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Using Technology to Aid in the Differentiation of Mathematics in a Sixth Grade Classroom

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An Action Research Report

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Abstract

This Action Research examines the effects of using an interactive, adaptive software program, Front Row, in helping a sixth grade teacher to differentiate mathematics. Ten students who go to a parochial school in a rural, midwestern community were included in the study. The data collection tools included a pre-research reflection, a journal of teacher observations, a daily student questionnaire, computer generated reports, a mid-research reflection, and a post-research reflection. Overall, this research showed an average growth of 1.74 years, or 44.9 percent with regard to grade level equivalency. This growth indicates the students' ability to perform mathematics skills independently. Due to the integration of Front Row, the students were more engaged in activities and showed growth on their achievement. This helped narrow existing gaps on the Common Core State Standards foundational domains. However, future research would consider other adaptive, technology integration tools to aid in mathematics differentiation.

Keywords: adaptive software, Front Row, mathematics, differentiation

Technology is taking differentiated instruction in education to a new level in terms of being responsive to student needs. Technology is making it easier than ever for teachers to have real-time data to support instructional decision-making. The data-driven decisions bring more objective clarity to the way in which to best meet the needs of students. The ability of technology to aid teachers in differentiating teaching and learning for today's students is critical to the success of the 21st Century classroom (Kleber, 2015). Adaptive software programs can assist teachers in the decision-making process (Foughty & Keller, 2011). This is done by collecting data, which provides teachers with essential information to make informed decisions about student groupings (Anderson, 2007; Kara-Soteriou, 2009).

Interactive, adaptive software programs use student data from their online practice, allowing teachers to group students in a variety of ways. Some suggestions of different types of groupings include same level or mixed level groupings, which leads to a more personalized educational experience (Davis, 2011). Pierce and Adams (2004) stated flexible groupings are an important component to successful differentiation. This action research study aims to identify how one such adaptive program, Front Row, can help a sixth-grade teacher to differentiate mathematics.

The setting of this research takes place in a small, rural, midwestern town. The school serves less than 100 students and the sixth-grade class has 10 students with an equal male to female ratio. It is a parochial school. This is the school's first year with a Chromebook cart. There are some iPads available, although not enough for a whole class unless borrowed from other teachers. No students in the class are on IEP's, but one student takes medication for behavioral concerns and anxiety. This student will use an iPad as opposed to a chromebook. Another student has a speech impairment and receives services, often during mathematics instruction because mathematics is his strongest academic area. No special accommodations will be used for this reason. This is a very homogeneous group, as all identify themselves as Caucasian and English speaking. All students indicate that they have internet access and a device to use at home if needed for educational purposes.

Through my observations during my teaching career, I have noticed an increasing dependence on finger counting, multiplication charts, and calculators to do basic computing. This slows the students down significantly when problem-solving. When learning more complicated concepts such as operations with fractions or solving algebraic equations, some students are inhibited, not because they can't do the higher complexity work, but because their understanding of foundational concepts and number sense is limited. Upon analyzing the data provided by the state standardized test, there is quite a large gap between the levels of achievement and readiness in my classroom. When using the National Grade Equivalency (NGE) scores, six students were performing above grade level, one at grade level, and three below grade level. I quickly determined that it would not be appropriate or effective for me to teach the grade level material when I would only be reaching one of my ten students. Meanwhile, three of my students would not be ready for it, and the other six would not be appropriately challenged. I need to increase the number of students performing at grade level and increase the learning and abilities of those students who are entering my class at above grade level already.

Since students come to a class with varying degrees of background knowledge, skills, misunderstandings, and misconceptions, differentiation is essential to meet individual student needs. Differentiated Instruction assesses where students currently are in their learning. It then encourages the adjustment of instructional delivery and content, the practicing of essential skills, and/or assessment to help students meet district, state, and national standards and benchmarks (Bender, 2013; Smith & Throne, 2007). The overarching goal of differentiation in the classroom is to meet diverse learner needs and support high levels of student achievement (Smith & Throne, 2007). This requires a lot of extra, but very important, work on the teacher's part. Ultimately, there should be something in place to prepare the teacher to target those specific needs.

Research indicates that technology impacts learning and can help improve student outcomes in six ways (Smith & Throne, 2007). These include when the application supports curriculum objectives, when there are opportunities for student collaboration, when the application adjusts for student ability and provides feedback to all parties about performance and progress, when integrated into the typical day, technology offers opportunities for projects that extend the curriculum, and when all parties support its use (Smith & Throne, 2007). The parties involved could include parents, teachers, administrators, and students, as appropriate.

Technology can aid both teachers and students in making sure they are meeting state standards as well. Research conducted using intelligent tutoring software has produced significantly improved student outcomes in mathematics (Bender, 2013; Dempsey & Kuhn, 2011). Front Row could be considered one type of intelligent tutoring software, because it adapts mathematics practice based on student responses, while providing videos to aid students in solving similar problems. Such software is not meant to replace the teacher. On the contrary, interactive software put the training and experience of teachers to their maximum use. According to Broyles (2012), when teachers formatively use data to inform their instruction, student achievement improves. The data the teacher receives can guide student groupings and inform the teacher as to specific areas of need or concern (Foughty & Keller, 2011). It can also allow teachers to vary content based on student readiness while still approaching and meeting standards (Anderson, 2007). Front Row is an online, adaptive software program. It generates data for the teacher to use in order to differentiate instruction and practice for students. Anonymized results from Front Row found that 75 percent of teachers who used the program for at least three months reported better student mathematics growth than the district average (Front Row, 2015). In a case study of "districts where average growth is already high, Front Row classrooms still showed significant improvement over the district average" (Front Row, 2015, p. 4).

Upon reflection and consideration of the context I work in and the resources that I have to work with, I chose to study what effects differentiation, facilitated by the adaptive, interactive software, Front Row, will have on mathematics achievement and engagement of students in a sixth grade classroom.

Review of Literature

This section discusses the literature on how technology can be used to differentiate mathematics to best meet the needs of all students. Technology is used for a multitude of purposes. For example, it can be used to inform instructional practices by providing teachers with suggestions to guide student groupings and highlight specific areas of concern, which need to be addressed with students (Anderson, 2007; Kara-Soteriou, 2009). When a teacher plans to incorporate mini-lessons into his or her instructional practices, their purpose is to work with a small group of students, while addressing targeted learning needs (Foughty & Keller, 2011).

Technology can also be used to increase student engagement, thereby impacting conceptual understanding and overall academic achievement (Dempsey & Kuhn, 2011). And, finally, technology can be used to increase teacher understanding of student learning outcomes, so the teacher can better differentiate his or her instruction to meet unique individual learning needs (Smith & Throne, 2007). The next section examines the approach to and importance of differentiated instruction in the classroom.

Differentiated Instruction

Differentiated Instruction is an approach to teaching and learning that meets an ever-widening array of academic diversity (Smith & Throne, 2007). Differentiation is the changing of content, process, or product based on student readiness, interest, and learning profile (Anderson, 2007; Pierce & Adams, 2004). When used in the classroom, the aspect of student choice in differentiation empowers teachers to be responsive and students to be aware of their areas of needed improvement (Anderson, 2007; Kleber, 2015). One important component and benefit of differentiated instruction is that students are more responsible for their learning and achievement (Smith & Throne, 2007).

There are many ways that a teacher can choose to group students when differentiating. When implementing differentiated instruction, students are generally separated into mathematics groups according to readiness, interest, or learner profile depending on whether content, process, or product will be differentiated (Anderson, 2007; Pierce & Adams, 2004; Preston & Hunt, 2014). The term “readiness” often coincides with the term “ability” to help educators qualify their student groupings (Pierce

& Adams, 2004). Bender (2013) reiterated that there are many different, yet appropriate, options for educators with regard to student groupings. Although differentiated instruction was initially based on the theory of multiple intelligences by Gardner in 1983, the act of considering learning styles, preferences, and learning profiles is becoming more prevalent (Bender, 2013). Pierce and Adams (2004) stated that flexible groupings are an important component to successful differentiation. Flexible grouping is a method of grouping students by which students move between groups as their understanding of the skills and concepts grow. Therefore data, with consideration of context and knowledge of students, will determine the most appropriate method for placing students in groups for the purposes of differentiation.

One way of differentiating instruction, which has proven worthwhile in various settings, is through tiered lessons or assignments. When tiering, it is important that the teacher tier either content, process or product, and then within that, decide if they are going to tier based on readiness, interest or learning profile (Pierce & Adams, 2004). Before tiering based on student needs, student groupings should be established. The notion of tiering revolves around meeting the needs of the individuals in each leveled group. It is important to note that whether the teacher is using a tiered approach or some other means to address learner needs, flexible, rather than static groups should be encouraged (Pierce & Adams, 2004).

The overarching goal of differentiation in the classroom is to meet diverse learner needs and support high levels of student achievement (Smith & Throne, 2007). For decades, educators have tried to personalize education, but have been limited in what they have been able to do because of the long hours required to prepare differentiated lessons and the varied needs of the students (Davis, 2011). Technology is making it easier for teachers to respond to student needs.

As is evident, technology can be an exceptional tool to aid in differentiation when used appropriately. The use of technology can help teachers spend more time on data analysis to guide individualized instruction rather than on grading papers (Foughty & Keller, 2011).

The Hybrid Approach

A critical component of knowing when, where, and how to differentiate is having evidence to support each student's current level of understanding before trying to move them forward (Broyles, 2012). One way to do that is through a hybrid approach, which combines face-to-face and online components. Through the use of technology, diagnostic assessments can be given and efficiently compiled to provide teachers with the data and information necessary for decision-making. Many interactive software programs are also available, such as ALEKS, Front Row, TenMarks, and DreamBox Learning, which give educators data to guide their professional practices and improve student outcomes (Bender, 2013). According to Broyles (2012), much of the increased student achievement is attributed to teachers using the data that they receive to inform their instructional practices. From there, teachers can implement more targeted instructional strategies and close any gaps or misconceptions in understanding (Dempsey & Kuhn, 2011). Once teachers have identified, targeted, addressed, and clarified misconceptions, students' overall achievement will increase (Dempsey & Kuhn, 2011).

Moreover, students who are already proficient or advanced for their grade-level can continuously be challenged. A significant benefit of interactive software is that, contrary to a traditional approach of accelerating students to a different class or grade level, which may unintentionally create gaps in understanding, students are able to stay in the same class and advance their knowledge through individually tailored learning paths (Foughty & Keller, 2011). Digital curriculum allows students to move forward at an appropriate pace (Foughty & Keller, 2011).

Not only can technology be used to provide teachers with data to inform instruction and interventions, but it can also be used to increase student engagement. Higher levels of student engagement yield greater academic achievement (Banitt, Theis, & Van Leeuwe, 2013; Lambert, 2014). For example, Siegle (2014) referenced research by the Flipped Learning Network in 2012, on flipping the classroom, in which 80% of the students had improved attitudes towards school. Sometimes thought of as a mindset more than a method, Spencer (n.d.) stated that flipping the classroom is one way of shifting the “attention away from the teacher and onto the student” (as cited in Siegle, 2014, p. 51). It is truly a shift in how educators view their role, the relationships they establish with their students, how they use their time, and the way in which they structure learning activities in today's 21st century classrooms (Kleber, 2015).

Siegle (2014) noted that the strongest effect on student achievement comes from the individual feedback that students receive. According to Siegle (2014), “In traditional classrooms, students only receive a few seconds of specific, individual feedback each day” (p. 52). To address this student need, technology can be used to provide students with direct feedback on their progress and areas for improvement (Dempsey & Kuhn, 2011).

All potential barriers aside, a hybrid approach to learning or the flipped classroom approach can have significant benefits for improving student outcomes. This effect is due to the nature of combining technology and differentiation so that each student receives a more personalized education (Foughty & Keller, 2011; Kleber, 2015; Siegle, 2014). Interactive software and online games attract today's students who are digital natives (Dempsey & Kuhn, 2011). Pring (2012) stated that when integrating technology into the classroom, students "move from passive listeners to active learners" (as cited in Siegle, 2014, p. 52). Through adaptive technology, students are empowered to take ownership over their work and take control of their learning (Kleber, 2015).

Conclusion

According to the National Council of Teachers of Mathematics (2000), "the tenets of differentiated instruction support both the Equity Principle and the Teaching Principle of the Principles and Standards for School Mathematics" (as cited in Pierce & Adams, 2004, p. 60). As described, the hybrid approach to learning and the flipped classroom models can support the implementation of differentiation to meet district, state, and national standards for increased student engagement and achievement. The use of digital tools is a very effective way that helps teachers better meet student needs, which improves student outcomes.

Methodology

For the purpose of assessing the effects of technology integration on the differentiation of mathematics in a sixth-grade classroom, I devised several methods of data collection to triangulate my results. My data collection sources included: (1) *Pre-Research student reflections* (2) *Journal of teacher observations*, (3) *Computer generated* *reports*, (4) *Mid-Research student reflections*, (5) *Daily student questionnaires*, and (6) *Post-Research student reflections*.

The timeline of this Action Research was set for 15, 45-minute sessions over five weeks. I began this research by administering a *pre-research reflection* (Appendix A) This reflection used an online Google Form which consisted of 12 questions used to gather information such as student online access and device availability from home, student comfort level with technology, student preference regarding how they practice or assess their understanding of mathematics, and their current level of engagement in mathematics class in comparison with other content areas. Four of the questions were open ended, while eight questions were multiple choice or checklist format.

After receiving the data from the *pre-research reflection*, the students began working on Front Row. Front Row is aligned with the Common Core State Standards (CCSS), which is evident by the reports that are able to generate data based on the CCSS within the program. According to Academic Benchmarks (2015), the CCSS have been adopted by 46 states in the United States of America. Within Front Row, the standards have been divided into two categories for mathematics; Foundational and Advanced. The foundational domains include standards that are primarily addressed during grades K-5, while the advanced domains include material from grades 6-8. Before being able to do adaptive practice on Front Row, each student was required to take a diagnostic assessment within the program for each Common Core domain. Each domain consists of a number of different standards that fall under the category of the overarching domain. The process of taking the diagnostic assessment for each domain was important, yet time consuming. While one student would only receive a few questions related to mathematics concepts, others would receive many before the diagnostic assessment would be considered complete by the program. They started with the Foundational Domains, such as Counting and Operations, Base 10, and Fractions and then moved on to complete the Diagnostic Assessments for the Advanced Domains. Some examples of the advanced domains include Ratios and Proportions, Statistics and Probability, and Functions. Although time consuming, Front Row wouldn't let the student move on to practicing concepts, without being able to place them at the appropriate, adapted level. This difference in the number of questions was because the students were at different ability levels and the program kept asking questions until it felt it had a good assessment of the students' current level of understanding on each topic. It was a mandatory component to the program being able to adjust to each student's level, which laid the foundation for adaptive practice. I also kept a daily *journal* for personal reflection (Appendix B).

This is our school's first year with a chromebook cart. It was completely new to our students, who are primarily Apple users. There was a little bit of a learning curve in using these devices, which prolonged my research process by about a week. Time constraints and schedule changes made it challenging to do a full 45 minutes of Front Row three times per week, as originally intended. The reality was closer to 30 minutes, three times per week, which three days depended on the school's schedule. This also seemed to be the students' stamina of time on task for this program in one setting.

After each session working on Front Row, the students completed a *daily student questionnaire* (Appendix C), which focused on their engagement and the relevance of the content they practiced that day. The *questionnaire* consisted of two, 5-point likert scale questions followed by space to explain why they rated themselves they way that they did. It also included one open-ended response with regard to what they felt the most important concept was that they practiced that day. Their responses provided me with information to consider when moving forward. The information that I received was in reference to on-task behavior, how well the students felt they practiced the designated skills, and an insight into what the students felt was the most important concept they practiced that day. I was able to compare my assessment of class or student behavior to their own perceptions of their behavior. It also encouraged the students to be intentional about their work, knowing they would be held accountable for doing their best and making sense of what they were learning and practicing.

Every Sunday, I received a *report* from Front Row in my email (Appendix D). This *report* provided a summary of the progress made on the various domains that week, which guided me in planning for the coming week based on student performance during the previous week. This *report* took into account the work that the students did at home over the weekend. It also provided students' current grade level equivalency in regards to their mathematics achievement on Front Row. The email indicated students who improved the most and least, as well as those who did not improve. I used that information, along with the suggested small group information, to determine which students to work with for targeted instruction during mini lessons.

Since the sixth grade math book at our school is not aligned with the Common Core, it does not follow the same standards and progression as Front Row. Therefore, it was necessary to shorten my large group instruction from the textbook, to mini lessons. These mini lessons consisted of 15 minutes spent on large group instruction with fewer whole group examples, followed by more adaptive practice on Front Row. I used the time with Front Row to focus on filling current gaps in conceptual understanding or skill acquisition and working with students more frequently within small groups or individually.

Twice per week, on the days opposite those using the Front Row program during school, the students had adapted-level homework printed from Front Row. Sometimes, the adapted level homework on Front Row was unavailable because the pdf generator was not working. Therefore, I still used Front Row's suggested groupings to determine what level of practice the students should receive. Then, I took the leveled worksheets from my textbook to give them assigned practice for that night which addressed the same standards.

After the first two weeks, the students became more comfortable using Front Row. Therefore, I began requiring an additional 15 minutes spent on Front Row from home so that I would have a better gauge of where the students were in relationship to one another. The more time spent on the program, the more data I was able to use to guide my instruction. This information was used to guide interventions and small group lessons according to the standard and level of readiness of the students.

At the midpoint of the research, I had the students complete a *mid-research reflection* using Google Forms (Appendix E). This information provided me with information such as what they did and didn't like about using Front Row. It also had six questions that were the same as the *pre-research reflection* so that I was able to make a comparison over time. I adjusted as necessary to best meet the needs of the individual students who were struggling or who didn't seem to be able to show what they knew on the computer program. One example of an adaptation was that a student seemed to be more successful using an iPad instead of a Chromebook because it was easier to manipulate. Finally, the students took a *post-research reflection* using Google Forms (Appendix F), which helped me more accurately compare changes over time, as six questions were the same or similar throughout the *pre-*, *mid-*, *and post-research reflections*.

Analysis of Data

In order to answer my research question "What effects does the integration of Front Row, an adaptive software program, have on a teacher's ability to differentiate mathematics in a sixth grade classroom?" I collected data from several sources. The first data source was a *pre-research reflection*, which gave me initial information about the students' learning preferences as well as device and internet access from home. I kept a research *journal* where I recorded my daily observations and reflected on the instructional changes that I would make the following session. Each day, after using Front Row, the students completed a *daily student questionnaire*, with the intent of encouraging the students to reflect on their level of engagement and content practiced. *Front Row reports* were generated weekly showing student progress. A *mid-research reflection* asked some of the same questions as the *pre-research reflection,* while asking questions more specific questions about Front Row. Finally, the students completed a *post-research reflection*, which mirrored the *pre- and mid- research reflections* in order to gauge change over time.

There were three main themes that developed from this research. First, students were more engaged and motivated than ever before. Secondly, the students had increased achievement, especially in the area of filling previously existing gaps. The final theme that emerged was a growing frustration with the free, online, interactive, adaptive software program, Front Row.

In order to appropriately differentiate for the varying needs of my students, it was important for me to understand the students' preferences in regards to how they learned and practiced mathematics content. At the beginning, middle, and end of my research the students were asked how they preferred to learn a new idea or concept in mathematics. The students were encouraged to select all that applied to them. Over the course of the research, there was no change in the number of students who preferred whole class or small group instruction when compared with other methods of instruction. Although, new methods were introduced such as one-on-one instruction from the teacher, online videos to watch, and other methods increased in relationship to student preference (Figure 1). For the "other" methods section, students mentioned the use of online games, watching videos as a whole class, and teacher instruction with slideshow presentations as additional methods that they liked to use to learn a new idea or concept in mathematics (Figure 1). From this, I concluded that the students became more versatile in the ways that they learned content because they feel more successful with a variety of approaches.

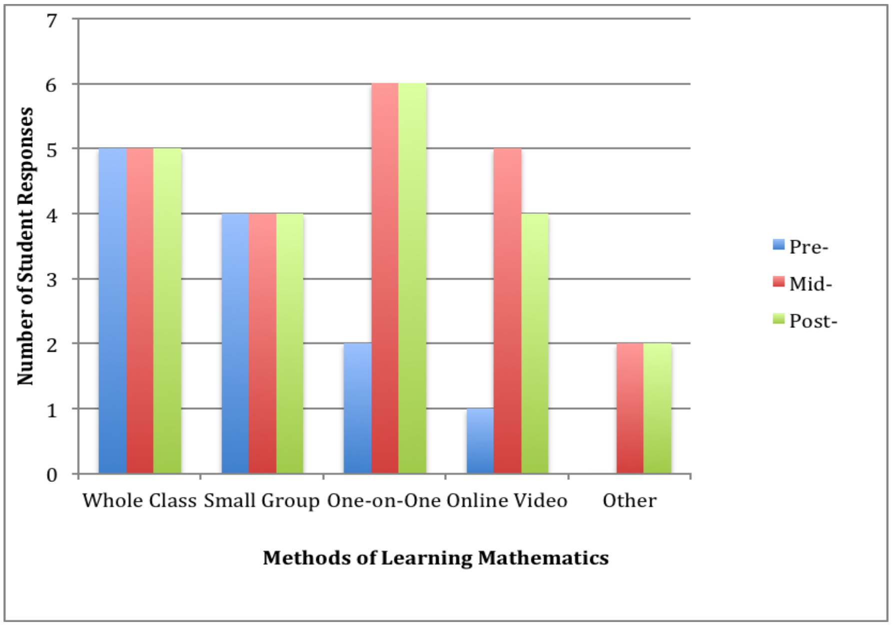

Figure 1. Students' preferences for learning a new idea or concept in mathematics. This figure demonstrates student responses in regards to the question posed during the *pre-, mid-, and post- research reflections*.

This data indicates that whole group instruction was consistently preferred by half of my students. The same five students found this method to be helpful throughout the research as indicated by their response on the *pre-, mid-, and post-research reflections*. It also tells me that 40% of my students found small group instruction helpful, although the students who preferred this method shifted slightly over the course of the research. Therefore, the total number of students did not change, but the individual students who preferred this method changed slightly. There was a limited amount of one-on-one interaction with the teacher or use of online videos prior to my research, hence the lower number of students who found it beneficial during the *pre-research reflection*. Upon using the adaptive program, Front Row and interacting with students on a more consistent individual basis, the number of students preferring one-on-one teacher interaction increased 200% from the *pre-research reflection* to the *mid-research reflection* and stayed that high through the *post-research reflection*. I believe that is because the students felt more comfortable asking questions one-on-one. During one of the *daily questionnaires*, Student 4 stated "I didn't get something so I asked a lot of questions." Meanwhile, Student 2 said, "When I asked for help I actually got what it meant." The use of online videos as a preferred method of learning increased 400% from the *pre-research* to the *mid-research reflection*. At first, the students thought it was neat to refer to a video before asking the teacher. From the *mid-research* to the *post-research reflection* the use of online videos as a preferred learning method showed a slight decrease. I believe the drop in students preferring the online videos on the *post-research reflection* might have been because as the student became more familiar with the program, he or she found the videos less helpful. The videos did not always closely relate to the type of problem that the students were working through. For example, if the student was working on a problem about subtracting fractions, the program suggested a video about adding fractions; the video was still about fractions, but with a different operation than the problem itself was focused on.

During the *pre-, mid-, and post-research reflections*, I asked students to note whether they paid less, more, or the same amount of attention in mathematics as in other subject areas (Figure 2). When considering the difference between the *pre-research and mid-research reflections*, there was a decrease in the number of students who said they paid less attention in mathematics than in other subject areas. On the *pre-research reflection,* 20% of my students said they paid less attention in mathematics than other subject areas. Figure 2 displays how in the *mid-* and *post-research reflections,* no students said they paid less attention in mathematics than in other subject areas

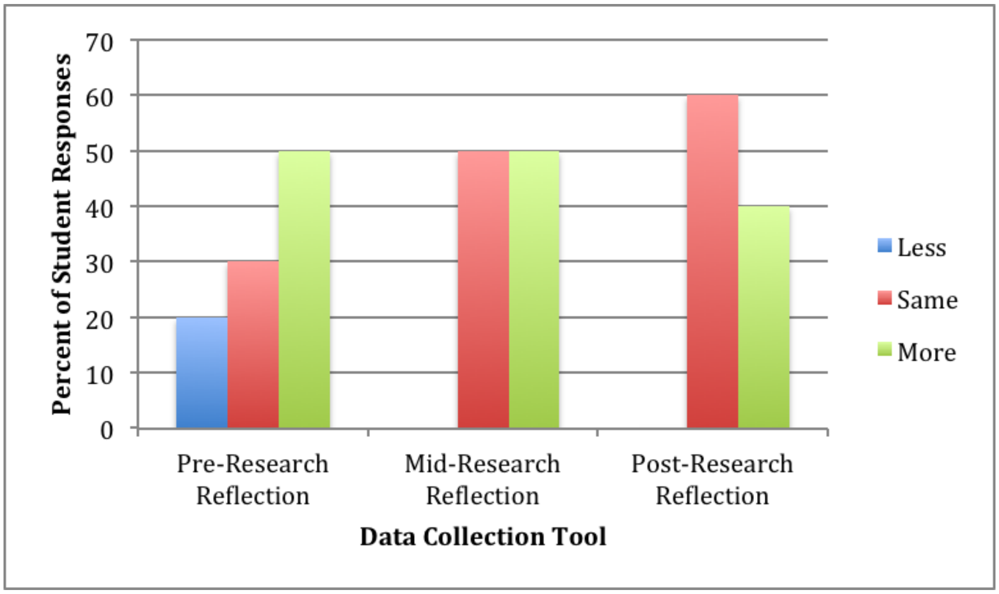

Figure 2 . Number of students and the degree of attention each stated they paid in mathematics as opposed to other subject areas. Student response with regard to whether he/she pays less, more, or the same amount of attention in mathematics class when compared with other subjects.

The biggest change occurred between the *pre- and mid- research reflections*, during which students became more noticeably engaged. Student 6 is an excellent example of this change. On the *pre-research reflection*, the student stated that he paid less attention in mathematics than in other subjects because “I don’t like math.” In the *mid-research reflection*, he stated that he pays more attention in mathematics than in other subjects because “math is my favorite subject.” Student 3 echoed this mentality because in the *pre-research reflection* she stated that she paid less attention in mathematics when compared to other subjects “because I don’t really like math cause I’m bad at that subject.” During the *mid-research reflection*, Student 3 stated that she pays more attention during mathematics “because I’m getting into Front Row and I’m starting to really like it.” The conclusion that I drew from this information was that the use of

Front Row created the biggest change in a positive attitude towards mathematics for some of the lowest students. Their participation and interaction with the adaptive program increased the students' self-efficacy. On the other hand, for many of the middle and higher-level students, there wasn't as drastic of a change in attitude or engagement as opposed to other classes as there was with the lower-achieving students.

Therefore, I consider this a positive connection to heightened engagement. When students assessed themselves about their level of on-task behavior on a Likert Scale each day after using Front Row, they consistently scored themselves at a level four or five, with five being the highest possible level of on-task behavior. This is consistent with my own observations during the research process. I believe this might be because the program was more interesting than a whole group lesson from the textbook. On one of the daily self-evaluations regarding engagement, Student 3 stated, "I stayed on task and kept gaining points." Student 9 stated that he was on-task because, "I wanted to learn a lot of things." Student 8 said, "I got a lot of coins, which means I worked hard." While using Front Row, coins were earned within the program as students answered questions correctly. These were recurring comments from a majority of the students at least once over the course of the research.

In addition to a sense of increased engagement was an increase in student motivation. The responses showed that the students were externally motivated to continue working through mathematics on Front Row because they were able to earn coins for correct answers. This program gave each student a pig that they could dress by purchasing items with the coins that they earned while practicing mathematics through the program. The students were also able to see the top five coin earners and would go home challenging their peers to get more coins than them. From my daily *journal*, it was noted on numerous occasions that students were leaving school challenging their friends to get more coins than them on Front Row and arrived to school in the morning talking about who earned the most coins from the night before. They were only asked to do Front Row at home for 15 minutes, and many of them were on for an hour or more. Student 8 even stated, “I worked hard and have over 1500 coins!” On another day, he stated, “I got more coins and almost got my piggy a new t-shirt!” These statements are evidence that students were empowered by the number of coins they were able to earn by correctly answering mathematics problems on Front Row.

In the daily reflections on the use of Front Row, the students were asked what they felt the most important concept was that they practiced that day. Student 2 stated, “the exponents and parentheses because I thought that it was pretty hard but when I learned about it, it was really easy.” When I initially analyzed the existing data to determine that there was a need for differentiation and intervention, I noticed some gaps existed between the levels of mathematics achievement between the students in my class (Figure 3).

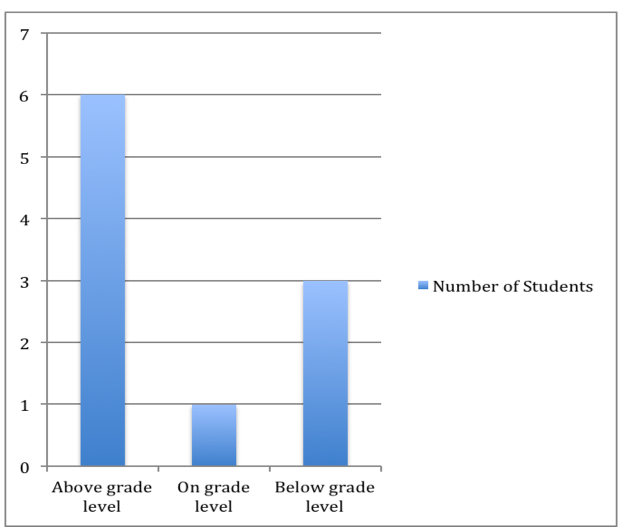

Figure 3. Baseline data from Fall 2014, compiled from the state standardized test. This figure illustrates the discrepancy of mathematics compentency for the sixth grade class.

One of the original goals of this study was to narrow the gap between students' mathematical achievement that were evident at the beginning of the Action Research. The line graph displayed as Figure 4 shows the grade level equivalency for the Common Core foundational domains. It shows the gaps in each area starting to close over the six-week course of my research. It is important to note that the Common Core foundational domains only go through fifth grade standards.

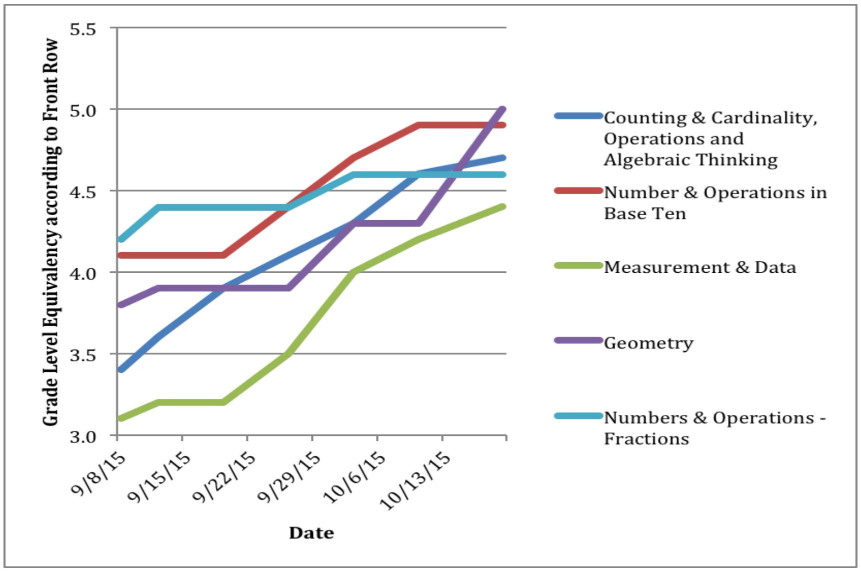

Figure 4. Foundational Domains-Class Data. This figure shows the class data indicating the level of growth within Common Core foundational domains. This graph shows how the gaps in foundational understanding narrowed over the course of the research.

I feel that the reason the students grew within the Numbers and Operations in Base Ten domain was due to the fact that on the days opposite using Front Row, there were related standards being addressed during a whole group instruction setting. The targeted instruction on a specific domain made the content fresh in the students' minds, which gave them enough confidence with the skills to be successful on Front Row. The Numbers and Operations – Fractions domain stayed fairly consistent. This slight growth might be due to the fact that nothing new was taught about fractions during this time. Rather, students were practicing and becoming stronger on fraction concepts they had already learned, without explicit instruction from the teacher. This is one more indicator as to how technology cannot replace the teacher, but enhance what the student is able to learn through a combination of online and face-to-face components. The reason that the Measurement and Data and Geometry showed such growth might be because it is covered in previous grades. Although taught to a degree in previous grades, the students have limited time with the content because it is usually towards the end of the textbook. Therefore, with additional, adapted exposure to practicing the respective standards, the students showed much more growth when compared to other domains. The domain that grew most consistently was Counting and Cardinality, Operations and Algebraic Thinking, which is likely due to the extra fast fact practice the students completed. Another possible explanation is that through the adaptive practice and interaction with the teacher, the students' understanding of number sense greatly improved.

The next theme that developed regarded an increased sense of personal achievement. As indicated in my *journal*, the students mentioned that they felt themselves getting smarter; they could feel themselves learning. These comments are supported by Table 1, in which the individual student growth is displayed.

Table 1
Average Percent and Grade Level Equivalency Growth

Student #	Percent Growth	Grade Level Equivalency Growth
Student 1	35.4%	1.7
Student 2	32.4%	1.1
Student 3	63.3%	1.9
Student 4	61.7%	2.9
Student 5	39.1%	1.8
Student 6	18.8%	0.6
Student 7	51.1%	2.3
Student 8	32.4%	1.2
Student 9	57.9%	2.2
Student 10	56.7%	1.7
Average	44.9%	1.74

Note. The average percent and grade level growth for each student as well as the class average.

As illustrated by Table 1, the students averaged approximately one and three-fourths of a year's growth. At first I felt there was a slight learning curve for using Front Row. This might have been because the chromebooks were new to our building, which took some time to learn how to use. Another reason for the initial learning curve was that the students were not used to online mathematics practice. When comparing my observations with the data, I would agree that the students made over a year's growth in what they were able to do independently.

When asked to reflect on whether or not they appropriately practiced the skills they were supposed to be working on each day, Student 4 mentioned, "yes because I did the problems the right way and asked questions when necessary." Student 1 stated, "yes, because the teacher assigns ones that fit the chapter we have in math." Student 7 echoed this statement by saying, "expressions and equations, it is what we are doing in math." When asked on a different day what the most important concept that he worked on that day was, Student 8 responded “order of operations because they were tough and they challenged me greatly.” Prior to Front Row and the daily reflection questions, I received very little feedback from students about how meaningful they felt the mathematics practice was each day. Some days the students felt they were less on task, as Student 3 mentioned, “Today I was getting distracted cause a lot of people were talking to me and showing their piggies to me.” On a different day, Student 3 also stated, “I didn’t know how to do half of the problems cause they were really hard.” I appreciated this honest feedback, both positive and negative, because it helped guide my instruction for the next day. For example, I then looked more deeply at the data from Student 3 to determine the areas she was having difficulty and was then able to work with her on filling some gaps in mathematical understanding. Based upon comments such as these, I reason that the students were excited and motivated to use the program for practice, but it cannot replace the teacher working with individuals or groups of students to clarify misconceptions or misunderstandings about the mathematical skills and concepts being studied.

The next line graph shows five of the six Common Core advanced domains (Figure 5). The Common Core advanced domains are designed for grades six through eight. Figure 5 illustrates the students were not focused on the advanced domains during the beginning part of the research and then midway through, started working on more complex skills after the gaps in foundational skills began to close. Only Student 4 and Student 7 worked on the sixth advanced domain, which focused on functions. They began working at an 8.1 grade level equivalency and increased to an 8.2 grade level equivalency. That data is not shown on the graph since it only involved two students. The largest growth can be seen in the Number System domain, which can be attributed to the fact that the textbook chapter we were addressing at the time also focused on standards from the same domain. When interpreting the graph below, it is important to note that not every student practiced each domain every day due to time constraints and instructional needs as determined by the teacher.

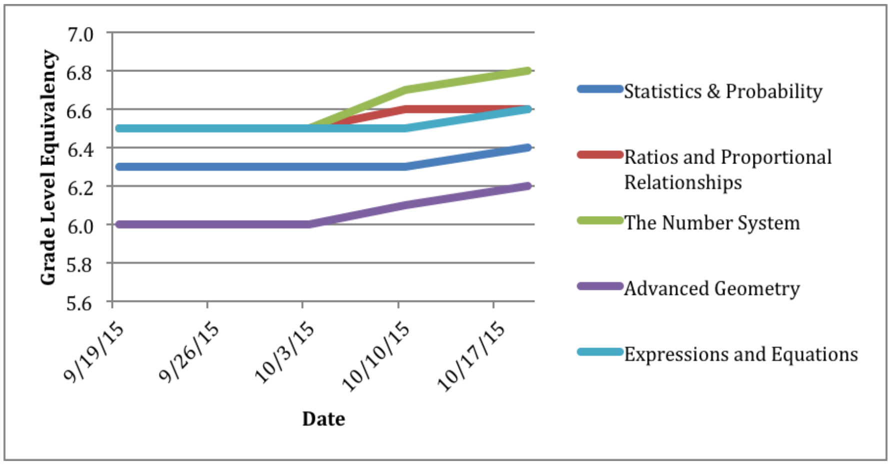

Figure 5. Advanced Domains-Class data. This figure shows class data of growth within the advanced domains according to Front Row. The sixth advanced domain was used by only two students, so has therefore been omitted from the graph.

The final theme that developed related to mounting frustrations with the online, adaptive program, Front Row. According to student responses on the *daily student questionnaire* as well as my *journal*, there was a growing frustration with the program. The students were frustrated that the program sometimes took away coins when they answered the problem correctly. Particularly towards the end of the research period, the program started to run slower than normal. I believe this was attributed to the fact that Front Row was implementing a lot of updates. Student 1 stated, “well, some of the answers are counted wrong when they are really right.” I can attest to the truth of this statement, as the students often called me over because they had checked their work and checked with friends before submitting their answer, and it was still marking it as wrong.

Therefore, they would call me over and I would confirm that they were correct with their chosen answers, and sometimes it would "take" their answer as correct and other times it would still say they were wrong. On another day, Student 4 identified that when she got a problem right it gave her 5 coins then when she got another one right it would take away 5 coins. She stated that after she answered a question it was very slow changing to the next question. Student 7 echoed this response and my daily *journal* confirms that other students mentioned experiencing the same problem. The students enjoyed using Front Row, but the frustrations that were caused due to the limitations of the program made it a somewhat unreliable choice for an adaptive program.

The culture of learning in my classroom greatly improved and I attribute much of that to this program and the integration of technology into the classroom. The majority of the students seem much more actively engaged in their learning. They made comments indicating how their attitudes have shifted from technology being used for gaming and social media, to technology as a learning tool, while still having fun. They truly enjoy competing against one another to earn more coins and they look forward to their "brain break" at the piggy store of the program where they can dress up their character using the coins they earned for correct answers. They are engaged and having fun, while not fully realizing how much they are learning and practicing their mathematical skills. As with the integration of any new strategy, there were aspects of the research that went well and others that could have been improved. The next section outlines the implications of this Action Research study while providing recommendations for future Action Research.

Action Plan

There were three main conclusions that I drew from the data of this Action Research. The first is that the students became more engaged and motivated than ever before because they wanted to compete against their peers. They also liked to see their grade level equivalency growth each week. Second, their achievement increased and students themselves noted and recognized that they were feeling themselves getting smarter and learning. Third, the excitement and achievement was coupled with a sense of frustration with the program as well.

The data of my action research study indicated that the students were motivated to do the Front Row program because they enjoyed earning coins, which allowed them to dress their "pig" within the program. Although at times, students distracted one another by wanting to share the character that they dressed within the program. This Action Research indicated an increased level of engagement and motivation over time based on student comments from my *journal* as well as the *research reflections* over time. Not all of the students reached grade level equivalency by the end of the five-week research. However, the reason they showed growth in the level of mathematics that they were able to do independently might be due to the adaptive nature of the program. It started them at a level where they could be successful and slowly increased the complexity through additional practice. The students in this study grew an average of 44.9%. Prior to the start of the action research study, only two students preferred one-on-one interaction with the teacher, where at the midpoint and end of the research, six students found one-on-one interaction with the teacher to be helpful when learning a new idea or concept in mathematics.

These results imply that students felt more comfortable working one-on-one with the teacher, thereby received more individualized assistance, which might have resulted in an overall higher level of independent achievement. The culture in my classroom is so much more interactive and personalized than it was before the study. It became more interactive because the way the study was designed built stronger relationships between the teacher and the students. Overall, students feel more comfortable approaching me and I have also noticed that they are more likely, than before my research, to try things and aren't as worried about taking risks or being wrong. Front Row provided an opportunity for my higher-level math students to progress forward as well. This was one of the biggest benefits of integrating the technology into the math classroom. I also don't fear cheating as much because I am constantly informed by the data and can quickly notice changes in scores to look into further. Students don't seem to feel the need to cheat either, because they are able to be successful in working towards the standards since it is adapted to their level. On the other hand, if this study were to be replicated, I would suggest finding a way to provide better security of student accounts because when this study was conducted, students could potentially log in with someone else's name followed by the same class code as their peers.

This research will impact my teaching in a variety of ways. I would like to try using another interactive, adaptive software program called ALEKS, which is a paid program. I feel as though I will prefer using ALEKS over Front Row for several reasons because it (1) is research-based (2) is Common Core aligned, (3) tracks the students' history and growth, and (4) tracks student mastery of the standards (ALEKS, 2016). I am not sure if I will be able to do it with all of my students since there is a cost associated with it, therefore I will have to inquire further as to whether or not this is a possibility. It will help me differentiate and track student learning within the respective Common Core standards that we are working on in our textbook. Using the ALEKS program, pending funding, will hopefully allow for increased depths of knowledge and understanding within the same standard at an appropriately adapted level for all students. Second, I will be more conscious of using data to inform my instruction and intervene where needed. An added benefit would be that I could maximize the rest of my time filling gaps in the understanding of content or skills with other students. This year I will continue to use Front Row with my students one to two times per week so that I can continue to use the data to inform my instruction. I will merge this with face-to-face whole group and small group instruction in order to reach the varied learning preferences that I discovered during this study. Students will have access to interactive, adaptive practice from both home and school where they can see examples being explained to them through videos. They can then make changes to their answers based on trial and error and receive immediate feedback from the program. They will be able to ask questions during small group and large group instruction as well. When working with smaller groups of students, I can also gear my responses to them in a more personalized manner by relating the discussion to their own lives. This is why I am going to balance the methods of face-to-face whole group, small group, and online components of teaching and learning in an effort to close existing gaps in understanding. This combination would also allow me to help my students grow in their knowledge and skills of mathematics with the ultimate goal of preparing them for future success. I will also use triangulated data to guide my instructional decisions.

Further research should be done to validate these findings on a larger scale. For example, it should be done with more students in bigger school districts. Researchers should consider whether or not the students are familiar with the type of device that the students will use during the course of the research. Additional research should build upon using interactive, adaptive software programs other than Front Row because there were some limitations with it, as a free program. Some examples of these limitations or issues included the program counting some questions wrong that were actually correct, thereby perhaps altering the results, although not substantially. Another issue that I experienced was that the videos offered, as assistance when a student didn't know how to do a problem, were not as closely aligned with the type of question that they were practicing, as desired. If doing further studies with the integration of Front Row, researchers might consider whether or not the paid version would eliminate some of the limitations that I experienced. Future researchers might also consider other interactive, adaptive software programs with which to replicate the study in order to compare the effects on student achievement. They should consider whether or not the program(s) are research-based and aligned with the Common Core State Standards before fully designing their study. Future research should focus on using technology as a tool, which provides teachers the data they need in order to maximize differentiated instruction in the classroom.

Extended time should also be considered. With only doing the research for five weeks, the online program was still somewhat of a novelty to the students. Therefore, extended time with using the program would show whether or not the positive benefits would be sustained. Extended time would also allow the teacher to consistently do the program three times per week, allowing designated time to analyze the data and make adjustments to instruction and meet with students for leveled, targeted instruction between online sessions. This would be for a situation such as mine, in which the adaptive program is being used to supplement textbook instruction and differentiated practice. If a future researcher would want to measure learning preferences, I would suggest having them rank their learning preferences as opposed to simply indicating all that apply.

Further research could evaluate whether this approach to teaching and learning should be implemented system-wide at grade levels K-8, or if there would be a point at which the benefits would start to diminish. Additionally, research could look to determine if there is a particular developmental age at which this style of differentiation would be most appropriate.

Extended research could also examine the effects of using a flipped classroom approach in which the students could do the adaptive program at home to practice while exploring more real-world applications and hands-on concepts during the school day. The students would still have to exhibit proficiency during classroom time, but would get the systematic practice at home and deeper problem solving and depths of knowledge of the same content during the classroom time.

The main contribution of this study shows an increase in student engagement as a result of technology integration. It demonstrates the importance of data-driven decision-making while better equipping the teacher to appropriately respond to student academic needs. This study contributes to the notion that varied instructional strategies and opportunities for adaptive practice can close gaps in students' conceptual understanding and skillset in mathematics.

References

Academic Benchmarks. (2015). [Interactive map displaying states that have adopted the Common Core State Standards]. *Common Core State Standards Adoption Map*. Retrieved from http://academicbenchmarks.com/common-core-state-adoption-map/

ALEKS Corporation. (2016). McGraw-Hill Global Education Holdings, LLC. Retrieved from https://www.aleks.com/

Anderson, K. M. (2007). Differentiating instruction to include all students. *Preventing School Failure, 51*(3), 49-54. Retrieved from http://search.proquest.com/docview/228568951?accountid=26879

Banitt, J., Theis, S., & Van Leeuwe, L. (2013). The effects of technology integration on student engagement. *Masters of Arts in Education Action Research Papers*. Paper 7. Retrieved from http://sophia.stkate.edu/maed/7

Bender, W. N. (2013). *Differentiating math instruction, K-8: Common core mathematics in the 21st century classroom.* Thousand Oaks, CA: Corwin.

Broyles, S. R. (2012). *A grounded theory approach to understanding educator perspectives on using data to inform instruction*(Order No. 3537905). Available from ProQuest Dissertations & Theses Global. (1328137659). Retrieved from http://search.proquest.com/docview/1328137659?accountid=26879

Davis, M. R. (2011). Moving beyond one-size-fits-all. *Education Week, 30*(25), 10, 11. Retrieved from http://search.proquest.com/docview/858787515?accountid=26879

Dempsey, K., & Kuhn, M. (2011). End the math wars: Increase your math students' procedural fluency and build greater conceptual understanding in virtual environments. *Learning & Leading with Technology*, *39*(3). Retrieved from http://go.galegroup.com.pearl.stkate.edu/ps/i.do?id=GALE%7CA273195089&v=2.1&u=clic_stkate&it=r&p=ITOF&sw=w&asid=2625195498a02c520e2e4e1da7884f6d

Foughty, Z., & Keller, J. (2011). Implementing digital math curricula. *Principal Leadership, 11*(5), 64-66. Retrieved from http://search.proquest.com/docview/821699418?accountid=26879

Front Row Education. (2015). Outcome report [Data file]. Retrieved from https://d116d2b4cs97oy.cloudfront.net/marketing-assets/OutcomesReport.pdf

Gardner, H. (2011). Frames of Mind : The Theory of Multiple Intelligences (3rd Edition). New York, NY, USA: Basic Books. Retrieved from http://www.ebrary.com

Kara-Soteriou, J. (2009). Using technology to differentiate instruction across grade levels. *New England Reading Association Journal*, *44*(2), 86-90. Retrieved from http://search.proquest.com/docview/206028586?accountid=26879

Kleber, J. (2015). Differentiation through blended learning. *Leadership, 44*(3), 20-24. Retrieved from http://search.proquest.com/docview/1645566280?accountid=26879

Lambert, E. E. W. (2014). *Effect of a laptop initiative on middle school mathematics achievement* (Order No. 3621892). Available from ProQuest Dissertations & Theses Global. (1548328670). Retrieved from http://search.proquest.com/docview/1548328670?accountid=26879

Pierce, R. L., & Adams, C. M. (2004). Tiered lessons: One way to differentiate mathematics instruction. *Gifted Child Today, 27*(2), 58-66. Retrieved from http://search.proquest.com/docview/203257737?accountid=26879

Preston, K., & Hunt, C. (2014). *The effects of heterogeneous and homogeneous grouping on student achievement in mathematics* (Order No. 3666938). Available from ProQuest Dissertations & Theses Global. (1641122085). Retrieved from http://search.proquest.com/docview/1641122085?accountid=26879

Siegle, D. (2014). Technology. *Gifted Child Today, 37*(1), 51-55. doi:10.1177/1076217513497579

Smith, G. E., Throne, S., & International Society for Technology in Education. (2007). *Differentiating instruction with technology in K-5 classrooms.* Eugene, OR: International Society for Technology in Education.

Appendix A

Student Pre-Research Reflection

Participation in this survey is voluntary, but highly encouraged. By completing this survey, you are giving your consent to participate in this study. Completing this survey is completely voluntary and you may quit at anytime. This survey will help me determine how comfortable you are using technology and digital tools. It will also help me better understand your feelings towards mathematics and technology. Please be honest. Your responses will not affect your grade. :)

What is your first name?

What is your last name?

If you had access to online mathematics games, would you be able to play them at home?

- ◯ Yes
- ◯ No

Which of the following technology would you be able to use at home to play mathematics games?
Check all that apply

- ☐ Computer
- ☐ iPad
- ☐ Kindle
- ☐ Chrome book
- ☐ iPod
- ☐ I don't have any technology at home available to play math games
- ☐ Other:

If you have technology at home and had mathematics games/homework to do, how often do you need to use the technology at the same time as others?

On a scale of 1 to 5, with 5 being the best, how comfortable are you with using technology?

	1	2	3	4	5	
Not very comfortable	◯	◯	◯	◯	◯	Very comfortable

In mathematics, if you could choose paper/pencil or on the computer/device, which would you prefer to do your homework on?
Note: This question is just asking about homework

- ◯ Paper/Pencil

- ○ Computer/Device

In mathematics, if you could choose paper/pencil or on the computer/device, which would you prefer to do your tests on?
Note: This question is just asking about testing

- ○ Paper/Pencil
- ○ Computer/Device

When learning a new idea/concept in math, how would you prefer to learn it?
Check all that apply

- ☐ Teacher explains it to the whole class
- ☐ Teacher explains it to you in a small group
- ☐ Teacher explains it to you individually
- ☐ You watch a video online
- ☐ Other:

Do you tend to pay more or less attention during math than in other subject areas?

- ☐ More
- ☐ Less
- ☐ I pay the same amount of attention in math as I do any other subject.

If you pay more or less attention in math than other subject areas, please explain why.
This will help me understand my research better. Please be honest.

What should Mrs. Morales know about your attitudes towards Math?
Is it too hard, too easy? Do you find a calculator helpful? Is it helpful to work in partners/groups?, etc.

What should Mrs. Morales know about your situation with Technology?
If you have one, do your parents/guardians let you use the computer or device for schoolwork? Do you have trouble remembering your passwords?, etc.

In general, how much time do you spend per night on mathematics homework?

- ○ less than 30 minutes
- ○ between 30 minutes and 1 hour
- ○ more than 1 hour

Appendix B
Action Research Journal of Mrs. Morales

Date:

What went well?

What didn't go well/could've gone better?

On a scale of 1-10, student engagement for students on devices today was a:

Notes about small group mini-lessons/interventions

What changes will I make based on today's results?

What did I learn from the reports I printed this week from Front Row?

Appendix C
Daily Student Questionnaire

Your responses will not affect your grade. They will just help me understand my research better.

1a. On a scale of 1 to 5, with 5 being the best, how would you rate yourself as being on-task?

1 2 3 4 5

1b. Why did you rate yourself that way? Please explain.

2a. On a scale of 1 to 5, with 5 being the best, do you feel that you appropriately practiced the skills you were supposed to be working on?

1 2 3 4 5

2b. Why did you rate yourself that way?

3. What was the most important concept you worked on today and why do you think that it is an important concept?

Appendix D
Report from Front Row
(Student identities have been protected)

I hope your students enjoyed using Front Row last week. Below are some highlights on student progress and performance for the past week.

Counting & Cardinality, Operations & Algebraic Thinking

- The average grade level is up to **4.1**, up from **3.9** last week, and up from **3.4** at the beginning.
- 4 students (33%) worked on the Counting & Cardinality, Operations & Algebraic Thinking domain last week, and they used the app for an average of 6.0 sessions. They grew an average of 0.5 grade levels.
- Last week, your students answered 149 questions. They have answered 1087 questions in Counting & Cardinality, Operations & Algebraic Thinking so far.

Student Level Data

- improved the most last week, 1.1 grade levels on average
- Below average students who didn't improve last week:
- Above average students who didn't improve last week:
- The highest performing students in the Counting & Cardinality, Operations & Algebraic Thinking domain are We recommend using them as student-tutors.

Number & Operations in Base Ten

- Students in your class are at a 4.4 grade level on average - which means they are nearly done with all the material in this domain!
- The average grade level is up to **4.4**, up from **4.1** last week, and up from **4.1** at the beginning.
- 12 students (100%) worked on the Number & Operations in Base Ten domain last week, and they used the app for an average of 5.2 sessions. They grew an average of 0.3 grade levels.
- Last week, your students answered 388 questions. They have answered 669 questions in Number & Operations in Base Ten so far.

Student Level Data

- improved the most last week, 1.2 grade levels on average
- Below average students who didn't improve last week:
- Above average students who didn't improve last week:
- The highest performing students in the Number & Operations in Base Ten domain are We recommend using them as student-tutors.

Appendix E

Student Mid-Research Reflection

This survey will help me determine how comfortable you are using technology and digital tools. It will also help me better understand your feelings towards mathematics and technology. Please be honest. Your responses will not affect your grade. :)

What is your first name?

What is your last name?

Are you able to access Front Row at home?

- ○ Yes
- ○ No

On a scale of 1 to 5, with 5 being the best, how comfortable are you with using technology?

	1	2	3	4	5	
Not very comfortable	○	○	○	○	○	Very comfortable

Do you feel that you get meaningful practice out of using Front Row?
Please explain

What do you like about Front Row?
Please explain

What are some things about Front Row that you don't like?
Please explain

When learning a new idea/concept in mathematics, how would you prefer to learn it?
Check all that apply

- ☐ Mrs. Morales explains it to the whole class
- ☐ Mrs. Morales explains it to you in a small group
- ☐ Mrs. Morales explains it to you individually
- ☐ You watch a video online
- ☐ Other:

As of today, do you tend to pay more or less attention during mathematics than in other subject areas?

- ☐ More
- ☐ Less
- ☐ I pay the same amount of attention in math as I do any other subject.

If you pay more or less attention in mathematics than other subject areas, please explain why.
This will help me understand my research better. Please be honest.

What should Mrs. Morales know about your attitudes towards mathematics?
Is it getting easier or harder? Do you find a calculator helpful? Is it helpful to work in partners or groups?, etc.

On average, how much time do you spend per night on mathematics homework?

- ○ less than 30 minutes
- ○ between 30 minutes and 1 hour
- ○ more than 1 hour

Appendix F

Student Post-Research Reflection

This survey will help me determine how comfortable you are using technology and digital tools. It will also help me better understand your feelings towards mathematics and technology. Please be honest. Your responses will not affect your grade. :)

What is your first name?

What is your last name?

Were you able to play online mathematics games at home?

- ○ Yes
- ○ No

On a scale of 1 to 5, with 5 being the best, how comfortable are you with using technology?

	1	2	3	4	5	
Not very comfortable	○	○	○	○	○	Very comfortable

In mathematics, if you could choose paper/pencil or on the computer/device, which would you prefer to do your homework on?
Note: This question is just asking about homework

- ○ Paper/Pencil
- ○ Computer/Device

In mathematics, if you could choose paper/pencil or on the computer/device, which would you prefer to do your tests on?
Note: This question is just asking about tests

- ○ Paper/Pencil
- ○ Computer/Device

When learning a new idea/concept in mathematics, how would you prefer to learn it?
Check all that apply

- ☐ Mrs. Morales explains it to the whole class
- ☐ Mrs. Morales explains it to you in a small group
- ☐ Mrs. Morales explains it to you individually
- ☐ You watch a video online
- ☐ Other:

Do you tend to pay more or less attention during mathematics than in other subject areas?

- ☐ More
- ☐ Less
- ☐ I pay the same amount of attention in math as I do any other subject.

If you pay more or less attention in mathematics than other subject areas, please explain why.
This will help me understand my research better. Please be honest.

How have your attitudes about mathematics changed since using Front Row?
Is math easier, harder, etc. ?

What were your favorite things about Front Row?

What didn't you like about Front Row?

On average, how much time do you spend per night on mathematics homework?

- ○ less than 30 minutes
- ○ between 30 minutes and 1 hour
- ○ more than 1 hour