

By

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APPROVED

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## **Abstract**

## Acknowledgments

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## **I. Introduction and Justification of Topics Addressed**

### **a. What is a Flipped Classroom?**

When most students recall the instructional design and architectural lay out of their high school classrooms, and perhaps even their college courses, they will most likely describe a typical traditional classroom: the instructor lectures during class time while homework is assigned to do individually elsewhere, leaving little time for asking questions or working together with fellow students during class. However, there is likely a minority of students who will explain a setting that is the reverse of traditional methods. Instead of receiving instruction during class time, the teacher has created lecture videos and other activities for students to watch at home *before* they come to class. Meanwhile, class time is used for working on practice problems, projects, activities and instructor facilitated-discussion in collaboration with other students, expanding the availability of time to ask the teacher any questions. This method is called the flipped classroom and allows students to create and assimilate their own understanding of the material under guidance from the instructor.

### **b. Historical Context and Importance of Flipped Classroom**

One of the most difficult tasks teachers encounter is adopting differentiated instruction to provide access to learning for all students. A single class can contain students who range in ability from low to high performers, are English Language Learners (ELLs), and students with special needs or disabilities. In order to attain classroom equity where each student has the opportunity to have a personalized education and reach their full potential, teachers need individual time with students. This cannot easily happen in a traditional classroom setting. With

the limited class time teachers are provided for student interaction, it is impossible for them to implement techniques to account for all of the different students' abilities. For this reason, Jonathan Bergmann and Aaron Sams (2012) were two of the first teachers to design the idea of flipping the classroom. Now students will receive content on their own and have opportunities to work personally with the teacher on concepts and problems they do not understand, satisfying Bergmann and Sams' main goal of flipped classrooms- to "reach every student in every class every day" as stated in the title of their book. As a result, teachers will have the ability to personalize the education of every student by having time to address each of their needs.

### **c. Which Students Can Be Positively Impacted by Flipped Classrooms?**

Over the past decade, flipped classrooms have gradually been implemented by more instructors, but are still not widespread. This paper analyzes the results of previously conducted research involving flipped classrooms to assess the effectiveness of this method, with special focus on the impacts flipped classrooms have on student diversities such as gender, ELL status, low performance levels, and special needs. Specifically, I wished to assess whether flipped classrooms are more effective for all students, no students, or only for certain types of students. My research reveals that while all kinds of learners can appreciate and enjoy flipped classrooms, there is the possibility of enhancing the learning experience for the special student categories listed. Through this possibility, the education system has the opportunity of creating a personalized education that satisfies every student's needs.

## **II. Research Findings**

## **b. Positive Effects of the Flipped Classroom**

A group of faculty from Universiti Teknologi Malaysia conducted a meta-analysis (Rahman et al 2014) on flipped classrooms. They reviewed numerous studies, the majority of which were conducted at other universities and a few additional secondary schools that spanned across different disciplines. Included in this work was a discussion of the various instruments employed to discover the impact of flipped classrooms. Rahman et al. found that flipped classrooms can be implemented across numerous disciplines, prepare students for the use of technology in the 21st century, and most importantly can lead to positive effects on students' academic performance.

The flipped classroom leads to these results because it provides a flexible environment. Teachers can spend time focusing on students who need extra help, work with small groups, or check in with every student. This allows them to easily spot students' misconceptions or mistakes as they interact during the period. According to Kathleen Fulton (2012), who interviewed teachers from a school district in Minnesota that flipped all of their mathematics classrooms, the participants reported multiple teacher and student benefits to flipping a classroom. In regards to teacher benefits, in class "homework" can be directly surveyed, allowing them to witness student difficulties, ability to provide curriculum to students 24/7, the opportunity to learn from other teachers' videos, and use class time more effectively and creatively. Students also benefit through the ability to move at their own pace, increase achievement, attain higher levels of interest and engagement, and prepare for 21st-century learning.

## **b. Active Learning Versus Traditional Classrooms**

Traditionally, teachers provide the students with the necessary information while students are expected to passively take notes to understand and memorize the content. As a result, it is hard to retain students' attention and they are not likely to engage in deep understanding. On the other hand, active learning is a method that focuses on student collaboration and participation. Instead of simply watching and listening to their teacher, students are engaging in their learning process through activities, discussions, manipulatives, and group work that build deeper meaning and relevance to the real world. As a result, students are held more responsible for their learning. Freeman et al. (2013) conducted a meta-analysis of 225 studies that provided data on undergraduate STEM courses in traditional lectures versus active learning within the classroom to compare the failure rates and test scores. Their results after compiling the data show students who experienced active learning scored an average of 6% higher than students in the traditional lectures and were 1.5 times less likely to fail the class. Flipped classrooms provide time for active learning which can help improve student engagement and learning outcomes.

### **c. Types of Learners**

Every student has a unique learning style. For this reason, the Grasha-Reichmann learning styles questionnaire (Reichmann and Grasha 1974) separates students into six categories. They can be dependent learners who need direct instruction from a teacher, independent learners who work best on their own, collaborative learners who learn best in a group setting, competitive learners who fight for the best grades, participant students that want to do as much as possible related to the class, and avoidant students who are not interested in what is going on in class.



By utilizing a flipped classroom, teachers may be able to accommodate all six types of learners. Providing lectures online at home allows independent learners to flourish on their own. Meanwhile, class time provides activities to be done in groups to aid the collaborative learners. As a result, the teacher has more flexibility and time to work directly with dependent learners. Additionally, a flipped structure allows competitive students to take responsibility for their own learning while providing participant learners more class time to engage in activities and group work focused on the content. Lastly, whereas avoidant students would normally zone out and attain little to no information from the lecture in a traditional classroom, they now can watch the videos at their leisure and will be more likely to participate in class because they will stand out if everyone except them is working together on an activity.

#### **d. Advantages for Special Student Groups**

##### **i. Effects on Gender**

Females make up half of the population and half of the workforce, yet only 25% of employees in the STEM field are female (Beede et al 2009). Additionally, these same authors posit females are less likely to continue on to higher education, especially in STEM related subjects. This problem arises from the stereotype threat. Females are brought up through the education system under the social norm that they are not as smart as males, and especially so in STEM fields. For this reason, they fear they will be evaluated based on this stereotype. They feel inferior because they believe they are constantly being compared to males. As a result, females adopt lower levels of confidence in their abilities which results in less female presence in STEM careers such as engineering. However, through the flipped classroom method, males and females

are encouraged to collaborate and work together to teach each other and improve their learning through one another.

In a study conducted at University of Michigan (Lage et al, 2000), survey results showed both male and female students preferred a flipped classroom over a traditional format, but females had a stronger satisfaction than males. They also responded to learning more from working in groups than males did. Additionally, females were observed by instructors as participating more actively than they do in a traditional classroom. This can be explained in part by Madison's (1995) finding that females feel more comfortable in environments promoting collaboration versus environments that fuel competition. When placed in collaborative environments, females are more likely to stay persistent and succeed. For this reason, the settings of flipped classrooms are not only preferred by both males and females, but also help females feel less pressure to prove themselves as worthy. Instead, both genders will work as a team which will allow females the freedom from social standards which may lead to more self-confidence and result in more females pursuing careers in which they have been historically underrepresented.

## **ii. Effects on English Language Learners**

According to the National Center for Education Statistics (2017), there were 4.6 million students in the United States who identified as ELLs during the 2014-2015 academic year, making up 9.4% of public school (K-12) students. Results from the National Assessment of Educational Progress state ELL students comprise the highest percent of below basic students in both reading and mathematics in grades 4 and 8 (Fry 2007). It is likely that ELL students' insufficient levels of English contribute to their lower academic performance. However, since

this same trend has historically persisted, it is evident that traditional classrooms are not helping ELL students progress. Instead, by giving these students the structure of a flipped classroom, they can begin the process of gaining a more effective education.

Hung (2015) conducted a study of 75 students at a Taiwanese University who were taking an English course. Students were separated into three class structures: flipped, semi-flipped, and non-flipped. He measured students' academic performance, attitude towards their learning experience, and their levels of participation in each structured setting. Results showed students in the flipped classroom demonstrated the most academic improvement from the first assessment to the last assessment and scored the highest overall. Additionally, the flipped classroom participants reported the highest levels of satisfaction and engagement. Lastly, students experiencing the flipped classroom watched a single assigned video an average of 2.31 times per lesson compared to the semi-flipped class viewing the same video 1.75 times and the non-flipped students only being exposed to the material once during class.

While students in this study were learning how to speak English, the same positive results can occur for non-native English speaking students trying to learn typical subjects such as mathematics and history in English-based education systems. Adopting a flipped classroom allows ELLs to learn the content at their own individualized pace. ELLs will have access to pausing the videos, rewinding the videos, and re-watching the videos as necessary to meet their academic needs. Moreover, the use of videos allows students to add subtitles to overcome their possible language barriers; in a traditional classroom, these students will only hear the material one time and at the pace designated by the teacher. Similar to how the students in the non-flipped classroom had the lowest academic performance, the same results will continue occurring for ELLs if teachers do not utilize the benefits flipped classrooms can provide these students.

Furthermore, Graziano (2017) studied thirty-nine ELL students at a newcomer high school in the United States who were enrolled in a flipped section of Algebra I. A newcomer high school is designed to meet the learning needs of non-native English speaking students before they transition into general education. ELL students in the flipped classroom rated higher in enjoyment of the course structure and test results showed they had a slightly higher academic performance than ELL students in the traditional course. Student responses to a survey about their experience indicated that by assigning students videos to watch at their own pace, proper preparation occurred before lecture. This can result in more student participation in class because students feel more confident in their understanding upon entering the classroom. Not only can ELL students gain positive attitudes towards learning and become engaged in the content through flipped classrooms, but they may be better capable of learning alongside native English speaking students.

### **iii. Effects on Low Performing Students**

Statistics from the Programme for International Student Assessment's (PISA) testing (OECD 2016) showed that in 2012, the percent of 15-year-old students in participating countries who are below average ranked poorly across subjects: 26% in mathematics, 17% in reading, 18% in science, and 12% in all three. Despite this disappointingly high frequency of students who are underperforming, these same students continue to get left behind in their classes because teachers do not have time or resources to slow down to a pace necessary for these students to fully understand the content. Through the design of flipped classroom, this issue can be resolved.

In a study conducted at Stockholm University in 2015 (Nouri 2016), 240 students' perceptions of flipped classroom were measured. The student population consisted of 202 low

achievers and 38 high achievers. Results showed 180 students felt positively towards flipped classroom because of three main reasons: the video lectures, more practice time in class, and more support in their learning process through scaffolding- a teaching method focused on building students' understanding one step at a time beginning with what they currently can comprehend. While these results support the notion that the flipped classroom model engages many different types of students more effectively than a traditional lecture, this study also shows the effects on low achievers were more significant than with high achievers. The study measured students' perception of five flipped classroom experiences: increased learning, more effective learning, attitude towards video, more active learning, and more responsibility for learning. Low achieving students revealed a higher mean than high achievers for all five of these experiences.

Similarly, another experiment (Bhagat et al 2016) divided 82 high school mathematics students into a control group who received traditional lectures and an experimental group who learned the same course content but through a flipped classroom. The results showed all levels of students were more satisfied in the experimental group. Moreover, high achieving students performed the same in both groups, average achievers performed slightly higher in the experimental group while low achievers performed significantly higher in the experimental group. In the same manner, Bidwell (2014) flipped a college level engineering class at Villanova University and found that the grades of low achievers were 10% higher in the flipped classroom versus the traditional classroom. Collectively these studies consistently reveal that flipped classrooms can not only make learning more enjoyable for all levels of students, but can significantly enhance the learning of lower achieving students.

One reason behind these collective but independently obtained results resides in the opportunity for low achieving students to learn at their own pace through the video resources.

Moreover, instruction can now be individualized to fit the needs of each student. Additionally, the method of flipped classrooms supports the design of a “low floor, high ceiling.” This means every student will have an access point to understanding the content. They have a foundation that allows them more time to digest content at home while receiving the individual attention necessary for them to further understand and practice the material during class time with guidance from the teacher. Meanwhile, higher performing students can move as quickly as they desire while having the opportunities to work on more challenging material during class. Therefore, high achievers are not impeded while there is no leaving behind low achievers.

#### **iv. Effects on Students With Special Needs**

While there was a wealth of literature focusing on other special interests, there was little research conducted involving the effects of flipped classrooms on students with disabilities. This is surprising and certainly deserves further research. Such a proposal has merit since according to the National Center for Education Statistics (2018), 13 percent of U.S. students in public schools had a disability and were receiving some type of special education during the 2015-2016 academic year. In 2015, under the Individuals with Disabilities Education Act, 63 percent of students enrolled in regular schools spent 80 percent or more of each day in standard education classes, which is 16 percent higher than in 2000. This means more students with special needs are being ushered into mainstream classes instead of spending the school day in classes solely containing students with disabilities. As a result, teachers are encountering more students with varying needs and disabilities each year and are in desperate need of finding ways to accommodate for each type of student.

With such limited time, teachers will find it impossible to differentiate instruction to best suit the needs of every student with a disability. However, readily available apps and online platforms, such as the video recording tool Panopto that was cofounded by Eric Burns and William Guttman (Company Leadership 2018), can be adopted in a flipped classroom to benefit students with special needs by providing audio and visual aids. Additionally, these resources allow teachers to create their own video content which provides options to include extra time to account for the individual needs of students with different disabilities. Bridget McCrea (2014) interviewed the vice president of Rethink, a service that creates educational solutions for autistic children. This high ranking corporate administrator supported the implementation of flipped classrooms for students with autism because they are allotted as much preparation time at home as they need. By having the ability to pause and rewind a video, students with special needs can gain a better understanding of the material and come to class feeling less pressured to either quickly grasp the content or be left behind. Non-traditional learners such as students with autism may perform higher in a flipped classroom setting because the teacher can arrange class time to focus on their needs instead of having students all passively listen to the lecture.

#### **v. Student and Teacher Absenteeism**

According to the U.S. Department of Education (2016), more than 6 million students were absent at least 15 days during the 2013-2014 academic year. Typically, if a student is absent, they will fall behind. In order to catch up on content, they must meet with the teacher at a time outside of class, and employ before or after school tutoring. They can also copy notes from a classmate. However, there is no guarantee a student will attempt to make up what was missed which may result in attempting to jump into current content without desiring to assimilate

intervening material. To avoid the possibility of falling behind, the use of technology in flipped classrooms now allows students to remain up-to-date on lessons because they can watch the videos at their earliest convenience to become caught up with their classmates. Not only will students never miss any material, but teachers will have more time to design rich and engaging activities instead of scheduling meetings with students who were absent.

Moreover, absence rates of teachers are a leading indicator of decline in student achievement. Clotfelter et al. (2007) gathered data from an elementary school in North Dakota and found when a teacher is absent for 10 days, students' mathematics test scores would decrease by 2.6%. It was reported nationwide that 36 percent of teachers were absent at least 10 days during the 2009-2010 academic year (Miller 2012). These absences have a drastic effect on student learning in a traditional setting because students do not receive the same content on a day their teacher is absent as when they are present. In most cases, a substitute teacher is hired often without having content knowledge in the subject for which they are acting as a substitute educator. Through the adoption of a flipped classroom, instead of students losing a day of instruction, they can still watch the necessary videos at home and can work on assignments or activities together in class organized by the primary instructor but now under the supervision of the substitute.

#### **vi. Rigor of Flipped Classroom Curricula**

Teachers may be hesitant to implement flipped classrooms because they are afraid students will not receive the same depth or breadth of content. On the other hand, with the ability to create one's own videos, a teacher has complete control to include what they believe is necessary in the same manner they would have done if they provided instruction during class



time. A study (Lage et al 2000) conducted at University of Miami analyzed student survey results after spending a semester in a flipped classroom. When asked to compare the difficulty of the course with traditional courses, student responded that they worked harder in the flipped course than the other traditional courses they were enrolled in the same semester. While this is only one study, it reveals that curriculum in a flipped classroom can be just as rigorous and go into as much depth as a traditional classroom. Students will not lose any exposure to content, but instead will have access to more time to process and review the material.

### **III. Conclusions**

This paper only includes but a portion of research studies reported in a vast number of papers currently written about flipped classrooms. My research reveals while it is evident that this method of teaching may not be necessary for all students, all students can be positively impacted by presence in flipped classrooms. Most importantly, unlike traditional classrooms, flipped classrooms provide the possibility of enhancing the learning experience for underrepresented students such as ELLs, students with disabilities, females, and lower performing students. Among these types of students, the most crucial commonality was the use of video sources to receive instruction. The ability to control how many times one can watch a video, pause it, rewind it, and take time to process the content creates a structure that can reach the individual needs of all of these types of students. Additionally, the flexibility of class time allows these groups of students to receive individual support from the teacher while other students can still be involved with activities and group work. As a result, it is important that research reporting students' academic performance being *hindered* by participating in flipped

classrooms has yet to be identified. It is worth the time to further investigate the merits of flipped classrooms and consider implementing it into one's own classroom.

#### **IV. Future Directions**

Given more time, I would further my literature review by researching if there are any positive effects on narrowing the gender gap in the STEM workforce after females experience flipped classrooms. I would branch out to learn the impacts flipped classrooms may have on other types of students such as students with physical disabilities, differing ethnicities, and low socioeconomic status. Additionally, my search would include finding if there is a change in the percent of students who seek to attain higher education after experiencing flipped classrooms. My goal would be to learn the long-term positive impacts flipped classrooms have on certain categories of students.

To conduct experimental research, I would use my future mathematics classrooms. One year I would teach using the traditional method. The next year I would provide the same content but through a flipped classroom. Both years I would collect data on students' tests scores and academic progress, observe differences in student behavior, and analyze surveys on student levels of enjoyment and engagement. This would allow me to directly analyze the effects flipped classrooms have on different types of students.

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