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Paul Jundt
St. Catherine University

Kelly A. Moormann
St. Catherine University

Andrew M. Voorhees
St. Catherine University

StaceyAnn Ziemann
St. Catherine University

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The Impact of a Flipped Classroom on Student Achievement in Mathematics, Science, and Physical Education Classrooms

An Action Research Report

By Paul Jundt, Andrew Voorhees, StaceyAnn Ziemann, and Kelly Moormann

The Impact of a Flipped Classroom on Student Achievement
in Mathematics, Science, and Physical Education Classrooms

Submitted on May 22, 2015

in fulfillment of final requirements for the MAED degree

Kelly Moormann, Andrew Voorhees, Paul Jundt, and StaceyAnn Ziemann

Saint Catherine University

St. Paul, Minnesota

Advisor



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Abstract

This study was designed to examine the effects of the flipped classroom model. Our study was conducted in Physical Education, Mathematics, and Science classrooms in the Bismarck Public School District. The participants were in both the middle and high school levels within the same school district. Data collection methods included a pre-assessment survey, written assignments, a student behavior checklist, and a post-assessment survey. The results of our study showed that students enjoyed learning with the flipped classroom method, completion rates were higher than previously observed, and students were successful at mastering classroom content. According to our student survey, the main benefits to the flipped classroom were the ability to view lessons without distractions and to view them multiple times. We will continue to look into the benefits of the flipped classroom through the analysis of standardized test scores and classroom assessments.

Keywords: flipped classroom, data collection methods, assessments

Homework completion has been a frustration within our secondary setting and has caused educators to explore different options. Instructors at the schools we teach at frequently discuss during teaming meetings how often students do not complete assigned homework. Teachers in these schools have estimated that at least 25% of their students do not turn in homework on a regular basis.

A flipped classroom approach to instruction is a possible solution to this issue. Each of us experimented previously with a flipped classroom model of instruction. However, we often experienced numerous limitations such as students not having access to technology away from the classroom and many classrooms not having personal computers. Within the last year, our school district has taken the initiative to move our district toward a 1:1 technology approach to instruction. All of us now teach in schools where every student in every classroom has access to a Chromebook on a daily basis and does nearly all of their work in some type of electronic format. Although our school district has provided little in the way of 1:1 instructional techniques, we felt strongly about pushing forward with this project since the use of technology is commonplace for students in our school.

We have noticed in recent years that even the lowest level socio-economic students of ours possess smartphones, which can be used for viewing videos outside of the classroom. Due to the changes in access to digital resources for our students, the flipped classroom provides a potentially compelling intervention with a proven success record elsewhere (Hamdan et al., 2013).

Our study was conducted at a middle school and high school in an urban community in central North Dakota. The student population at the middle school was

approximately 850 students, while the high school population was nearly 550 students. Male students comprised fifty-four percent of the students in the study and females made up forty-six percent of the subjects in the study. Minority students were few in number with Native American students making up five percent of the students, African American students comprised of two percent, and Asian students less than one percent. A vast majority of the students fell in to the middle of the socio-economic spectrum. Fifteen percent of the participants in the study were on an individualized educational plan (IEP).

We are not the only teachers in a school district to experience frustration regarding student progress lately. According to an article from The Washington Post, academic achievement in the United States has flat lined in recent years (Layton, 2013). This provided us with more reason to introduce a flipped model of instruction to our students. Our background research on flipped classroom instruction shows that many students experience significant gains in student achievement. Research shows that classrooms implementing a flipped approach are observing a remarkable increase in achievement, such as a drop in the failure rate of 9th grade math students from forty-four percent to thirteen percent (Morgan, 2014).

The basic foundation of a flipped classroom involves a teacher assigned video lesson as homework that introduces the concepts the students need to use during the following class period (Raths, 2014). The lessons should be planned with learning in mind while the teacher should be prepared to reinforce the content in the classroom (Raths, 2014). Educators should make sure that the videos reinforce the lower-order thinking skill from Bloom's taxonomy while reviewing higher-order skills in class (Raths, 2014).

Although flipped classrooms are fairly new in the educational realm, data, thus far, shows students involved in this type of instruction are learning more than their counterparts in a traditional classroom (Fulton, 2012). In some traditional classrooms, instructors lecture for much of the period and assign work when there is little time left to complete it (Fulton, 2012). The success of students that participate in a flipped classroom can be attributed to a variety of reasons. Students involved in this educational structure discovered they had a more positive learning experience and perceived the flipped classroom as a better form of instruction (Galway, Corbett, Takaro, Tairyan, & Frank, 2014). Students in this type of setting come to class with more background knowledge than those assigned to read textbook literature because students assigned reading were less likely to complete it (Bishop & Verleger, 2013).

Not only does this type of instruction bring students to class better prepared, it is also beneficial for diverse learners who may struggle with the pace of a standard classroom lecture (Hamdan et al. 2013). These students can replay the lesson as many times as needed in order to ensure a full understanding of the information. The diverse learner may also experience a lower stress level and increased interactions with their peers when allowed to view lessons in advance (Crouch, 2014). Time restraints due to the lecture format in the traditional classroom setting often prohibit peer interactions from taking place on a consistent basis. In a flipped classroom, these interactions are common. The time saved by assigning a lecture or video outside of the regular class gives students the opportunity to teach and tutor one another on the content presented (Hamdan et al., 2013).

One of the most important advantages of a flipped classroom is a student's ability to complete classroom activities and receive assistance from their instructor (Hoffman, 2014). According to Ullman (2013), introducing lessons ahead of time by video or other means allows teachers to spend much of their time in class answering questions while their students attack their work. The time students spent previously rushing to write down information is used to complete assigned work. Early research suggests that nearly 70% of students in flipped classrooms earned higher standardized test scores than their counterparts in regular classrooms (Crouch, 2014). The amount of time a teacher can save by having students preview class information prior to class allows them to address everything that's required. In turn, this enables teachers to delve deeper into their subject and be much more creative with their daily lesson plans (Vaughan, 2014).

The ability for teachers to go further in depth with their curriculum is sometimes hampered by missing students (Roehl, Reddy, & Shannon, 2013). Student absences can prevent instructors from proceeding through their curriculum at an acceptable rate (Roehl et al., 2013). Illnesses and extra-curricular activities are often the cause of student absences (Roehl et al., 2013). Running a flipped classroom can help teachers in maintaining their pace without delay, this is vital to the students who are absent as they appreciated the opportunity to view what was missed (Roehl et al., 2013).

The flipped classroom allows students to achieve maximum growth by becoming active learners instead of being passive listeners inside the classroom. Becoming an active learner is a crucial life skill that will be reinforced with each lesson presented as students become responsible for being prepared each day to work collaboratively with

others. The flipped classroom model shows promise that student achievement levels will be positively impacted in classrooms where it is a common practice.

Review of Literature

Academic Achievement in the United States has flat lined in recent years (Layton, 2013). Research shows that classrooms that are implementing a flipped approach are observing a remarkable increase in achievement (Morgan, 2014). The basic foundation of a flipped classroom is the teacher assigns a video lesson as homework that introduces the concepts the students need to use during the following class period (Raths, 2014). The lessons should be planned with learning in mind and the teacher should be prepared to reinforce the content in the classroom (Raths, 2014). Educators should make sure that the videos reinforce the lower-order thinking skill from Bloom's taxonomy while reviewing higher-order skills in class (Raths, 2014).

When first establishing a flipped classroom, educators need start implementing portions of their classroom (Raths, 2014). It's important for the teacher to have a positive attitude about the idea of a flipped classroom. Once the teacher has decided the model that they will incorporate into their initial flipped classroom it is essential to begin designing the layout (How to Flip a Class, n.d.). Deciding how to divide curriculum is the second most challenging task alongside the creation of the videos and instructional methods. The most efficient way to begin this process is for a teacher to create three separate categories; before, during and after (How to Flip a Class, n.d.). The categories will consist of the knowledge the students need to enter the classroom with, where will they go with the information, and what will they do with it after (How to Flip a Class, n.d.).

After an educator has established what the students need to learn before they enter the classroom the next step is to decide upon specific instructional methods that will be utilized in the flipped classroom. The instructional methods will create the foundation for the virtual classroom. This is accomplished through various methods: discussion boards, wikis, Blackboard, website, videos, and PowerPoints. (How to Flip a Class, n.d.). These methods need to be kept short in length and to the point. Ideally, these lessons are videos that are approximately five to seven minutes in length and contain slides that are not overbearing (Johnson, 2014). The rule of thumb is one idea per slide (Johnson, 2014). Educators must be fluent with the use of technology when implementing a flipped classroom. Whether the lesson is narrated or incorporates a video, it is critical that special attention is paid to the audio (Johnson, 2014). It is recommended to utilize an external microphone to eliminate feedback that is often received with onboard microphones. Taking account for these key suggestions will allow students to view the lesson across all types of devices.

The final process of implementing the flipped classroom is creating student buy-in. This is where educators get their students onboard with the concept of the flipped classroom. In order for the classroom to be successful, it is critical that students are motivated and buy into the concept (Raths, 2014). Once the students understand that this type of classroom will allow for a more interactive experience, it is time to teach them how to use the virtual classroom. Students need to know how to use the software as well as where to access the information. They also need to be educated on how to watch the videos as not all students understand how to do this. The students should be taught how to take notes from a video and develop questions based on the information. The teacher

can now complete a trial run of the flipped classroom with the students. During this step, communication with the students is imperative. The teacher should seek feedback regarding ease of access to the virtual classroom, the appearance of the information, as well as their overall experience with the flipped classroom. If students find the flipped format difficult, learning cannot effectively take place (Raths, 2014).

Although flipped classrooms are fairly new in the educational realm, data, thus far, shows students involved in this type of instruction are learning more than their counterparts in a traditional classroom. In these classes, instructors lecture for much of the period and assign work when there is little time left to complete it (Fulton, 2012). The success of students that participate in a flipped classroom can be attributed to a variety of reasons. A study of health students involved in this educational structure discovered they had a more positive learning experience and perceived the flipped classroom as a better form of instruction (Galway, Corbett, Takaro, Tairyan, & Frank, 2014). The results of a post course survey (1=lowest rank, 5=highest rank) showed a 4.7 out of 5 rating by these students as compared to a 3.7 out of 5 rating one year earlier without flipped instruction (Galway et al, 2014). Since students in this type of setting can view class lectures using home computers or personal communication devices, they come to class with more background knowledge than those assigned to read textbook literature (Bishop & Verleger, 2013). A study of a senior level computer course done by Day and Foley showed students involved in a flipped model of instruction were better prepared and scored higher on homework assignments, projects, and tests (Bishop et al, 2013).

This type of instruction is beneficial for diverse learners who may struggle with the pace of a standard classroom lecture (Hamdan, McKnight, McKnight, & Arfstrom,

2013). These students can replay the lesson as many times as needed in order to ensure a full understanding of the information. Research suggests struggling students have the ability to look back and reference information presented as often as needed. A flipped classroom also gives those students who are behind in their work the opportunity they need to catch up to their peers. Students behind in their work in chemistry classrooms at Woodland Park High School in Colorado received individual instruction necessary to catch up with a flipped classroom (Hamdan et al, 2013).

In addition to being more prepared, these students experience a lower stress level and increased interactions with their peers when allowed to view lessons in advance (Crouch, 2014). According to Deanna Brewer, a fourth grade teacher, her students have a lower stress level because they are able to view video lectures as much as needed. Brewer says a flipped classroom provides her students with a considerable amount of peer interaction and cooperative learning (Crouch, 2014). Time restraints due to the lecture format in the traditional classroom setting often prohibit these types of interactions from taking place on a consistent basis. In a flipped classroom, these interactions are common. The time saved by assigning a lecture or video outside of the regular class gives students the opportunity to teach and tutor one another on the content presented (Hamdan et al., 2013).

One of the most important advantages of a flipped classroom is a student's ability to complete classroom activities and receive assistance from their instructor (Hoffman, 2014). According to Ullman (2013), introducing lessons ahead of time by video or other means allows teachers to spend much of their time in class answering questions while their students attack their work. The time students spent previously rushing to write

down information is used to complete assigned work. The ability to complete work in the classroom with proper support has shown to increase standardized test scores (Hamdan et al, 2013). Early research suggests that nearly 70% of students in flipped classrooms earned higher standardized test scores than their counterparts in regular classrooms (Crouch, 2014). Troy Faulkner, a high school math teacher, has seen such improvement in his classes. By using a flipped classroom, almost three-fourths of the students at his school passed the state math test, more than doubling the number of students to pass the exam three years earlier (Hamdan et al, 2013). Using a flipped classroom can alleviate some of the stress and pressure teachers may feel to deliver results and when standardized tests are administered (FairTest, 2012). Some of this pressure causes teachers to “narrow” their curriculum due to time constraints, which results in less information presented to students (FairTest, 2012). According to Michelle Vaughan of Florida Atlantic University, teachers in a flipped classroom are able to cover their curriculum and expose their students to all of the information they are required to present (Vaughan, 2014). The amount of time a teacher can save by having students’ preview class information prior to class allows them to address everything that is required. In turn, this enables teachers to delve deeper into their subject and be much more creative with their daily lesson plans (Vaughan, 2014).

The ability for teachers to go further in depth with their curriculum is sometimes hampered by missing students (Roehl, Reddy, & Shannon, 2013). Student absences can prevent instructors from proceeding through their curriculum at an acceptable rate (Roehl et al, 2013). Illnesses and extra-curricular activities are often the cause of student absences (Roehl et al, 2013). Running a flipped classroom can help teachers in

maintaining their pace without delay, this is vital to the students who are absent as they appreciated the opportunity to view what was missed (Roehl et al, 2013).

One of the most important aspects to a flipped classroom is the incorporation of technology. The use of technology into classrooms presents an opportunity for teachers to change traditional lectures to reach millennial learners. Teachers are able to use technology in a flipped classroom to deliver the content and instruction to their students outside of the classroom, which is accessed at home, before they get to class. Students can utilize various methods to access the class information such as computers, smart phones, and tablets. This allows students to review the classroom content before they arrive at school (Vaughan, 2014). Technology use within the classroom has the potential to increase student learning and achievement. This strategy involves new techniques along with tested traditional teaching styles (Siegle, 2014).

There is no one correct way to use technology in a flipped classroom. Since the classroom is being reversed, there are numerous ways in getting the content across to the students. Videos from the internet and interactive lessons are a great way to introduce a topic (Siegle, 2014). There are also more quality resources available to teachers in addition to online videos. Other options for online teaching content are websites such as refseek.com, The Khan Academy, and Apple's iTunes U. Refseek is an online directory that offers free educational sites to users. The Khan Academy provides numerous educational videos that range from content in geometry to content in chemistry. Finally, Apple's iTunes U contains a half million free books, videos, and other resources on numerous topics (Siegle, 2014). These are a few of the most commonly used online resources for the flipped classroom.

Teachers can also create their own videos to present to their students by using online applications and this is a great way for teachers to show off their creative side. This allows teachers to reflect on how they teach and instruct a lesson in that manner. Examples of this would be adapting the pace of the lesson, making sure appropriate examples are being used, and making sure the content is understandable for the students (Siegle, 2014). While creating the video, teachers need to structure their video as an overview of the lesson. The video needs to contain appropriate content so the students can understand the knowledge being taught. It might also be beneficial for teachers to end the video with a summary to wrap up the lesson. Teachers are encouraged to add their voice, video clips, and images which should be no longer than ten minutes (Alvarez, 2012).

One of the most important components to student achievement is individual feedback. According to Siegle, during class in a traditional classroom, students receive very little feedback from their teacher. In a flipped classroom, the teacher is available to spend more time with their students discussing and elaborating ideas. It is crucial that students are guided through the work process in order to ensure accuracy, flipping the classroom is ideal for maximum student learning. The flipped classroom allows students to achieve maximum growth by becoming active learners instead of being passive listeners inside the classroom (Siegle, 2014). Becoming an active learner is a crucial life skill that will be reinforced with this teaching style. Another advantage of flipping the classroom is in regards to special education programs. Allowing special education students the chance to see the material outside the classroom gives them a chance to work more closely with their teachers during class. Many students need to review the material

several times before they fully understand the concepts, this will be possible with the flipped classroom (Siegle, 2014). This allows students to spend more time discussing and working through problems with the instructor when working on classwork compared to a traditional classroom setting (Siegle, 2014).

With every new teaching method there will always be students that don't follow the guidelines. It is inevitable that along the way some students will not complete the assigned work, in these situations it is critical to have them access and complete it during class while the other students are moving forward. Re-teaching the students that did not complete the assigned videos is not an option with the flipped classroom, this would only delay the students that did their work. If re-teaching occurs, the students that took the time to complete their assignment will believe the work they did was meaningless (Raths, 2014).

Ultimately, there is no one way to flip the classroom. Every teacher will find their own methods that work the best in their classroom and with their students. There are no hard and fast rules when a teacher creates their workspace, often times the best teachers borrow bits and pieces from various successful teachers in their community or school. When learning is taking place, and guided instruction is occurring, the flipped classroom will become successful (Raths, 2014).

Methodology

We conducted our research in a public school setting in eighth grade mathematics, science, and physical education classrooms. The study period for each of the classrooms lasted for seven class periods or one unit. While implementing our action research

project we developed various types of assessments and measurement tools. These data sources included: a pre-assessment survey, written assignments, a student behavior checklist, and a post-assessment. Each of the mentioned classrooms implemented the flipped classroom midway into the school year. We wanted to get a broad picture of its benefits and get a valid data source from the student participants. By allowing the students to experience a traditional classroom and a flipped classroom from the same teacher, consecutively, we believe we will have a solid foundation for our study. All of the data collection tools have been designed to study the effectiveness of the flipped classroom.

The pre-assessment survey (Appendix A) was the first data to be collected and was given in each of the three content areas. The purpose of the survey was to assess current knowledge of the flipped classroom, gather student preferences, and measure the students' technology skills. Students were provided with an area in which they could ask questions or state concerns in regards to the flipped classroom. The results of the pre-assessment survey helped guide each of the teachers in their instruction and introduction to the flipped classroom.

After the pre-assessment was analyzed each of the teachers introduced the flipped classroom in a formal lecture-type manner. The science students were introduced via Prezi presentation, physical education students watched a YouTube video introduction, and the math classroom used Google Classroom as an introduction. During these introductions students were introduced to the format of the flipped classroom, how to access videos and classroom content, and the methods of evaluation (observation and homework completion) that would be used. Also at this time, the parents received a

notification form (Appendix B) explaining our research process and our goal of implementing the flipped classroom.

Once the students and parents were informed on the process we began implementation and data collection. Each of the classrooms utilized various methods of data collection. The students were monitored using Google Classroom, a student assignment rubric (Appendix C), and a student-behavior checklist (Appendix D). All three classrooms used the same format for assessment. This format included: checking Google Classroom for video completion, scoring each student using the student assignment rubric, and completing the student behavior checklist. Each teacher had a Google Classroom account set up with their video lessons. This is where the students accessed the videos and other course content. When the teacher accesses the Google Classroom they are able to see which students have viewed the assigned video lesson and which ones have not. This is made known to the students at the time of introduction. This process is very beneficial and reinforces the student accountability required for the flipped classroom to be successful.

The student assignment rubric was the next step in our data collection process. This is a very basic assessment tool based on our rubrics that our district uses for standards based grading. The rubric uses a three-point scale to determine proficiency of the content (not proficient, partially proficient, and proficient). Items on this rubric include: evidence of content understanding, student mastery, student collaboration, and assignment completion. Each student is given a score on the content, if the student is unhappy with their level of mastery they are able to continually improve their score until proficiency is proven.

Once this assessment is completed the teacher moves on to the student behavior checklist. This checklist has each of the students' name with three fields: assignment completed, on-task behavior, and preparedness. In order to show proficiency in each of the fields they need to meet the specific expectations. For assignment completion, the students should complete and turn in the assignment on time. On task behavior requires the students to stay on task for the duration of the assignment or class period with two or less redirections. Student preparedness is demonstrated by bringing all necessary materials to class. This assessment is a tool that teachers in a traditional classroom would also benefit from because it forces students to become accountable for their actions.

The daily events of each group varied due to the basic differences in content material. In the physical education classroom the students were asked to demonstrate their knowledge of a specific skill, which was taught in the videos the students watched independently. For example, in Physical Education, the students would demonstrate the ability to complete the bench press which was taught via video lesson. By successfully demonstrating the skill they proved proficiency of the knowledge obtained in the video lesson. In the science classroom, the students were working on a climate and weather project. The students were asked to view a video the night before the start of the project so they would be able to use their class time to work collaboratively with other students.

The procedures in the mathematics classroom were very similar to the science classroom. The students watched videos on a set of skills for multiplication and then were assessed the following day. All of the students were allowed to watch the videos in their own time and as many times as necessary for full understanding. They were also encouraged to take notes and record questions on the content of the video. When students

arrived in class the next day the teachers briefly discussed the material and answered any student questions. This discussion was helpful to develop a further understanding of the content and also provided a clear picture of student knowledge. The events following discussion vary from project work to individual practice or demonstration. During student work time each teacher was able to walk around the room and answer questions and monitor on-task behavior.

The final data collection was through a post-assessment survey (Appendix E). Now that our students have experienced both the traditional classroom and the flipped classroom they are able to give appropriate and valid feedback. Each of the three classrooms used this tool to determine post-flipped classroom attitudes. Some of the questions involve the level of satisfaction with the flipped classroom and opinion of video lectures. The students were also asked to rate the ease of access to the lecture material, as well as the number of times they accessed the videos. In one of the questions they were asked if they took notes during videos, wrote down questions, and if they watched the video without distractions. The final question on the post-assessment survey was if they prefer a video lecture over a classroom lecture; this question is a very important part of the post-assessment. Student attitudes towards classroom procedures and their learning is very valued. We are very interested in analyzing the data, data collected and analyzing is a critical part of improving future instruction.

In the next section, we will analyze the described data sources to determine effectiveness of the flipped classroom. Our content area data will be compared in the different content areas and analyzed to see if there are concrete benefits of the flipped classroom.

Analysis of Data

The purpose of our study was to inspect the effectiveness of the flipped classroom in the middle and high school classrooms. The data points we used to collect the data included: a pre-assessment survey, written assignments, student behavior checklist, and a post-assessment. The pre-assessment was the first data to be collected. The pre-assessment was given to all students in each of the three content areas. The pre-assessment survey was to assess the student's previous knowledge of the flipped classroom approach and to gauge their technology skills. The results of the pre-assessment were analyzed separately and then put into a graph to show the similarities and differences between content areas. The first question of the pre-assessment asked students how familiar they are with the flipped classroom teaching method (Figure 1).

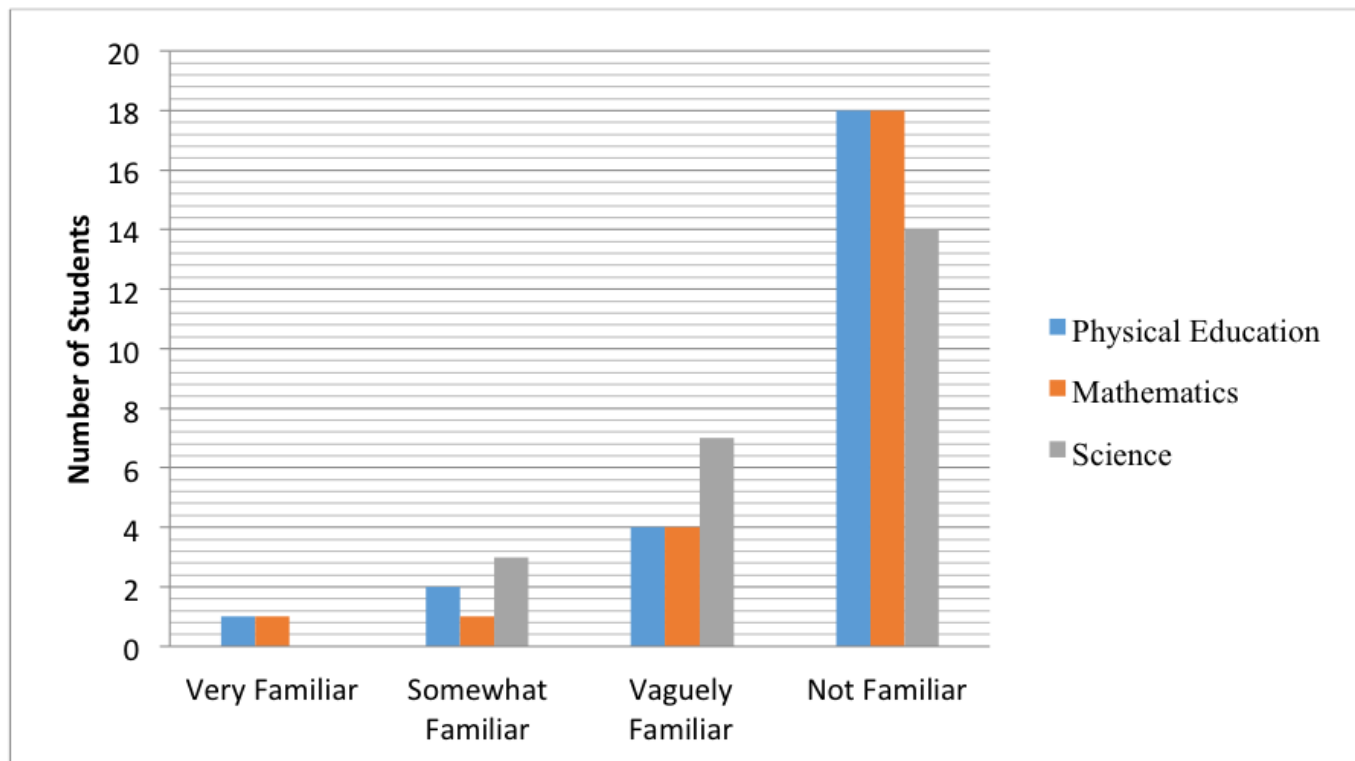


Figure 1. How familiar are you with a flipped classroom teaching method? Students respond to questionnaire in regards to knowledge of the flipped classroom.

As shown by Figure 1, our students were mostly unfamiliar with the flipped classroom approach. This data was very helpful in the planning process because it illustrated the fact that we needed to teach our students what the flipped classroom would look like.

The students were also asked about their technology skill level. This was an important factor to our study due to the fact that the flipped classroom is based on the idea that students are capable of accessing online information independently. According to Figure 2, there were only two students that ranked themselves below average with technology. This information was very encouraging for apprehensive students or teachers involved in the study.

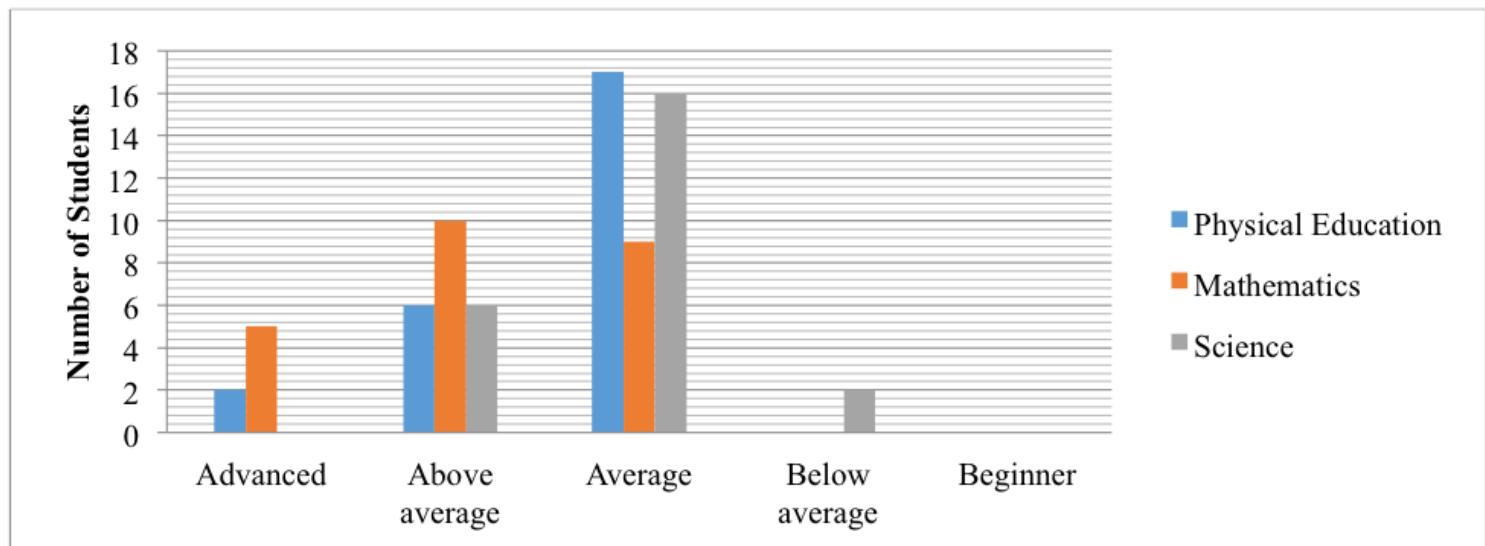


Figure 2. Please rate your skill level concerning the use of technology. Students rate their technology skills.

As shown in Figure 2, the majority of students rated themselves average or better in regards to their technology skill level. This data was reassuring and helped us ease into the flipped classroom approach knowing our students would be able to access the information.

The final question on our pre-assessment survey assessed different factors that would determine the successfulness of the flipped classroom. These factors included: distractibility, comprehension, note-taking skills, and time management. We hoped to be able to address these problems with the flipped model approach to instruction. The results of this survey are shown in Figure 3. This final question encompassed many classroom aspects and therefore was a very good indicator of what the teachers would be dealing with when working in a flipped classroom. The students were able to be honest about their experience in the classroom due to the electronic style of the survey which lends itself to much more reliable results.

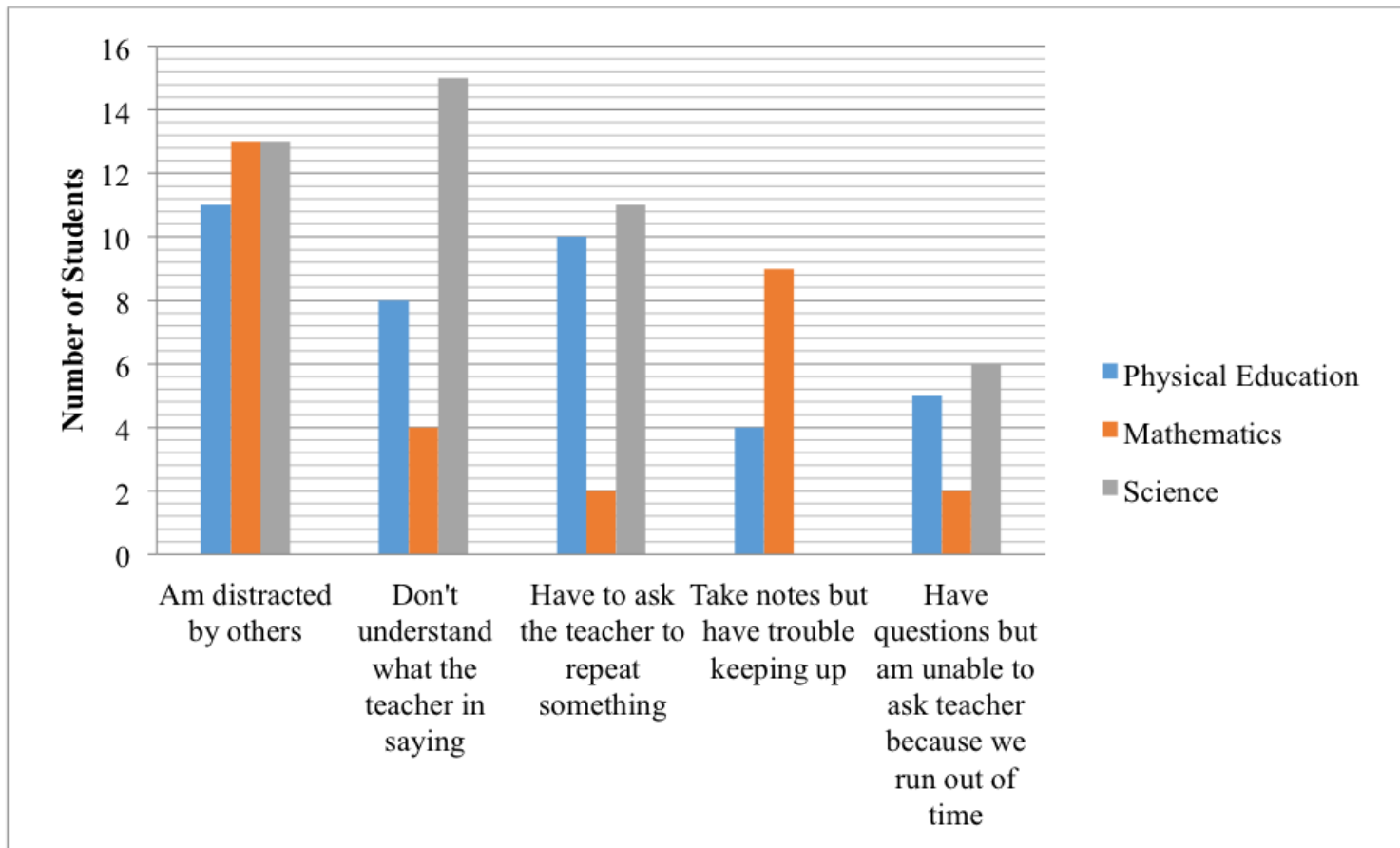


Figure 3. When I am in a classroom sometimes I. Students mark all that apply in regards to their classroom behavior.

Students were able to choose more than one factor that affects their time in the classroom. As Figure 3 illustrates, many students are distracted by others, don't understand what the teacher is saying, and have to ask the teacher to repeat something that was said. All of these factors are concerning to hear as a teacher, but they are solvable problems, specifically through the employment of the flipped classroom. Upon completion of the flipped classroom study we hoped to see improvement in all of these factors.

As we implemented the flipped classroom we took note of different factors to gauge academic improvement. Each of the content area teachers took records on evidence of understanding, independent work (without assistance from teacher), student collaboration, and assignment completion. Figures 4 shows the proficiency of the students in the four areas being scored.

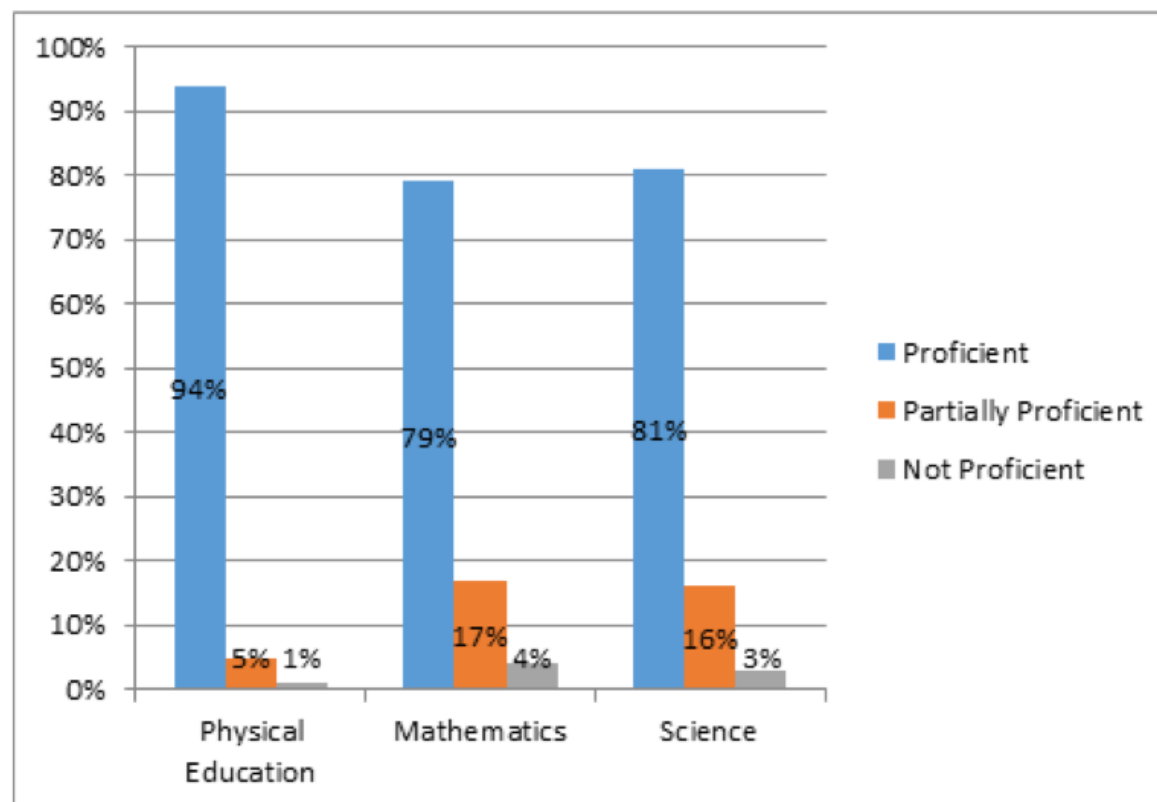


Figure 4. Student Assessment Rubric: Physical Education, Mathematics, and Science.

Each of the four areas are compared against each other.

In Figure 5, we put the information together to get a better picture of how the students rated in the four areas they were being assessed (e.g. evidence of understanding, independent work without assistance from teacher, student collaboration, and assignment completion).

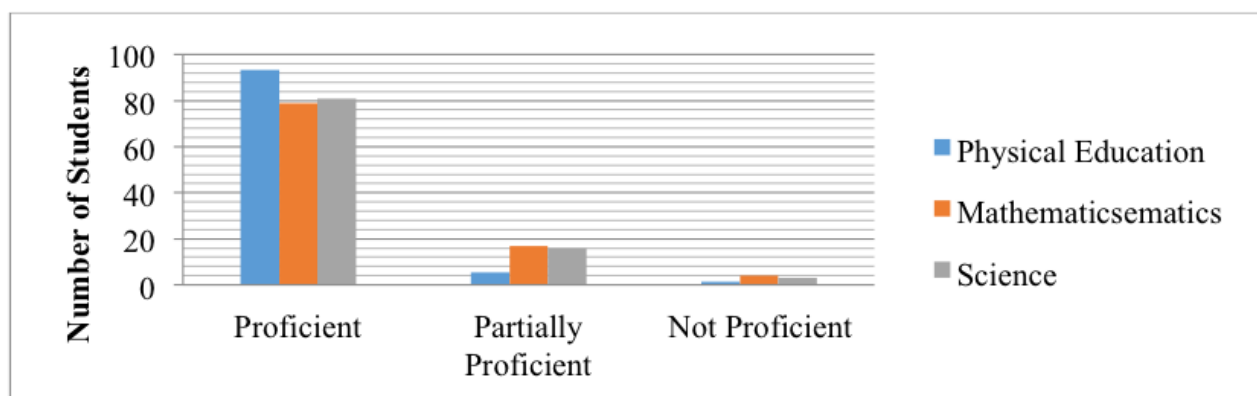


Figure 5. Student Assessment Rubric: Physical Education, Mathematics, and Science. Graph shows levels of proficiency in the test classrooms.

It is clear that a high percentage of our students were able to show proficiency in the areas we scored them on (all 4 areas). It was readily apparent that each student viewed their “homework” as they were able to come to class and get right to work completing the assignment. They were also able to work with others while not having to receive directions from the teacher.

The next group of data we looked into was the student behavior checklist (Figure 6). This evaluation tool is similar to the student assignment rubric in many ways. We paid special attention to the second column titled “completed assignment” and noted that a high percentage of our students displayed this and few needed reminders to focus and remain on task.

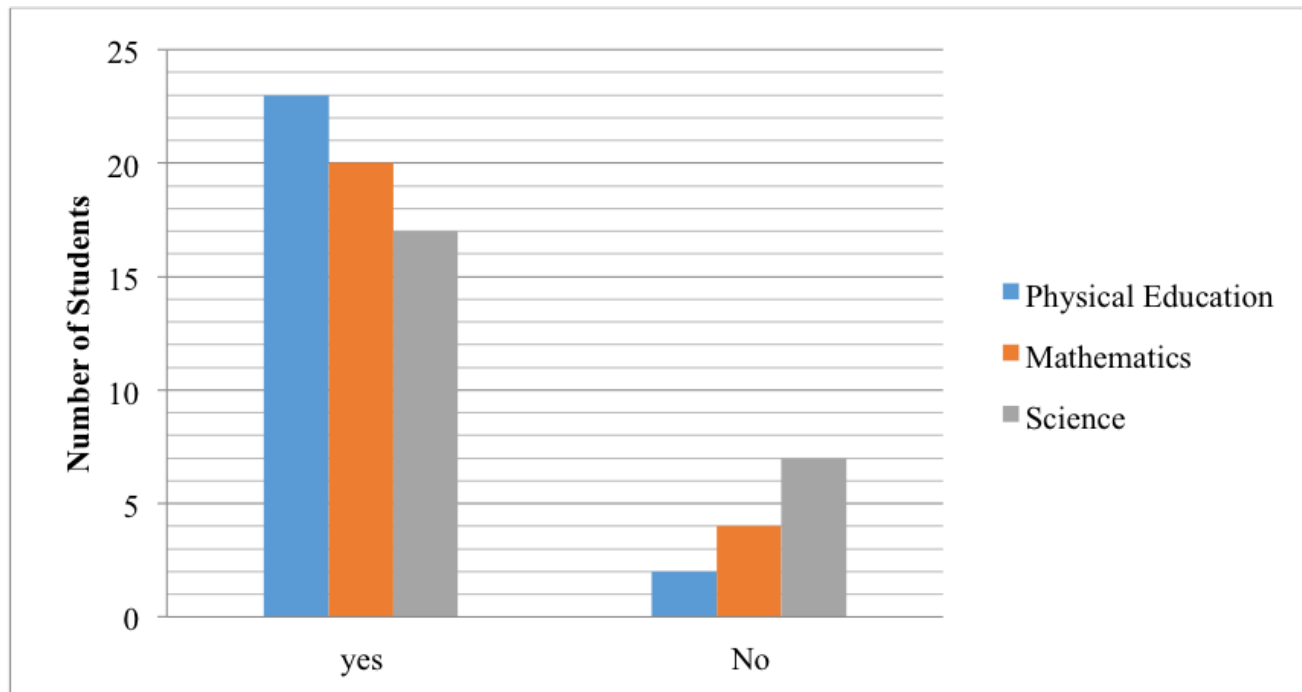


Figure 6. Behavior Checklist: Physical Education, Mathematics, and Science. Graph shows the number of students with on-task behavior in each of the test classrooms.

As shown in Figure 6 the overwhelming majority of students in all three content areas completed their lesson on time. This is one of the most important factors we were concerned about when using the flipped classroom model because assignment completion is a very high indicator of learning. As our study was coming to a close we had the students fill out a post-assessment survey.

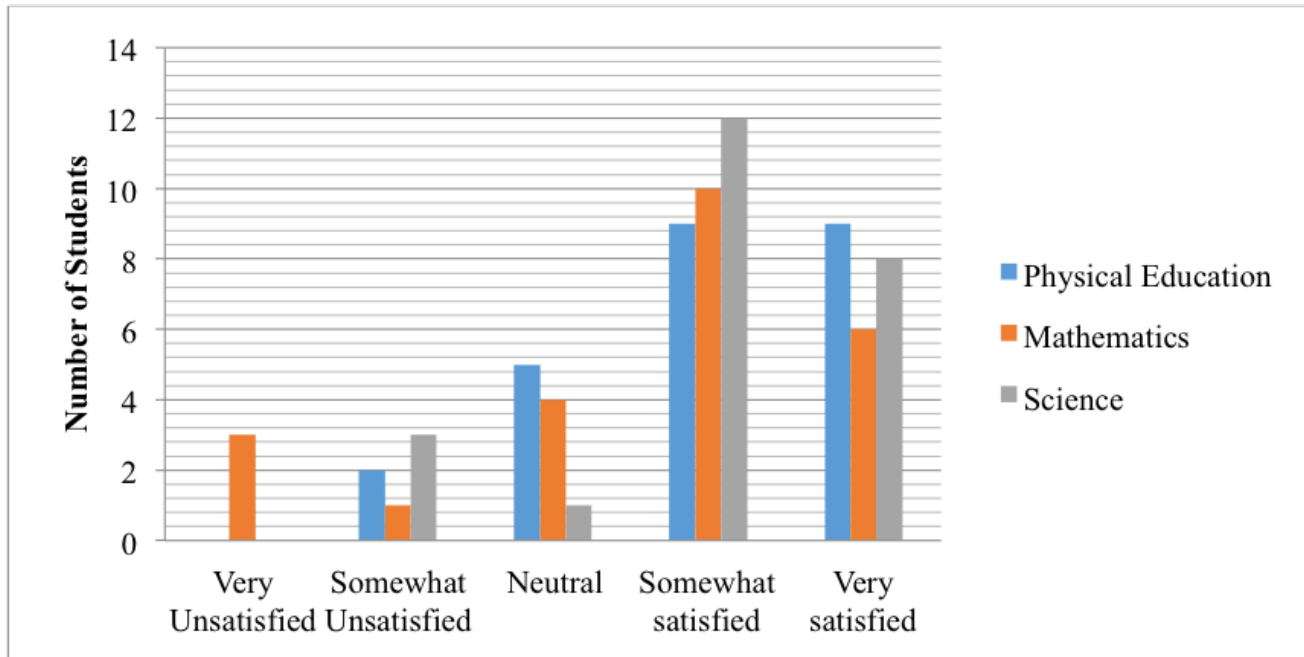


Figure 7. Level of satisfaction with the flipped classroom. Students rate their level of satisfaction with the flipped classroom.

As shown in Figure 7, most of the students responded they were either somewhat satisfied or very satisfied with their experience in a flipped classroom. The students were also asked their opinions on some of the other aspects of the flipped classroom such as their opinion of a regular classroom lecture compared to the video lectures, the ease of which they accessed online lectures, number of times watched, and other behaviors while watching the videos.

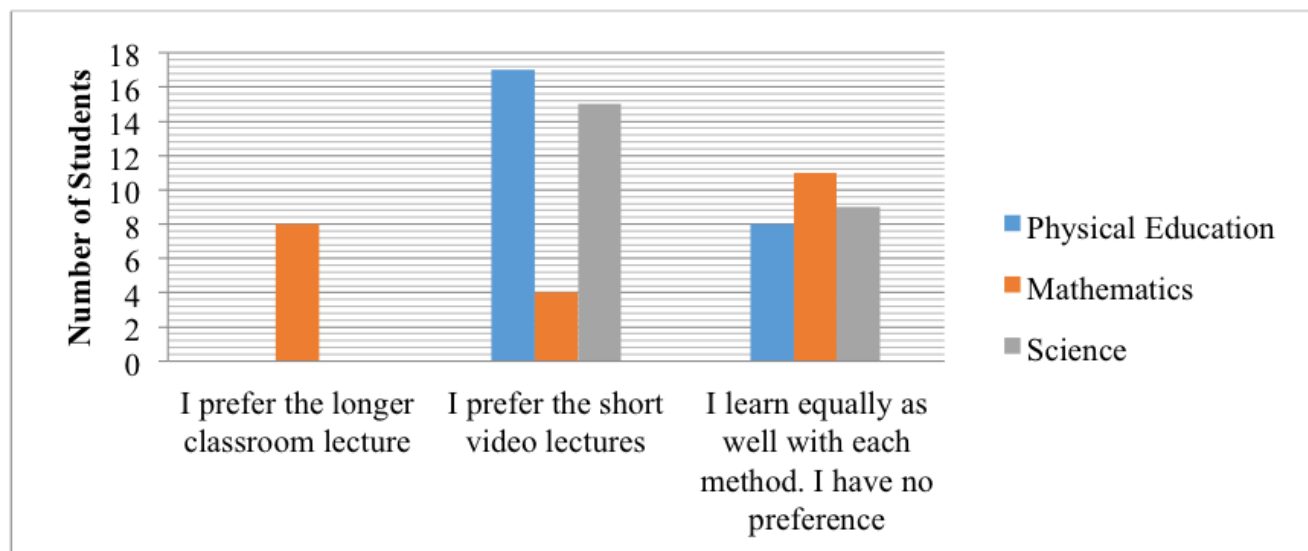


Figure 8. Regular classroom lecture verses video lectures. Graph shows the student's learning style preference.

According to the data, students seemed to favor the flipped classroom instructional model. Students also noted they preferred the shorter classroom lectures, the videos were very easy to access, and very few experienced problems understanding them (Figure 9).

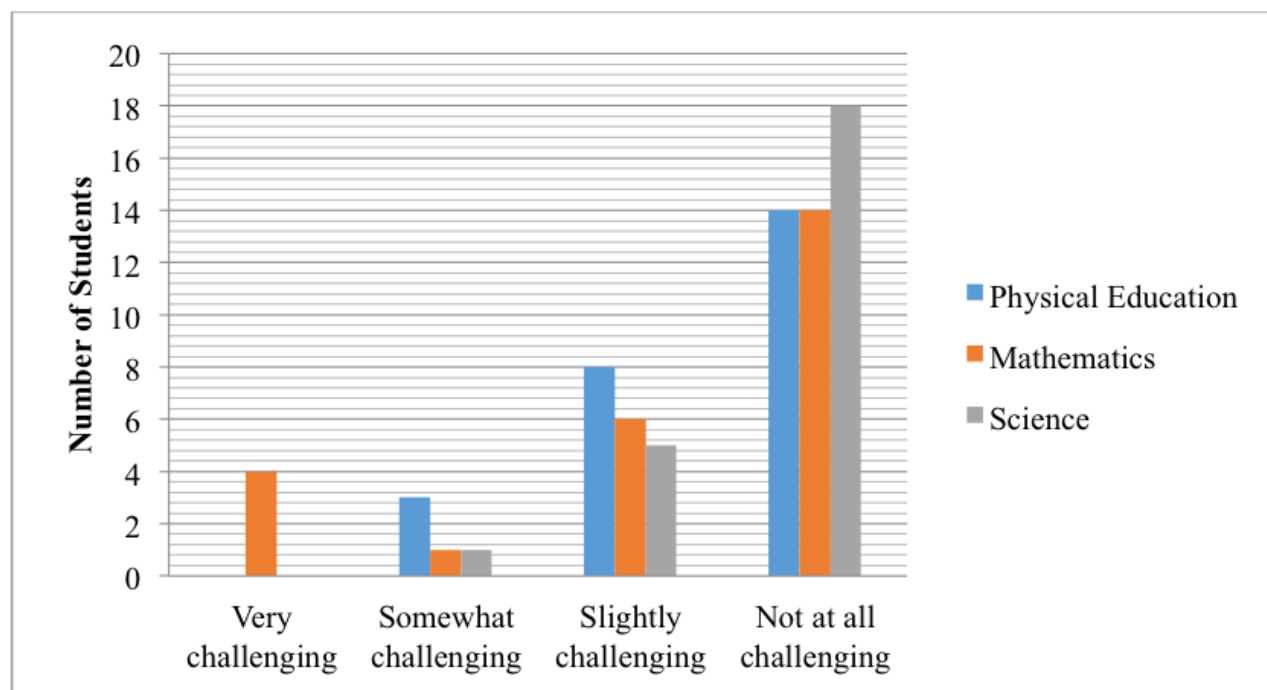


Figure 9. Ease of access to online lectures. Students responded to their ability to access the online lecture.

It should also be mentioned that students seemed appreciative that they were able to view the video as often as needed and that doing so outside of class limited in-class distractions (Figures 10 and 11). As illustrated in Figure 10, there were students that accessed the video more than one time.

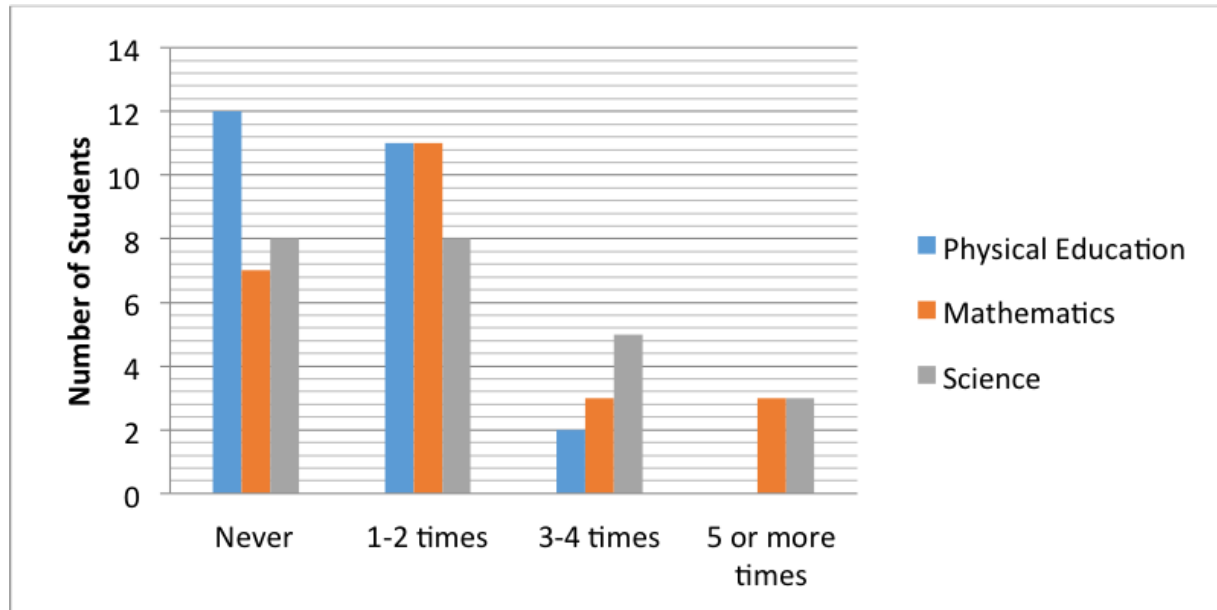


Figure 10. Number of times video lecture was accessed. Students record how many times they watched their assigned videos.

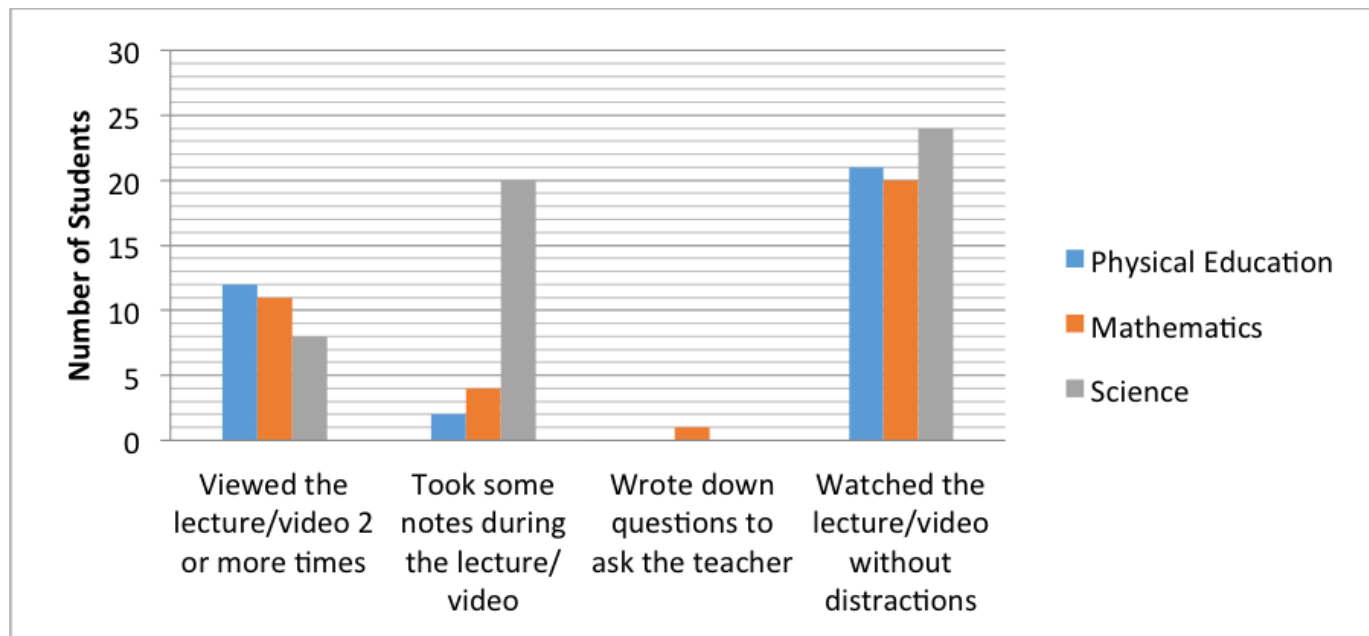


Figure 11. Behaviors while watching video lecture. Students' responses of their behavior during the duration of the video.

In the next section of the report, we will discuss our conclusions drawn from the data along with the implications for future research and possible changes to the flipped classroom approach.

Action Plan

We conducted our research on the flipped classroom in mathematics, science, and physical education classrooms. During this period we developed various types of assessments and measurement tools. These data sources included: a pre-assessment survey, written assignments, a student behavior checklist, and a post-assessment. The post-assessment survey provided us with important information regarding student attitudes and the success of the flipped classroom experiment. We were glad to see the students enjoy learning through the flipped classroom. According to our post-assessment survey results a few students responded with negative opinions of the flipped classroom. We were also pleased to see that many students showed a high level of task proficiency and a very high level of assignment completion.

We also learned in our post-assessment survey that many of the students watched the videos more than one time and were able to watch them without distractions. Both of those aspects would not be possible in the traditional classroom, therefore we found it to be beneficial to the students.

We would like to see growth in the “questions for the teacher” section. A few students responded by saying they wrote down a question to ask the teacher the following day. By making teacher-directed questions requirement we might see an even greater rise in scores due to the critical thinking skills being utilized. We also saw a great variance in note taking during the videos. With science having nearly four times as many students responding that they took notes during the video than in math. A future goal of ours would be to analyze whether students might see higher test scores with note taking. Lack

of note taking might also be due to the device the students used to watch the video, for example, watching the video on a computer versus a cell phone.

One of the major concerns that we had going into this study was whether the students would actually watch the videos and how difficult they would be to access. To our delight, according to our post-assessment survey, the majority of students responded that the videos were not at all challenging to access. A smaller proportion of the students responded that the videos were slightly challenging and very few students chose somewhat challenging. We were very pleased with the students' willingness to watch the videos and especially to have them viewed before class time.

As a result of utilizing the flipped classroom approach we have seen more student engagement, through class discussions and work time during class, when using technology to assist in the learning process. We have also experienced an increase of the 21st century skills for learning in our classrooms. Some of those skills include collaboration, creative thinking, and innovative learning. Traditionally class time would be spent learning the information or getting a lecture from the teacher, now students are able to talk with their peers and work together on homework or projects during class time. Students have also been able to work on different projects using their computers and the information they have learned from the flipped classroom. In our district we have many classrooms and schools as a whole moving towards 1:1 technology. This type of delivery can be useful in preparation for students that are planning to continue their education online instead of attending a traditional post-secondary institution. Online instruction seems to be the direction of education today, so it seems appropriate that we expose our students to this method.

Our overall experience with the flipped classroom has been very positive. The students were very open and excited to try something new and experiment. They enjoyed accessing the classroom material in their own time with a more comfortable setting and the ability to replay the lesson several times. We have learned that the flipped classroom approach may not be the best for every classroom or every group of students, but it does seem beneficial in some areas.

As a result of this study we have become more aware of each of our teaching methods and also recognized each of our student's learning styles. In the future we plan to utilize a blend of the flipped classroom with the traditional classroom in order to reach more student's learning styles and preferences. A blend of both methods could be a nice compromise for the more traditional teacher or student so they are not overwhelmed with change. According to our post-assessment survey many of the students responded that they learned equally as well with each teaching method. Though we did see large numbers of science and physical education students respond that they prefer the short video lectures. This could be due to the nature of the classroom which is naturally more action or activity based.

As we continue to move through this process data collection techniques become more apparent to each of us. We would like to compare standardized test scores between the students in a regular classroom setting versus a flipped classroom. Another piece of data to look into would be classroom test scores before the implementation of the flipped classroom against the scores after implementation.

As we continue to grow and change in our teaching styles we keep the most important aspect of education in mind, the students. The flipped classroom has shown to

be successful in helping our students understand the classroom content in a way that is different from the education they have experienced in the past. If something is working for the students then it is worth pursuing.

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Appendix A
Flipped Classroom Pre-Assessment

- I. How familiar are you with the Flipped Classroom teaching method?**
- a. Very Familiar
 - b. Somewhat Familiar
 - c. Vaguely Familiar
 - d. Not familiar
- II. What type of instructional delivery method would you prefer in your classes?**
- a. Teacher lectures in class
 - b. Video presentations viewed on your own
 - c. A combination of teacher lecture and video presentations.
 - d. Other—please write below
- III. Please rate your skill level concerning the use of technology**
- a. Advanced
 - b. Above average
 - c. Average
 - d. Below average
 - e. Beginner
- IV. Please read the following statement and circle all that apply.**
“When I am in a classroom, sometimes I _____”
- a. Am distracted by others
 - b. Don’t understand what the teacher is saying
 - c. Have to ask the teacher to repeat something
 - d. Take notes, but have trouble keeping up
 - e. Have questions but am unable to ask teacher because we run out of time
- V. Do you have any questions or concerns about being involved in a Flipped Classroom?**

Appendix B
Benefits of a Flipped Classroom Parent Notification Form

Dear Parents,

As you may know, we are students at St. Catherine University in pursuit of a Masters of Education degree. An important part of our program is the Action Research project.

As the teacher of your children in class, we have chosen to learn about flipped classrooms because we would like to improve student learning outcomes within the classroom. We are working with Yasemin Gunpinar, Assistant Professor of Mathematics Education at St. Kate's to complete this particular project.

We will be writing about the results that we get from this research, however none of the writing that we do will include the name of our schools, the names of our students, or any references that would make it possible to identify outcomes connected to a particular student. Other people will not know if your child is in our study.

When we are done, our work will be electronically available online at the St. Kate's library in a system called Sophia, which holds published reports written by faculty and graduate students at St. Kate's. The goal of sharing our final research study report is to help other teachers who are also trying to improve the effectiveness of their teaching.

We will be teaching all children using our curriculum, but will also be incorporating some flipped classroom concepts into our instruction. It is our hope that through this study we will discover that the flipped classroom method is a much more effective form of instruction. All students are expected to come to class prepared for the day's lesson by viewing a video lecture prior to meeting with their instructor. Students may view the videos on a home computer, a smartphone, an I-pad, or on a Chromebook at school. Classroom time with the instructor will focus on homework completion while the instructor is present and available to answer questions. All students are expected to show an increase in the amount of homework completed in the classes included in the study.

If you decide you want your child's data (self-assessment, checklists, pre-assessment and post assessment, student assignment rubric) to be in our study, you don't need to do anything at this point.

If you decide you DO NOT want your child's data included in our study, please note that on this form and return it to us by January 30th, 2015. There is no penalty for not having your child involved in the study; we will simply not include their data information in our research. All children will receive the same treatment in our class, regardless of your decision on this matter. If at any time you decide you do not want your child's data to be included in the study, we will remove included data to the best of our ability.

If you have any questions, please feel free to contact us via e-mail at andrew_voorhees@bismarckschools.org, staceyann_ziemann@bismarckschools.org, kelly_moormann@bismarckschools.org, or paul_jundt@bismarckschools.org, or by phone at 701-323-4600. You may ask questions now, or if you have any additional questions later, you can ask any of us or our advisor Sarah Porisch (sporisch@lfalls.k12.mn.us) who will be happy to answer them. If you have other questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you may also contact Dr. John Schmitt, Chair of the St. Catherine University Institutional Review Board, at [\(651\) 690-7739](tel:6516907739).

You may keep a copy of this form for your records.

Please see the reverse side of the letter and complete the requested information if you choose to not have your child participate in the study.

Opt Out

I DO NOT want my child’s data to be included in this study. Please respond by January 30th, 2015.

Name of Child

Date

Signature of Parent

Date

Signature of Researcher

Date

Appendix C
Student Assignment Rubric

	1 Not Proficient	2 Partially Proficient	3 Proficient
It was evident the student understood the content upon coming to class.			
The student was able to get to work on examples without needing any assistance from the teacher.			
The student collaborated well with other students in groups.			
The student was able to complete the assignment during class with proficient work shown.			

Appendix D
Student Behavior Checklist

Target behavior 1: Completing and turning in assignments on time

Target behavior 2: Staying on task for the duration of the assignment or class period with 2 or less redirections.

Target Behavior 3: Bring all appropriate materials to class (pen, pencil, paper, and planner)

Student Name	Assignment Completed	On Task Behavior	Preparedness
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			
26.			

Appendix E
Flipped Classroom Post Assessment

I. Please indicate below your level of satisfaction with the Flipped Classroom approach:

1. Very unsatisfied
2. Somewhat unsatisfied
3. Neutral
4. Somewhat satisfied
5. Very satisfied

II. How do you feel about regular classroom lecture versus video lectures?

1. I prefer the longer classroom lectures.
2. I prefer the short video lectures.
3. I learn equally as well with each method. I have no preference.

III. Was it challenging for you to find a way to access the lecture information prior to coming to class?

1. Very challenging
2. Somewhat challenging
3. Slightly challenging
4. Not at all challenging

IV. How often did you have trouble accessing the lecture/video?

1. Never
2. 1-2 times
3. 3-4 times
4. 5 or more times

V. When you viewed the lecture/video prior to class, did you do any of the following?

1. Viewed the lecture/video 2 or more times
2. Took some notes during the lecture/video
3. Wrote down questions to ask the teacher
4. Watched the lecture/video without distractions

VI. If you preferred one over the other (Video lecture compared to classroom lecture) please explain why.