the flipping literature show a wide variation in types and number of activities that are done in class to enhance student learning and performance. Using a wide variation is appropriate because the theory suggests that individuals learn in different ways, thus the greater the variety in stimulating classroom activities, more students will be reached by the process. That is, the "light bulbs" of a greater number of students will come on because of a particular activity or activities that triggered the switch. Presumably, for some students the flipping activities may serve only to add to, or create more intense illumination. In any case, the theory would predict greater student learning and performance.

This paper questions whether there is a threshold of flipping activity beyond which a benefit is realized. Accordingly, this paper reports the results of testing the effects with three different levels of flipping activity.

METHOD

The purpose of the study is to test the proposition that the flipping model would be an effective way to increase the performance of African-American students on final exams. Because the flipping process involves one-on-one coaching, interaction, monitoring, and helpful assistance, it is expected to increase the interest and performance of these students. Based on the results of previous researchers, it is expected that students whose classes are flipped most (high flipping level) will perform better on the final test compared to students who experience moderate or low level (i.e., no) flipping. It is also expected that some flipping is better than none, thus, a moderate level of flipping would result in students performing higher on the final exam than students who do not

experience flipping. Finally, it is expected that the effect will be greater with females who may be somewhat more prepared for active involvement than males.

The students in this study included undergraduate seniors enrolled in one of three business policy classes. The control class was not flipped, but taught with the traditional lecture method during the spring semester, 2012. Two of the classes were flipped, which took place over the course of two semesters (spring semesters, 2013 and 2014). These students whose classes were flipped comprised the 2 experimental groups. The mean exam scores of these flipped classes were compared with the mean exam scores of other students whose class was not flipped. The latter group of students constituted the control group, because their classes were not flipped.

Student participants in the study all took the same departmental final exam, although in different Spring semesters of 2012-2014. These tests were all based on the same textbook chapters, used the same number of questions, with minor variation of randomly selected questions from the same test bank, provided by the textbook publisher. Each test contained multiple choice questions drawn from a test bank population of over 500 questions. There was often considerable overlap in terms of drawing the same or very similar questions each time for the tests.

In addition, it should be noted that all classes had cases and assigned homework. But these assignments were done outside of class and there was minimal discussion about them. However, the control group's class time was totally taken up with lectures as the primary method for teaching the class. It was expected that students would stop by the office during office hours if they wanted to talk about anything. However, most students were working, or had other priorities, so stopping by the office rarely happened. Very minimal time was given for interaction with the 39 control class students in 2012. These students came and sat for 1 hour 20 minutes, listened to the lecture, took notes, or not, and left the class. Questions from students were very infrequently asked. No discussion about the homework took place, as it was turned in, graded and returned to the student without discussion. There was usually some discussion about the exam grade from a few individuals. The experimental groups had a different experience.

The experimental groups were students enrolled in business policy during the spring semesters of 2013 and 2014, respectively. There were 39 students each group. The 2013 experimental group received considerably less flipping as this was the first semester using the approach so it was only partly flipped. The 2013 group had approximately 60 percent having lectures. Although expected to complete readings before class, most students seldom did. Most students were often first exposed to chapter material in class. The on-line lab was optional and few students registered for the lab. But there was at least some class time in this group doing exercises and active engagement to assimilate the core concepts.

The 2014 class received a full semester of using the flipping process. They received only a few brief in-class lectures to clarify more difficult concepts, but typically, class time was spent doing exercises, applications, discussions, online research, role plays, group and individual assignments. During class, time was spent engaging in exercises that assimilated the basic content. The instructor would go around engaging the students, providing assistance, answering questions, clarifying, reviewing, encouraging, etc. Also the instructor would encourage them to engage each other discussing the assignments. Another benefit of flipping is that often students can teach each other more easily than the instructor of the class. The 2014 experimental group was specifically required to read the chapters before class and be prepared to use the chapter content to apply to the cases, exercises and applications during class time. However, in the 2013 class, this was not always reinforced. During the 2014 class, students were required to turn in answers to chapter questions as proof that they had answered the questions before class. Students were also required to also register for and use MYMANAGEMENT LAB, provided by the publisher to read and prepare for class. As the lab provided a variety of ways to study the chapter content, including summaries, videos of lectures, flash cards, power point slides, quizzes, etextbooks, applications, and exercises, students could choose the method that is best for them to do before class. Even the individual assignments often resulted in discussion among the class about the results or recommendations of individuals for that particular assignment. Both the experimental groups and the control group was administered the same final exam. It is these data from the final exams of these three classes of students (spring, 2012-2014) that are compared in this study.

The analysis of the data included calculating means, variances, a one-way anova, and a Tukey Post Hoc analysis. The SPSS software was used to calculate the statistical results.

Subjects

The participants were all undergraduate, second semester seniors, enrolled in the School of Business Administration who agreed to participate in this study. They represent varying majors within the School, including Management, Accounting, Marketing, Finance, Information systems, and Supply Chain Management, among other majors. Ninety-eight percent of the students were under age 24, and 100% were African-American. The total number of participants was 117, including students from all three classes. Table 1 shows a classification of the student participants by class, test group (control vs. experimental) and gender. It also shows that the control group class size was equal in number to the class size of the experimental groups. Approximately 22 to 30 percent more females were enrolled in the classes.

TABLE 1

Distribution of Subjects by Class, Sex and Test Group

Class/ Test Group	Females	Males	Total
2012-Control	23	16	39
2013-Experimental	22	17	39
2014-Experimental	21	18	39

RESULTS

The purpose of the study was to test the null hypotheses of no differences in the final exam mean scores of students of business policy in spring semesters of 2012-2014. It also tested whether the experimental groups have higher mean final test scores as a result of the flipping method used. Research on the flipping pedagogy with test scores have rarely been reported in studies of black college students. The subjects used in most of the reported flipping studies excluded non-white students. This paper purports to test the null hypotheses for this latter sample of students.

Hypothesis: No statistical difference exists between the mean final exam scores of students who took business policy in spring 2012-2014.

In order to test this hypothesis, the researcher used the final exam scores of students from three business policy classes. This included 117 total students, with an equal number of 39 in each group or class. Each group had a different classroom experience, ranging from the traditional lecture format (class of 2012), to the beginning but incomplete introduction of flipping the classroom (2013) to flipping complete (2104).The same comprehensive departmental final exam was given for all three classes for all three years. Table 1 shows the gender and class and gender of the subjects in this study, all of whom were African-American.

The exam scores were analyzed using the one-way analysis of variance method and Tukey's Post Hoc Test in order to test the difference in the means of the groups of final exams. The analysis of variance results indicates the existence of high variances of the scores both within the specific classes and between groups or classes. Table 2 shows the results of the means test. Also, in table 2, the $F_{2,114}$ value is 3.15, which is determined to have a probability level of .046605. Thus the null hypothesis is not supported. The research question is answered: The students who were exposed to and were taught with the flipping methodology had higher final exam scores than the students who experienced the traditional lecture method. This one finding is true at a statistically significant level of .0466, or just a little more probable than the commonly accepted .05. The second

experimental group, which had moderate flipping only, was not significantly different from the control group. This might suggest the requirement of a potential threshold of flipping activity necessary before a significant impact of exam grades can be observed.

TABLE 2:
Anova Summary: Test of Final Exam Means
for the Three Classes

Source	SS	df	MS	F	p
BG Effect	84,496	2	2520	3.15	0.0466
WG Error	5,040	114	799		
Total	89,536	116			

While the anova analysis examines this study’s main research question of whether flipping the classroom affects the final exam scores of the samples in this study, it does not address the question of the relationship between the specific classes or groups. Therefore the Tukey Post Hoc Test was done to test the significant differences between specific groups. According to the results of the test, only the means between the low flipping group (from 2012) and the high flipping group (from 2014) are significantly different from each other. The mean of the medium flipping group is numerically greater than the low flipping group, but they are not statistically different from each other. In that sense, the hypothesis is only partially supported because those who studied under the partially flipped condition did not have statistically significant mean score differences than the students who had the lecture only format.

It is also clear from Table 1 that the females in the study outnumbered the males, thus, they likely had a greater effect on the final exam mean scores due to sheer numbers. This study did not include a gender variable analysis however.

DISCUSSION

The study’s findings provide several points of convergence with previous studies, although different in some ways. First, these finding show that the flipping experience does increase final exam grades over traditional lecture for college students, as it does for most of the articles reviewed in this paper (e.g., Dwortzan, 2012). This sample of black college students also had higher grades affected by this flipping format used. Flipping the classroom seems to restore the connection lost from the lecture-only teaching style because teachers move around the classroom to interact with students and it breaks down barriers between student-teacher. It seems to also create more interest and more active, rather than passive participation. This fosters more connectedness and more learning

taking place in class through exercises, cases and applications. This greater knowledge translates to better grades. Accordingly, this finding suggests that a change in teaching style from a traditional lecture style to flipping style would possibly create better learning and grades.

It is suggested here that having the class reach a threshold level of flipping may be necessary in order for flipping to have an effect. The analysis of the data in this study showed that the moderately flipped class did not receive the same benefit of statistically significantly higher grades than the low flipping control group. How much flipping should take place to receive the benefit and what proportion of students receives a benefit? What particular activities are most or least effective in turning on the switch? Can we distinguish different activities by their impact on the masses of students compared to those activities that only have an impact on a small segment of students? Are there some activities that are only effective in certain circumstances? Are some exercises more cost effective than others? Is flipping different for women vs. men? Which independent learning aids are most effective? Further study is needed to answer these questions.

The students used in this study were not engineering, science or math students as they were in many of the previous studies. These were business students in a management class with a large behavioral management component. But the flipping effect worked nonetheless, as Brame (2012) suggested it would. The design of this study also supported those previous researchers. However, in terms of designing future flipping studies, a need exists for students to prepare before class. This point was made by Brame, who assigned chapter questions to be submitted before class started. However, in order to motivate students, this assignment must be given significant value in terms of points. If students read before class, it makes the in-class activity more effective, but without preparation, it becomes very difficult if not impossible, for students to benefit. This study, like others, employed many of the same before-class preparation resource options for students including the lecture video. It also included many other methods like power point presentations, cases, exercises, the etextbook, etc. In addition, one difference is that the present study also used an on-line lab provided by the textbook publisher, which enabled the students to test themselves, and get feedback before class. The lab also contains the textbook as well as other electronic resources.

While it is pointed out here as a limitation that we did not partial out the effects of gender in this study, it is possible that there was a significant gender influence due to the much larger enrollment of females in all samples. However, the ratio gender bias was constant in all groups in this study, not just some. Future research should definitely test for gender effects. It is even conceivable that women may be able to more effectively navigate the active in class-exercises better than men which could, even in this present study, increase the bias of gender effects just from sheer numbers alone. Another limitation of this study

is that it did not attempt to determine which of the various aids and resources are more or less effective than others, if a difference exists. In fact, it has been suggested by other researchers that flipping presents a type of learning opportunity that matches a variety of different learning styles, from lectures to power points, study quiz aids, flash cards, etc. The representativeness of this study is also a limitation as the number of participants was small for both men and women, which limits generalization of results.

The major finding of the study is: By flipping the class, the teacher will likely engender positive effects on student exam performance and learning. This study confirms and expands that finding among this population of students. Included in this population of students are both business students who are also African-American. This paper also expands the thinking in terms of samples that include significantly more women than men. It seems reasonable to assume that a woman may be better prepared for the flipping process as they are more verbal and often more sociable in an academic setting. Women, more than men, are likely to stop by the professor's office for a chat. Also, it is possible that a threshold of flipping activity is required before an effect is observed. This could have implications for practitioners and students. For those teachers who want to increase the performance of their students but may also want to lecture, there may be a level of flipping necessary to turn on the switch. But knowing the level of flipping required to accomplish the greater performance would be necessary. More research should be done to study the question of thresholds for the various levels of flipping. This line of research would have future implications also for students, including choosing to make self-learning plans that utilize the number and type of flipping activities that would accomplish their individual goals. Again, more research would be helpful for students to benefit. One might envision self-learning situations in which a student's knowledge of how flipping works could result in a "self-flip". Lastly, the study results suggest the need to evaluate the various resource options in terms of efficacy. This would streamline the process of flipping by eliminating un-utilized resources.

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