

THE EFFECTIVENESS OF THE FLIPPED CLASSROOM ON STUDENT LEARNING



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Abstract

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The flipped, or inverted, classroom model is where lectures are viewed by students as videos outside of the classroom environment, so class time can then be used for completing homework or for student-based activities. The model also makes the instructor more accessible to students in the classroom setting to guide them through homework or other activities as needed. The different methods some researchers used in flipping their classrooms are described. How successful the researchers were in using the flipped classroom is reported in an attempt to identify successful methods in the flipping of classrooms. Finally, more research must be done to evaluate the flipped classroom model, and identify best practices.

KEY TERMS: Classroom, Traditional classroom, Flipped classroom, Inverted Classroom, Active learning

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Chapter One: Introduction

The traditional classroom is a room where classes have been taught in a school, college or university (Merriam-Webster, 2014). At the time of this research paper, the “flipped classroom” concept was a recent trend in how to teach to students in the classroom setting. In fact, the phrase “teach to” is the opposite of what the flipped classroom exemplifies. In the flipped classroom, lectures, readings and viewing educational videos were to be done outside of the classroom, while more learner centered activities and homework were to be done in the classroom. Therefore, the traditional classroom lecture model where homework was to be done outside of class time was “flipped”, or “inverted”. It has been proposed the flipped classroom model better educates students than does the traditional classroom lecture model of teaching (Berrett, 2012; Herreid & Schiller, 2013).

The flipped classroom concept is not new. The recent interest in the flipped classroom was driven by several trends, including technological innovation, recent economic trends and the movement to improve higher education outcomes (Berrett, 2012; Herreid & Schiller, 2013).

Another trend advanced by the idea of the flipped classroom was the success of the Khan Academy, which offers free educational videos and materials via the internet (Baker & State, 2013). Having materials available in such a way allows the student to learn the material at their own pace outside the classroom. The student is then better able to ask for help or guidance with any questions they may have inside the classroom (Baker & State, 2013).

Statement of the Problem

What are the effects of the flipped classroom on student learning? Can best practices of the flipped classroom be identified?

Definition of Terms

Classroom: A room where classes are taught in a school, college, or university (Merriam-Webster-2014).

Traditional classroom: A room where a lecture-based curriculum is taught (Tune, Sturek, & Basile, 2013).

Flipped classroom: An instructional model where what is normally done in the classroom and what is normally done as homework is switched or flipped (Herreid & Schiller, 2013).

Inverted classroom: In an inverted classroom, course content is distributed for use outside the classroom through traditional formats such as assigned reading and homework problems and through new formats such as video lectures, PowerPoint presentations, and Web-based tutorials (Mason, Shuman, & Cook, 2013).

Active learning: Learning which actively engages the student in the learning process by having the student perform meaningful learning activities in the classroom to encourage thought about what they are doing (Bonwell & Eison, 1991, as cited in Blumberg, 2009).

Delimitations of Research

The research was collected over a 75 day period using multiple search engines and using the key search terms Classroom, Traditional classroom, Flipped classroom, Inverted classroom, and Active learning.

Method of Approach

A review of literature on flipped classroom research was conducted. The findings were summarized and synthesized, and recommendations made.

Chapter Two: Review of Related Literature

The flipped classroom has been increasing in popularity among educators in the United States. Flipping the classroom improves learning among students, as well as improving their motivation to learn and making the resulting instructional activities in the classroom setting more interactive and engaging for students (Berrett, D., 2012). The flipped classroom model of teaching promotes student success. This chapter will review professional literature describing how classrooms might be flipped, the success of the flipped classroom concept as compared to traditional classroom methods, and best practices in flipping the classroom.

Methods of Flipping the Classroom

There are many different methods in creating the flipped classroom. Only a part of a class might be flipped, or all of it might be flipped. Lecture might simply be switched with homework in the classroom setting, or more activities may be tied to the lectures outside of class, as well as more active learning exercises being used in the class.

There is research on the effectiveness of the flipped classroom. Researchers Tune, Sturek, and Basile (2013) compared the effectiveness of a traditional classroom lecture format with a modified flipped classroom format of cardiovascular, respiratory, and renal physiology presented to first-year graduate students. The researchers refer to the traditional lecture-based curriculum as passive, and the modified flipped classroom as active (2013). In their modified version of the flipped classroom, students were required to watch prerecorded lectures before class and then attend class, where they received a quiz over the material covered in each lecture followed by a question and answer/problem-solving period. The active curriculum was compared with a traditional curriculum, which had optional lectures and no quizzes. The researchers found that

those students in the flipped classroom format outperformed those in the traditional classroom format, as shown in Figure 1 from Tune, Sturek, & Basile (2013).

A Master of Law (LL.M) legal research course at the McKinney School of Law was redesigned into a flipped course, which provided students with more real world experience in the area of analytical legal work. These changes in the course design allowed students to “mimic the context of what lawyers actually do” (Lemmer, 2013, p. 473). Reading assignments and web-delivered materials were to be done outside of the classroom, while in the classroom, students worked in small groups on research projects that centered on advising clients. The small group sessions fostered teamwork and improved student confidence, which was deemed to be more important than finding the correct answers. Lemmer’s (2013) approach is similar to that of Tune, Sturek, and Basile (2013). All emphasize that reading and web-based materials must be a part of instruction outside the classroom. Small group activities and role playing in the classroom are also important (Lemmer 2013).

Team learning is another important tool of the flipped classroom. Michaelsen (Michaelsen, 1992; Michaelsen, Knight, & Fink, 2002) described “team learning” as utilized with science, technology, engineering and mathematics (STEM) courses. These studies used a case study component as a part of team learning. Students received reading assignments before class. In class they received individual quizzes, group quizzes, and finally moved to case studies with a team approach. Michaelsen’s method was described as successful by Herreid (2002). Because respiratory therapy instruction applies STEM learning principles, this research supports use of the flipped classroom in respiratory therapy classes.

A high school level physics course taught by Kettle (2013) in the United Kingdom required students to view video lectures outside of class. The videos were not self-made, but

were chosen by the researcher from the internet. The students were required to take notes for each video to bring to the next class, where they were required to use the notes to work out problems presented. The researcher found that as the course proceeded, it was necessary to be more specific as to what notes to take and what examples to pay attention to.

Clark (2014) described hands-on activities used in flipped classrooms in a radiologic science program. In this example, instructors created five to ten minute videos on many topics. Students view the videos outside of the classroom. Students had unlimited access to the videos, allowing them to learn at their own pace and review videos as necessary. Hands-on activities included: using everyday objects to simulate how x-rays interact with the human body using a window screen, a shoebox and sand; and using plastic beads for chromosomes in demonstrating the different phases of mitosis.

Real-world applications utilizing the flipped classroom and role-playing were also cited by Clark (2014). Role-playing is described as a way for students to become familiar with various situations encountered once on the job: students in an introductory radiologic science course could take on the identity of Wilhelm Roentgen and explain the discovery of the glow from the x-ray and the cathode ray tube; radiation protection students could prepare presentations to create awareness of how patients are protected from radiation in the radiology department; and pathophysiology students could solve case studies by discussing pathologies, prognoses, and how they could be treated.

Another example from Clark (2014) is the development of teamwork skills, which are needed by all allied health care professionals. Clark (p. 687) states, “there is little formal training in teamwork in many health professional education programs, so the need to develop

these skills is critical. Moreover, collaboration among students in the flipped classroom improves participation, builds confidence, and promotes a sense of teamwork.”

Action research supports the flipped classroom approach. For example, a mechanical engineering course was inverted by Mason, Shuman, and Cook (2013) and compared to the same course taught in the traditional classroom method. The researchers offered 45 videos, each between 5 and 15 minutes in length, and posted them to YouTube for students to access as needed. The researchers did not assign any of the videos. Instead, students were expected to identify which videos were important to watch given the homework assignments and sample quizzes they received each week. Class time was spent solving problems individually or in groups. All classes for the inverted group were held in a computer lab, while only five classes for the traditional group were held there. The course was presented over a ten week quarter with classes meeting four times a week for both groups. Problems formerly solved by the instructor in the traditional classroom were now solved by the students in the inverted classroom. While students worked on the problems, the instructor moved around the classroom to answer questions. A student or group of students presented an answer, and identified any concepts they did not understand. Here the instructor was able to clarify concept questions (Mason, Shuman, and Cook (2013).

Other researchers (Boucher, Robertson, Wainner, and Sanders, 2013) describe in detail extensive flipped classroom activities used in a physical therapist program musculoskeletal course at Texas State University. Viewing of recorded lectures and accessing links to other resources is done outside of class. Students use faculty designed “prep” sheets in preparation for contributing to and facilitating class interaction and discussion. Use of prep sheets is strongly encouraged by faculty as an important part of the lecture process. Prep sheets contain reference

citations for important articles and three to five questions related to lectures and/or articles.

Activities in the classroom include review and discussion, lab activities, problem solving and clinical reasoning, case studies, and evidence-based practice assignments.

Technology is also cited as being an important component. The recorded lectures are produced so the material can be viewed on smartphones and other mobile devices. The recorded lectures are accessed through the learning management system (LMS) used by the college, which allows student access to the material without having to download large files to their devices.

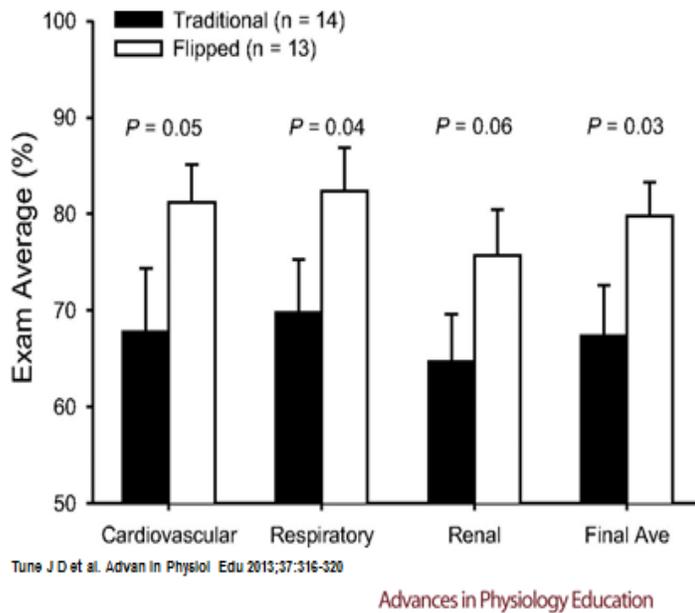
Lectures are also limited to 30 minutes in length, as surveys found students had a low tolerance for lectures exceeding 30 minutes (Boucher, et al., 2013). “Smart” classroom technology uses lectures, videos, overhead projections, recorded content, and an overhead camera for viewing of lab activities and demonstrations. Learning is facilitated by the use of these technologies.

Instructors can easily switch between formats to enhance the classroom experience.

Effectiveness of the Flipped Classroom

Tune, Sturek, and Basile (2013) report the flipped classroom is effective in improving student learning. As shown by the figure on page eight, students in the flipped section scored over 12% higher on exams than students learning in the traditional lecture format (Tune et al., 2013).

Overall exam averages on cardiovascular, respiratory, and renal physiology exams in traditional versus flipped classroom models.



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Figure 1. Tune et al., 2013. Reprinted with permission.

Tune, Sturek, and Basile (2013) in their research discussion state, “Our findings provide the first direct comparison of traditional versus flipped classroom models in which students were subjected to the same instructors, course material, lectures, and exams.”

In another example, Lemmer (2013) reports positive results from student surveys following a flipped legal research course. The flipped classroom is effective in preparing students for law practice and other scholarly work. It allows students to work collaboratively. It also allows faculty to engage more with students by developing relationships which are more professional in nature. The researcher states law students must become informed learners to be successful, and using the flipped classroom supports such a transition through collaborative small group work.

Flipped learning is effective for “able, motivated students” (Kettle, 2013, p. 595).

However, students with poor motivation or who are disorganized with time management skills outside of the classroom will have problems learning. Nevertheless, Kettle’s research showed high school physics students in the flipped class increased their performance by over 33 percent, while the students in the traditional class improved by only 11 percent.

Clark (2014), while not conducting research, stated the flipped classroom has significant potential benefits that must be acknowledged:

- Active learning is promoted via hands-on learning, real-life applications, and independent practice.
- Instructors can provide more feedback to individual learners with such activities occurring in the classroom.
- Instructors can get a better feel for students’ emotional and learning needs by talking “with” students instead of “at” students.
- Students who may not want to ask questions in the middle of a large lecture can now be more comfortable and ask questions one-on-one, in private if need be, with the instructor.
- Active learning provides greater instructor-to-student interaction than the traditional classroom lecture model.

Clark (2014) also cited the development of teamwork skills as an important aspect of the flipped classroom. Critical teamwork skills are difficult to develop in the traditional classroom because there is little time for student interaction. The flipped classroom model by its nature is very conducive in developing teamwork skills.

Mason, Shuman, and Cook (2013) found that students in the inverted classroom were able to cover more material because more class time was available for solving problems. The inverted classroom group performed statistically better than the traditional classroom group on design problem sets, and demonstrated equal or higher quiz and exam scores. The inverted group rated the class higher in post-class student surveys, and reported a decreased need to study over the duration of the course than the traditional classroom group.

In an extensive flipping of the physical therapist musculoskeletal curriculum at Texas State University, faculty noted overall class outcomes were improved from the traditional classroom lecture model (Boucher, Robertson, Wainner, and Sanders, 2013). Student surveys were positive regarding experience in the flipped classroom. One significant outcome was that no students failed a practical examination during the most recent course. This is an atypical experience, and is supported by the use of clinical examiners external to the program for grading purposes.

The flipped classroom method has received wide media coverage, and several books have been published on the subject, as noted by Horn (2013). What is not known is how many teachers are using it, how it is being applied, and what is the effectiveness on student learning. It is unknown if the flipped classroom can benefit students from lower-income families, a group which is less likely to be able to afford the required technology in the home, including high-speed internet access. Students with a lower-income background may also lack family support. These issues might be solved by making computer labs more accessible after school hours, and that family assistance with homework is less critical when watching a video than solving homework problems (Horn, 2013).

Summary

There are many ways a classroom may be flipped, or inverted. In the simplest method, lecture is studied outside the classroom by the student, typically by viewing video lectures.

Homework is done in the classroom, where the instructor is now available to help.

In much of the research cited here, the video lectures often had related tasks assigned to them to encourage retention of the material and preparation for the activities to be performed in the classroom.

- Kettle (2013) advocates high school physics class students take notes while viewing videos, and suggests that students may need to be guided as to which content to pay particular attention to. Motivation, or the lack thereof, by students was thought to be a key to whether or not students would succeed.
- Tune, Sturek, and Basile (2013) in a cardiovascular, respiratory, and renal physiology course had students take a quiz in class after viewing video lectures. The quiz is followed by a question and answer or a problem solving period.
- Lemmer (2013) also assigned lecture materials outside of class time for a legal research class. In-class time was used for small group activities and role playing sessions.
- Michaelsen, Knight, and Fink (2002) advocate team learning in their case study-based STEM courses with the use of individual and group quizzes. These activities prepare students for case studies that follow.
- Clark (2014) states class time can be used for hands-on activities and role playing by radiologic science students. Clark (2014) also asserts the flipped classroom format is very effective in building teamwork skills needed by all allied health students.

- Mason, Shuman, and Cook (2013) inverted the classroom for mechanical engineering students, but had the students decide which video lectures were important to watch based on homework and sample quizzes assigned for the week. In the classroom students work on homework and various engineering design projects. Instructors are available to act as guides to help with questions.
- Boucher, Robertson, Wainner, and Sanders (2013) emphasized the use of prep sheets to be used for guidance while physical therapy students watched video lectures. In class, students participated in numerous active learning exercises.

All of the research articles cited here have variations in the methods used and the extent to which classrooms were flipped. The research cited also unanimously agrees on the improved effectiveness of the flipped classroom model versus the traditional classroom model. Some authors made minor modifications to their models to further increase its effectiveness.

Horn (2013) raises several questions about the flipped classroom. It is not known how many teachers are using the flipped classroom. Nor is it known how the classrooms are being flipped, their effectiveness on student learning, and whether or not students from lower socio-economic groups can benefit from the flipped model.

Chapter Three: Conclusions and Recommendations

In conclusion, the research demonstrated the proliferation of the flipped classroom model to a variety of academic subjects, as well as to different demographic categories of learners. Research described students from a high school physics class to several college undergraduate classes to a graduate level class and a law school class. It was evident the common theme in a disparate group of learners is that the flipped classroom was adaptable and able to be tailored to each specific age group and each specific area of study. Some of the researchers even made minor changes during a course in order to improve effectiveness. Adaptability is a strength of the flipped classroom method.

The variety of methods used in flipped classrooms was remarkable. The ability for students to view lecture videos at their own pace, as well as the ability to view them repeatedly on their own schedules and on a variety of electronic devices, was a huge advantage over the traditional classroom lecture method, especially in our wired world, where student use of communication technology has exploded. Supplemental exercises for viewing video content were widely varied, from just watching the video, to taking notes during the video, to receiving guidance from teachers as to what to watch for in a video via prep sheets or sample quizzes. The use of the classroom itself also had many numerous variations. The multitude of variations was also a powerful tool in being able to modify student classroom activities to the curriculum, to change up student activities to keep them more engaged in the material, and to encourage active learning in the classroom.

All research cited supports the premise of the flipped classroom being effective in improving student learning. However, the research was done with insufficient numbers of subjects to be considered impressive, with only 38 subjects in the largest study cited (Tune,

Sturek, & Basile, 2013). More research studies, with larger cohorts of students, and direct comparisons of the flipped classroom to the traditional classroom need to be performed to more fully validate the flipped classroom model as being superior to the traditional classroom model.

The degree of success of the flipped classroom model differed in each study. Comparing studies was difficult given the difference in subjects being taught, the difference in the methods of flipping the classroom being used, as well as the varying educational levels of the students studied. All of these variables must be taken into account in future studies of the flipped classroom method. More research discerning which methods are best to be used in flipping the classroom need to be performed. Research should also look at which methods are more effective for different age groups and for different subject matter.

It is evident the flipped classroom can improve the effectiveness of student learning. What are not evident are the best practices to be used when flipping a classroom. More research needs to be done on a much larger scale in order to validate any best practices for use in the flipped classroom. The flipped classroom method needs more direction, more standardization and more sharing of standardized videos in order to properly perform research (Herreid and Schiller, 2013). In light of such circumstances, a cautious approach is best. Each teacher may want to slowly flip their classroom in ways which work best for their subject matter, the age of their students, the differentiated abilities of the students in each class, the technology available, and the amount of class preparation time they have if they wish to make their own videos. Slowly flipping the classroom will also make it easier to make changes as necessary.

In conclusion, any method which replaces the “sage on the stage” with a “guide on the side” in the classroom will provide more active learning opportunities for students. More active

learning opportunities for students will lead to improved effectiveness of student learning. The flipped classroom has the potential to facilitate such a goal.

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