

Student Responses to Math Instruction: A Comparison Between Human and Electronic Delivery
in the Elementary Classroom

A Thesis Presented to
The Faculty of the Education Program
California State University Channel Islands

In (Partial) Fulfillment
of the Requirements for the Degree
Masters of Arts

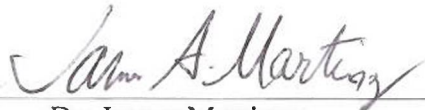
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May 2015

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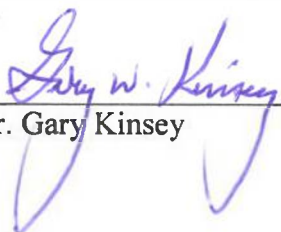
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Student Responses to Math Instruction: A Comparison Between
Human and Electronic Delivery in the Elementary Classroom
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Chapter 1

Statement of Problem

Los Angeles Unified School District (LAUSD) recently spent over \$1 billion to put iPads in the hands of all 600,000+ of its students. This program quickly came under fire when many students were able to bypass the school district's content filters and have unfettered access to the Internet. There were also issues of iPads being reported as missing (causing the district to repurchase them) and the fact that the installed curriculum was scheduled to expire after three years and would require renewal at a cost of \$50 - \$100 per iPad device. A 2013 Los Angeles Times article by Howard Blume quoted LAUSD Superintendent John Deasy defending his program by saying, "[Technology] is no longer a maybe or a luxury. It is a fundamental right of students." Critics, however, pointed out the spiraling cost of a computer device that is doomed to become outdated quickly, and there were other concerns about how the technology would be used in the classroom. The iPad program in LAUSD continues to be a divisive issue, as evidenced by the recent dismissal of Superintendent Deasy and the decision to seek a multi-million dollar refund from curriculum software company. As my school district moved to implement a 1:1 iPad structure for students in fourth and fifth grade, I felt that similar concerns about the academic rewards of this massive expenditure should be addressed. The money that was spent on iPads by the district (which is over 85% English Language Learners [ELLs]), could have been used to hire intervention teachers, hire more classroom teachers (to lower the teacher:student ratio), provide staff training, or hire specialists (Resource Specialist Program teachers for special education classes, counselors, etc.). Would iPads prove as effective as these other possibilities? Was this program a godsend, or a fool's errand?

Purpose of the Study

The purpose of this study was twofold: 1) to look at how the level of student engagement changed (whether for good or ill) when assignments were completed using the Front Row adaptive math software application on an iPad device, and 2) to evaluate if the Front Row adaptive math software application provided a more individualized and engaging math experience for students as compared to the traditional “lecture” method of math instruction.

Significance

This problem interested me because I teach in a 1:1 iPad environment, and I wish to “squeeze every beneficial drop” from the iPads in my room. If technology and Common Core State Standards (CCSS) instructional practices are the future, districts need to make sure that all of the money they are spending on technology will meet the rigorous demands of these new standards and do an exemplary job of preparing their students for the world they will be expected to lead.

There have been many 1:1 technology programs over the past few decades (i.e. computers, iPods, laptops, iPads), so one might assume that a consensus had been reached as to their usefulness, the optimum methods of delivering technology-based instruction, and the populations for which they were most beneficial. However, results of these types of initiatives have thus far been mixed. Lemke & Martin (2004) found that educators in Indiana and Michigan noted gains in student engagement, attendance, academic achievement, and cross-disciplinary knowledge, but research by Norris, Hossain, & Soloway (2011) found that there are schools that have canceled their programs because of a lack of evidence of improvement. Part of the concern with 1:1 schools may be that there doesn't seem to be one common “result” of the initiative. The discrepancy in results, according to Bebell & O'Dweyer (2010), may be due to the fact that the term

“1:1” simply refers to the access students have to technology, and says nothing about pedagogical changes, learning outcomes, or other related educational practices. It is hoped that this action research project can shed some more light onto the topic of iPads and technology use in education, and provide at least a small window on the relative usefulness of such costly initiatives.

Setting

The setting for this proposal was at my home school, Garden Variety School (The name of the school, and the names of any participants in the study, have been changed for reasons of confidentiality). It is located in the Plainview School District in Seaside City, CA and has a population of over 700 students. The student body is largely Hispanic (89%) and is made up of over 85% English Language Learners. Garden Variety School is a rural school in an area of high poverty, and all the students are eligible for free or reduced-price lunch.

Definitions of Terms

Academic Performance Index: a measure of the academic performance and progress of individual schools in California under the Public Schools Accountability Act passed by the California legislature in 1999.

Annual Yearly Progress: the measure by which schools, districts, and states are held accountable for student performance under Title I of the No Child Left Behind Act of 2001 (NCLB).

Direct Instruction: this term refers to class time spent where students are listening to the teacher discuss or explain a new topic. This also includes students' time spent taking notes on said topic.

EO (English Only): this term refers to a description of the curriculum taught to students, in this case describing the fact that all subjects are taught in English.

ELLs (English Language Learners): a student whose home language is not English and who is not fluent in English. For the context of this study, the students will be ones who have either transitioned or been exposed to EO instruction for their entire school career.

E-Reader: a portable electronic device used for reading books and other text materials that are in digital form.

1:1: This term describes a classroom environment where there is one iPad or compatible tablet device for every one student in the room.

Smart Phone: a cellular phone that is able to perform many of the functions of a computer, typically having a relatively large screen and an operating system capable of running general-purpose applications.

Technology: any electronic device that allows the user to interact with curriculum, content, and knowledge.

Transition: This term refers to the time when an ELL is redesignated as Fluent English Proficient and moved into an English-only (EO) setting.

Low Socioeconomic Status (SES): The economic and sociological condition whereby a person's or family's economic and social position in relation to others is lower than the median, when based on income, education, and/or occupation.

Research Questions

1. How does the level of student engagement change when assignments are completed using the Front Row adaptive math software application on an iPad device?
2. Can the Front Row adaptive math software application provide a more individualized and engaging math experience for students as compared to the traditional "lecture" method of math instruction?

Methodology

This project was designed to measure levels of students' thoughts on engagement, lesson difficulty, preference of delivery method, and related topics. To that end, informal interviews were conducted with students to gauge their thoughts on the matter after providing the appropriate curricular content to them during school time.

Limitations

The conclusions drawn from this project would be restricted to observing results as they apply to upper-elementary classrooms in a rural, low SES, predominantly ELL school. Age was certainly a factor (as a kindergarten student might have different resources in and responses to tech use in education), as was affluence. Upper and middle-class children have home-related factors that can account for improvements in school, such as highly educated parents, level and frequency of discourse, paid tutors, and the availability of academic resources at home. ELL children in high-poverty areas are much less likely to benefit from these factors.

Chapter 2

Literature Review

While there was a great deal of available literature about the impact of 1:1 iPad programs on schools, not much of that was focused on the impact of these devices on English Language Learners in upper elementary (fourth and fifth grades). However, the use of personal computing devices such as iPads are just the latest manifestation of a phenomenon that has been with educators for more than four decades - that of the personal educational technology device. In his history of instructional design and technology, Reiser (2001) reminded readers that the idea of technology in the classroom goes all the way back to the 1970s, when personal computers became popular because they were inexpensive, compact, and multi-functional. As Internet access increased in the 1990s and 2000's, schools began adopting 1:1 laptop programs in an effort to capitalize on the perceived benefits of these machines. However, results have been mixed. Lemke & Martin (2004) found that educators in Indiana and Michigan noted gains in student engagement, attendance, academic achievement, and cross-disciplinary knowledge, but research by Norris, Hossain, & Soloway (2011) found that there are schools that have canceled their programs because of a lack of evidence of improvement. Part of the concern with 1:1 schools may be that there doesn't seem to be one common "result" of the initiative. The discrepancy in results, according to Bebell & O'Dwyer (2010), may be due to the fact that the term "1:1" simply refers to access students have to technology, and says nothing about pedagogical changes, learning outcomes, or other educational practices.

In the core content areas, students in 1:1 programs had significantly higher test scores and grades for writing, English-language arts, and mathematics than students in non-1:1 programs. Silvernail & Gritter (2007) found that a great majority of students indicated that the laptops

helped facilitate their learning, that they did a greater quantity of work, and that that work was of a higher quality than normal. A study by Dunleavy & Heineck (2008) found that middle school students in a 1:1 program saw a significant increase in their science achievement when compared with their non-laptop peers. Shapley et al. (2006) indicated that students' use of their laptop at home was the strongest predictor of improved reading and math state achievement scores. Then again, when studies were completed using the Texas Assessment of Knowledge and Skills (TAKS), Shapley et al., (2009) noted that (over a 3-year-period) language arts and math scores for students in a 1:1 program did not show any statistically significant gains over their non-technologically immersed peers.

So, while there seemed to be some evidence that using laptops in a 1:1 setting could have a positive effect, there was also some contradictory data that again spoke to the newness of these areas of research. In order to reach a better consensus, studies were examined which involved other pieces of technology, such as smart phones and iPods. In a recent study of Singaporean third graders, Norris, Hossain, & Soloway (2011) reported that (among six mixed-ability classes in the third grade) at a particular school, the class that used smartphones for 30-60 minutes per day over the course of a 21-day unit of study performed significantly better than the five classes that did not use smart phones. Norris, Hossain, & Soloway (2011) also related anecdotal stories, as related in the findings of schools all over the U.S., where smartphones and related technologies have had positive impacts upon students' motivation, opportunities, and academic outcomes.

The same gains can be seen by schools, classes, and students who make use of iPods in their education. A study of 240 fourth grade English Language Learners in a science setting conducted by Billings & Mathison (2012) concluded that ELLs with access to iPods performed sig-

nificantly better than their counterparts who used either whole-class DVDs or who received no extra technology component. According to the students, the iPods supported their learning by introducing new material, introducing and reviewing daily academic vocabulary, and helping them anticipate behavioral and procedural expectations of hands-on activities. Teachers also reported an increase in the motivation and engagement of students in the iPod group, as noted in the findings of Billings & Mathison (2012). The iPod, as pointed out by Blaisdell (2006) had two main functions that made it a useful educational tool: 1) playback (of speeches, podcasts, slide shows, videos, etc.), and 2) audio content capturing (recording speeches, interviews, oral reports, etc. that could later be uploaded to computers).

Released in 2011, iPads very quickly became a ubiquitous sight on many elementary school campuses. While there have not yet been any in-depth studies to see how effective these tools are in a 1:1 setting as of this writing, there were many studies showing the positive benefits of iPads as related to specific topics, such as: 1) visual/practical support, 2) writing/drawing apps, 3) fluency/word work apps, and 4) collaboration/motivation (Allsopp, Kyger, & Lovin, 2007; Bennett, 2012; Blow & McConnell, 2012; Carr, 2012; Clark & Ernst, 2009; Demski, 2011; Ensor, 2012; Huizenga, Admiral, Akkerman, & Dam, 2009; Hutchison, Beschorner, & Schmidt-Crawford, 2012; Larson, 2010; Plowman & Stephen, 2003; Shane, 2012; Shroff & Vogel, 2009).

iPads also key into several aspects of Self Determination Theory, as explained by Shroff & Vogel (2009). This theory states that individuals have a psychological need to feel competent, self-determined, and related to work they complete. Teachers must address these needs if motivation is to remain high. When students are motivated, they are also eager to learn, and such feelings are easily maintained within a technology-supported learning environment. Individual social experiences also contribute to feeling interpersonally connected, and when students feel this

sense of connectivity and a relationship between themselves and the activities they are being asked to do, student motivation is increased.

Visual/Practical Support

The iPad offers a wealth of software applications (“apps”) that provide learners (especially ELLs) with much-needed visual support (Demski, 2011; Hutchison, Beschoner, & Schmidt-Crawford, 2012; Larson, 2010). Demski (2011) pointed out many of these in his findings. The Dictionary™ app provided students not only with the definition of a particular word, but also spoke it aloud, which allowed ELLs to improve both their reading and listening skills. Similarly, the Kindle™ app quickly became an essential tool for non-native speakers of English. The app provided instant definitions for students who clicked on unfamiliar words, and it also provided options for students to search for the word in Google or Wikipedia (which search results could themselves then be translated into the student’s native language). Demski (2011) found that this instant interactivity inspired students to become more self-guided in their learning and allowed teachers to present more challenging reading material. Demski (2011) also concluded that videos and online presentations about topics (such as volcanoes) provided ELL students with visuals of unfamiliar content that had the ability to markedly increase their understanding of challenging academic content.

The iPad also allowed students to access stories in ways that they could not with traditional texts (such as books and magazines). E-Readers possessed an advantage over traditional printed texts in that students were able to physically interact with and manipulate texts to meet their needs and interests. Larson (2010) found that these features made the reading experience more individualized, interactive, and engaging. The Popplet™ app allowed students to create visual diagrams of stories with any organizational pattern they wished, include images as well as

type-written words, and create a variety of different end products that would have been severely limited had they been presented with a prefabricated worksheet instead. In addition, Hutchison, Beschorner, & Schmidt-Crawford (2012) found that students were able to use the iBooks app to record digital notes, navigate the features of a digital text, and leave “virtual sticky notes” in the book for future readers, which facilitated conversations among classmates.

Writing/Drawing Apps

The idea of visual support to develop student writing skills was a common theme in the research that was investigated for this study. Demski (2011) pointed to many teachers that crowded about students who wrote autobiographies on the Keynote app and uploaded them to the school’s iBooks library. Now their stories were “sitting right on the iBooks shelf next to classics like *The Outsiders* or *The Raven*” (Writing and Creating section, para. 1) and creating a culture of readers and writers. “...they know that their work is going to be published and that other students are going to read their work,” stated one reading specialist. “I’ve noticed a change in attitude. They take it more seriously. They put more thought into what they’re writing” (Writing and Creating section, para. 2). Also, according to one social science teacher, creating projects on the iPad allowed students to simultaneously access all four language domains (listening, speaking, reading, and writing) (Demski 2011).

In my experience, teachers could also use the iPads as a way to differentiate instruction, promote collaboration, and increase student ownership of learning outcomes. Students could, for example, use the Educreations™ app to make video presentations about topics of their own choosing. In my opinion, this small group learning is critical because it increases students’ self-reliance, and teaches them to lean on their peers to help them solve problems, answer questions, and share discoveries (rather than focusing all of that energy on the teacher). This echoes the re-

sults of research by Ensor (2012), who found that these types of activities allowed students to become not only consumers of content, but creators of it as well.

Fluency/Word Work Apps

I had often experienced that content creation, however, sometimes needed to take a “back seat” when students were struggling with prerequisite skills. In instances like these, the iPad could be put to use in a rehabilitative manner to help students “fill the holes” in their learning and get caught up with their peers.

ELL students could record their voices and monitor their own fluency at home. Desmki (2011) found that the inclusion of dictionaries, translators, and other language-based tools (in a package the size of a traditional notebook) allowed ELL students easy and constant access to vital linguistic resources. Similarly, Ensor (2012) found that apps like iDiary or Read Me Stories allowed students to practice word work, fluency, vocabulary, and writing skills all at the same time. For students who might not have any language models at home, I found that the iPad served as a way for them to get continued access to the English language in a way that was structured, prescriptive, and non-threatening.

Collaboration/Motivation

iPads have also been shown to be beneficial to students in ways that standardized tests could not measure (Blow & McConnell, 2012; Carr, 2012; Ensor, 2012). As pointed out by Blow and McConnell (2012), the ease and varied methods of presentation allowed ELL students to practice their language skills in a safe environment and share what they learned with others. These benefits were not limited solely to the area of language arts. Carr (2012) found that mathematics apps could also foster rich discussions, especially when students took the time to discuss solving strategies with their peers and expand their conceptual understanding of math. This re-

peated what Ensor (2012) found, namely that when presentation apps were brought into the mix, students were given an opportunity to show understanding in non-traditional ways. They gave students an avenue to build up their confidence and share ideas with their peers in an informal setting.

Perhaps more so than in any other area, iPads proved invaluable as a tool to motivate and engage students in a variety of ways and across content areas. Like Carr, research by Clark & Ernst (2009) and Huizenga, Admiral, Akkerman, & Dam, (2009) showed that math games could be used to engage, motivate, and drive student learning. Allsopp, Kyger, & Lovin (2007) went further, noting that students using math games also had multiple opportunities for real-world content application followed by positive encouragement or corrective feedback.

As previously mentioned in the section on writing/drawing apps, research by Demski (2011) showed that kids felt more motivated when the books and presentations they created could be uploaded to the iBooks app and sit alongside recognized and beloved classics. Furthermore, drawing on testimonial used in the research of Shane (2012), "the apps offer an easy way to do research, solve problems quickly and motivate students," according to one science teacher. "You really get away from a lot of the photocopying and the pen and paper. This kind of teaching definitely keeps (students) engaged" (Standard teen equipment section, para. 8).

iPads also provided avenues to meet the learning needs of students with different dominant modalities. Bennett (2012) pointed out that, when used as personal whiteboards, they could easily meet the needs of kinesthetic learners because they allowed for the manipulation of content. Bennett further stated that they also cut down on the disruptions that physical whiteboards often caused when students called their answers out in chorus.

The motivational benefits of using the iPad's e-reader function has been mentioned in previous sections, as was research by Hutchison, Beschorner, & Schmidt-Crawford (2012) which acknowledged that assignments given on the iPad tended to be less rigid and restraining than traditional worksheets. Finally, Plowman & Stephen (2003) posited that the development of newer, more interactive touchable interfaces might be more suitable for children, because they allowed for physical manipulation that encouraged curiosity, creativity, self-expression, and discovery.

Conclusions

As of this writing, the literature was encouraging but very incomplete. There was research to support the hypothesis that iPads allowed students to engage with language and written texts in ways traditional texts could not. Also, as mentioned above, iPads had been proven to motivate and engage students in a variety of ways and across content areas and meet the learning needs of students with different dominant modalities. Further studies are needed to determine the precise extent of beneficial results (if any such quantifiable findings existed at all), especially in my chosen area of math.

It is hoped that this study will serve as a worthwhile addition to previously published literature. Especially in light of the mixed results garnered by 1:1 laptop programs, I feel that it is imperative that educators who find themselves teaching in 1:1 iPad schools have access to and are able to utilize the findings of all relevant studies to make sure that their programs are as successful as possible.

Chapter 3

Methodology

Setting of the Study

Garden Variety School was a Title I School with a population of over 700 students. It was 89% Hispanic, 85+% ELL, and was a neighborhood school situated in an area of high poverty and with a higher-than-average incidence of multi-family residences. It was a Program Improvement School, which meant that it was a Title I School that had failed to make Annual Yearly Progress (AYP) for two consecutive years in the same content area school-wide, for any numerically significant subgroup, or on the same indicator (Academic Performance Index [API]) school-wide. It was one of three K-5 elementary schools in the Plainview School District, and was in the first year of a 1:1 iPad program for fourth and fifth grade students. The K-3 classes had, for the past 2 years, been operating on a system where each class was in possession of a set of six iPads.

Participants

The participants of this study were my own 5th Grade students (potential participant pool = approximately 30 students). They were 67% Hispanic, 23% Filipino, 7% Caucasian, and 3% Vietnamese. More than 70% were ELLs, all received free and reduced-price breakfast and lunch from their school cafeteria, and they lived in a rural community that had a high degree of poverty and a higher-than-average incidence of multi-family residences.

Permission slips were distributed to the parents of all 30 students, and all 30 granted permission. Students were then asked for permission to enroll them in the study, and 27 out of 30 (90%) granted it. A coin was flipped to determine which group would be the experimental group

(heads), and which group would be the control group (tails). Since the coin came up heads, Group #1 was the experimental group, and Group #2 was the control group. Six students (five plus an alternate) were selected for each the experimental and the control group.

Since I wanted to interview students on the same day that the research was conducted, I decided to interview one group of students during lunchtime and the other group after school. Since eight of the 27 consenting students participated in the Boys' and Girls' Club program which took place on Plainview's campus after school hours, those eight were put into a pile from which the six for the experimental group were pulled. After an impartial third party randomly shuffled their papers, he called out the first six names he saw. Those six were assigned to the experimental iPad group. The two remaining students were then returned to the second pile (which contained the consent forms for the rest of the students). From that pile of 19, the impartial third party shuffled and pulled out six more papers. Those six were assigned to the direct instruction control group.

Research Design

This project was designed to measure levels of student engagement and student thoughts on an academic task in the area of math, both with and without the use of the Front Row software application. To that end, students were interviewed both in the control group (those who received direct instruction) and in the experimental group (those who engaged with the topic via the Front Row iPad app). This was a comparative design study that looked at an assignment given with the aid of technology versus that same assignment given without that aid, to compare the level of variables such as engagement, perceived performance, and satisfaction.

The assignment was to practice multiplying fractions, which was a new concept that would be addressed again later in the year with the whole class. Students in the control group

received direct instruction, took notes on the algorithm, and solved a few sample problems with pencil and paper. Students in the experimental group solved 10 sample problems on their iPad using the Front Row app without receiving front-loading of any kind. The only assistance they received was in the form of instructional, step-by-step videos that were activated by the app when a student missed a problem.

Since multiplication of fractions was not a concept that the students had studied yet, it was highly likely that they would utilize the “help” function at least one time during the course of the assignment. Similarly, during the pencil/paper task completed by the control group, helpful guidance was provided prior to the start of the task, and was available upon request during completion of the task.

After both groups had completed their task, students were interviewed to determine (among other things) the benefits and deficits of each form of instruction, which form of instruction they preferred, and which form of instruction they felt allowed them to grow and progress the most as individual learners.

Nature of Data Collection

Students were organized into three groups of 10: 1) the experimental iPad group, 2) the direct instruction control group, and 3) the non-participant group. Math rotations had been used for a month prior to the data collection date, so the math class on the day of data collection was structured in the same way. Thus, three groups of similar size were constructed. Both the experimental and the control group were composed of 10 students (the five participants plus the alternate plus four other non-involved students). The non-participant group was also composed of 10 students (the three students who did not grant their consent plus seven other non-involved stu-

dents). That way, math class would have the same visual appearance as the students were used to, and it would not appear as if anything special were occurring on the day of data collection.

It was determined that Friday would be the best day to collect data. Fridays were unique during the school week in that the students went home right after lunch. They returned to the classroom for 10 minutes to write down their homework, plug their iPads back into their charging stations, clean up their desks and the floor, and carry their materials out to their backpacks. Usually, students had 70 minutes after lunch, during which they could work, talk, and interact with one another. Conducting the research on a Friday (when the students would not have such time) allowed the purity of the interview results to be preserved, while avoiding the need to create an artificial construct to achieve that result. Like with the creation of the three math groups, the pre-existing nature of the students' school day was used to help facilitate collection of the data.

Data was collected during the course of the students' usual math time (10:30am - 12:00pm). The direct instruction control group was then invited to eat lunch with me in the classroom so that they could have 40 minutes for their interview. That way, students could not only answer my questions, but take part in a true back-and-forth discussion that would hopefully provide a richer window on their feelings about the task and their performance on it. Having the interview during lunch also allowed those students to enjoy a meal while they talked in a relaxed, informal manner about the task that they just completed. Likewise, interviewing the experimental iPad group after school took advantage of a natural school occurrence (having those students stay together after school). Those students were also given a snack at the beginning of their after-school program, which allowed them to enjoy the same informal "chatting over a meal" atmosphere that the direct instruction control group had.

Procedures for Human Subject Protection. Authorization was secured from the Institutional Review Board (IRB) to conduct this study involving human subjects before data collection began, and followed IRB procedures to ensure their protection.

Qualitative Data Sources. Qualitative data was gathered through the use of informal student interviews, which allowed for both specific and open-ended responses.

Reliability and Validation. There are a number of different methods of validating a particular study, and a number of different lenses through which data can be examined. Since this study is concerned with the student perception of math instruction as delivered by both human teachers and electronic, adaptive iPad apps, I felt it best to focus on the lens of study participants. After examining what are, according to Creswell (2000), the three most common methods of validation as relates to this lens (member checking, prolonged engagement in the field, and collaboration), I decided to do member checking. This method was chosen for several reasons. First, I could not stay with the participants for a prolonged period of time because they were only in my classroom for one school year. Furthermore, I felt that collaboration was not the ideal route to take because I did not feel that the students were cognitively prepared to fulfill the roles required by it (namely, that of assisting with data collection and analysis and writing the narrative account). Member checking, then, seemed his best option for two main reasons: 1) according to Lincoln and Guba (1985), member checking is “the most crucial technique for establishing credibility” (p.314) in a study, and 2) it would allow me the chance to revisit the concept with some students and go over my interpretations with them. I was confident that my students would be cognitively able to carry out that task. Because students’ quotes were, in many cases, used verbatim, I did not feel the need to member check with all of them. However, in the three cases where I took a student’s direct quote and interpreted it to fit the narrative of my themes, I went back and member checked

with those students to make sure that my interpretation was a correct reading of what they had stated. In all three cases, the students affirmed that that I had interpreted their comments in the way they had intended.

Schedule

I utilized the following timeline to conduct my research.

Research Proposal	May, 2014
Consultation with Adviser	May - September, 2014
IRB application	September, 2014
Data Collection	October - November, 2014
Analysis	November - December, 2014
Report/Thesis	January - April, 2015

Chapter 4

Findings and Analysis

After Plainview School District adopted a 1:1 iPad program for upper elementary (fourth and fifth grade) students, questions arose as to whether the iPads could provide a compatible math experience when compared to traditional instruction. Namely, how did the level of student engagement in classroom activities change when activities were completed using an iPad, and could math apps (such as Front Row) provide a more individualized and engaging math experience for students as compared to the traditional “lecture” method of math instruction? A literature review of the history of personal educational technology devices in the classroom from the 1970s to today revealed the somewhat conflicting evidence of current studies. Software applications in a variety of educational domains were then examined, and I hypothesized what benefits (if any) might arise from an inclusion of 1:1 technology in the classroom.

A qualitative study was conducted with fifth grade students. An impartial third party assigned six students to the experimental iPad group and six students to the control direct instruction group. Pre-existing math routines were used on the day of data collection. Interviews were conducted on the same day to ensure a lack of communication between the two groups.

The recorded interviews were sent to an online transcription service. Seven themes were identified in the conversations from both groups. I will now identify these themes, elaborate on underlying reasons for their existence, make connections between the themes, and provide general conclusions as to the usefulness of the data that has been collected.

In looking at the interview transcriptions, several things stood out. The first was that the direct instruction group had a difficult time formulating concrete and on-topic answers to the questions that were asked. They stumbled over articulating answers to three questions in particu-

lar: 1) What skill did we work on today?, 2) What part of direct instruction helps you the most?, and 3) What part of direct instruction is challenging for you? Their lack of articulation might be due to poor wording in the question, a preoccupation with other matters (the interview occurred during their lunch time, and they had given up their play time to speak with me, so they might have been thinking about that), or the unique nature of the interaction (since they had never previously been interviewed by me about math topics). Regardless of those hindrances, I noticed that the students agreed emphatically on a few key topics. They all wanted more time with direct instruction. They expressed a great affection for the piggy store present in the iPad software application and the joy they obtained from designing their own pig. Overall, they found the concept (multiplication of fractions) to be a difficult one that got easier the more they practiced. It is no surprise, then, that they thought the task would have been harder had they attempted it solely on the iPad without any input from their teacher.

In contrast, the iPad group enjoyed a spirited discussion on all of the questions. This may have been because they had Randy in their group, who is not only a high math student but very vocal and encouraging. His responses and demeanor may have lowered the inhibitions of the other students and encouraged their participation in the discussion. It may also have had something to do with the fact that they were used to me coming to get them for various academic-related issues during their after-school time, so it was not a new interaction for them.

The iPad group, like the direct instruction group, was vocal in wanting more time with their assigned method of math practice and in their affection for the piggy store and their own pig. They expressed their likes and dislikes with the software application, specifically its use of daily rankings and reliance on word problems. Students commented multiple times on the fact that, while they didn't think the help videos on the software application were very helpful, I was

someone that they knew they could turn to for help. Even though they didn't hesitate to point out negatives about my method of instructional delivery ("He sometimes speaks too fast," for example), a majority stated that they would prefer to get new instruction directly from me.

After analyzing the discussions with both groups, themes were noted in the areas of: 1) persistence, 2) insufficient time, 3) frustration with math instruction, 4) motivation, 5) help and support provided by me, 6) a lack of clarity, and 7) a preferred method of instruction. Based on comments made by four out of five students in the direct instruction (control) group, persistence was a common thread in their discussion. Insufficient time was also mentioned as a detriment to comprehension by all five students in the direct instruction group, as well as three out of five students in the iPad group. The control group wanted more time spent on direct instruction, while the students in the iPad group expressed a desire to spend more time using the Front Row software program. Both groups shared a frustration with math instruction. Four students in the iPad group expressed a single source of frustration, while three out of five students in that group shared multiple sources of frustration.

As for the direct instruction group, three out of five students communicated their frustration with how material was delivered to them. A great majority of students stated that the software application did a great job of providing motivation. Having had previous experiences with the software application, all five students in the direct instruction group emphatically confirmed this, and four out of five students in the iPad group also felt similarly regarding motivation as a significant factor when using the software program. Students in one group commented overwhelmingly on the help and support provided by me. Unexpectedly, these comments were offered not by the students in the direct instruction group, but by the students in the iPad group.

Three out of five students in the control group were initially unable to identify which specific skill they had been working on, despite the fact that the skill had been identified right at the beginning of the lesson. Finally, students appeared to reach a consensus regarding their preferred method of instruction, at least as relates to this particular mathematical task. Four out of five students in the direct instruction group stated that they felt they would have had more success with direct instruction as opposed to instruction on the iPad, and three out of five students in the iPad group echoed that sentiment.

The need to persevere was a very important factor to the perceived success of students in the direct instruction group. Students initially struggled with the content presented, but found that, as they worked, the problems became more manageable. “It was kind of confusing,” Bridget stated, “but then I got better at it.” David echoed Bridget, saying, “It was something new for me. At first it was kind of hard, but then I ended up understanding it.” Overall, four out of the five students in the direct instruction group evidenced a similar feeling of struggling at the beginning of the lesson, but becoming more confident as the lesson progressed. Even so, students in the direct instruction group felt that time was a limiting factor. “I (would like) more time,” said Homer. “Maybe some people don’t (understand) the examples.” It is assumed that he meant that students who don’t understand the initial examples would need to be given other examples, which would take up more time and thus require more time for him/her to finish learning and practicing the skill. This statement was echoed by all members of his group. Interestingly, the group that used the Front Row application also felt that more time would be merited. “I think there should be more time on Front Row,” Sarah said. “You can learn more about math. If you struggle with something, you’d have more time to try to solve it and try to figure it out.” Overall,

three of the five people in the iPad group felt that more time on the software program would have been beneficial.

Related to the Front Row software program, there were some areas where students in the iPad group expressed a level of frustration with the technology. “What I don’t like,” Randy said, “is that (the software program) just give(s) you an example of solving the problem as help. It doesn’t really help me at all of trying to find out a problem.” Sarah agreed, stating, “What I don’t like about it is what Randy said, that it gives you an example of a problem, but it doesn’t actually help you with (the) problem.” Overall, three out of five students in the iPad group expressed frustrations with the support videos. They also had difficulty with the word problems presented. “I don’t really get the word problems,” Randy stated. “(They’re) really hard. Sometimes, it’s really confusing...there’s this whole page full of words.” Sarah expressed the same mindset, saying, “The hardest part is the word problems. They go on and on. I don’t understand it.”

On the other hand, the students expressed great affinity for the software program. The pig feature, in particular, acted as a source of motivation and was crucial to their enjoyment of the software program. When students in the direct instruction group were being interviewed, David talked about the pig feature, saying, “It’s a good thing because...some kids in lower ages, they think it’s fun, and so they can keep dressing their pig, especially some girls. They like...dresses, the clothing. I think they’ll work harder to get them.” When I responded by saying, “When I hear you say that it would be good for younger kids, that makes me infer that you don’t really enjoy that part of it,” all five students immediately jumped in and said that they did, in fact, enjoy the pig feature. The iPad group also enjoyed the pig feature. Their feelings were summed up by Sarah, who remarked, “I prefer the pig. As Joshua and Randy said, ‘In the pig store, when you’re

designing a pig, it tells you how much coins you need. That will encourage you to do more and more problems’.”

Another factor that encouraged the students to continue working through difficult problems was the support they received from me. All five students in the iPad group spoke to the help they could have received had they been given the same lesson through direct instruction. “When we get (a problem) wrong, you help us a lot,” Katie said. “We can learn much better and see what’s wrong.” Janessa agreed, saying, “(When) we do a problem wrong, you come and help us. Sometimes, you tells (another student) to come and help us.” Randy discussed how he prefers my help to the Front Row videos, saying,

When we’re doing problems and I get it wrong, you know that. Then, you can give an example to help me. If I get that wrong, you knows that you could help me rather than the Front Row software program, (which gives) me an example and (then) it can’t help me anymore.

There was, however, one caveat to my helpfulness, as discussed by the students. “Sometimes during a lesson, you talk really fast,” Sarah said. “I don’t understand it.” Katie agreed, saying, “(It’s) the same thing as Sarah. (You) talk too fast, only sometimes.”

Finally, the students in each group professed an unexpected preference for direct instruction over the use of the iPad software program, at least in the limited context of the assignment. In the direct instruction group, Jose stated, “I don’t feel comfortable if (you don’t) just teach us and we get it wrong.” It is assumed that what he meant by that statement was that he would feel uncomfortable being put in front of the software program and asked to solve problems in a skill that was unfamiliar to him. David agreed, saying, “I would have felt frustrated because (you’re) telling me something to do, but maybe I’m not going to get it.” Juana concurred, saying that she

would have felt “uncomfortable.” It is assumed that Juana is here expressing a concern similar to that stated by Jose a few sentences ago. In the iPad group, a majority felt that they would have been more successful tackling the lesson with my assistance. Randy summed up the group’s feelings, stating:

I think I would’ve had more success (working with you). (You) would have gone slower. More than just an example from the Front Row software program. (You) would explain it more better to us. (You) would know if we’re not getting it.

Sarah concurred, stating, “I think it would’ve gone more successful. If (you) explain it more good, I would know what to do.” Janessa echoed this statement, saying, “(I would’ve been) probably more successful, (because you are) there to help us do everything.”

A pair of tables have been included in the appendices (Appendix I and Appendix J). The first describes or directly transcribes memorable quotes or observations from the direct instruction group, and the second does the same for the iPad group. The number of students in each group who shared the idea(s) expressed in the quote is then shared, and then those specific students are named. In one instance in Appendix I, an observation was made to try and explain student’s inability to answer or understand the questions that had been asked. From these quotes and observations, themes were constructed that could be used to later analyze the underlying feelings expressed. These tables were instrumental to my ability to draw the conclusions that will be discussed further in Chapter Five.

Control Group Overall Results

Overall, the students in the control group, while stating that the pig feature on the Front Row software program encouraged them to work hard, preferred direct instruction to working on

the iPad. They found the task they were engaged in to be a challenging one whose difficulty decreased as they became more familiar with it. They all stated that they would like to spend more time in their daily math period engaged in direct instruction, and felt that completing a lesson under the format of direct instruction would allow them to be most successful.

iPad Group Overall Results

Overall, students in the iPad group gave a balanced review of both the Front Row software program and direct instruction time. They pointed out the negative and positive features of both presentation forms. While they wanted to spend more of their daily math time engaged with the Front Row app, they did agree with their direct instruction counterparts on two points: 1) the pig feature on the software program was a useful and motivating force, and 2) they felt they would have had more success completing this lesson under the format of direct instruction.

Surprisingly, the comments that endorsed direct instruction the most came during the interview with the iPad group. They mentioned the supportive nature of the direct instruction environment during three separate points in the interview. It is unclear if this favoritism towards direct instruction is related to prior experience in this instructional mode when tackling a concept that was totally foreign to them.

The results of the student interviews both corroborated my personal thoughts and surprised me with the candor and openness of student conversation. In walking around the room during math time, I could tell that students enjoyed earning coins to dress and accessorize their pigs and looking at the daily leaderboard to compare their progress with that of their fellow students. I could also see that they got frustrated at times with the length and difficulty level of some of the word problems, and did not always find the videos to be very helpful in the context of the problem that they were stuck on. However, it was surprising how willing the students were

to communicate what worked and didn't work during instruction time, as students (in my experience) can oftentimes be reticent to discuss problems of that nature in front of their teacher. It was pleasing to hear that so many students appreciated my efforts to help them when they got stuck, and I appreciated their feedback that I sometimes talk too fast during instruction, which may have had the unintended consequence of leaving some students behind.

Chapter 5

This study was designed to explore the effect that a 1:1 iPad program might have on classroom engagement, and to examine to what degree an adaptive practice math application (such as Front Row) could provide a more individualized and engaging experience as compared to the traditional “lecture” method of math instruction. It came in response to Plainview School District’s adoption of a 1:1 iPad program for the upper elementary grades (fourth and fifth grades). A qualitative study was used with ten students, where five would be placed in a control group and taught a new concept via direct instruction, while the other five would be placed in an experimental group which learned that new concept via the Front Row app and its associated help mechanisms. Results were gathered via smartphone interview, themes were identified, and it was observed that while students appreciated many parts of the math app, they still preferred to receive new material in the form of direct instruction. They expressed that their preference was mainly owed to the human help that they felt they would receive if troubles arose and they needed some assistance.

Overall, students had mixed feelings about both the software program and direct instruction. It was interesting to note that students in the iPad group contradicted themselves at one point, saying that they both liked one of the features of the Front Row software program and found it to be the source of greatest frustration. My hypothesis is that, when the videos were directly related to the problem the student was struggling with, they found them to be very helpful. When, however, the videos were not directly related to the problem the student was struggling with, they did not allow them to progress in their understanding of the concept.

In addition, after looking at the students’ responses regarding what motivates them to persevere when using the Front Row software program, it would be interesting to see what the

students identified as motivating factors in persevering during direct instruction time. It was also interesting to see that, while the students felt that the software program did a lot to motivate them to push past their limits and tackle new and difficult material, students in both groups felt that accessing lessons via direct instruction gave them the best opportunity to be successful. My initial hypothesis as to the cause of this came from hearing student comments about both my helpfulness and the sometimes non-helpfulness of the Front Row videos. It appeared as though students felt that, if they struggled, direct instruction would provide them with the best opportunity to voice their confusion and get an appropriate level of help. That would allow them better access to the concept they were investigating and, therefore, make them more successful.

The seven themes that were identified as a result of examining the interview transcripts spoke to a variety of factors, from the intrinsic (motivation, perseverance, sources of frustration, and a preference for instructional method) to the extrinsic (having a clear focus, being given sufficient time to complete the given task, and feeling supported). Two findings were of particular significance. The first was that most students, even students who had effusive praise for the Front Row software program, still preferred to receive their new math content via direct instruction. It seemed, based on their comments, that this was mostly due to the perceived multiple points of access for struggling students that could be provided during this time, as well as the ability to be matched up with a peer who could provide timely and appropriate assistance.

The second key finding was that students could enjoy working on math problems (specifically word problems) that were hard for them, if they were properly scaffolded and given appropriate incentives. This connected back to their comments about the challenging nature of the word problems, the statements two of the five iPad students made about the helpfulness of the videos, and the comments made by the direct instruction group about how a concept got easier

for them as they solved more problems connected to it. I felt that these findings were significant because they indicated that students still preferred working in a group setting where help from a human expert was never far away, and that students were eager to take on challenges and push themselves to extend their competencies, rather than simply stay with problems and concepts that were familiar to and easy for them.

After viewing the results and interpreting the findings, some connections can be made to the literature review. As in the results of Lemke & Martin (2004), an increase in engagement and academic performance was observed in students who used the Front Row software program. Improvements were seen in other areas, such as self-confidence, interpersonal skills, and teamwork-oriented behaviors. After speaking with grade-level colleagues, I observed that they were not as impressed with the results of the Front Row software application as I was. However, I knew that they didn't use it every day, as I did. This made me wonder if I was witnessing first-hand the problem discussed by Bebell & O'Dwyer (2010) that dealt with pedagogical changes that helped to drive learning outcomes.

Math improvement was marked for many students, most of whom saw gains of more than a year equivalent in just the five months that they had been using the Front Row software program (as of this writing). When this growth was compared with that of previous classes, it corroborated the findings of Norris, Hossain, & Soloway (2011), which said that students who used smart devices in class performed better than students who did not. Most students reported an increase in motivation and engagement, which confirmed the results of Billings & Matheson (2012). The visual support aspect of the iPad, as pointed out by Demski (2011) could not be overstated. The videos, drag and click menus, and pig-decorating options definitely provided support with both difficult math concepts and designing fun.

The collaborative benefits of the Front Row app have also been immense. As Carr (2012) pointed out, student use of the application led to a large network of peer-to-peer help, where students could share expertise, discuss solving strategies, and improve their abilities by placing themselves in the role of teacher/expert. The motivational factor present in the application (whether in the coins, rankings, or piggy store) was a huge motivator that drove students to push past difficult problems and excel, as shown by Huizenga, Admiral, Ackerman, & Dam (2009). The plethora of word problems, especially those that utilized sports or pop culture references, provided students with ample opportunities for real-world application of math. This, coupled with the positive encouragement of the coins and the corrective feedback of the videos, made the Front Row app well worth the student's investment in time, as posited by Allsop, Kryger, & Lovin (2007) in their research.

Finally, the application succeeded in meeting the needs of a wide variety of learners. The whiteboard portion of the application allowed, as Bennett (2012) noted, for the manipulation of content. Since the assignments were tailored to students at their individual level, they were, as Hutchinson, Beschormer, & Schmidt-Crawford (2012) theorized, less rigid and restraining than typical worksheets. These were just a few of the reasons why the Front Row app was a valuable resource for students.

This study has some interesting implications for classroom teachers. The "flipped classroom," where students spend time working on assignments at their own level while the teacher walks around and acts as a helper/facilitator, seems to be a particularly successful way to meet both the teacher's need to have specified time to work with certain students on certain skills while simultaneously allowing students to work at a pace that is in line with their ability level. The Front Row software application possesses a wide array of tools designed to help both teach-

ers and students get more out of their daily math experience. From personalized problems (and worksheets) and the creativity of the “piggy store” to a list of student helpers for each completed skill and the ability to personalize intervention and extension groups, Front Row has completely changed the way students interact with math. The iPads and the Front Row software application have proven to be a catalyst for cooperative behavior, encouraging students to go off and help each other, support their friends in their struggles, and take on new and exciting challenges in the area of math. According to the Front Row website (www.frontrowed.com), one in five elementary schools are currently using Front Row in some fashion (as of April, 2015), so it would appear that I was not alone in seeing such positive developments in my students.

This study contributes to research related to the use of personal educational technology devices in the classroom. The qualitative methodology used was transferable to any other situation involving a software application that had as its primary function the desire to personalize and individualize learning for school children. This was a very sensitive area to some, as it could be seen as a brick on the path to an “automated” learning experience devoid of teacher input. However, if used judiciously and under the guiding eye of a teacher who was able to maximize the benefits of such a software application through effective peer teaching, student grouping, and small group re-teaching, the benefits of such a program could be immense.

Limitations/Areas for Further Research

While I believe that this study was an important addition to the field of personal educational technology devices in the classroom, by no means did it answer all of the questions that this field raised. There are still quite a few areas for further research that could yield informative results and inform classroom procedures and policies. In my opinion, there remain four key areas for further research. The first would be to determine if there exists a maximally beneficial point

beyond which software applications like these begin to have a negative return on investment. To wit, could one rely on technology such as this too much, to the point where it is no longer a beneficial learning tool? Second, it is vital to know the accuracy level of the produced metrics of software applications such as this. If the program was telling teachers that a student's math ability was equivalent to a student in the fourth month of fourth grade (4.4), could they trust those results? How could they calibrate software programs such as these to ensure that the data received was reliable? What companion tests would need to be developed?

The third area centered around the videos used by the software application to assist students who answered questions incorrectly. As mentioned in the study's findings, students often found the videos to be confusing and/or unrelated to the problem that they were trying to answer. A related question may be stated as follows: "How close could a helping video be to the problem the student was attempting to solve before it stopped helping and just ended up telling them how to solve the problem they missed?" In effect, the question seemed to be, "How could you make a 'perfect video' that was both instructive and helpful without giving everything away?" Finally, it would be interesting to see how the Front Row software program compared with another, more well-known 1:1 adaptive math software program for kids (Khan Academy). Were the problems similarly difficult? Were the videos in one program better than the videos of the other? Were the results obtained more reliable for one than the other? Which, in the end, was the software application that was most beneficial to struggling students? Students who are on grade level? Advanced students? Students with particular needs (English language learners, special education students, gifted students)?

This study was able to extend and apply past research in the area of personal educational technology devices by isolating seven themes related to how software applications such as Front

Row could be both beneficial to students (individualized problems) and a hindrance to their success (unrelated videos). Results showed that students who enjoyed working on the iPad in many cases still preferred to receive new instruction from their classroom teacher, and that software programs such as these might be best-suited to helping the student review previously-discussed material, as opposed to exploring entirely new content. Connections were made to the studies of other researchers who had investigated such technologies, and found many of their claims to be validated by this particular study. Implications to the teaching profession were examined, especially as relates to the idea of the “flipped” classroom. Methodological implications were considered, and it was determined that the study was repeatable, but that the results needed to be counterbalanced by the reality that having a teacher in the room was always, in my opinion, the best option.

Finally, four areas for further research were identified: 1) a maximally beneficial point of return on investment, 2) examining the accuracy level of the produced metrics, 3) how to make a “perfect video” that was instructive and helpful without giving too much away, and 4) seeing how Front Row compared with other adaptive math programs, such as Khan Academy. Exploring these areas will hopefully shine some more light into this area of instructional research and better hone a teacher’s ability to determine whether a particular software program was going to be an effective component to add to their 21st century classroom.

I feel that a repeat of the following statement from the opening paragraphs of the literature review is apropos: “Part of the concern with 1:1 (laptop) schools may be that there doesn’t seem to be one common “result” of the initiative. The discrepancy in results may be due to the fact that the term “1:1” simply refers to access students have to technology, and says nothing about pedagogical changes, learning outcomes, or other educational practices.” It is my belief

that the pedagogical changes, expected learning outcomes, and allowances for a transitional "learning curve" period will ultimately prove to be the most reliable indicators as to the success or failure of initiatives such as these.

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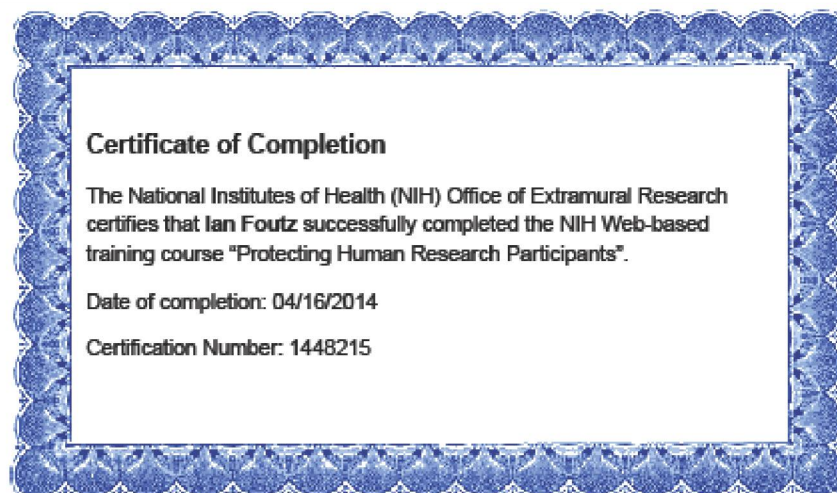
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Appendix A: NIH Certificate

Protecting Human Subject Research Participants

<http://phrp.nihtraining.com/users/cert.php?c=1447215>



Appendix B: IRB Application & Approval

Student/Faculty/Staff Form



RESEARCH
& SPONSORED
PROGRAMS
C H A N N E L
I S L A N D S

IRB APPLICATION CHECKLIST

NO RESEARCH CAN PROCEED UNTIL YOU HAVE RECEIVED IRB APPROVAL

Use the following list to confirm that all required steps of the IRB Application process are completed. Complete this form by clicking on the boxes and submit a copy along with your IRB Application.

- ☐ The researcher has completed the PI Certification Training.
<http://phrp.nihtraining.com/users/register.php>
- ☐ The researcher using human subjects has submitted an electronic IRB Application for IRB Committee Review to: irb@csuci.edu
- ☐ The IRB Application was submitted both as hard copy and electronically to the Research and Sponsored Programs office (RSP).
- ☐ The researcher submitted one electronic copy, two hard copies, one, the signed original of the completed IRB Application, for a total of three copies. All proposals/applications should be received no later than the close of business on Thursday to make the Monday IRB review meeting.
- ☐ The researcher attached copies of protocol, informed consent forms, and other instruments that will be used for research.
- ☐ The researcher has included an informed consent form for the parent/guardian for minors (under age 18) and an informative letter or script that explains the project to the minor, written in language appropriate for the participant's age.
- ☐ The researcher answered question # 21 of the IRB application in detail. For example, give the length of time that the data will be stored, where it will be stored, and when it will be destroyed. Data is not secure if it is stored on the CSU Channel Islands (CI) network, server, or desktop.
- ☐ The researcher agrees to send notification via email to RSP when the research project is finished or will submit a continuation form to IRB annually for approval of an extension.
- ☐ The researcher signed all paper copies of the IRB Application and obtained appropriate signatures on the last page.

All Email inquiries should be directed to: irb@csuci.edu

The IRB Chair and RSP meet Monday, weekly, or as needed, to review Category 1 Research: Exempt/Expedited proposals. The Category 1 proposals take 3-4 weeks for review. The IRB Committee meets as needed for Category 2 Research: Full-review proposals. Category 2 proposals take 1-3 months for review.

All proposals/applications should be received by RSP no later than 8:00 a.m. on the Thursday prior to the Monday exempt/expedited weekly review meeting.



RESEARCH
& SPONSORED
PROGRAMS
C H A N N E L
I S L A N D S

Completed by IRB:

IRB PROJECT #:

☐ Exempt/Expedited Review:

☐ Full Review:

INSTITUTIONAL REVIEW BOARD (I.R.B)

APPLICATION FOR THE REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS

Directions: Please complete Sections I - IV. *In all cases, no research may proceed on or off campus unless approved by the IRB.*

Submission Instructions: Email an electronic copy of the completed IRB Application, proposal and attachments to irb@csuci.edu in the following format:

1. IRB application should be saved as: First letter of the first name and the full last name of the Principal Investigator (Example: John Smith = jsmith IRB Application)
2. Email subject heading: IRB Application
3. Attachments: Include all attachments (surveys, consent forms, letters)
4. Interoffice mail or hand deliver: 1 signed original and 2 copies of your IRB Application and attachments to Research and Sponsored Programs (RSP) located at Madera Hall, Suite 1300.
5. **DO NOT SUBMIT IN PDF FORMAT**

All IRB Applications and proposals must be submitted by 8:00 a.m. on Thursday to make the Monday review. An IRB Application is incomplete without the signature of the Principal Investigator and Program Chair/Administrator on the last page of the application. Before research starts the PI must take the PI Certification Training and present the certificate to RSP. <http://phrp.nihtraining.com/users/register.php>

SECTION I: Category Review Requested (CLICK ON CHECK BOX)

☐ Category 1 Research: Exempt/Expedited Review

☐ Category 2 Research: Full Review

SECTION II:

1. Name of Principal Investigator	Phone:	Email:
Ian Bradley Foutz	(805)-402-2180	misterfoutz@yahoo.com

Investigator is (CLICK ON CHECK BOX): ☐ Faculty ☐ Staff ☒ Graduate Student ☐ Undergraduate

2. Name of <input type="checkbox"/> Co-PIs <input type="checkbox"/> Research Collaborator:	Phone:	E-mail:

3. Program Affiliation:	4. Sponsor (if funded):
5. Amount of Award: \$	6. <input type="checkbox"/> Internal Funding or <input type="checkbox"/> External Funding

7. Title of Project:	Project Start Date:	End Date:
iPads: Educational Boon, or Expensive Toys?	August, 2014	October, 2014

8. This application is for Masters Thesis Project (iPads: Educational Boon, or Expensive Toys?)

9. Age Range of Subjects: 9-11 years old

10. Type of subject: ☐ Adult ☐ Non-student ☒ Minor ☐ CI Student

☐ Other (describe):

11. Subjects (CLICK ON CHECK BOX): ☒ Normal Volunteer ☐ In-patient ☐ Out-patient ☐ Mentally retarded
☒ Mentally disabled ☐ Pregnant women & fetuses ☐ Individual with limited civil freedom

12. Estimated # of Subjects/participants: 20 # of Treatment Subjects (If Applicable): 10
 # of Control Subjects (If Applicable): 10

SECTION III:

Please check the appropriate response for questions 13 to 17. Please be brief and concise in your responses to each of these questions. Failure to respond to any questions will cause significant delays.

13. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Does this project involve secondary analysis of public data sets? If yes, skip questions 20, 21 and 23 of the IRB application. Please provide the following information in the explanation box below (name of the data set, public URL address, and the name of the organization)
---	---

Explanation:

14. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Will subjects receive payment or extra credit point compensation for participation? If yes, detail amount, form, and conditions of award.
---	---

Explanation:

15. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Will access to subjects be gained through cooperating institution? If yes, indicate cooperating institution and attach copy of approval letter from that institution. (e.g. Copy of institution's IRB approval, copy of approval letter from school board, etc.)
---	--

Explanation: Cooperating institution is Ocean View School District. I have included a copy of the approval letter from my district Superintendent.

16. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Does this project involve investigator(s) at another institution? If yes, identify investigator(s) and institution and attach copy of agreement to cooperate.
---	---

Explanation:

DIRECTIONS: In a total of no more than four pages, please answer the questions 17-23. Please be brief and concise in your responses to each of these questions. Failure to respond to any questions will cause significant delays.

17. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Will the subjects be deceived, misled, or have information about the project withheld? If so, identify the information involved, justify the deception, and describe the debriefing plan if there is one.
---	---

Explanation:

Research Protocol Description (Please attach surveys and instruments to the IRB Application):

18. Describe the objectives and significance of the proposed research below.

The objectives of the research are twofold: 1) to see how (or if) the nature of student engagement in classroom assignments changes after the introduction of iPads, and 2) to try and identify specific apps that will help improve students' reasoning skills and deepen their understanding of content in the area of social studies. This research is significant because many schools and districts are adopting 1:1 iPad programs that are incredibly costly and labor intensive for a great deal of people. I want to see if these massive expenditures of time, money, and effort are worth it, or if in the end they are quantifiably unjustified.

19. Describe methods for selecting subjects and assuring that their participation is voluntary. Attach a copy of the consent form that will be used. If no consent form will be used, explain the procedures used to ensure that participation is voluntary. (See attached: sample/standard consent form and guide)

I will be selecting students from the 4th and 5th Grade classes at Tierra Vista School, since they are the only grades currently operating on a 1:1 basis with the iPads. I have attached a copy of both the parent consent form and the minor assent form. Participation will be strictly voluntary, and there will be no negative repercussions should students decline to participate.

20. Describe the details of the procedures that relate to the subject's participation below. Attach copies of all questionnaires or test instruments. Additionally, (NOT IN LIEU OF) attach a copy of the technical portion of the grant application if this project is part of a sponsored funding request.

Students will be completing seven activities under the umbrella of this research. Of those seven activities, three will utilize "traditional" technologies like paper, pencil, construction paper, markers, glue, etc., while the other four will utilize iPads, apps, and related "21st Century" technologies. The activities will be balanced so that for every non-technology assignment, there will also be a very similar one that uses technology. Also, the activities will be almost identical in nature to try and avoid any increase in motivation or performance due to factors unrelated to technology. Specifically, the assignments will be: 1) Assessment (pencil and paper quiz vs. Quick Key quiz vs. Socrative quiz, 2) history biographies using textbook vs. history biographies utilizing the Internet and the Educreations and iMovie apps, and 3) crafting a written one-paragraph response to a video on Columbus' arrival from the point of view of one of the participants vs. live-tweeting Columbus' arrival in the persona of one of the participants after watching that same video. Additionally, students will be given surveys relating to their thoughts on: 1) enjoyment, 2) academic performance, 3) level of engagement, 4) on- vs. off-task behaviors, 5) level of creativity, individuality, and challenge posed, and 6) how to balance iPad activities with other, "non 21st Century tech" activities. (see attached survey).

21. Describe below the methods that will be used to ensure the confidentiality of all subjects' identities and the stored data (include how data will be handled after research is completed). Confidentiality of data is required.

Confidentiality will be ensured by randomly assigning an ID number to each student in the study. The students will then "sign" their work by using the number (as opposed to their name). The lists containing students' names and ID numbers will be stored in a separate area (teacher's locked cabinet in the staff work room) that is inaccessible to students.

22. Describe below the risks to the subjects and precautions that will be taken to minimize the risks to the subjects. Risk goes beyond physical risk and includes risks to the subject's dignity and self-respect, as well as psychological, emotional, employment, legal, and/or behavioral risk. (Note: There is always minimal risk (s) associated with a project.)

There are few risks for the 4th and 5th Grade students. The primary risk would be that they would perform poorly on one of the assignments, their classmates would become aware of it, and they would suffer a social or emotional stigma as a result of that. However, since: 1) students' ID numbers will be known only to themselves, 2) student ID numbers will range from 1 - 20, so there will be no chance to use a "process of elimination" to figure out someone else's ID #, 3) performance grades will only be shared with the individual students at the conclusion of the study, and 4) the comprehensive list of student names and ID numbers will be in a location that is not only inaccessible to students, but never mentioned in their presence, there will be no chance of students suffering either the social or the emotional stigma mentioned above.

23. Describe below the benefits of the project to science and/or society. Also describe benefits to the subject, if any exist. The IRB must have sufficient information to make a determination that the benefits outweigh the risks of the project.

The benefits of the project are threefold. First, the students will benefit because they will have the opportunity to interact with their iPads in ways designed to maximize not only their enjoyment of this popular technology, but also the academic benefit of such a tool. Second, it will give the school district an opportunity to either justify the massive expenditure of time, money, and effort to the community, or utilize resources to further investigate the problem (if no academic benefit exists) or perhaps to curtail the experiment and find other, more proven, ways to spend their funds in an academically useful way. Finally, this project will contribute to the growing body of research about 1:1 technology programs in schools. Even after more than 20 years of such programs (utilizing technologies such as desktops (for computer labs), iPods, laptops, and smartphones), the results are mixed, and opinions are still divided as to whether or not such programs are beneficial for students. I would like to help contribute to the research, regardless of which side of the debate my results fall on.

24. Describe below how the results of your study will be disseminated.

The results of this study will be presented in the form of a project report, a CSUCI Masters Thesis, proposed as an item to go up for discussion before the district Board, proposed as an item to be presented at staff meetings and district inservice days, and submitted for review to appropriate educational journals.

APPLICATION FOR THE REVIEW OF RESEARCH INVOLVING HUMAN SUBJECTS

SECTION IV – ASSURANCES

This protocol review form has been completed and typed. I am familiar with the ethical and legal guidelines and regulations (i.e. The Belmont Report, The Code of Federal Regulations Title 45 Part 46, and CI's Policy) and will adhere to them. Should material changes in procedure involving human subjects become advisable, I will submit them to the IRB for review prior to implementing the change. I understand that I have to notify the IRB when the project is completed. Furthermore, if any problems involving human subjects occur, I will immediately notify the IRB. I understand that IRB review must be conducted annually and that continuation of the project beyond one year requires submission of Research Continuation Form for IRB approval.

Signature Ian Bradley Fontz Date 7-14-14
 Printed Name Ian Bradley Fontz
 Principal Investigator (Student, Faculty, Staff)

Signature [Signature] Date 7/15/14
 Printed Name JANET MARTINEZ
 Supervisor (Faculty, Chair, Administrator)

End of Application – THIS SECTION MUST BE COMPLETED FOR IRB REVIEW



Channel Islands

CALIFORNIA STATE UNIVERSITY

Research and Sponsored Programs Office
Institutional Review Board

Date: September 27th, 2014
To: Ian Foutz, Principal Investigator
James Martinez, Co-Principal Investigator
Cc: Jason Miller, Senior Research Officer
Subject: Study (GO5055): iPads: Educational Boon, or Expensive Toys?

The Institutional Review Board Chair of California State University Channel Islands (CI) reviewed your *exempt/expedited category* research at CSU Channel Islands. According to the Basic HHS Policy for Protection of Human Research Subjects and policies and procedures of the Institutional Review Board (IRB), your research falls under the **Exempt** category and has been reviewed following guidelines dictated under that category. You may begin your investigation upon receipt of this notification.

Your IRB approval is granted for **one year and your approval will expire on September 26th 2015**. At the end of this period, the principal investigator(s) must submit a status report to the IRB via email at irb@csuci.edu stating if the study has concluded (or otherwise terminated) or whether the approval period will need to be amended for continuation of the originally approved study.

Principal investigator(s) will also need to:

1. Notify the IRB within 10 days if the research was prematurely terminated;
2. Promptly report to the IRB any changes in a research activity, proposed amendments, or unexpected reactions;
3. Promptly report to the IRB any unanticipated problems involving risks to subjects or others; and,
4. Notify the IRB Chair immediately after any adverse reactions are experienced by participants of the investigational study or as reported to you by the sponsor/manufacturer/co-principal investigators.

You may not initiate changes to the approved research protocol without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the human subjects. Should you have any questions please contact Jason Miller, Senior Research Officer (805) 437-8898.

Sincerely,

Nitika Parmar, Ph.D.
Institutional Review Board Chair

One University Drive, Camarillo, California 93012-8599 Tel: (805) 437-8495 - Fax: (805) 437-8817 www.csuci.edu

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Maritime Academy • Monterey Bay • Northridge • Pomona • Sacramento • San Bernardino • San Diego • San Francisco • San Jose • San Luis Obispo • San Marcos • Sonoma • Stanislaus

Appendix C: Cooperating Institution Letter

Approval Letter from Cooperating Institution

June 6, 2014

Research and Sponsored Programs Office
CSU Channel Islands
One University Drive
Camarillo, CA 93012-8599

Dear Members of the Committee:

On behalf of Tierra Vista School, I am writing to formally indicate our awareness of the research proposed by Ian Foutz, a student at CSU Channel Islands. I am aware that Mr. Foutz intends to conduct his research by coordinating a series of assignments with the 4th and 5th Grade teachers, and by administering written surveys to our employees, students, and their parents, and by interviewing students.

I am responsible for employee relations and am the school Principal. I give Mr. Foutz permission to conduct his research in our school.

If you have any questions or concerns, please feel free to contact my office at (805)488-4454.

Sincerely,

Javier Bolivar
Principal, Tierra Vista School

Appendix D: Parental Informed Consent Form for Minors (English)

Parental Informed Consent Form for Minors

Mr. Ian Foutz, a 5th Grade teacher at Tierra Vista School, wants to learn how effective iPads are in instructing your children and getting them engaged with class content. He also wants to learn about specific apps that can help children do better in school, especially in Math, and understand how students feel about learning with iPads versus learning with “traditional” tools such as pencil and paper. He would like to invite your child to participate in his iPad effectiveness project.

If you would like your child to participate, you should know that your child will be completing one lesson and (if they wish) participating in 2 audio-only interviews with Mr. Foutz. The lesson **will not** be graded and **will not** affect your child’s grades in any way. In order to achieve best results, the lesson will be conducted during recess time. Mr. Foutz will then interview the participating students in small groups in his classroom during lunchtime.

All information will be kept in a locked cabinet at Tierra Vista School. No identifying information (such as the name of your child) will be used if the results from this study are published.

Your child’s participation in this study is completely voluntary, and you may decide to remove your child from participation in this study at any time. Your decision about your child’s participation will not have any influence on your relationship with Mr. Foutz or Tierra Vista School.

If you have any questions about this study or your rights, please call Mr. Foutz at (805)- 402-2180 or our school Principal Mr. Bolivar at (805)-488-4454.

If you give your permission for the participation of your child in this study and for the use of information gathered from the lesson and interviews, please sign below and return this form to Mr. Foutz. Thank you.

Parent or Guardian Signature

Date

Print Your Child’s Full Name

Signature of Researcher

Date

PLEASE KEEP A COPY FOR YOUR RECORDS

Questions or problems about your rights in this research project can be directed to Research and Sponsored Programs at CSUCI, (805) 437-8495 or irb@csuci.edu

Appendix E: Parental Informed Consent Form for Minors (Spanish)

Formulario de consentimiento informado de los padres para menores

Sr. Ian Foutz, un maestro de 5º grado en la escuela Tierra Vista, quiere aprender iPads efectivos son en la instrucción de sus hijos y lograr que comprometida con contenido de clase. También quiere aprender acerca de aplicaciones específicas que pueden ayudar a los niños les va mejor en la escuela, especialmente en matemáticas, y entender cómo se sienten aprendizaje con iPads en comparación con el aprendizaje con herramientas "tradicionales", tales como el lápiz y el papel. A él le gustaría invitar a su hijo a participar en su proyecto eficacia iPad.

Si usted desea que su hijo participe, usted debe saber que su hijo estará completando una lección y (si lo desean) participando en 2 entrevistas de sólo audio con el maestro Foutz. La lección **no será** calificado y **no afectará** calificaciones de su hijo en cualquier forma. Para lograr mejores resultados, la lección se llevará a cabo durante el tiempo de recreo. Maestro Foutz entonces entrevistar a los estudiantes que participan en grupos pequeños en su salón durante el almuerzo. Toda la información se guarda en un armario cerrado con llave en la escuela Tierra Vista. No hay información de identificación (como el nombre de su hijo) se utilizará si se publican los resultados de este proyecto.

La participación de su hijo en este proyecto es completamente voluntario, y usted puede decidir retirar a su hijo de la participación en este proyecto en cualquier momento. La decisión sobre la participación de su hijo no tendrá ninguna influencia en su relación con el maestro Foutz o la escuela Tierra Vista.

Si usted tiene alguna pregunta acerca de este proyecto o sobre sus derechos, por favor llamar al maestro Foutz al (805) - 402 - 2180 o nuestro Director Sr. Bolívar al (805) - 488 - 4454.

Si usted da su permiso para la participación de su hijo en este proyecto y para el uso de la información obtenida de la lección y entrevistas, por favor firme abajo y devuelva este formulario a maestro Foutz. Gracias.

Firma del Padre o Tutor

Fecha

Escriba su nombre completo de su hijo

Firma del Investigador

Fecha

POR FAVOR MANTENGA UNA COPIA PARA SUS ARCHIVOS

Las preguntas o problemas acerca de sus derechos en este proyecto de investigación se pueden dirigir a la Investigación y Programas Auspiciados en CSUCI, (805) 437-8495 o irb@csuci.edu

Appendix F: Minor Assent Form

STUDENT ASSENT FORM

What is going on?

The 4th and 5th Grades at our school are taking part in a “1:1 iPad initiative,” where each student in the class is given use of a tablet. The purpose of this research study is to investigate the degree to which iPads are effective in assisting students with academic tasks (specifically in math). Depending on the nature of the findings, the information learned may be used to assist other teachers, schools, or districts in improving or altering their 1:1 tablet adoption programs and / or selection of student apps. This study will last from October to November, 2014.

Who is doing the study?

As part of his Masters’ Degree in Curriculum and Instruction at California State University Channel Islands, Mr. Foutz is required to conduct original educational research. This assent form, if agreed to and signed by you, allows him to do so with you as a research participant.

What would happen?

Students taking part in the study would be asked to complete 5 different tasks. These **will not be** graded, and will not affect your grade in Mr. Foutz’s class. The tasks will be spread out across 5 mathematic domains: **1)** Numbers in Base 10, **2)** Fractions, **3)** Geometry, **4)** Counting & Cardinality / Algebraic Thinking, and **5)** Measurement and Data. Ten students will be chosen for this study, and they will be randomly separated into two groups: one that completes these tasks using pencil, paper, and the teacher as a resource for questions, and one that uses the Front Row app and videos as a resource for questions. When students in the iPad group are completing their tasks, their tablet screens will be recorded and their keystrokes may be tracked.

Mr. Foutz will also interview the students. The interviews are designed to investigate how students feel about iPad use in the classroom and is completely voluntary. Mr. Foutz would be conducting the interviews, which would occur during lunchtime in his classroom beginning in late October. Interviews will be conducted 5 students at a time, and **will not be 1-on-1**. Your participation or lack thereof will not affect your grade in Mr. Foutz’s class nor would it would not be a commentary on the quality of your relationship with Mr. Foutz. Selection of the interview participants will be based solely on their desire to be interviewed. In other words, if a student from the research group volunteers, s/he will be granted an interview; if a student does not volunteer, s/he won’t.

Students’ responses during the interviews will be recorded (but audio only; no video), and will be deleted after the final report is written and approved by faculty and officials at CSUCI. The names of participating students will be not be revealed (pseudonyms will be used), and responses will be generalized to ensure that all identities will remain confidential. Note that the interviews are voluntary, meaning that **students do not have to answer the questions if they so choose**.

How might students be affected?

The interviews will last about 20 minutes each. Each student selected will be interviewed twice; once before the study begins and again when the study concludes. Participants will be allowed to view the interview questions ahead of time and will be given the opportunity at the beginning of the interview to point out any questions they do not wish to answer. Also, during the interview, Mr. Foutz will remind all students that their comments are being used to assess the impact and effectiveness of the iPad program, not their performance in class.

If a student decides not to take part in the interview, that decision would not affect whether that student can take part in any other class activity or school program. **Neither participation nor one's answers will impact student grades in any way.**

What if I have questions?

If you have questions about the study, you can ask your parents, Mr. Foutz, or the principal (Mr. Bolivar).

How do I join the study?

To give your assent, please fill out the form below and give it to your teacher, Mr. Foutz.

This form was read aloud to me. All of my questions were answered. All parts of Mr. Foutz's study are clear to me.

Please check one:

_____ I assent (give my permission) to take part in the task completion and interview portion of the study.

_____ I **do not assent** (give my permission) to take part in the task completion and interview portion of the study.

Student Name - Please Print

Student Signature

Date

Rights of Participants: You may withdraw your consent at any time and end participation without any consequences. You are not waiving any legal rights because of your participation in this study. If you have questions regarding your rights as a research participant, please contact the Office Research and Sponsored Programs at CSU Channel Islands at (805) 437-3285 or via email at irb@csuci.edu.

Appendix G: Direct Instruction Control Group Interview Questions

1. On a scale from 1 - 10, rate how well you like direct instruction. Why?
2. While you were working with me, what math skill were we focusing on?
3. Knowing what you know about how direct instruction works, in a typical 70-minute math class, how many minutes would you ideally want to see spent on using direct instruction?
 - a. Why do you feel that way?
4. Which part of direct instruction do you enjoy most?
5. What part(s) of direct instruction helps you learn, individually?
6. What part(s) of direct instruction is challenging for you?

(Now, we're going to transition to some questions about what this lesson that you just did would have looked like if you had completed it using the Front Row app on the iPad.)

7. Which part of the Front Row app do you enjoy most?
 - a. If students don't answer, prompt them. The problems, the videos, the rankings, the coins, the pig, or something else?
 8. Which part(s) of the Front Row app helps you learn, individually?
 9. Which part(s) of the Front Row app is challenging for you?
 10. In your opinion, what makes an iPad app "good"?
 11. Does the app need the pig feature in order to be successful and fun? Explain.
 12. On a scale from 1 - 10, rate how well you like using the Front Row app on the iPad. Why?
- If this math lesson had been all Front Row and not used direct instruction at all, how would you have felt about that? Explain.

Appendix H: iPad Experimental Group Interview Questions

1. On a scale from 1 - 10, rate how well you like using the Front Row app on the iPad. Why?
 2. While you were using Front Row, what math skill were you focusing on?
 3. Knowing what you know about how Front Row works, in a typical 70-minute math class, how many minutes would you ideally want to see spent on using the Front Row app?
 - a. Why do you feel that way?
 4. Which part of the Front Row app do you enjoy most?
 - a. If students don't answer, prompt them. The problems, the videos, the rankings, the coins, the pig, or something else?
 5. Which part(s) of the Front Row app helps you learn, individually?
 6. Which part(s) of the Front Row app is challenging for you?
 7. In your opinion, what makes an iPad app “god”?
- Does the app need the pig feature in order to be successful and fun? Explain.
- (Now, we're going to transition to some questions about what this lesson that you just did would have looked like if you had done it with me teaching you directly. I'm going to call that “direct instruction.”)
8. What part of direct instruction do you enjoy the most?
 9. What part(s) of direct instruction helps you learn, individually?
 10. What part(s) of direct instruction are challenging for you?
 11. On a scale from 1 - 10, rate how well you like lessons with me giving direct instruction. Why?
 12. If this math lesson had been all direct instruction and not used Front Row at all, how would you have felt about that? Explain

Appendix I: Interview Themes from the Direct Instruction Group

Quotes/Observations	Said by Whom? Where?	Theme
"At first it was hard, but then I ended up understanding it."	Said by four out of five students (<u>Bridget, David, Homer, & Jose</u>)	Perseverance
DI group had a hard time articulating the skill they had been working on. iPad group called it right away.		Lack of Clarity (Students)
"I would like more time with Direct Instruction."	Said by all five students (<u>Juana, Bridget, Homer, David, & Jose</u>)	Insufficient Time
Students did not understand my question, "What part of direct instruction helps you the most?"		Lack of Clarity (Teacher)
Students also seemed to not understand the question "What part of DI is challenging for you?"	<i>They named specific skills that were hard for them, not a part of the DI itself. <u>Maybe my questions were flawed or poorly worded?</u></i>	Lack of Clarity (Teacher)
"I think the pig feature is a good thing because it encourages kids to work hard."	Said emphatically by all five students (<u>Juana, Bridget, Homer, David, & Jose</u>)	Motivation
"I think it would have been harder if I were in the iPad group and didn't get any direct instruction."	Said by four out of five students (<u>Bridget, Juana, David, and Jose</u>)	Preference: DI vs. iPad

Appendix J: Interview Themes from the iPad Group

Quotes/Observations	Said by Whom? Where?	Theme
Some students really liked the rankings and the videos, other students really disliked the rankings and the videos.	Three out of five students also disliked the videos (<u>Joshua, Randy, and Sarah</u>), because they “weren’t about the actual problem.”	Source of Frustration (App)
"I think the pig feature is a good thing because it encourages kids to work hard."	Said emphatically by four of five students (<u>Joshua, Randy, Sarah, and Katie</u>)	Motivation
"I would like more time with Front Row."	Said by three out of five students (<u>Joshua, Sarah, Janessa</u>)	Insufficient Time
"It helps me to have the problems expressed as word problems."	Said by three out of five students (<u>Janessa, Joshua, Katie</u>)	Helpful Features of App
"The most challenging part about Front Row is that the problems are expressed as word problems."	Said by four out of five students (<u>Randy, Sarah, Janessa, and Joshua</u>)	Source of Frustration (App)
"What I like about DI is that, when we get something wrong, [researcher] has many different ways to help us."	Said by all five kids in the iPad group (<u>Joshua, Randy, Sarah, Katie, Janessa</u>)	Student Support
"The part about DI that is most helpful is that teacher gives examples and shows how to solve problems."	Said by three out of five students (<u>Joshua, Randy, and Sarah</u>)	Student Support
"One difficulty with DI is that [researcher] can sometimes talk too fast [causing students to be confused]."	Said by three out of five students (<u>Sarah, Katie, and Janessa</u>)	Source of Frustration (DI)
"One good thing about DI is that [researcher] helps us when we have trouble."	Said by three out of five kids in iPad group (<u>Joshua, Randy, and Sarah</u>)	Student Support
"If I'd done this lesson through DI instead of through Front Row, I think I would've had more success with it."	Said by three out of five kids in iPad group (<u>Randy, Sarah, and Janessa</u>)	Preference: DI vs. iPad