

## Abstract

Title of Document: UNPROVEN INNOVATION: IPADS IN K-12 ENVIRONMENTS

Meri Elizabeth Robinson, Doctor of Education, 2016

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Nationally, the education sector spends more than 5 billion dollars annually on digital tools, “yet seldom are technology solutions factored into any viable equation for improving student academic achievement” (Moersch, 2014, p. ix). Consider the following case in point: In July 2014, Apple announced that in just 3 years, the company had sold more than 13 million iPads to educational institutions worldwide (Cavanagh, 2014). Put into perspective, that represents more than 5.2 billion dollars spent by the education industry to purchase iPads, which is the equivalent of the annual salaries of 89,655 teachers (“*High School Teacher: Salary*,” 2014). Despite such vast expenditures, there have been very few attempts to evaluate the efficacy of these digital tools on improving academic achievement.

This research involved a quantitative data review of participant (student and teacher) survey data to explore one of the country’s largest K-12 iPad implementation undertakings in an effort to identify (a) best practices and (b) lessons learned from implementing the iPad into K-12 educational environments. It should be noted that the school system forming the basis of this research already had administered and collated the surveys used in this study.

*Keywords:* iPads, educational technology, 21<sup>st</sup>-century skills, student engagement, learning environments, levels of technology integration

UNPROVEN INNOVATION: IPADS IN K-12 ENVIRONMENTS

by

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## **Dedication**

This dissertation is a true result of many prayers. Thank you, Jesus, for answering ALL of my prayers. Thank you, Father, for your strength, love, and wisdom. This dissertation is dedicated to my family and friends, as a testament that you “can do all things through Christ who strengthens you” (Philippians 4:13).

## Acknowledgements

There is an African proverb that teaches, “It takes a village to raise a child.” Well, as a student, I still needed to call upon that village to succeed. It is with great respect and thanks that I would like to acknowledge my advisory committee for their help and support through this process. Special thanks to my advisor, Dr. Thomas Davis; his guidance and patience were invaluable to my learning and the completion of this journey.

I would also like to thank my family for their unwavering support and their belief in my abilities. My family has been a continuous source of support. Throughout this process, they have endured endless discussions on technology integration, late night writing, and dissertation babble. My family has been a continuous source of support. Starting with my incredible husband, Erik Robinson, my biggest fan and inspiration. Also to my beautiful children, Erika, Isaiah, and Remi: You are my heart, motivation, and inspiration. Huge thanks to my mother, Annette Townes, for always believing in me and teaching me to always put my trust in the Lord and to never give up. Vivianne, the master wordsmith and Cecelia, thanks so much for the proofreading and valuable feedback. To all of my babysitters, Mama, Tira, Melba, and Pop Robinson, thank you so much for your time and energy and watching over my angels. I could not have done it without my family, and I am eternally grateful for their love and support.

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## Table of Contents

Abstract.....	ii
Dedication.....	ii
Acknowledgements.....	iii
Table of Contents.....	iv
List of Tables.....	vi
List of Figures.....	vii
Chapter 1: Introduction.....	1
Problem Statement.....	1
Justification/Rationale.....	7
Critical Literature.....	12
Analysis of Prior Attempts to Address the Problem.....	16
Proposed Investigation.....	19
Chapter 2: Investigation.....	25
Research Questions.....	25
Design.....	29
Methods and Procedures.....	32
<i>Figure 7. LoTi “Sniff” Test (Moersch, 1995).....</i>	<i>38</i>
Plan for Analyses.....	39
Human Subject Review.....	45
Limitations.....	46
Summary.....	46

Chapter 3: Results and Implications .....	48
Section 1: Results.....	48
Section 2: Conclusions.....	74
Section 3: Impact for School District.....	85
Recommendations.....	82
Conclusion .....	84
Appendices.....	89
Appendix A: LoTi Digital Age Survey for Teachers.....	90
Appendix B: Permission for Use of the LoTi Framework.....	94
Appendix C. LoTi Framework.....	96
Appendix D: 2015 MES Student Survey Questions .....	98
Appendix E: SY 2015 MES Teacher Survey.....	101
Appendix F: Current Instructional Practices Framework .....	104
Appendix G: Personal Computer Use Framework .....	108
Appendix H: LoTi Digital Age Survey Scoring Calculation Key .....	110
Appendix I: Data Journey .....	110
Appendix J: How the Composite Variables Answers the Research Questions .....	119
Glossary .....	122
Bibliography .....	126

## List of Tables

Table 1. <i>Timeline</i> .....	32
Table 2. <i>Participants</i> .....	33
Table 3. <i>Crosswalk of Teacher and Student Surveys</i> .....	36
Table 4. <i>Composite Variables of InnovateSkills, TechSkills, and LifeSkills</i> .....	58
Table 5. <i>Regressions of Impact on Instruction Composite Variables from LoTi</i> .....	59
Table 6. <i>T-test comparing Student and Teacher MES Survey Responses for Impact on Student Engagement</i> .....	65
Table 7. <i>Composite Variables for Student Engagement</i> .....	70
Table 8. <i>Regressions of Student Engagement Composite Variables from LoTi</i> .....	70
Table 9. <i>T-test Comparing Student and Teacher MES Survey Responses Showing how the iPad Is Being Used in the Education Environment</i> .....	72
Table 10. <i>Regressions of Levels of Teaching Innovation from the LoTi Survey</i> .....	75

## List of Figures

<i>Figure 1.</i> Data for timeline collected from Edudemic and Public Broadcasting Service (PBS)....	8
<i>Figure 2.</i> Technology barriers and measures to address them.....	21
<i>Figure 3.</i> Conceptual framework.....	22
<i>Figure 4.</i> Outcomes of the Framework for 21 <sup>st</sup> Century Learning .....	26
<i>Figure 5.</i> The research questions were derived from the themes that drove the research questions. .....	27
<i>Figure 6.</i> Kochendorfer's (1997) Action Research Framework.....	31
<i>Figure 7.</i> LoTi “Sniff” Test (Moersch, 1995).....	37
<i>Figure 8.</i> Research Question 1 data sources.....	40
<i>Figure 9.</i> Research Question 2 data sources.....	41
<i>Figure 10.</i> Research Question 3 data sources.....	40
<i>Figure 11.</i> Survey Participants.....	44
<i>Figure 12.</i> Students and teachers who took the MES Survey by School.....	45
<i>Figure 13.</i> Students and teachers who took the MES survey by grade level.....	45
<i>Figure 14.</i> Comparison of Phase 1 and Phase 2 teachers who took the MES Survey.....	46
<i>Figure 15.</i> Teachers who took the LoTi Survey by grade level.....	47
<i>Figure 16.</i> Teachers who took the LoTi Survey by subject area.....	47
<i>Figure 17.</i> Teachers who took the LoTi Survey by MES Phase.....	52
<i>Figure 18.</i> Teachers who took the LoTi Survey by years of teaching.....	48
<i>Figure 19.</i> Student MES Survey - Reading Habits.....	53
<i>Figure 20.</i> Teachers MES Survey - Impact on Instruction.....	50

<i>Figure 21.</i> Teacher MES Survey - iPad Impact.....	54
<i>Figure 22.</i> Student Learning and Innovation Skills - Comparison of LoTi Q1 and Q8.....	51
<i>Figure 23.</i> Students' Processing Information, Media, and Technology Skills – Results of LoTi Q4, Q5, and Q38.....	53
<i>Figure 24.</i> Life and Career Skills - Results of LoTi Q21, Q40 and Q47.....	54
<i>Figure 25.</i> Student MES survey responses to Question 5 about motivation. ....	60
<i>Figure 26.</i> Teacher MES survey – Engagement and Motivation. Question 9a. How has the iPad impacted student engagement and motivation? .....	61
<i>Figure 27.</i> Comparison of teacher and student responses – Real World Problems.....	57
<i>Figure 28.</i> Comparison of Teacher and Student - Classroom Content.....	58
<i>Figure 29.</i> Comparison of teacher and student responses – Investigate Issues.....	62
<i>Figure 30.</i> Comparison of teacher and student responses – Taking a Position.....	62
<i>Figure 31.</i> Comparison of teacher and student responses – Making a Decision.....	63
<i>Figure 32.</i> Comparison of teacher and student responses – Seeking a Solution.....	63
<i>Figure 33.</i> Comparison of Teacher and Student - Ethical Use.....	60
<i>Figure 34.</i> Comparison of teacher and student responses – Creativity.....	64
<i>Figure 35.</i> Comparison of teacher and student responses – Effective Use.....	64
<i>Figure 36.</i> Digital Aged Learning Experiences Q10.....	62
<i>Figure 37.</i> Learner-Centered Q19.....	63
<i>Figure 38.</i> Self-directed: Q14, Q22, & Q36.....	68
<i>Figure 39.</i> Assessments: Q6, Q20, Q32, Q41, & Q50.....	69
<i>Figure 40.</i> Comparison of teacher and student responses – Collaboration.....	70

<i>Figure 41. Comparison of teacher and student responses - Communicate</i> .....	70
<i>Figure 43. Teacher Computer Use (TCU)</i> .....	72
<i>Figure 44. Student Computer Use (SCU)</i> .....	72
<i>Figure 45. Current Instructional Practices (CIP)</i> .....	73
<i>Figure 46. Personal Computer Use (PCU)</i> .....	73
<i>Figure 47. Levels of Teaching Innovation (LoTi)</i> .....	74
<i>Figure 48. Phase 1 versus Non-Phase 1 Loti Levels</i> .....	75
<i>Figure 49. STEM versus Non-STEM Loti Levels</i> .....	75



## Chapter 1: Introduction

Dr. Smith<sup>1</sup>, middle school teacher in High Definition Public Schools (HDPS), announced her retirement after 30 years of teaching. Just after her announcement, Dr. Smith's school was chosen to pilot an iPad implementation to begin the next school year. Under this pilot program, every student and teacher would receive the mobile device. When she first heard the news, she asked: "Why would you give a toy to students? They are here to learn, not to play games." After touching the device during her initial professional development training, however, she was amazed at the possibilities and decided to teach an additional year.

Four years later, Dr. Smith was still teaching with the iPad. She attributed the use of the iPads as the main reason she decided to continue teaching. Dr. Smith stated, "This is the first time in my teaching career that I am able to reach my students where they are!" This declaration, however, bears closer examination; specifically, was it the device that enabled her to reach her students, or did her teaching strategies change since implementing the devices?

### Problem Statement

This study addressed the problem of school districts' investing large amounts of money into purchasing iPads without knowing if this is a good investment (i.e., the impact of iPads on instruction and learning). Not knowing the impact of the iPad as an instructional tool will continue to be a problem unless the education industry puts into place a system that evaluates the effects of having the iPad in the education environment.

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<sup>1</sup> To protect the confidentiality of the district, schools, and employees, the names of the school district, individuals, positions, and schools have been changed.

**Scope.** In 2010, Apple transformed the technology world with the release of the iPad, a lightweight, portable computer device with a 10-inch touch screen, about the size of a one-subject spiral notebook, which allowed consumers to access the Internet from anywhere. Mobile access to the Internet can be a powerful tool in education. Students no longer are tethered to a wired Internet connection or a power source. Instead they have instant access to updated information, access to experts in every field imaginable, and are able to extend their learning outside the classroom.

The education industry is gradually embracing the iPad, as evidenced by the 13 million sold to educational institutions in just the past 3 years. A closer examination of the statistics bears out the fact that the iPad revolution is nothing short of amazing. The following are examples:

- As of February 28, 2013, iTunesU content downloads had topped one billion (Apple, 2013). (iTunesU is a dedicated platform that features educational content from educational institutions for free download exclusively to the iPad.)
- According to a 2013 Harvard University study, 23% of teens aged 12-17 owned a tablet computer, representing a level comparable to that of adults. Almost one fourth of middle and high school students already have access to the mobile technology. (Berkman Center for Internet Technology, 2013).
- According to *Education Week*, Apple's iPad "dominates the market for tablets in K-12 schools in the United States" (Cavanagh, 2014, p. 1).

- Between April 2011 and October 2014, High Definition Public Schools (HDPS) had acquired more than 21,623 iPads.

Given the sheer volume of iPads being sold to education institutions (more than 5.2 billion dollars in iPad sales from the education industry, equivalent to the annual salary of 89,655 teachers (“High School Teacher: Salary,” 2014), the trend appears to be that schools are moving toward 1:1 implementation of mobile devices, meaning each student would have a mobile device as an instructional tool.

Given the amount of money being invested in purchasing iPads, the educational community stands to gain a great deal from evaluating the iPad as an instructional tool: “The heavy investment that schools spend nationally on digital tools and resources in the United States exceeds five billion dollars annually, yet seldom are technology solutions factored into any viable equation for improving student academic achievement” (Moersch, 2014, p. ix). Conducting program evaluations can make available pertinent information needed to make sound decisions, and the lessons learned from the evaluations can be used to improve services, build capacity, and increase the program’s effectiveness. Shulha, Caruthers, and Hopson defined program evaluation as

the systematic investigation of the quality of programs...for purposes of decision making, judgments, conclusions, findings, new knowledge, organizational development, and capacity building in response to the needs of identified stakeholders leading to improvement and /or accountability in the users’ programs and systems ultimately contributing to organizational or social value. (Shulha et al., 2010, p. xxv)

This study evaluated the impact of iPads on teaching, learning, and student engagement. The research also examined how the devices were being used in the

classroom. It is essential for decision makers to be equipped with this information so that they can make informed decisions on future purchases.

**1:1 iPads in Title I High Definition Public Schools.** In 2011, High Definition Public School System's (HDPS) Title I Department launched the Mobilizing Education for Success (MES) initiative, spending more than 3 million dollars to purchase iPads for each Title I middle school student and teacher, spanning four middle schools (Phase I). The goal of the initiative was to create digital learning environments to equip teachers and students with the tools required to meet the needs of the modern global society. The Title I Department hoped that this environment would motivate students to be engaged in their work, which would, in turn, increase student achievement.

Between 2011 and 2015, HDPS expanded the initiative into four additional Title I schools (Phase 2): one academy (K-8th), two elementary schools (K-5th), and one middle school (6th-8th). HDPS continued to purchase additional iPads without evaluating whether or not the goal of the MES initiative had been or was being met.

**Consequences of not addressing the problem.** There has been substantial and substantive research conducted on the impact and outcomes of technology integration in higher education and professional development; other research has suggested that the use of Digital Age Best Practices while integrating technology tools into kindergarten through 12<sup>th</sup> grade (K-12) environments has a positive effect on student outcomes (Moersch, 2014). Moersch's Digital Age Best Practices referred to a set of classroom best practices that

- (a) Can be seamlessly expanded when used in conjunction with digital tools and resources (e.g., mobile devices, interactive whiteboards, digital responders) and/or
- (b) Apply the principles of 21<sup>st</sup> Century Skills (e.g., critical thinking and problem solving, communication and collaboration). (Moersch, 2014, p. x - xi)

Although the Moersch (2014) research findings are more general in nature and are not specific to the iPad, they suggest that using Digital Age Best Practices in K-12 environments provides a solid foundation for instructional decision making, differentiating instruction, and integrating technology. Nevertheless, there has been very little research surrounding the correlation between student use of mobile device technology and academic achievement.

The paucity of research on Apple's iPad in general is, in part, attributable to the recent development of the technology. There has been even less research examining the ways in which iPads affect the academic environment. In particular, there was little research available related to the efficacy of the iPad as an instructional tool.

This lack of research has not slowed the rate at which schools are purchasing iPads. It is precisely for this reason, the increasing rate of purchases and use of iPads by and in schools, that practitioners should engage in targeted research to assess the impact and effectiveness of iPads as an instructional tool.

Although most educators might agree that mobile devices do provide the *opportunity* to create new learning experiences, the question remained: Are institutions preparing teachers to take full advantage of these opportunities? Given the large and growing investment that educational institutions are making, it was important to examine the impact of the technology on the learning environment and

student engagement. Most importantly, with the large investments these educational institutions are making, practitioners need to ascertain whether or not there are sufficient data to demonstrate that these mobile devices are positively impacting students' education.

According to the Maryland Educational Technology Plan, "it is critical to continually evaluate whether or not investments in time and resources spent in integrating technology into instruction makes a difference in the classroom" (Committee on Technology in Education, 2007). Although there has been very little evaluation of the iPad's effectiveness, K-12 institutions around the United States are heavily investing in the technology without assessing the value of their investment.

With this commitment of resources, including time and money, for the MES project, it is imperative that HDPS evaluate the impact of the use of iPads in the MES program.

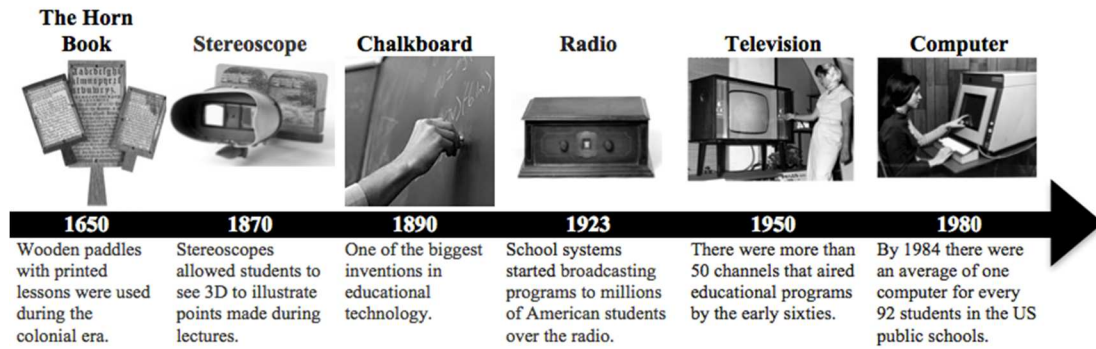
Having entered the 4<sup>th</sup> year of the MES program, HDPS was beginning to experience some of the consequences of not having previously conducted an evaluation. The specific purpose of an evaluation is to make judgments about a program, to improve its effectiveness, and to inform programing decisions (Patton, 1987). The current lack of data explaining the effects of the iPads on instruction and learning has forced HDPS decision makers to make uneducated decisions about future purchases. The consequences of these decisions may lead to unnecessary expenditures. Specifically, schools in HDPS that are not a part of the MES program have acquired the devices without an implementation plan, an assessment strategy, realistic expectations, or measurable outcomes.

Likewise, the MES program has continued not only to spend additional resources on the maintenance of the devices already in service but also to purchase additional equipment. The end result is that HDPS has continued to spend millions of dollars on these digital tools and resources without adequate information correlating its technology investments to its desired educational outcomes and, thus, has been unable to make truly informed decisions about the utility of the iPads.

As the manager of the MES project, the researcher looked forward to identifying the outcomes of the initiative. The researcher conducted a quantitative study to determine (a) if the instructional strategies of teachers who participated in the MES project changed and (b) if they experienced any changes in their students' engagement. This research assisted with moving HDPS forward by developing a monitoring tool to facilitate data collection on an ongoing basis, and the data, subsequently, aided in modifying the program to net better, more consistent, and positively sustained education outcomes.

### **Justification/Rationale**

**Background information.** Technology is defined as “the application of scientific knowledge for practical purposes” (Webster, 2012) In fact, schools have been using technology to engage students since the beginning of recorded history. The chalkboard, introduced in 1890, still is a valuable tool used in many classrooms. As evidenced in Figure 1, the classroom has evolved based on the available technologies.



*Figure 1.* Data for timeline collected from Edudemic and Public Broadcasting Service (PBS).  
(Dunn, 2011; PBS, 2001)

Before the introduction of the radio to the classroom, educational content was limited to available materials and the teacher's education level. The advent of radio, and later of television, introduced and integrated content and instruction from outside sources. Today's technology has expanded the classroom even further by totally demolishing the traditional barriers of the four walls. Students today are able to receive affordable instruction from experts throughout the world with virtually no geographical limitations.

According to Public Broadcasting Service (2001), until the year 2000, the computer was the fastest growing technology in U.S. public schools. In 1984, there was one computer for every 92 students. By 2001, that ratio changed to one computer for every four students—an increase of approximately 2,500% (PBS, 2001). With these increases, the technology itself has evolved dramatically. The capacity, speeds, affordability, and size of the computers all have transformed substantially. Today, these devices have access to the Internet, thereby changing the landscape of education forever.



The advent of the Internet in education is revolutionary. Teachers and students now are given seemingly unlimited access to data, research, and experts from around the world. What makes this phenomenon so revolutionary is the fact that information is available in real time. Educators and students do not have to rely on outdated textbooks. With little effort, teachers and students can access current information.

The Internet also gives students a voice and a platform. Prior to the Internet, the students' audience was limited to their teacher and classmates. Students now are able to publish their work online, where the entire online world becomes their audience. Research has indicated that students are motivated to write at their best levels when they know their work will be published. In fact, research conducted by Ensio and Boxeth (2000) proved that publishing benefits are twofold in that they improve students' writing skills as well as encourage students to write by creating purpose and vision for them.

In 2010, Apple released the iPad, which allowed consumers to access the Internet from anywhere, forever changing the way society accessed information. The following are salient iPad and mobile device statistics compiled by MDG Advertising (2012):

- Within the first 45 days of iPad sales, 47,000 were sold to schools in the United States;
- There are more than 20,000 educational apps available for iPads;
- iTunesU, Apple's catalog of free digital education content, offers more than 500,000 pieces of audio and video material; and

- iPads are used by more than 1,000 colleges worldwide.

There is a plethora of research on technology integration in higher education and professional development (Moeller & Reitzes, 2011). The research also suggests that specific uses of technology can improve kindergarten to 12<sup>th</sup> grade (K-12) student outcomes. Although these research findings are general, Moeller and Reitzes (2011) suggested that the research does indicate that technology in K-12 environments can (a) aid in diagnosing and addressing individual needs, (b) equip students with skills vital for work and life in a 21<sup>st</sup>-century global society, and (c) offer an active experience for students. Nevertheless, there is little research correlating student use of mobile device technology and achieving academic goals.

Because of the newness of Apple's iPad, there was a gap in the literature with regard to understanding the iPad as an instructional tool. It was time to examine the impact of iPads on teacher instructional strategies and pedagogy, as well as student engagement, and to determine whether the professional development received related to that impact. Even though there was a gap in the literature, HDPS gathered data from the MES initiative that the educational industry could use.

At the beginning and end of each year, participants (students, teachers) in the MES initiative took surveys that measured engagement, behavior, and the use of the iPad as an educational tool. Evaluations also were given to teachers after they participated in professional development about how to use the iPad as an instructional tool. Evaluating the data collected through these surveys provided insight into the participants' perception of how the iPad was affecting teaching and learning and how the device was being used in the classroom.

In SY 2015, instructional technology specialists from the district conducted informal observations in several classrooms that were implementing the iPad. Examining the data collected through the observations shed an unbiased light of how the tool was being used.

At the beginning of SY 2015 teachers were given the Level of Technology Integration (LoTi) digital survey to help determine the type of professional development that should be offered to the teachers. The survey generated a level of technology integration for each teacher and provided recommendations on how to move to the next level of integration. The data collected from the LoTi survey can be a useful tool in understanding how the iPad was integrated into teachers' practice.

**Contribution to knowledge base and best practices.** This study is significant because it adds to the body of limited research about iPads and mobile devices in the educational environment. The findings can (a) inform school districts about how the devices are being used and (b) address potential pitfalls prior to implementing 1:1 computing initiatives. Further, results can provide valuable information to educational technology and other mobile device developers concerning shortfalls, underperformance, and other problems experienced by the educational community, consequently, leading to more educationally specific devices.

The advent of Common Core, national standards in mathematics and language arts literacy, has created national standards, thereby opening the door for a national evaluation tool. The student's being able to understand the proper use of technology is an underlined thread throughout the Common Core Standards. The researcher hoped to recommend a method that school districts can use to evaluate the

effectiveness of technology projects as related to Common Core and the national Partnership for Assessment of Readiness for College and Careers (PARCC) test.

**Advanced educational opportunities for students.** According to the State Educational Technology Directors Association (2008), students benefit in the following ways when educational technology is evaluated: (a) improvement of academic achievement through effective technology use, (b) assurance that students acquire 21<sup>st</sup>-century skills through effective technology use in the context of high standards and high quality learning, and (c) engagement of students in learning through effective technology use (para. 9).

### **Critical Literature**

Over the past 2 years, the researcher consulted Google Scholar, EBSCOhost, ProQuest, and ERIC databases to find peer-reviewed literature surrounding the topics of “technology integration into education,” “evaluation of technology tools in education,” “iPads in education,” “mobile devices in education,” “evaluation of technology in K-12,” and “evaluation of K-12 programs.” The researcher combed through the references of the peer-reviewed articles to find additional sources of information. The researcher also conducted interviews with HDPS leadership about the process of evaluating initiatives and reviewed HDPS documents, for example, the HDPS Master Plan and the HDPS Technology Plan.

Based on the literature review, all of the sources seemed to agree that a key aspect of technology implementation in schools should be whether such tools improve learning and teaching and increase student achievement (Born, 2007; Lawless & Pellegrino, 2007; Roblyer & Knezek 2003; U.S. Department of Education,

2002). Likewise, there appeared to be a mutual understanding about the “complexities and challenges of reliability evaluating the effectiveness of technology” (Noeth & Volkov, 2004, p.7).

Although technology is an essential part of education, it can be difficult to separate the effects of technology from the effects of other dynamics that impact learning and teaching (Noeth & Volkov, 2004). Finding credible literature related to the integration of a new technology, specifically the iPad, into the field of education was challenging due to the limited research on this topic. Nevertheless, overarching themes did arise. For example, the American Association of Colleges for Teacher Education (AACTE) advisory group and the strategic council of the Partnership for 21<sup>st</sup> Century Skills (2010) identified the most critical component in technology use as the preparedness and skill level of those implementing the technology. Consequently, this literature review drew on the observational research regarding digital learning, 21<sup>st</sup> Century Best Practices, and teacher preparedness as a foundation for this study.

**Key issues.** The goal of the MES initiative was to create an environment that would motivate students to be engaged in their work so that student achievement would improve. The questions were worded as follows: Has this program been effective, and more importantly, has it produced its desired outcomes? If not, what corrective actions are required? Does HDPS have adequate resources to make these adjustments, if needed? Given the large commitment of resources such as time, personnel, and money for the MES initiative, does HDPS have an exit strategy for the program if these goals are not met, or have they fully vested themselves into the success of this project?

With these concerns, evaluating the MES initiative was a needed part of the process. With the creation of a proper evaluation process for the MES initiative, HDPS will have an understanding of the program's current status in relationship to its target goals as well as identification of areas for improvement. This information will be critical in making effective programming decisions in the future.

The MES program has many facets. Being implemented in eight different schools offers eight unique experiences. Although the program has specific guidelines and parameters germane to school participation, each school may have developed individual implementation strategies to achieve its goals, and these strategies may or may not work in other schools. This individual dynamic made it difficult to create a baseline by which to evaluate the program. Thus, to evaluate the MES initiative properly, the researcher kept the MES initiative's goal as the focal point of the evaluation. This goal was subdivided into two major themes: learning environment and student engagement.

**Learning environment.** In exploring the MES classroom, on the surface, the fact that every child and teacher had an iPad led one to believe that this truly was an engaging, 21<sup>st</sup>-century, educational instruction environment. Having spent considerable time in these classrooms as a Title I Instructional Technology Specialist, the researcher found that this conclusion was not necessarily true. According to Grabinger and Dunlap (2011), rich environments for active learning, or REALs, are comprehensive instructional systems that evolve from and are consistent with constructivist philosophies and theories. To embody a constructivist view of learning, a REALs classroom must

- Promote study and investigation within authentic contexts;
- Encourage the growth of student responsibility, initiative, decision making, and intentional learning;
- Cultivate collaboration among students and teachers;
- Utilize dynamic, interdisciplinary, generative learning activities that promote higher-order thinking
- Utilize processes to help students develop rich and complex knowledge structures; and
- Assess student progress in content and learning-to-learn within authentic contexts using realistic tasks and performances. (Grabinger & Dunlap, 2011, p. 10)

By surveying teachers who participated in MES initiative, the researcher investigated the impact of the iPad on the learning environment to determine if teachers experienced rich environments for active learning.

**Student engagement.** According to Fredricks, Blumenfeld, and Paris (2004), there are three dimensions of student engagement: behavioral, emotional, and cognitive. Toshalis and Nakkula (2012) asserted that self-regulation theory provides a student-centered perspective on the various dimensions of student engagement. Self-regulation theory is focused on what students do to produce and maintain their engagement. According to self-regulation theory, engagement begins with the students' understanding that they are active participants in their own learning. These researchers posited, "to be self-regulated is to be goal-directed and demonstrate control over and responsibility for one's focus and effort when engaged in learning activity" (Toshalis & Nakkula, 2012, p.18). By surveying teachers and students who participated in the MES implementation, the researcher explored teachers' and students' perceptions regarding the impact of iPads on students' engagement.

### **Analysis of Prior Attempts to Address the Problem**

As a part of the MES initiative, the Title I Department purchased a "data analysis" from Apple to evaluate the program each year. Apple provided keynote presentations at the end of each school year (SY 2012, SY 2013, & SY 2014) that outlined comparative student data in the areas of attendance, behavior, state test, and teacher survey data collected from the Title I department. The presentation compared MES schools to non-MES schools with similar demographics. The analysis was very positive for Apple and the school system's showing growth in student achievement and teacher attitudes.

The researcher questioned the validity of these reports for two reasons. First, the vendor performed the evaluation. This situation creates a possible conflict of



interest. Even if the information presented were factual and accurate, how motivated would the vendor be to develop reports that expose possible negative aspects of the implementation? After all, negative outcomes could hurt future sales to the education community. Second, each of the schools had multiple intervention initiatives underway during the same time as the iPad implementation. Therefore, it was not possible to conclude that the students' achievement gains were a direct result of the iPad implementation.

An evaluation specialist from the HDPS Department of Research and Evaluation noted, "Our office has not done an evaluation of the iPad initiative in the schools" (Personal communication, October 4, 2014). For a program to be evaluated by the Department of Research and Evaluation, there must be a formal request made by the district, the school, or program leaders. No formal request had been made.

There was no set process or evaluation protocol that the department used to conduct evaluations; each evaluation was tailored to the need(s) of the requestor. There was a rationale for this process, according to the evaluation specialist: "Every evaluation project is different and it depends on what the sponsor wants to know and/or what we would reasonably be able to report within a given time frame and with the data that we have or will get" (Personal communication, October 4, 2014).

The evaluation specialist also claimed,

The Department of Research and Evaluation tries to determine how the program impacted the target population and estimate how well the target population would have done in the absence of the program. If the difference between those two measures is significant and positive, we can usually conclude that the program had an impact. (Personal communication, October 10, 2014)

The interview with the evaluation specialist confirmed that HDPS has not made public an evaluation of the MES iPad implementation.

**District documentation.** There was no formal technology evaluation tool in High Definition Public Schools (High Definition Public Schools Board of Education, 2008; 2013). The county's technology plan stated that they would utilize the state's tool: "We intend to use the Maryland State Department of Education assessment tools to assess meeting student, teacher, and administrator standards" (High Definition Public Schools Board of Education, 2008, p. 12). When the researcher visited the Maryland Department of Education website and called their Research and Evaluation Department, however, there was no identified assessment tool for technology programs.

**HDPS evaluation of software and hardware.** In examining the evaluations conducted in HDPS, it appeared that the majority of evaluations were conducted before making purchasing decisions. Conversation with the Executive Director of Curriculum and Instruction (C&I) revealed that all of the evaluations were done prior to purchasing textbooks, curriculum, and other instructional tools. "Since we cannot afford to re-adopt, a lot of work goes into getting it right the first time. It is too hard to do otherwise but we do listen to teacher feedback to support the adoption," confirmed the Executive Director of C&I (Personal communication, October 4, 2014). This was not only true for C&I; the same pattern was observed with the HDPS Technology Department.

According to the HDPS Chief Information Officer (CIO), the HDPS Technology Department evaluated hardware and software to ensure it could work

within the HDPS network. For large system purchases, there was an Information Technology Governance Process for approval; however, neither of these processes evaluated the effectiveness of the program. When the school district implemented Oracle and the student information system, they targeted compatibility and integration. Again, even with a purchase of this magnitude, neither of the products was evaluated on the basis of determining its effectiveness for the organization. The CIO stated, “Whether it is a technology program or an instructional program, I do not think the process would be different” (Personal communication, October 4, 2014).

The researcher agreed with the county’s decision to invest time in researching the viability of a program prior to making a purchase. The researcher also believed, however, that it was equally important to evaluate the program after the implementation to measure if it was meeting the ultimate, defined, and stated program goal: increasing student achievement.

According to the State Educational Technology Directors Association (2008), students benefit in the following ways when educational technology is evaluated: (a) improvement of academic achievement through effective technology use, (b) assurance that students acquire 21<sup>st</sup>-century skills through effective technology use in the context of high standards and high quality learning, and (c) engagement of students in learning through effective technology use. Therefore, evaluation will benefit administrators and students.

### **Proposed Investigation**

The Title I Department of HDPS purchased iPads for one academy (Grades kindergarten to 8<sup>th</sup>), five middle schools (Grades 5<sup>th</sup> through 8<sup>th</sup>), and two elementary

schools (Grades kindergarten to 5<sup>th</sup>) with the intent to increase students' levels of engagement in their work, which would, in turn, increase their achievement on the state assessment examination.

With the approval of HDPS and the University of Maryland Institutional Review Board, this study explored the perceptions of students and teachers involved in the MES implementation. The researcher conducted a quantitative data review of student and teacher surveys that were administered during SY 2015 by the school system's Title I Office.

According to Hew & Brush (2006), when implementing technology as an instructional tool in the K-12 environment, there are six barriers that affect student learning:

- a. Resources – refers to the lack of technology or resources such as time
- b. Institution – may include scheduling, leadership and planning
- c. Subject Culture - refers to the “general set of institutionalized practices and expectations which have grown up around a particular school subject, and shapes the definition of that subject as a distinct area of study” (Goodson & Mangan, 1995, p. 614).
- d. Attitudes and Beliefs – refers to whether teachers like or dislike the technology
- e. Knowledge and Skills – refers to whether teachers knows how to use the device as well as how to integrate the tool into the curriculum
- f. Assessment – refers to the tendency of teacher, in the face of the pressure of high stake testing, to revert to traditional ways of teaching rather than using technology because of the additional technology planning time required to identify and select appropriate software to match lesson objectives. (Hew & Brush, 2006 p. 230)

Over the past 4 years the Title I Department put into place several strategies to overcome some of these barriers. For instance, the office administered surveys to participants to try to gauge attitudes and beliefs. These surveys also were used to measure differences in usage based on the subjects teachers taught, which would

allow the office to accurately identify the subject culture. If the survey noted a specific content area was significantly lower than other content areas, additional professional development was offered to those teachers.

The office also offered more than 100 hours of professional development to each teacher to help build teachers' knowledge and skills, the objective's being to increase the positive attitudes of the teachers. The office administered evaluations to teachers after they participated in the professional development.

Finally, the Title I Department also developed professional learning communities focused on technology integration, for example, Flipped Classroom and Challenge Based Learning. Figure 2 depicts technology barriers and the measures the Title I Department put into place to overcome or address these barriers.

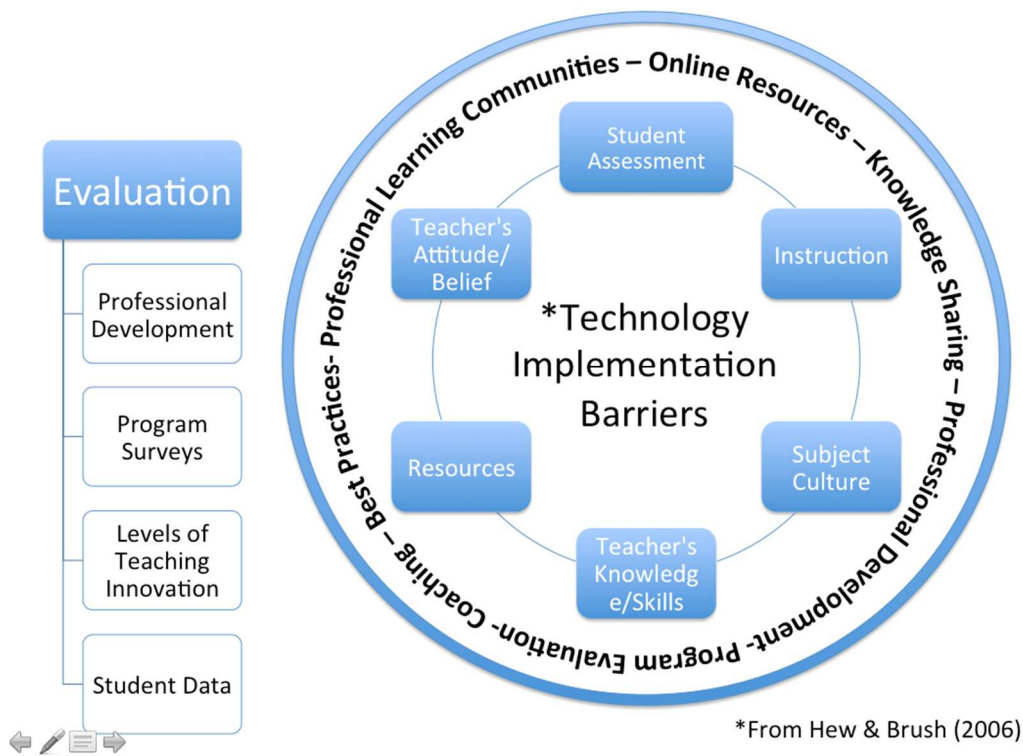
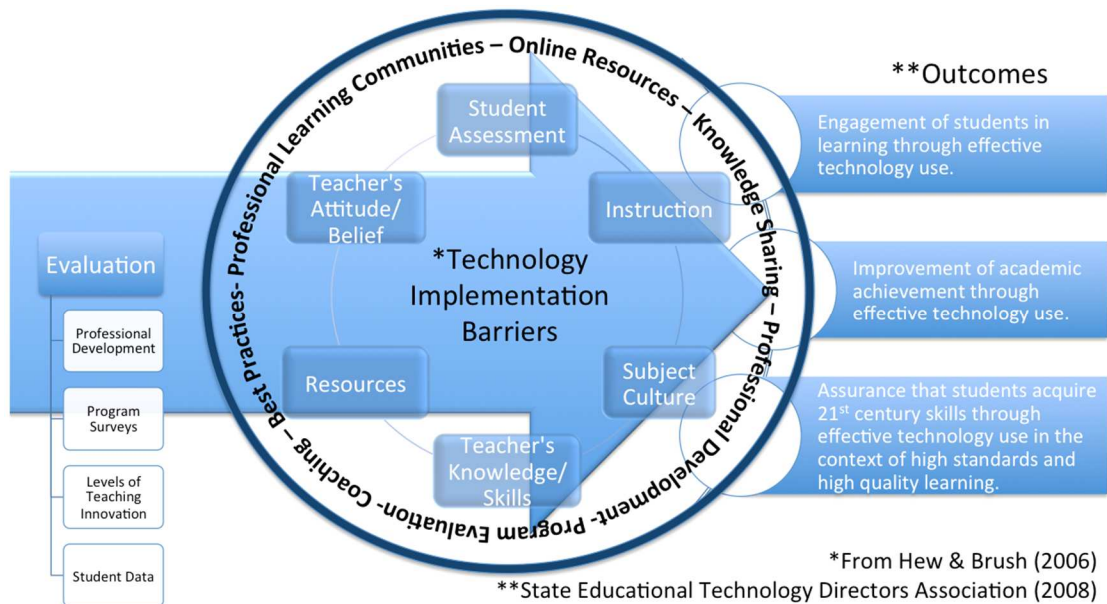


Figure 2. Technology implementation barriers and measures to address them.

This figure illustrates the technology implementation barriers in the center ring. The outer ring represents resolutions put into place to counteract the barriers. Technology implementation barriers were gathered from Hew and Brush (2006). Listed to the left are evaluation tools.

This research explored the data collected from the surveys, evaluations, and student assessments. In the conceptual framework depicted in Figure 3, these data points are listed under evaluation. The data were classified as outputs from the MES implementation, providing useful information about iPads in an educational environment.



*Figure 3.* Conceptual framework.

The conceptual framework builds on Figure 2 by adding the arrow which points to the expected outcomes from the State Education Technology Association (2008). \*Barriers to technology implementation came from Hew and Brush's (2006) research.

As Figure 3 depicts, there are three outcomes from evaluating educational technology (State Educational Technology Directors Association, 2008): (a) engagement of students in learning through effective technology use, (b) improvement of academic achievement through effective technology use, and (c)

assurance that students acquire 21<sup>st</sup>-century skills through effective technology use in the context of high standards and high quality learning.

More than 6,000 participants (students and teachers) took part in the MES implementation over the past 4 years. With such a large population, quantitative research was the most useful method for this study (Christensen & Johnson, 2007). The quantitative data provided a better understanding of the implementation of the technology. Using a quantitative design provided more precise information about iPads in educational environments (Christensen & Johnson, 2007). Moreover, Christensen and Johnson postulated that quantitative research might have higher credibility with many people in power.

Therefore, this study utilized a quantitative descriptive statistics design. The descriptive statistics design is straightforward. Descriptive statistics uses data analysis techniques that produce meaningful pieces of data with a small number of indices (Gay, Mills, & Airasian, 2006). In essence, quantitative research allowed the researcher to objectively measure and analyze data.

In addition, this quantitative research design study was conducted using the action research framework, defined by Fleming as “a systematic inquiry into a school or classroom situation with the intent of improving the quality of teaching and learning and gaining a deeper understanding of the complex context in which it occurs” (Fleming, 2000, p. 11). The secondary rationale for the action research framework was to change practice, create new understandings, develop new relationships, and/or to seek answers to problems; these were fundamental outcomes espoused by Kochendorfer (1997).

Researchers perform action research studies to enhance education and close the divide between practice and theory (Hinchey, 2008; Stringer, 2014). This researcher used the action research framework to create new understanding relative to the use of iPads in an educational environment. Specifically, in her position as Title I technology instructional specialist, the researcher played the role of an action researcher, working with schools implementing the devices while simultaneously seeking ways to improve practice within the school district.

This study is significant because it adds to the body of limited research about iPads and mobile devices in the educational environment. The findings inform school districts about how devices are used and address potential difficulties and barriers prior to implementing 1:1 computing initiatives. Further, results provide valuable information to educational technology and other mobile device developers concerning shortfalls, underperformance, and other problems experienced by the educational community, which potentially will lead to more educationally specific devices.

The advent of Common Core has created a national curriculum, which opens the door for a national evaluation tool. The researcher hopes to produce an evaluation tool that school districts can implement to evaluate the effectiveness of technology implementations.



## Chapter 2: Investigation

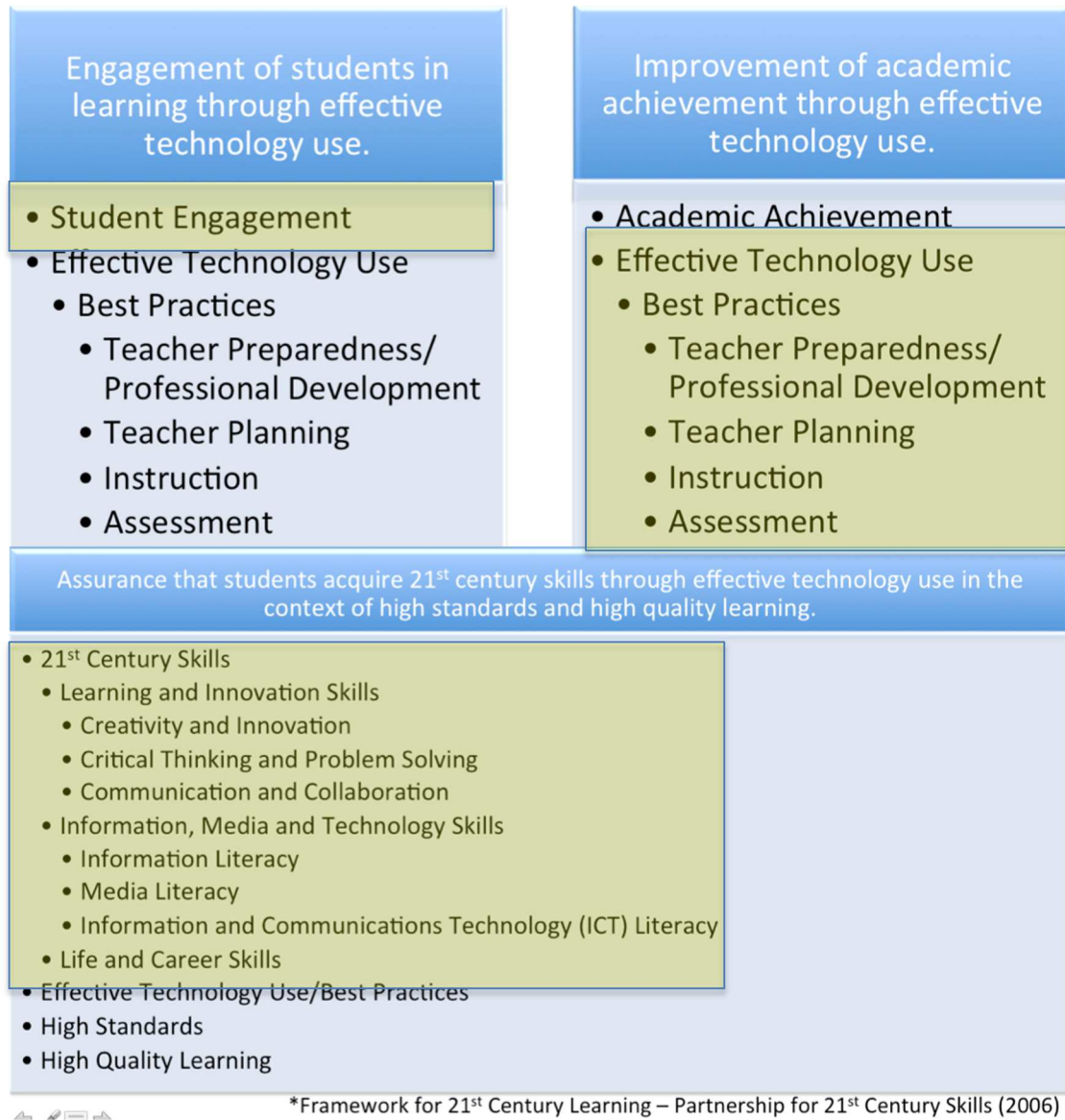
### Research Questions

In the previous chapter, the researcher introduced the initiative entitled Mobilizing Education for Success (MES), through which the High Definition Public Schools (HDPS) Title I Department spent more than 3 million dollars to purchase iPads for four Title I middle schools in Phase I; the school district recently expanded the initiative to four additional Title I schools. Every student and teacher who participated in the MES initiative received an iPad. The purpose of this study was to explore what can be learned from the MES initiative, specifically, the effects of the iPads on learning environments and student engagement.

The conceptual framework (Figure 3) depicts the outcomes of successful technology implementations. Figure 4 places those outcomes as headings and categorizes the outcomes of the Framework for 21<sup>st</sup> Century Learning, which was developed by the Partnership for 21<sup>st</sup> Century Skills (2006). Figure 5 also highlights the major themes and constructs from which the research questions were developed; the constructs and major themes that drove the research were (a) student engagement, (b) effective technology use, and (c) 21<sup>st</sup> century teaching and learning. Figure 5 introduces the research questions and illustrates how the research questions coincide with the major themes and constructs from Figure 4. By conducting this study, the researcher answered the pertinent questions.

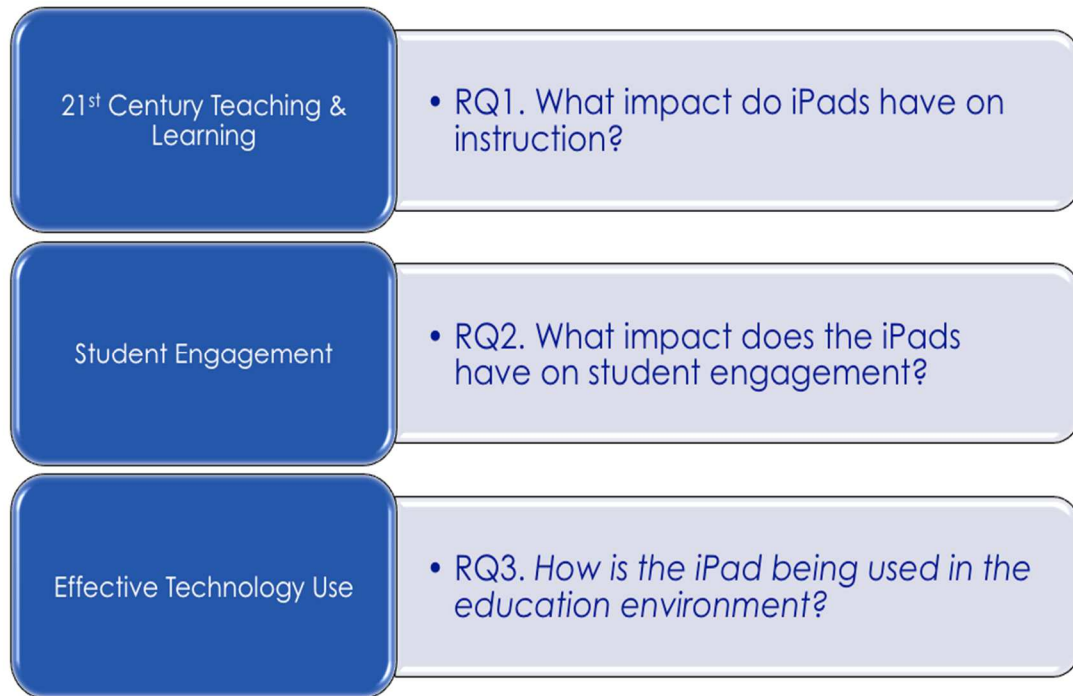
**Research Question1: What impact do the iPads have on instruction?** The teacher sets the learning environment based on instructional strategies he or she employs.

- Did instructional strategies change when teachers and students were given the iPads?
- Did the professional development change teacher instructional strategies?



*Figure 4.* Outcomes of the Framework for 21<sup>st</sup> Century Learning.

The constructs listed in the dark blue section are the outcomes of effective technology implementation according to the State Education Technology Directors Association (2008). The light blue area categorizes the outcomes of the Framework for 21st Century Learning, which was developed by the Partnership for 21st Century Skills (2006). Highlighted in yellow are the themes that drove this research.



*Figure 5.* The research questions were derived from the themes that drove the research questions.

Christopher Moersch identified six instructional strategies that “have the potential to elevate student growth beyond those documented by conventional best practices” (Moersch, 2014, p. X), which he labeled Digital Age Best Practices (DABP). DABP was used as a guideline to assess whether teacher instructional strategies had, in fact, adapted to the best practices found in the DABP. To measure their levels of innovation and assess their incorporation and use of DABP, teachers took the Levels of Technology Innovation (LoTi) Survey (See Appendices C and D for the LoTi Framework and the teacher survey questions.).

The teachers who took the LoTi survey were all teachers who taught in Title I schools. Title I schools receive additional federal funding to improve academic achievement of students who have been identified as disadvantage. More than 66%

of students in HDPS Title I schools have been identified as disadvantaged (meaning the students come from low-income families, foster homes, neglected or delinquent, or families receiving temporary assistance from the state government). The pool of Title I teachers surveyed with the LoTi instrument included teachers in Phase I, and Phase II of MES, as well as teachers who didn't participate in the iPad initiative. As noted previously, MES expanded in Phase II to four additional Title I schools: a middle school, two elementary schools, and one academy. Surveying these teachers provided the researcher with a wide range of perspectives of teachers who taught grades preK-8, thereby allowing the researcher to determine any differences that might be evidence across a greater span of grades. Finally, the researcher compared data from teachers who participated in the iPad initiative versus those who were not part of the iPad initiative to detect if there were any differences in instructional strategies.

**Research Question 2: What impact do the iPads have on student engagement?** This research evaluated teachers' perceptions of the iPads' impact on (a) student engagement, (b) student motivation, (c) student study habits or strategies, (d) metacognition, and (e) academic performance.

The iPads are personal devices; students received their own iPads for which they were responsible. The iPads were not shared amongst students. Because the iPad belonged to the student, the student had ownership of her or his work in the ability to track it. The literature indicated that students who were better able to regulate their learning in a deliberate and reflective way frequently exhibited greater academic motivation and achievement (Zimmerman, 2008). Therefore, it was

expected that the iPads would improve students' engagement, motivation, study habits or strategies, and academic performance.

**Research Question 3: How is the iPad being used in the education environment?** It is important to assess the return of investment of the iPads purchase, for example: How are the iPads being used? Are they sitting in a closet somewhere? Are they being used daily or just taken out for special occasions? The researcher answered these and other questions and identified best practices for the iPads' implementation and integration into the education environment.

Working at the district level, the researcher observed that schools often operating in self-contained silos, keeping their experiences to themselves. This self-containment resulted in the district's experiencing only pockets of success rather than widespread, sustained success.

This study was based on data collected from a reflection survey administered to teachers and students currently participating in the MES initiative. The results will be shared openly throughout the district so that everyone may benefit.

This research also has identified lessons learned and best practices from the iPad implementation and integration into the education environment. Data collection included examining Title I surveys and evaluations and studying national test results of students participating in the MES initiative. By collecting and disseminating learned lessons and best practices, all schools will benefit.

### **Design**

This research explored what could be learned from a pilot program that incorporated the iPad into Title I elementary and middle school classrooms. Having

been approved by HDPS and the University of Maryland Institutional Review Board, this study explored the perceptions of participants (teachers and students) based on HDPS Title I-administered surveys and evaluations.

The composition of the research questions, in conjunction with the accessible resources for the study, should determine selection of a research design (Gall, Gall, & Borg, 2003). Based on the research questions, reviewed earlier, and collection of the surveys that the school district had administered, the researcher determined that quantitative descriptive and inferential statistics would represent the most appropriate type of research design.

Descriptive research is an “efficient way to document the views of large groups in a short period of time” (Bickman & Rog, 2009, p. 560). Using descriptive statistics, the researcher was able to explore quantitative responses of students’ and teachers’ perceptions collected through the MES surveys as well as teachers’ responses to the LoTi survey.

The researcher also used inferential statistics to examine the MES surveys. Inferences were made about the entire population of MES teachers and students using the sample data from the surveys. The t-test is one of the simplest inferential tests used when you want to compare the average performance of two groups on a single measure to see if there is a difference” (Trochim, 2006). The researcher used t-test to compare the differences between students and teachers. Another form of inferential statistics the researcher used was regression analysis to examine the LoTi data. To sum it up, the researcher used inferential statistics to draw conclusions from the data collected from MES surveys and LoTi to reach general conclusions; by the same

token, the researcher used descriptive statistics to describe what was going on in both data sets.

This study also employed the use of the action research framework. Fleming defined action research as “a systematic inquiry into a school or classroom situation with the intent of improving the quality of teaching and learning and gaining a deeper understanding of the complex context in which it occurs” (Fleming, 2000, p. 11). Kochendorfer (1997) said that action research should be performed to change practice, create new understandings, develop new relationships, or seek answers to problems. (See Figure 6.)



*Figure 6.* Kochendorfer's (1997) Action Research Framework.

The researcher used the framework of action research to create new understanding surrounding the use of iPads in an urban, middle and elementary 1:1

iPad environment. The research also examined the iPad's impact on both the learning environment and perceptions of student engagement.

Researchers perform action research studies to enhance education and close the divide between practice and theory (Hinchey, 2008; Stringer, 2014). In her position as Title I Technology Instructional Specialist, the researcher played the role of action researcher, working directly with schools implementing the devices, while simultaneously seeking ways to improve practices within the school district.

### **Methods and Procedures**

During the beginning of SY 2015, the Title I Department collected survey information from teachers and students by using the LoTi and MES surveys. From March to May of 2015, the researcher obtained the proper approval from the University of Maryland College Park research committee and HDPS to use the data collected from the LoTi and MES surveys to conduct this research. In June and July of 2015, the researcher combed through the survey data to organize it into an easily analyzed format, subsequently importing all of the data into a Microsoft Excel file, which facilitated the analysis.

**Timeline.** Table 1 outlines the steps taken by the researcher in analyzing the data.

Table 1. *Timeline*

Date	Task
April - June 2015	Obtained approval from <ul style="list-style-type: none"> <li>• University of Maryland College Park research committee</li> <li>• High Definition Public Schools</li> </ul>



July - August 2015	<ul style="list-style-type: none"> <li>Gather and organized HDPS surveys, evaluations and observations by transferring them to Excel format</li> </ul>
September 2015	Converted data from the survey administered in April to Excel format
October - November 2015	<p>Analyzed</p> <ul style="list-style-type: none"> <li>The MES Survey (Appendices D and E)</li> <li>Final Loti Survey administered (Appendix A)</li> </ul> <p>Start writing the results, conclusions, and impact on school district.</p>

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**Participants.** All of the participants were either students or teachers who attended or taught at a HDPS Title I school. As defined earlier, Title I schools in HDPS districts have more than 66% of students who have been identified as disadvantaged. The initial rollout of MES in SY 2012 included four Title I middle schools (Middle School A, Middle School B, Middle School C, and Middle School D). In SY 2015, MES expanded to include two Title I elementary schools (Elementary School A and Elementary School B), one Title I academy (Academy A), and one additional Title I middle school (Middle School E). Table 2 presents a breakdown of the participants in the MES initiative for the 2015 school year:

Table 2. *Participants*

School	Type	Grade Level	Number of Students	Number of Teachers	Number of Admin
Academy A	Academy	K-8 <sup>th</sup>	560	47	3
Elementary School A	Elementary	K-5 <sup>th</sup>	612	38	2

Elementary School B	Elementary	K-5 <sup>th</sup>	499	28	2
Middle School A	Middle	5 <sup>th</sup> -8 <sup>th</sup>	1,085	64	3
Middle School B	Middle	5 <sup>th</sup> -8 <sup>th</sup>	985	39	3
Middle School C	Middle	5 <sup>th</sup> -8 <sup>th</sup>	868	50	3
Middle School D	Middle	5 <sup>th</sup> -8 <sup>th</sup>	1,013	53	3
Middle School E	Middle	5 <sup>th</sup> -8 <sup>th</sup>	639	44	3
Total:	8 Schools	K-8 <sup>th</sup>	6,261 Students	363 Teachers	22 Admin

**Instruments.** The researcher analyzed three instruments, MES teacher survey, MES student survey and the LoTi survey, to answer the research questions. The HDPS Title I Department administered all of the instruments. The following sections describe the survey instruments, how and when they were administrated and the targeted participants.

*MES teacher and student surveys.* The Title I Office had a team of seven educators develop the MES teacher and student surveys. The team was made up of four teachers who taught in an MES school, two Title I technology specialists and one Apple data analyst. The student survey was made up of 12 questions and teachers survey contained 13 questions. The team used Google Forms as the platform to deliver and collect the survey answers. By using Google Forms all answers from the MES surveys where collected into a spreadsheet. The Title I Department administered the MES teacher and student surveys every year. The Title I office only

administered the MES survey to the students and teachers participating in the 1:1 iPad initiative.

Each principal at the MES participating schools identified a teacher to be the MES lead. The MES lead served as the liaison between the Title I Office and the school. The Title I office sent an email to each MES lead and principal requesting that they administered the MES surveys to their teachers and students. The email provided hyperlinks to the MES teacher survey (Appendix E) and MES student survey (Appendix D). The Title I Office asked the MES leads to email the survey links to the MES teachers. The teachers were given a two-week window to take the teacher survey and administer the student survey. The Title I Office sent two reminders to the MES leads and principals asking them to remind their teachers to take and administer the surveys.

The researcher analyzed the teacher survey results by comparing Phase 1 schools, Phase 2 schools, and STEM teachers. Teachers who taught math, science, technology, and engineering were grouped together as STEM teachers. The survey contained both multiple choice and open-ended questions. Appendix E lists all of the questions on the teacher survey. Appendix D delineates the questions asked on the MES Student survey in SY 2015. By using both the student and teacher surveys the researcher was able to gain an accurate picture of both perspectives. Table 3 presents a crosswalk of the student survey and the teacher survey, showing similar questions posed to each type of participant.

Table 3. *Crosswalk of Teacher and Student Surveys*

Teacher questions	Equivalent student questions
1. School	1. School
2. What subject area(s) do you teach?	7. How often do you use the iPad in the following subjects?
3. Do you have Internet access at home?	3. Do you have Internet access at home?
4. What grade level(s) do you teach?	2. Grade level
5. Rate the following statements: <ul style="list-style-type: none"> <li>• Students in my class engage in planned activities that involve the use of the iPad to solve real-world problems.</li> <li>• I encourage my students to use the iPad to supplement the curriculum and reinforce specific classroom instruction.</li> <li>• I promote, monitor and model the ethical use of mobile technologies in my classroom.</li> <li>• I encourage students to use the devices in my classroom to promote creativity and innovative thinking.</li> <li>• I model and facilitate the effective use of current and emerging mobile devices, applications and programs to support teaching and learning in my classroom.</li> </ul>	8. Rate the following statements: <ul style="list-style-type: none"> <li>• In some of my classes, I engage in learning activities that involve the use of mobile devices to solve real-world problems or issues.</li> <li>• I use mobile technologies in the classroom and/or to study classroom content.</li> <li>• In some of my classes mobile technologies are used only by me (the student) and not by my teachers.</li> </ul>
6. In my class, students use the iPad for research that requires <ul style="list-style-type: none"> <li>• the investigation of issues/problems</li> <li>• taking a position</li> <li>• making a decision seeking a solution</li> </ul>	11. Rate the following statements: <ul style="list-style-type: none"> <li>• My teachers promote, monitor, and model the ethical use of mobile technologies in their classrooms.</li> <li>• My teachers encourage me to use mobile devices while in the classroom to learn and to spark my creativity.</li> <li>• My teachers model and facilitate the effective use of current and emerging mobile devices, applications, and programs to support teaching and learning in their classrooms.</li> </ul>
	9. In class we use the iPads to <ul style="list-style-type: none"> <li>• investigation of issues or problems</li> <li>• taking a position</li> <li>• making a decision, Seeking a solution</li> </ul>

(Table continued)

<p>7. I encourage my students to use the iPads in the classroom to</p> <ul style="list-style-type: none"> <li>• collaborate with others</li> <li>• communicate with others</li> <li>• research problems of personal interest that address specific content areas</li> </ul>	<p>10. In class we use the iPads to</p> <ul style="list-style-type: none"> <li>• collaborate with others</li> <li>• communicate with others</li> <li>• research problems of personal interest that address specific content areas</li> </ul>
<p>9c. How has the iPad impacted</p> <ul style="list-style-type: none"> <li>• student attendance</li> </ul>	<p>5. Does using the iPad in class motivate you to come to school?</p>

As is evident in Table 3, some of the questions in the teacher and student surveys mirror one another. The researcher analyzed the survey responses to determine if the teachers' perceptions mirrored the students' perceptions and vice versa. The researcher determined whether or not there was a correlation between the teachers' perceptions and those of the students.

***Levels of Teaching Innovation (LoTi) survey.*** This survey was administered to all Title I teachers who attended the beginning of the year Title I technology training for teachers (August/September 2015). Christopher Moresh's company, Learning Quest developed the LoTi survey. The Title I teachers who took the LoTi survey fell into one of three categories; MES Phase I (taught at MES school that has had the iPads in 1:1 for four years), MES Phase II (taught at MES school that has had the iPads in 1:1 for one year) or Non-MES (teachers did not teach at school which had a 1:1 iPad initiative). The LoTi survey was housed on Learning Quest's website: <http://loticonnection.com/>. The Title I trainer walked the participants through getting to the website and creating a profile, followed by answering the LoTi Survey. The questions asked teachers about their technology integration and assigned the teacher a

Level of Teaching Innovation (LoTi) based off of the teachers answers. The LoTi survey can be found in Appendix A.

Moersch (1995) identified the following six levels of technology integration in the LoTi framework, as outlined in Appendix C. Figure 7 illustrates how the teachers or schools were assigned a LoTi level of implementation.

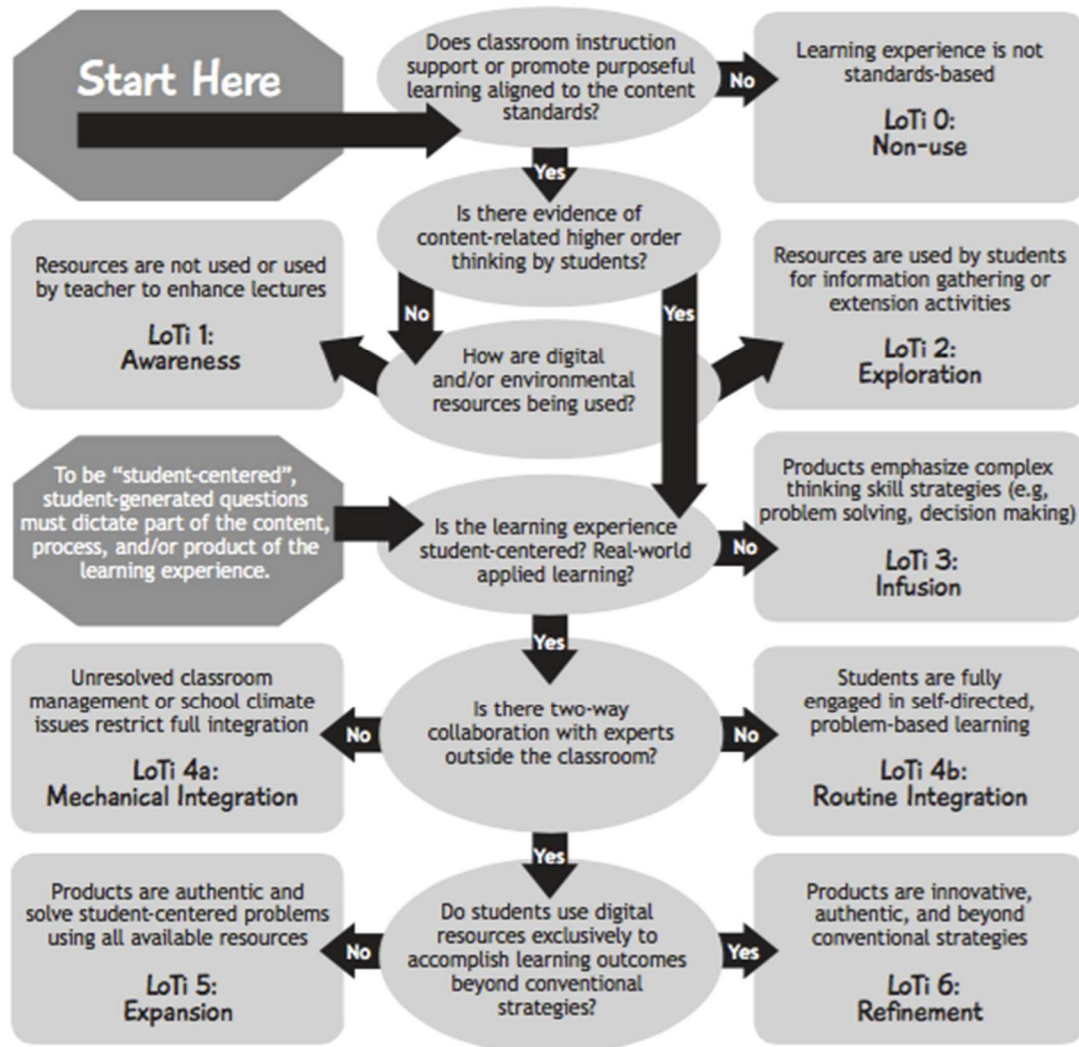


Figure 7. LoTi "Sniff" Test (Moersch, 1995)

Moersch has two additional frameworks that are included in the LoTi's model:

- Current Instructional Practices (CIP) Framework, which measures classroom teachers' current instructional practices relating to a subject matter versus a learner-based instructional approach in the classroom (Moersch, 2010). Appendix F explains CIP in more detailed.
- Personal Computer Use (PCU): measures classroom teachers' fluency level with using digital tools and resources for student learning. (Moersch, 2010). Appendix G lists out the PCU levels and explains behaviors represented at each level.

Moersch also takes into consideration the student and teacher's computer usage when evaluating the LoTi level by asking teachers the following questions:

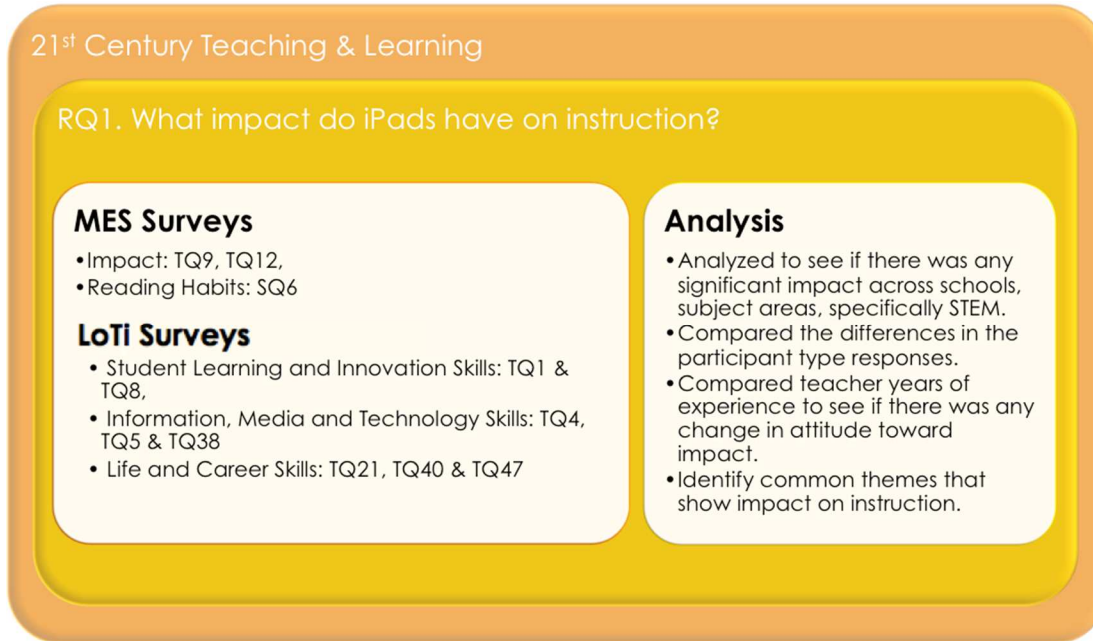
- Student Computer Use (SCU)
  - How often are your students using digital tools and resources during the instructional day?
- Teacher Computer Use (TCU)
  - How often are you (the teacher) using digital tools and resources during the instructional day?

### **Plan for Analyses**

The data analysis process began immediately upon research approval.

Research Question 1 falls under the theme of 21<sup>st</sup>-century teaching and learning.

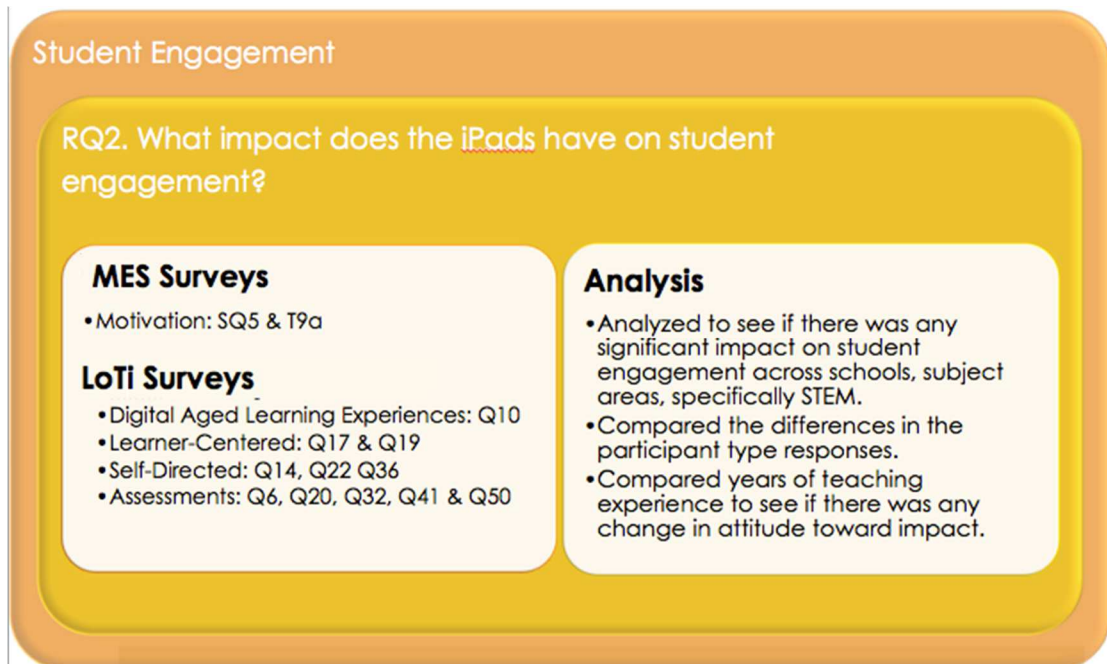
Figure 8 presents a breakdown of the exact responses to the surveys and evaluations that the researcher used to answer the question: What impact do iPads have on instruction?



*Figure 8.* Research Question 1 data sources. TQ refers to teacher questions; SQ refers to student questions.

The theme of Research Question 2 is student engagement. The answer to this question relies heavily on the results of the surveys administered to the teachers and students, as outlined in Figure 9.





*Figure 9.* Research Question 2 data sources. TQ refers to teacher questions; SQ refers to student questions.

Research Question 3 falls under the theme of effective uses of technology.

The researcher used the surveys and professional development evaluations to answer this question. (See Figure 10.)

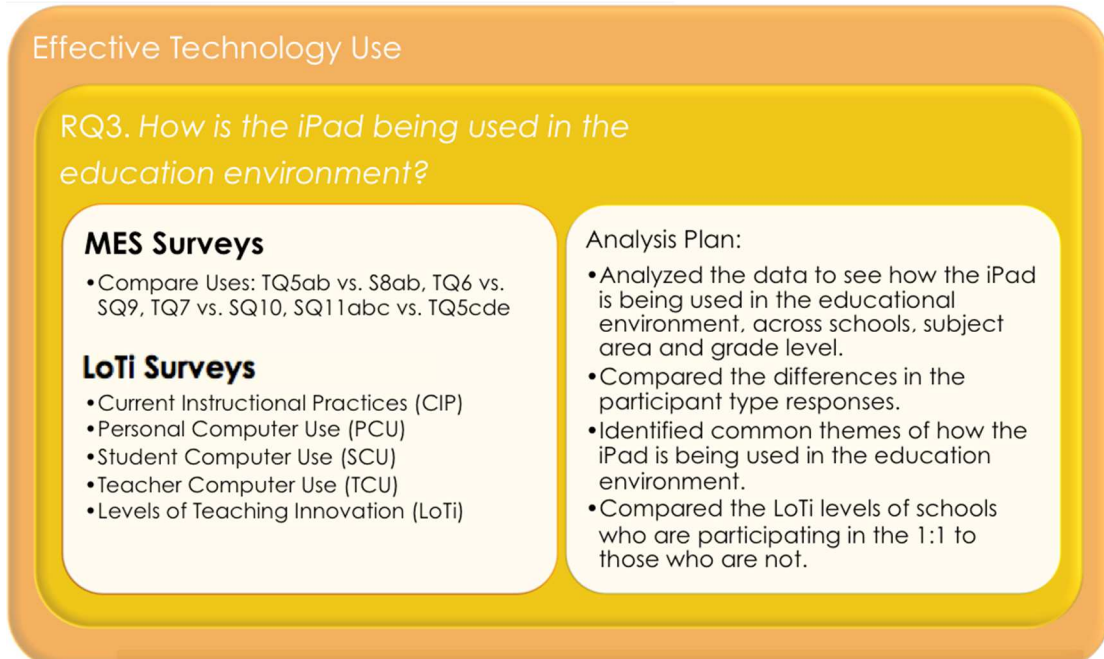


Figure 10. Research Question 3 data sources. TQ refers to teacher questions; SQ refers to student questions.

A data journey, which is the detailed step-by-step process that the researcher used to clean up the data for analysis, can be found in Appendix I. The following are the steps the researcher took to analyze the data:

**Step 1. Organize Survey Data.** The researcher used Microsoft Excel to analyze the surveys, evaluations, and observations. Prior to importing the data into Excel, the researcher set up the structure of each file, including (a) the data tab, which was used to house all of the raw data; and (b) the variable tab, where each variable was coded with a number. Each data tool response was imported into a separate Excel document to create a database of responses. The researcher then cleaned the data, looking for unusual entries or errors.

**Step 2. Explore Data.** The researcher created frequency tables and pivot tables. The frequency tables displayed the frequency and the percentage for

each answer. In addition, the average (mean), range, and standard deviation of the collected data were calculated to help understand the data.

**Step 3. Analyze quantitative data.** In this step the researcher explored relationships between variables and compared groups through the use of charts and tables. The researcher used the StatPlus Excel add-on to run ordinary least squares regressions and *t*-tests. The following comparisons were made to determine any variation between groups: (a) STEM (math, science, technology, and engineering) versus non-STEM classes; (b) Phase 1 schools versus Phase 2 schools; (c) MES schools versus non-MES Schools; (d) student versus teacher perspectives; and (e) teachers who had been teaching for 20+ years versus those who had not.

To obtain a clear understanding of the impact of the iPad, the researcher created composite variables based on the average of the responses to the aforementioned questions. The purpose of creating the composite variables was to reduce the data demands by collapsing multiple survey questions into one composite variable. Table 4 shows the components of each composite variable and the corresponding Cronbach's alpha.

Appendix H has a graph, entitled "LoTi Digital-Age Quick Scoring Device to create LoTi Digital-Age Professional Development Priorities Graph." This graph groups like questions into five categories. The researcher found that the questions from the "Digital Learning Experiences and Assessment" and the "Student Learning and Creativity" categories would answer the three research questions. The researcher created a composite

variable from the “Digital Learning Experiences and Assessment” category called Assessment as outlined in Table 7. However, there were 12 questions listed in the “Student Learning and Creativity” category. The researcher saw possible subgroups that could be created from the larger category of “Student Learning and Creativity.” The researcher saw that the Cronbach’s alphas were greater than .7, with the exception of questions 10 and 19 because single questions has no Cronbach alpha. Since the sub-groupings Cronbach’s alphas was greater than .7, there is a high reliability among the survey questions for each composite variable. Tables 4 and 7 show the results of the Cronbach’s alphas. Appendix J outlines how the composite variables were used to answer the research questions and provide examples of how the iPad may have been used.

**Step 4. Create data charts and tables.** The researcher created charts and tables to systematically analyze the data and break it into meaningful pieces (Miles & Huberman, 1994). Finally, the researcher created data charts to facilitate data analysis. Upon completion of independent data analysis from the MES survey, the researcher compared data results.

**Step 5. Draw conclusions.** During this step, the researcher posited conclusions based on the research. The researcher revisited the data to verify and confirm themes and patterns observed, and subsequently, in a written analysis, the researcher correlated the identified common themes or patterns in the answers generated by the research questions. Deviations from the patterns and explanations were also documented. It should be noted that the researcher

presumed the participants read through the survey thoroughly and answered each question honestly. The perceived limitations of this study surround the high mobility rate of the student population. The district was located in a very transient area, which might have affected the survey and evaluation data; the participants who took the surveys at the start of MES might not be the same students taking the surveys later.

### **Human Subject Review**

Participants in the iPad initiative included 6,261 students, 363 teachers, and four Title I technology specialists. The identities of all participants have been and will remain completely confidential; the principal investigator used preexisting survey data, evaluation data, and observation data collected by the district with no identifiers or linkages.

The researcher obtained the proper approvals or clearances from the University of Maryland College Park Institutional Review Board and High Definition Public Schools to conduct this research. The data collected from students and teachers of all participating Title I schools will remain anonymous.

The only survey that was not conducted anonymously was the LoTi Survey. When participants took the LoTi Survey, they were each assigned a unique ID. Upon survey completion, they immediately received a report identifying their level of technology integration. The report also provided recommendations to move to the next level. The collected data then were transferred to an administrative report. The administrative report provided a LoTi score for the school and the cluster (group of schools in the same area). The administrative reports were anonymous; that is, an

administrator could not tell who took the survey, just the number of teachers that took the survey from a particular school or cluster. In short, the administrative report protected the confidentiality of all participants.

Only the researcher had rights or access to see how the individuals at each school performed; the participants' unique IDs were not disclosed to the researcher, thereby ensuring and protecting the anonymity of the participants.

### **Limitations**

Since this research focused on the implementation of iPads taking place in a single school district, there are obvious limitations that should be considered. The experiences and insights of the students and teachers involved in this research may not be able to duplicate. Nevertheless, it is believed that this study provided valuable insight into how the iPad is being used as an instructional tool in a K-12 environment.

An added limitation that should be considered was the possible bias representation of the researcher's findings. The researcher was a member of the team that developed the MES teacher and student surveys. The researcher represented the Title I Office as a Technology Specialist at the time the surveys were being developed. Attention was given to ensure that the researchers involvement in development of the survey did not affect the truths that developed from the data.

### **Summary**

This chapter has outlined the researcher's plan for conducting a quantitative descriptive statistics evaluation of the MES initiative. The purpose of this study was to explore what can be learned from the program participants' perceptions concerning the integration of the iPad as an instructional tool.

To conduct this research, three research questions were proposed. Using HDPS surveys, evaluations, and student data, answers to these research questions were generated.

This research commenced after approval of the dissertation committee had been secured, and the Institutional Review Board process at University of Maryland at College Park had been successfully completed.

### Chapter 3: Results and Implications

The purpose of this study was to investigate what could be learned from the MES iPad 1:1 initiative, that is, the effects of iPads on learning environments and student engagement. The previous chapters outlined the data collection and analysis process. This chapter provided a clear, comprehensive report of the results. The chapter also includes discussion of the implications of the research for the school district.

#### Section 1: Results

**Descriptive statistics.** The results section reports summary statistics and the findings from the analysis of the data as they relate to each research question. The results are based on the SY 2015 Student MES Survey, SY 2015 Teacher MES Survey, and LoTi Survey. Figure 11 shows the number of participants for each survey.

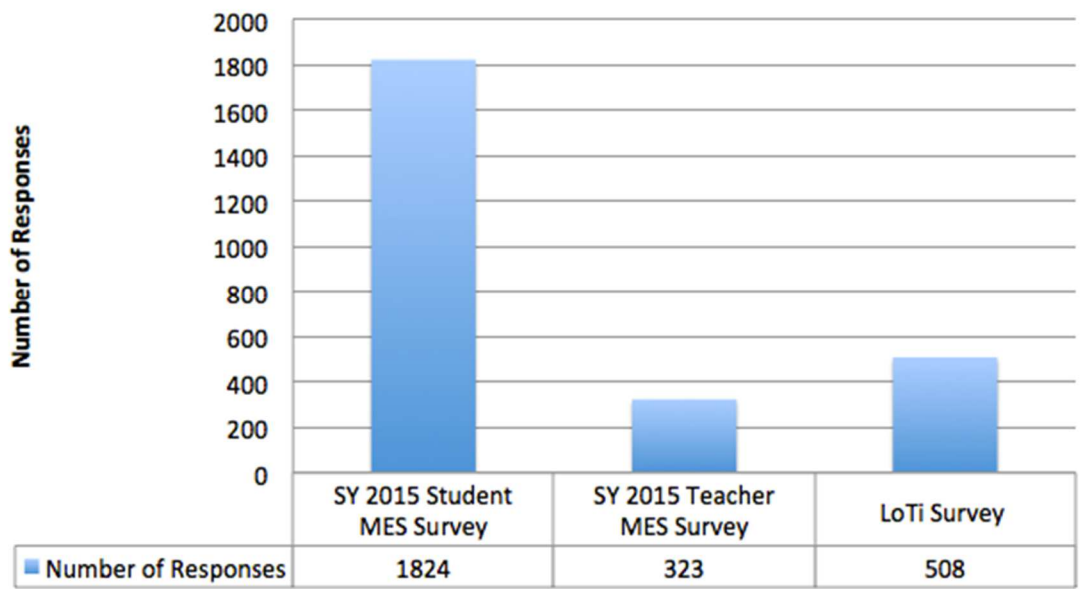


Figure 11. Surveyed participants.



Figure 12 and Figure 13 compare the students and teachers who took the MES survey by school and grade level. It should be noted that all students and teachers who took the MES survey attended or taught at an MES school.

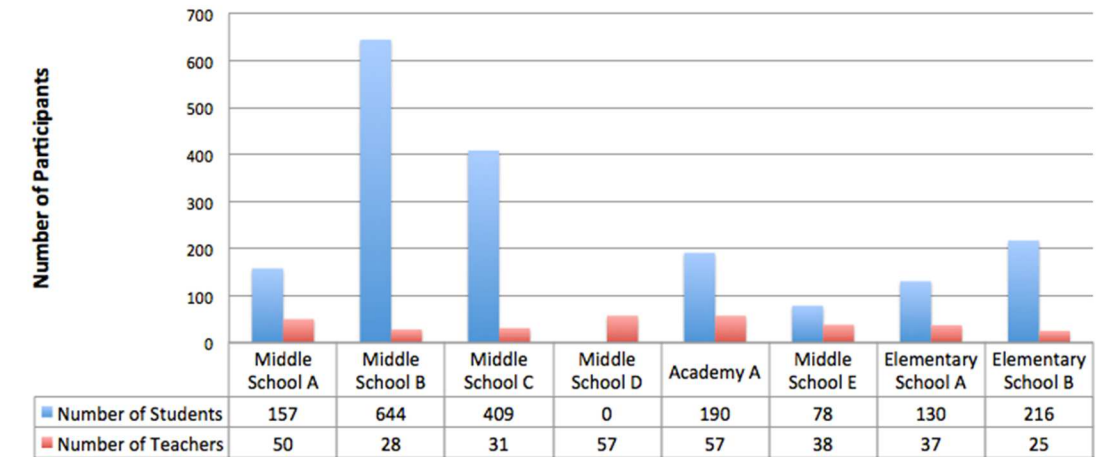


Figure 12. Students and teachers who took the MES survey by school.

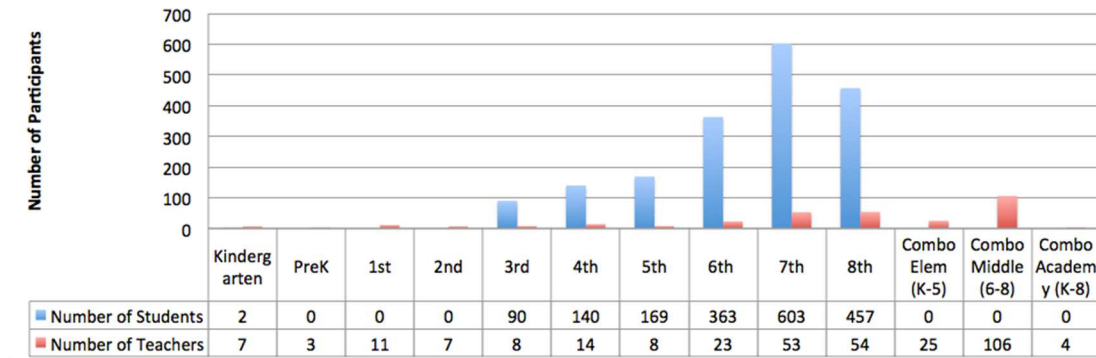
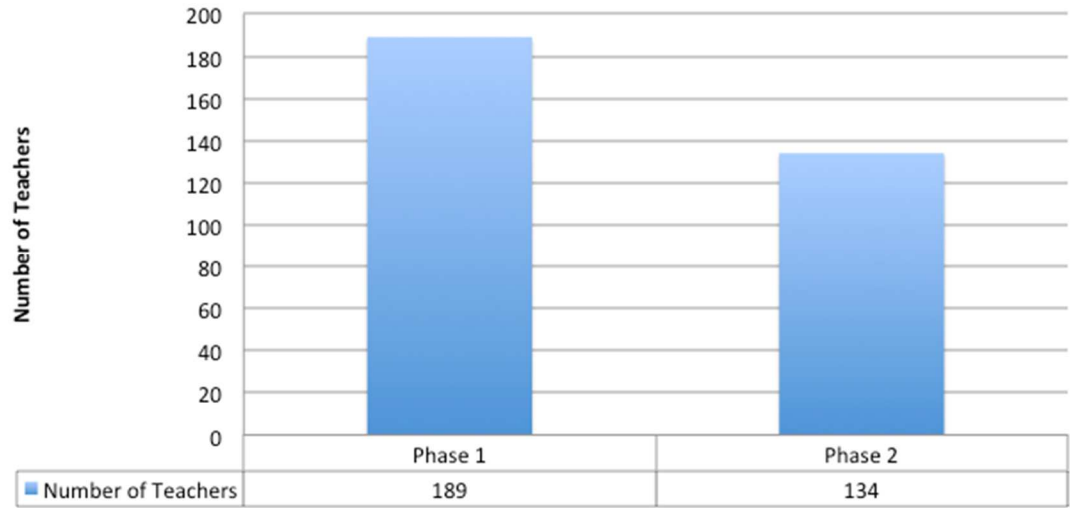


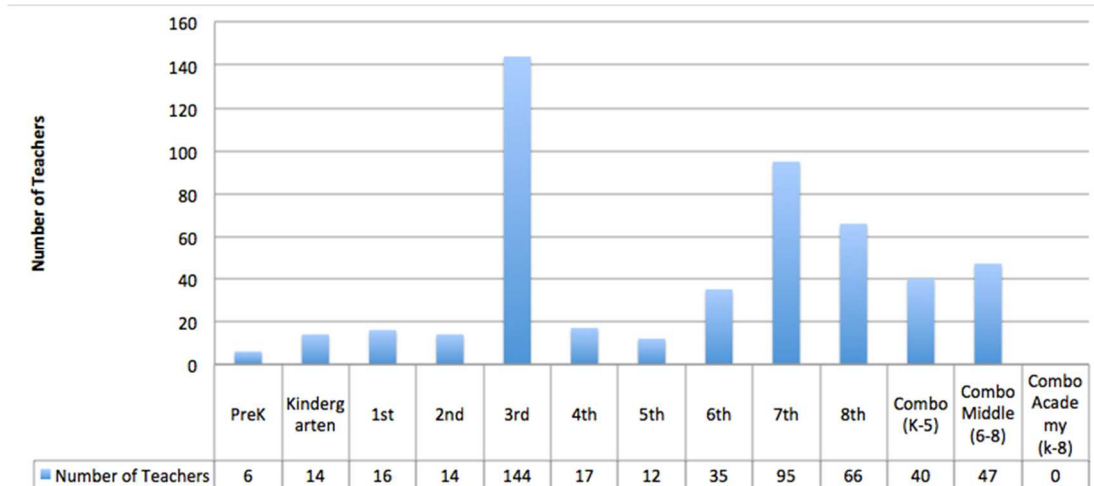
Figure 13. Students and teachers who took the MES survey by grade level.

The following were two of the independent variables in this study: Phase 1 participants (schools that had participated in the 1:1 iPad initiative for 4 years at the time of the survey), and Phase 2 participants (schools that had participated in the 1:1 iPad initiative for 2 months at the time of the survey). Figure 14 compares the number of Phase 1 responses to the number of Phase 2 responses.

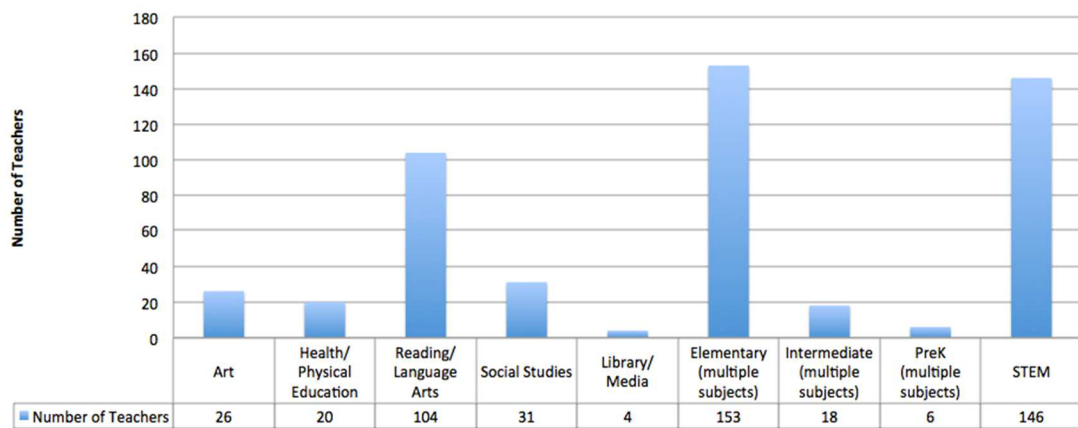


*Figure 14.* Comparison of Phase 1 and Phase 2 teachers, who took the MES Survey.

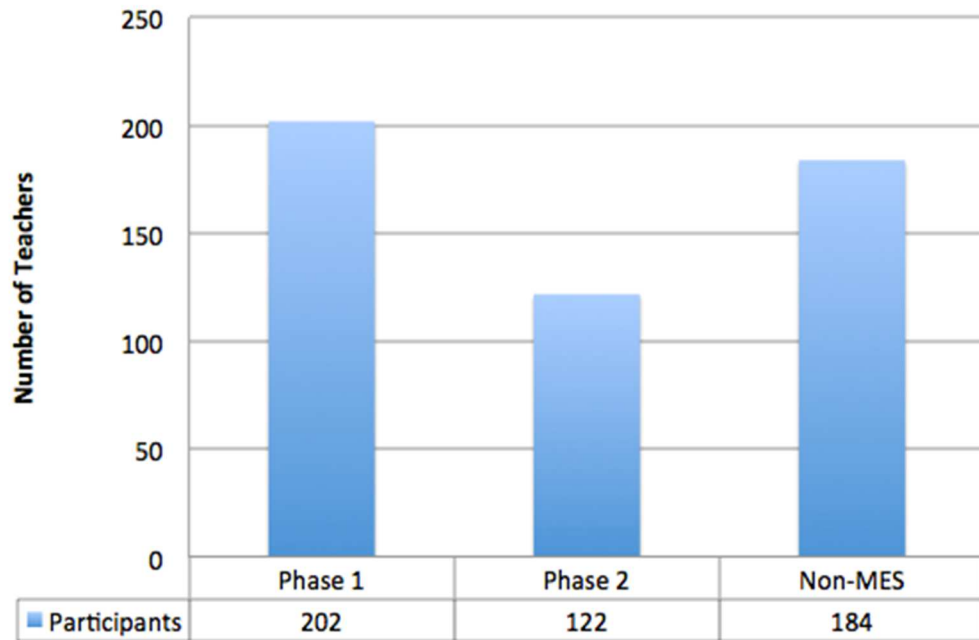
The final survey administered to teachers was the LoTi Survey; it was administered to all Title I teachers, both MES teachers and teachers who did not participate in a MES school, who attended the beginning-of-the-year training. Figures 15 through 18 display frequencies for the teachers who took the LoTi survey, broken down by grade level, subject area, MES phase, and years of teaching, respectively.



*Figure 15.* Teachers who took the LoTi Survey by grade level.  
Note. Two teachers did not report their grade level.

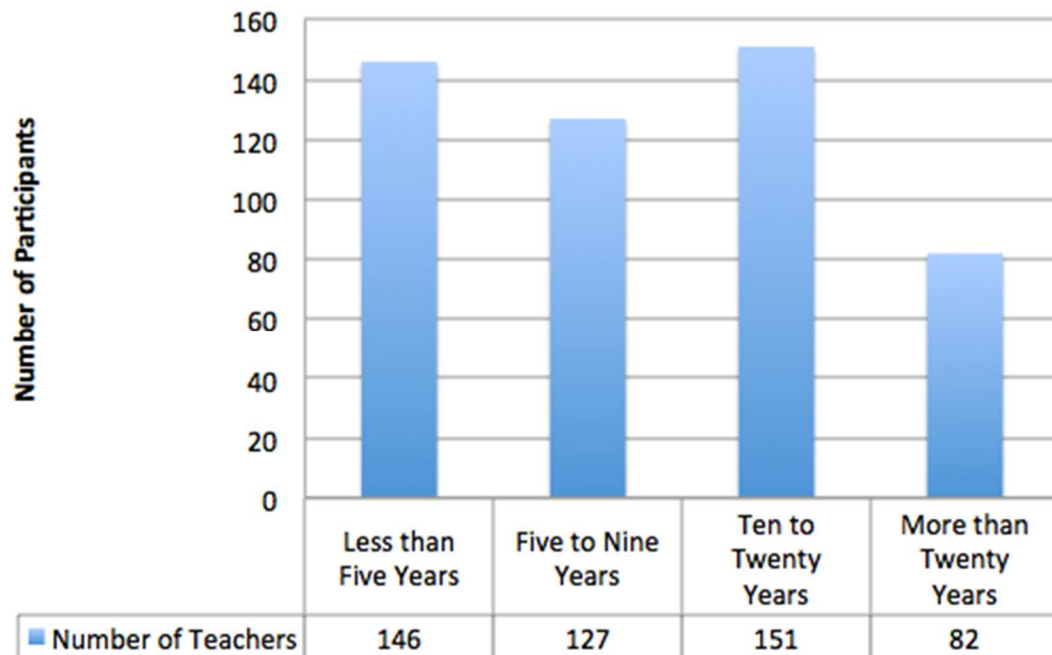


*Figure 16.* Teachers who took the LoTi Survey by subject area.  
Note. STEM is a combination of science, math, and technology teachers.



*Figure 17.* Teachers who took the LoTi Survey by MES Phase.

Note. Non-MES are teachers who were not apart of the MES 1:1 iPad initiative.

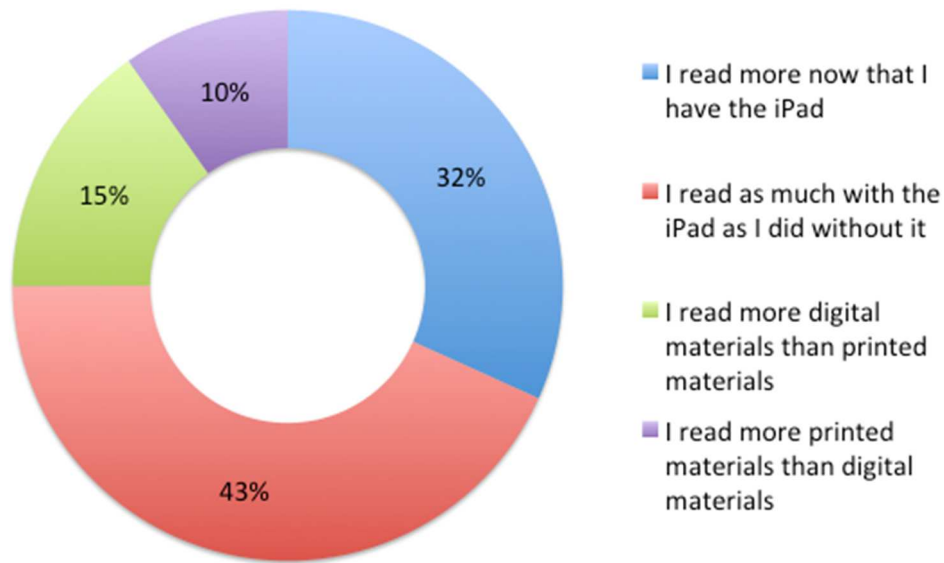


*Figure 18.* Teachers who took the LoTi Survey by years of teaching.

Note. Two teachers did not report the number of years of teaching.

The next sections present the research results organized by research question.

**RQ1. What impact do iPads have on instruction?** The students and teachers who participated in the MES initiative were asked for their opinions of the iPad's impact through the MES survey. Figures 19 through 21 display the findings of those impact-focused questions.



*Figure 19.* Student MES Survey data - Reading Habits.  
Question 6 of the MES student survey asked, "Since you started using the iPad, what are your reading habits?"

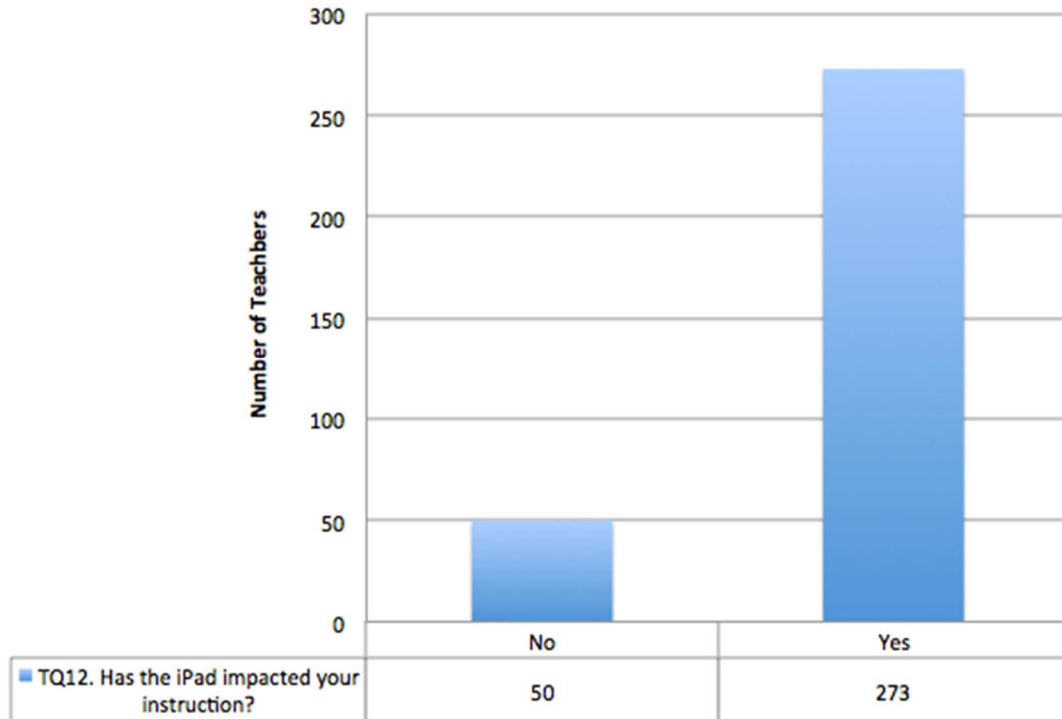


Figure 20. Teacher MES Survey - Impact on Instruction.  
 Question 12 of the MES teacher survey asked teachers if the iPad had an impact on their instruction.

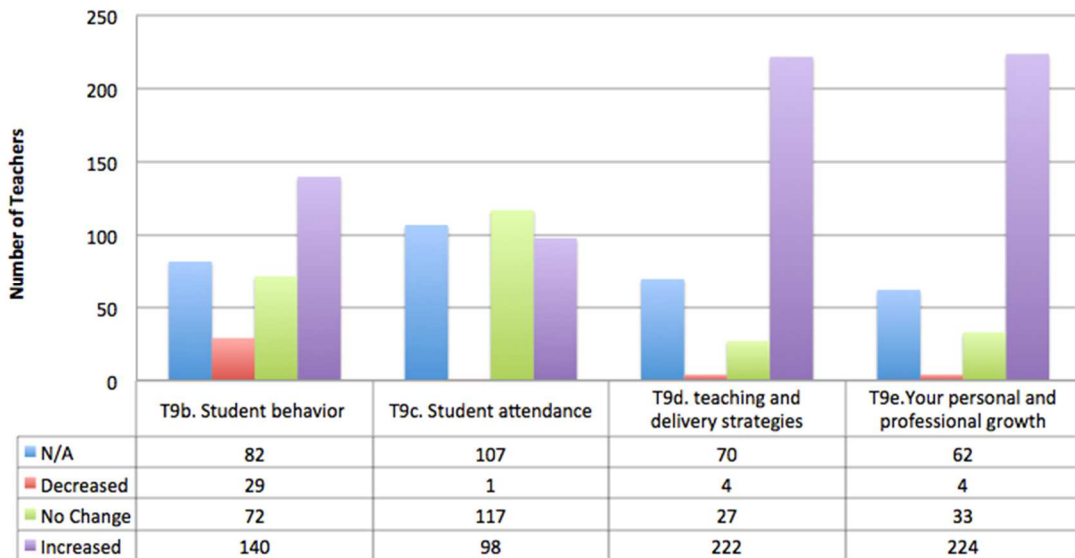


Figure 21. Teacher MES Survey - iPad Impact.  
 Question 9 on the MES survey asked the teachers a series of questions about the impact of the iPad.

In Q9d, teachers were asked how has the iPad impacted their teaching and delivery strategies. This question assessed whether teachers noticed any change in

their teaching and delivery strategies. In essence what the question is asking, “Did the teacher rely more on the iPad teaching students (decrease) or did they have to use additional strategies (increase) to integrate the iPad into the instruction?”

Figure 22 compares the results of Q1 to Q8. Both questions focused on student learning and innovation skills. The survey asked teachers to analyze the following statements:

- Q1. I engage students in learning activities that require them to analyze information, think creatively, make predictions, and/or draw conclusions using the digital tools and resources (e.g., Inspiration/Kidspiration, Excel, InspireData) available in my classroom.
- Q8. I use the digital tools and resources in my classroom to promote student creativity and innovative thinking (e.g., thinking outside the box, exploring multiple solutions).

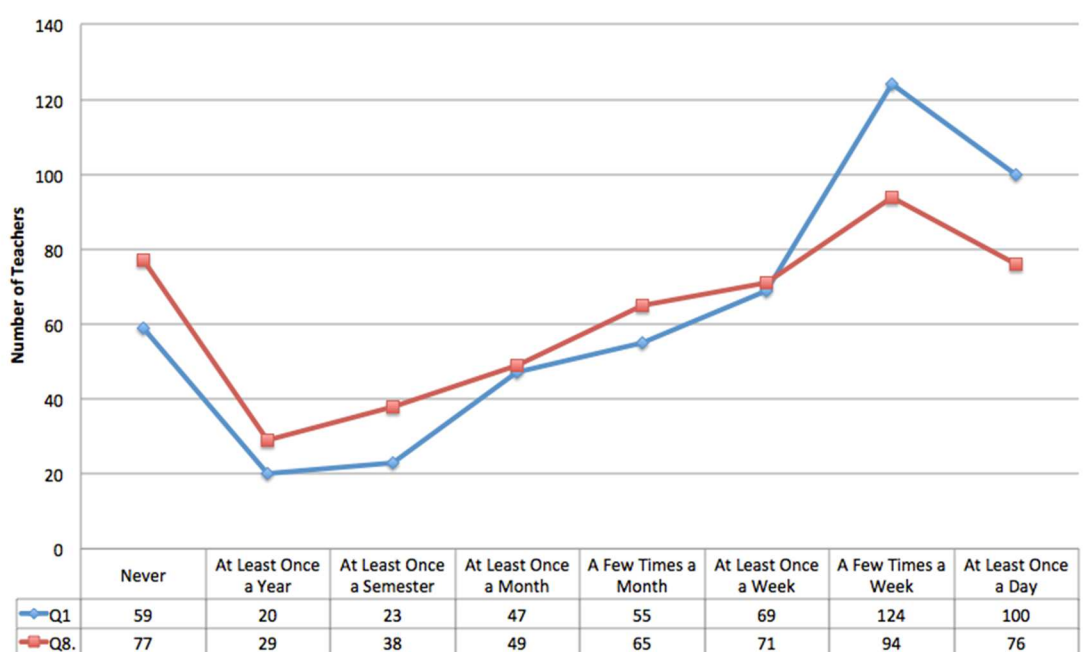


Figure 22. Student Learning and Innovation Skills – Comparison of LoTi Q1 and Q8.

The LoTi survey also asked teachers to rank three statements concerning students' processing information, media, and technology skills. Figure 23 compares the answers to the three questions. The survey asked teachers to analyze the following statements:

- Q4. Students in my classroom use the digital tools and resources to create Web-based (e.g., Web posters, student blogs or wikis, basic webpages) or multimedia presentations (e.g., PowerPoint) that showcase digitally their research (i.e., information gathering) on topics that I assign more than for other educational uses. □
- Q5. I assign Web-based projects (e.g., Web collaborations, WebQuests) to my students that emphasize complex thinking strategies (e.g., problem solving, decision making, experimental inquiry) aligned to the content standards. □
- Q38. My students use the digital tools and resources in my classroom primarily to increase their content understanding (e.g., digital flipcharts, simulations) or to improve their basic math and literacy skills (e.g., online tutorials, content-specific software).





Figure 23. Students' Processing Information, Media, and Technology Skills – Results of LoTi Q4, Q5, and Q38.

The final factor, based on the LoTi survey responses, was Life and Career Skills. The survey asked the teachers to analyze the following three statements about their students:

- Q21. My students participate in collaborative projects (e.g., Jason Project, GlobalSchool-Net) involving face-to-face and/or virtual environments with students of other cultures that address current problems, issues, and/or themes. □
- Q40. My students use digital tools and resources for research purposes (e.g., data collection, online questionnaires, Internet research) that require them to investigate an issue/problem, take a position, make decisions, and/or seek out a solution.
- Q47. My students use all forms of the most advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems, handheld devices) and resources (e.g., publishing software,

media production software, advanced Web design software) to pursue collaborative problem-solving opportunities surrounding issues of personal and/or social importance.

Figure 24 compares the responses to the three questions.

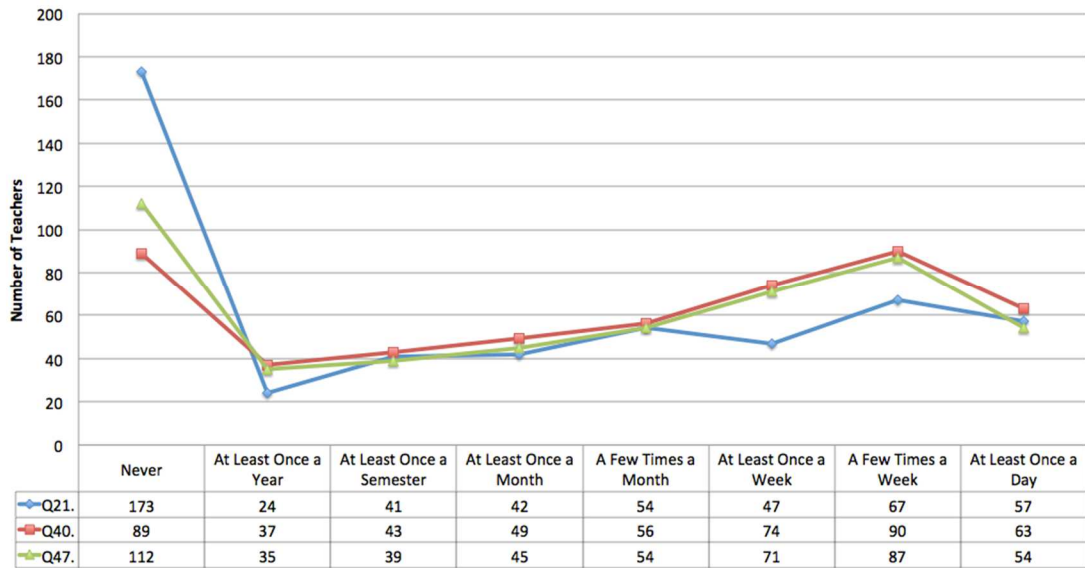


Figure 24. Life and Career Skills – Results of LoTi Q21, Q40, and Q47.

To obtain a clear understanding of the impact of the iPad, the researcher created composite variables based on the average of the responses to the aforementioned questions. The purpose of creating the composite variables was to reduce the data demands by collapsing multiple survey questions into one composite variable. Table 4 shows the components of each composite variable and the corresponding Cronbach’s alpha.

Table 4. Composite Variables of InnovateSkills, TechSkills, and LifeSkills

Composite variable	LoTi survey questions	Cronbach’s alpha
InnovateSkills	= average(Q01 and Q08)	.835

TechSkills = average(Q04, Q05, Q38)	.762
LifeSkills = average(Q21, Q40, Q47)	.853

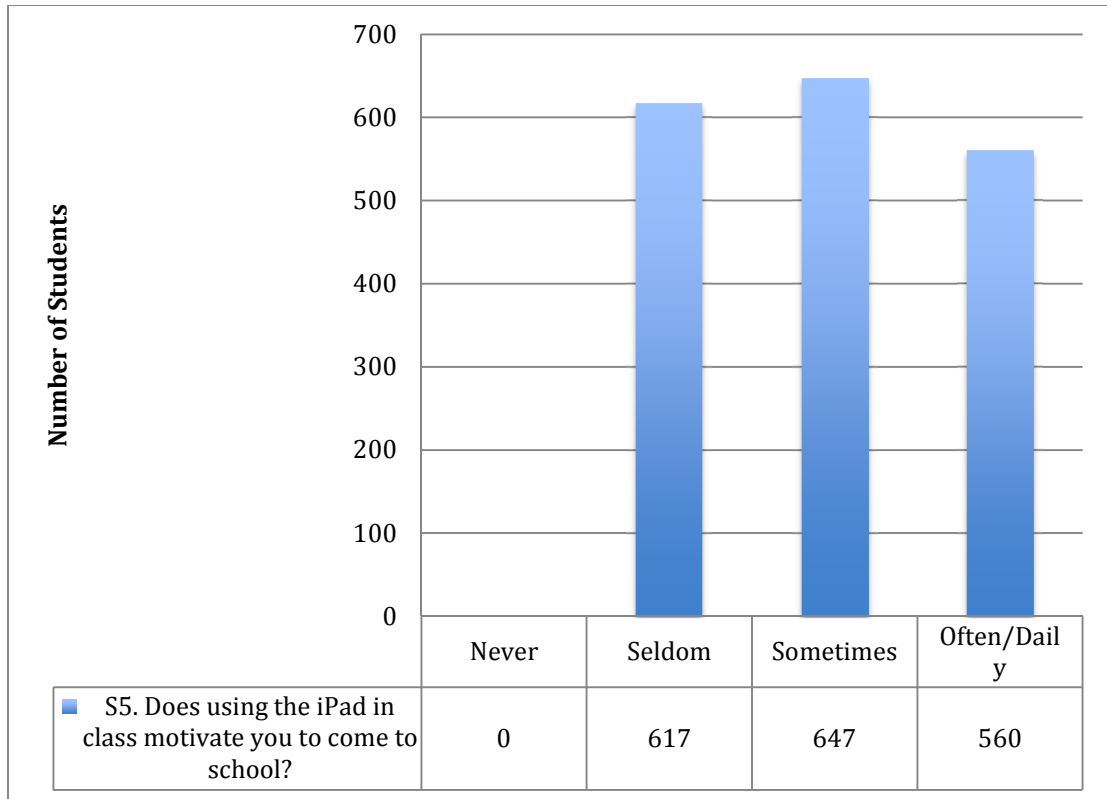
The researcher ran regressions with the composite variables for impact on instruction as the dependent variables and the following independent variables: MES Phase 1, MES Phase 2, a STEM teacher dummy variable, and a dummy variable for teachers who had taught more than 20 years (20plus). Table 5 displays the results of those regressions.

Table 5. *Regressions of Impact on Instruction Composite Variables from LoTi*

Independent variables	InnovateSkills	TechSkills	LifeSkills
Phase 1	1.494*** (0.000)	1.668*** (0.000)	2.00596*** (0.000)
Phase 2	0.702*** (0.004)	0.554*** (0.009)	0.80925*** (0.001)
STEM	0.225* (0.281)	-0.231 (0.202)	0.27102 (0.184)
20Plus	0.366 (0.144)	0.142 (0.513)	0.3443 (0.160)
N	507	507	507
R <sup>2</sup>	.106	.144	.178

Notes. This chart depicts the regression of the composite variables called Innovation Skills, Technology Skills, and Life Skills. The top number represents the coefficient, and the number in parentheses reports the *p*-values. \*Statistically significant at the 10% level (.051-.10); \*\*statistically significant at the 5% level (.011-.05); \*\*\*statistically significant at the 1% level (0-.01).

**RQ2. What impact do the iPads have on student engagement?** Both the MES and LoTi surveys offered insight on the impact of the iPads on student engagement. Question 5 on the MES Student Survey asked the students if the iPad motivated them to come to school? Figure 25 depicts their responses.



*Figure 25.* Student MES survey responses to Question 5 about motivation.

The MES survey asked teachers, “How has the iPad impacted student engagement and motivation?” Figure 26 depicts their responses.

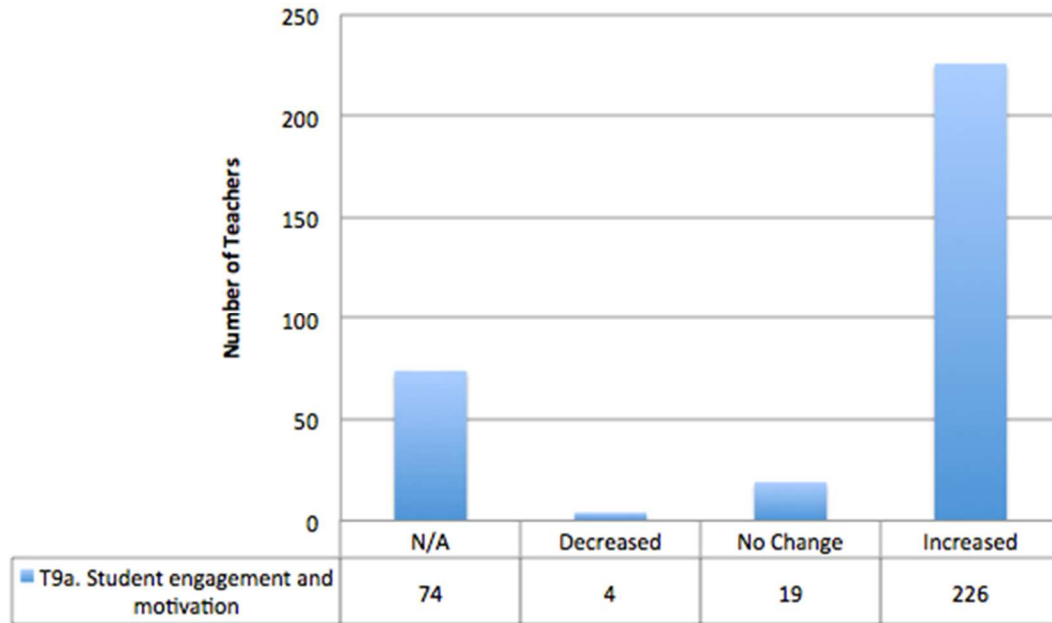


Figure 26. Teacher MES survey – Engagement and Motivation. Question 9a. How has the iPad impacted student engagement and motivation?

Several questions on the MES student survey and MES teacher survey asked the same questions, as outlined in Table 3, Crosswalk of Teacher and Student Surveys, on page 35. The purpose of asking the two groups of participants the same question was to obtain answers from the different viewpoints. Figures 27 through 35 compare the students' versus the teachers' answers.

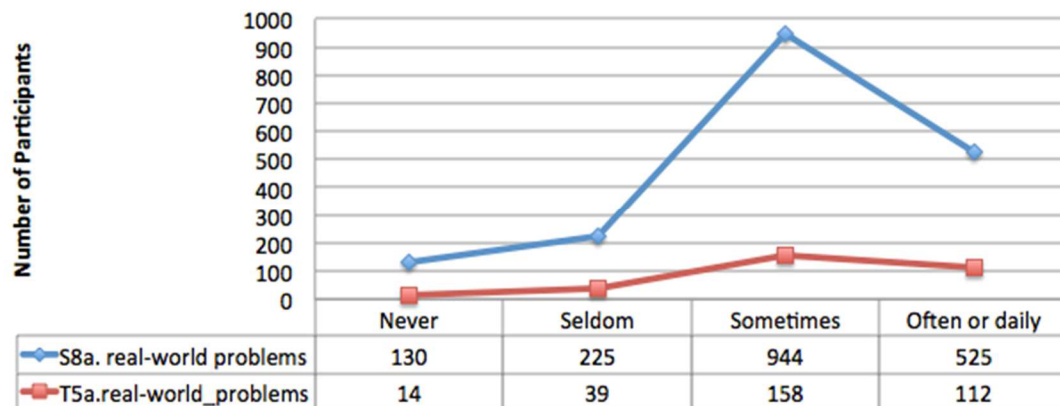


Figure 27. Comparison of teacher and student responses – Real World Problems.

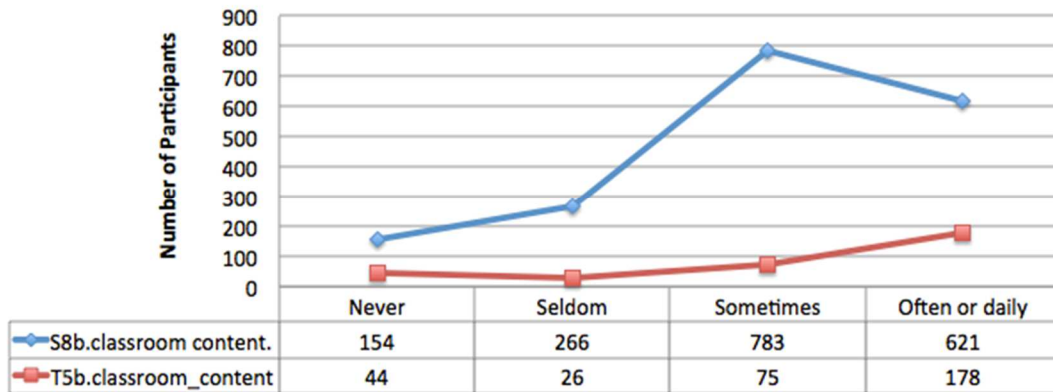


Figure 28. Comparison of teacher and student responses – Classroom Content.

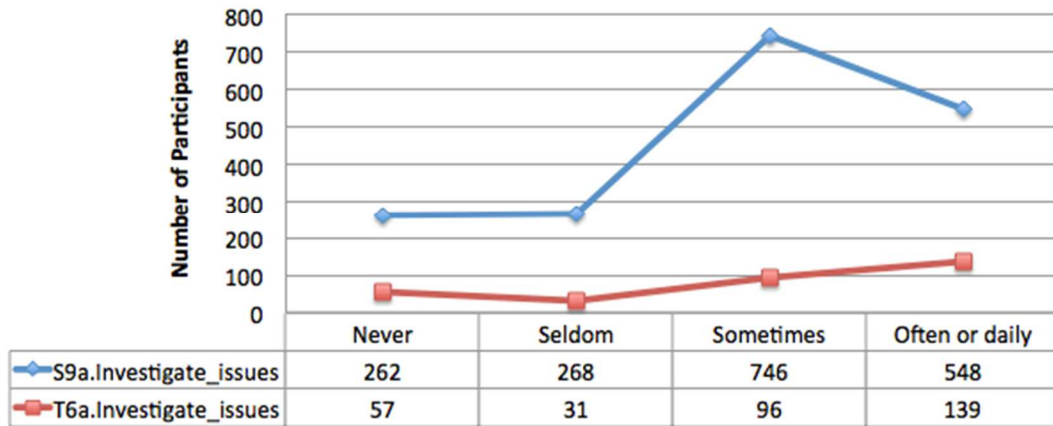


Figure 29. Comparison of teacher and student responses – Investigate Issues.

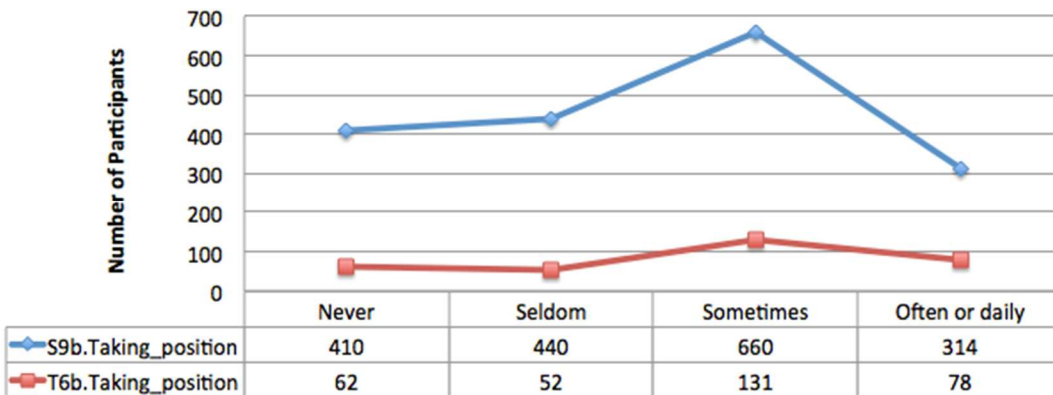


Figure 30. Comparison of teacher and student responses – Taking a Position.

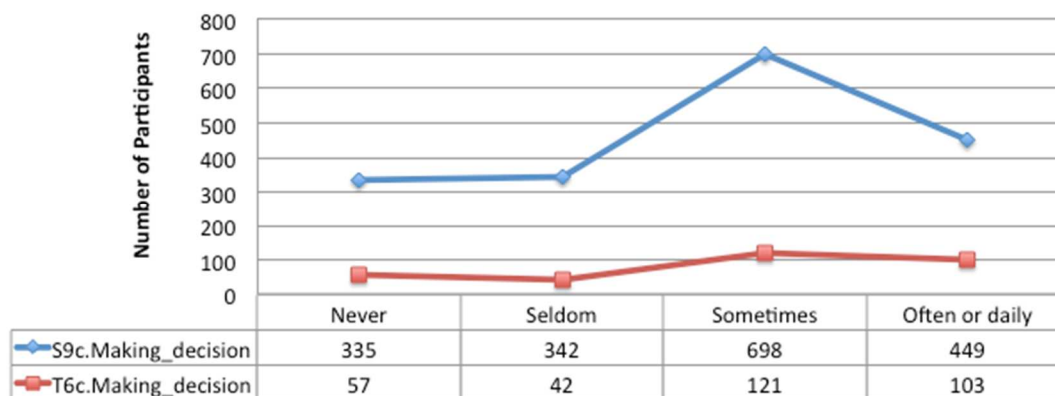


Figure 31. Comparison of teacher and student responses – Making a Decision.

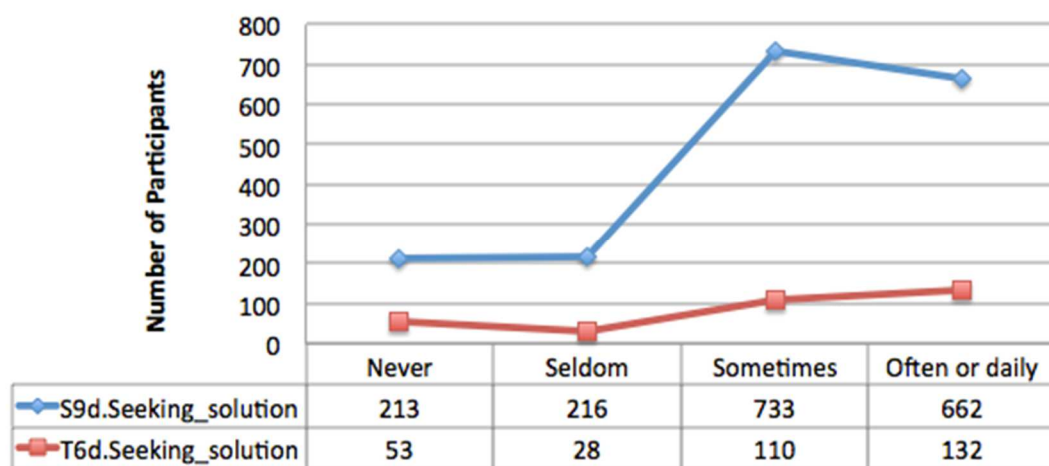


Figure 32. Comparison of teacher and student responses – Seeking a Solution.

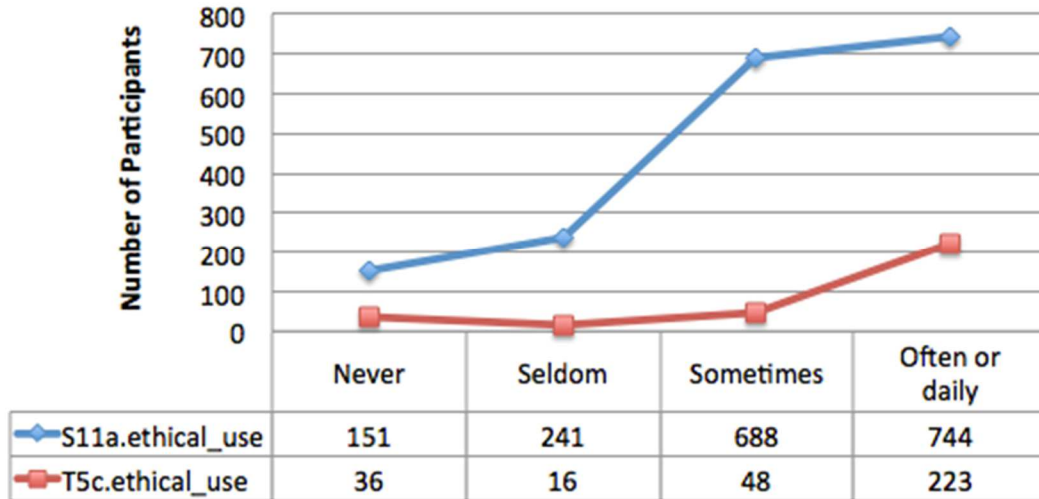


Figure 33. Comparison of teacher and student responses – Ethical Use.

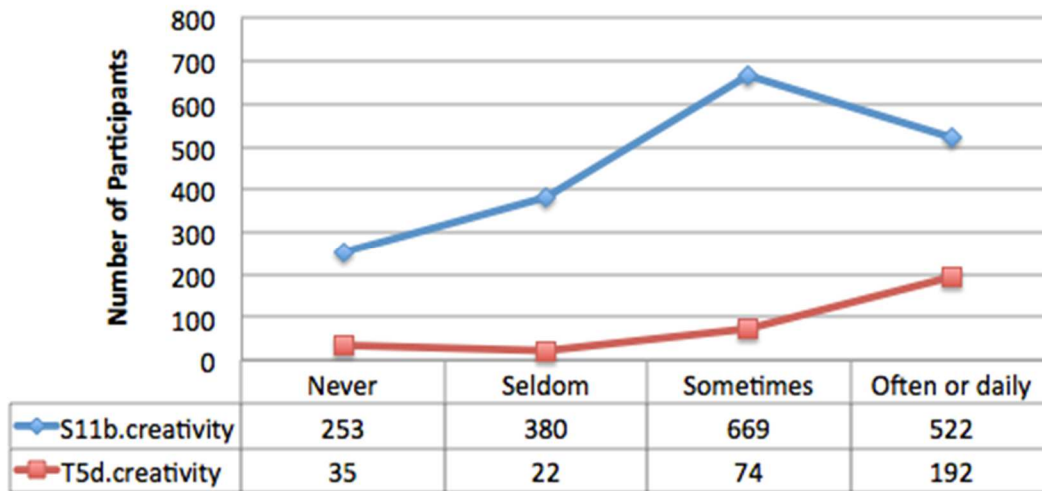


Figure 34. Comparison of teacher and student responses – Creativity.

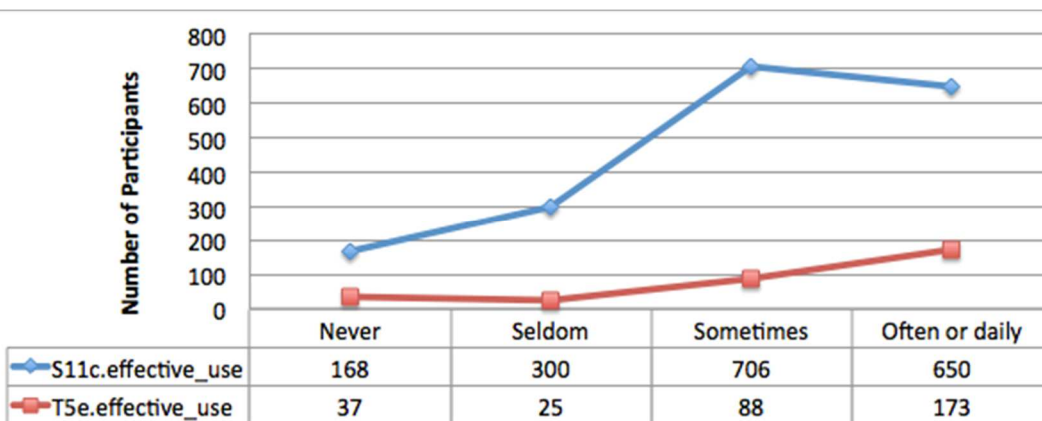


Figure 35. Comparison of teacher and student responses – Effective Use.



The researcher ran a *t*-test on the MES survey data comparing the students' and teachers' responses to identical questions. The *t*-tests were used to compare the means of the student and teacher to see if there was a difference. Table 6 displays the results of those *t*-tests.

Table 6. *T-test comparing Student and Teacher MES Survey Responses for Impact on Student Engagement*

	Student			Teacher			<i>p</i>
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	
RealWorld	3.022	0.834	1824	2.955	1.030	323	0.257
Content	3.026	0.823	1824	3.143	1.051	323	0.050
Investigate	2.866	1.002	1824	2.817	1.050	323	0.421
TakePosition	2.481	1.021	1824	2.536	1.012	323	0.355
MakeDecision	2.691	1.036	1824	2.674	1.007	323	0.771
SeekSolution	3.011	0.974	1824	2.862	1.043	323	0.007
EthicalUse	3.110	0.927	1824	3.386	0.954	323	1.261
Creativity	2.600	1.005	1824	3.243	0.937	323	0.000
EffectiveUse	3.007	0.943	1824	3.182	0.933	323	0.002

Note. The following are the meanings of the letters: mean (*M*), standard deviation (*SD*), *I* (*N*), and *p*-level for two-tailed test (*p*).

The LoTi Survey also captured data concerning student engagement and motivation. To analyze student engagement with the LoTi data, the question responses were grouped according to the following themes: digital-age learning experiences, learner centered, self-directed, and assessment.

To gain insight regarding digital-age learning experiences, teachers were asked to evaluate the following statement in Question 10 of the LoTi survey:

- My students identify important real world issues or problems (e.g., environmental pollution, elections, health awareness), then use collaborative tools and human resources beyond the school building (e.g.,

partnerships with business professionals, community groups) to solve them. Figure 36 displays the results.

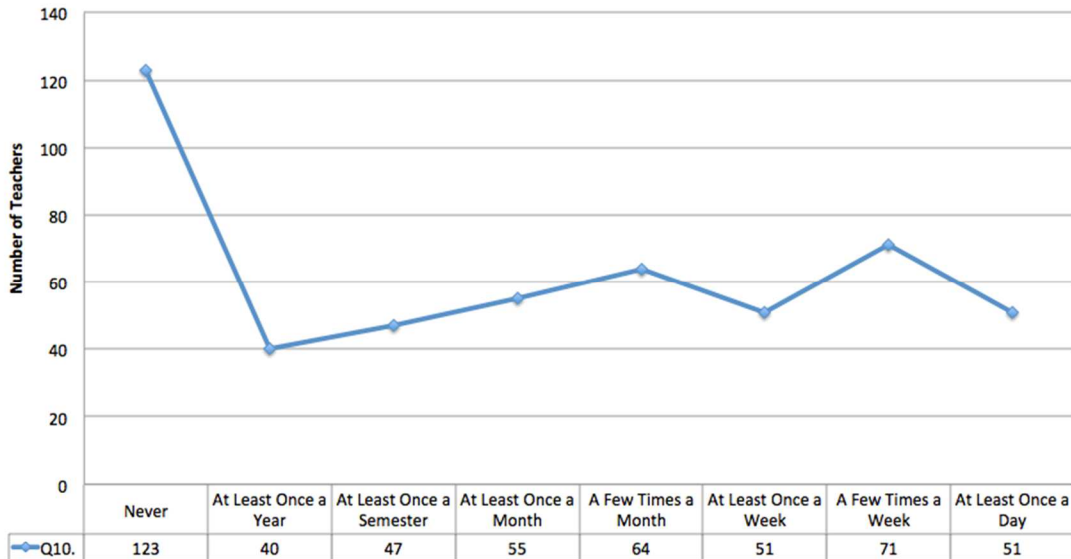


Figure 36. Digital-age learning experiences: Q10.

To gain insight regarding learner-centered activities, teachers were asked to evaluate the following LoTi question (Q19):

- Q19. I employ learner-centered strategies (e.g., communities of inquiry, learning stations/centers) to address the diverse needs of all students using developmentally appropriate digital tools and resources.

Figure 37 displays the teacher results for Q19.

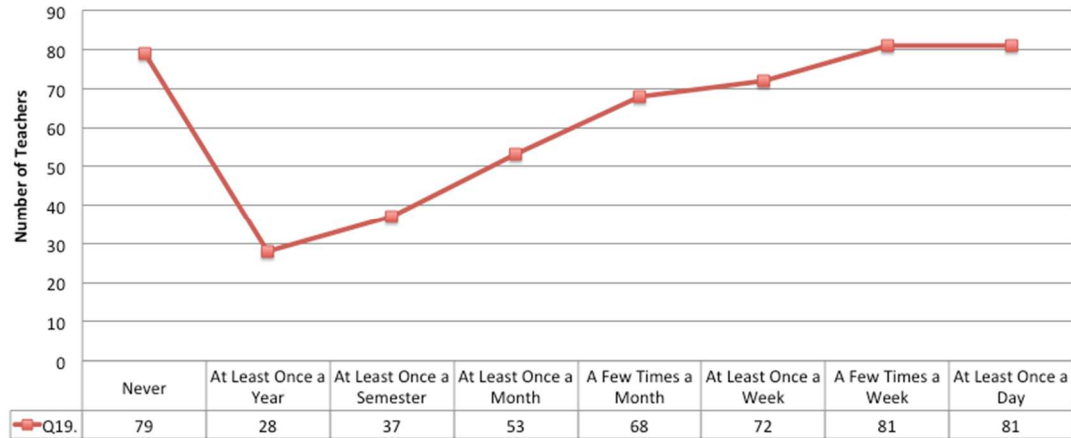


Figure 37. Learner-centered: Q19.

Figure 38 compares three questions that teachers were asked focused on student self-directed activities. The following are the LoTi questions:

- Q14. My students propose innovative ways to use our school's advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems) and resources (e.g., publishing software, media production software, advanced Web-design software) to address challenges/issues affecting their local and global communities. □
- Q22. My students use the available digital tools and resources for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of personal interest that address specific content standards.
- Q36. My students use the classroom digital tools and resources to engage in relevant, challenging, self-directed learning experiences that address the content standards. □

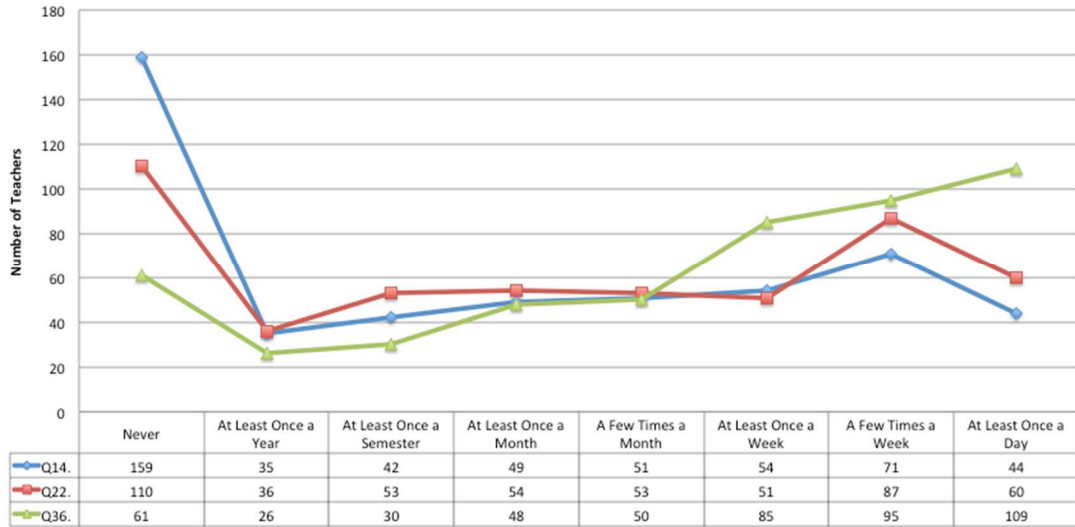


Figure 38. Student self-directed activities: Q14, Q22, & Q36.

The final area concerning student engagement on the LoTi Survey comprised questions about assessment. The teachers were asked the following questions on the LoTi survey:

- Q6. I provide multiple and varied formative and summative assessment opportunities that encourage students to “showcase” their content understanding in nontraditional ways.
- Q20. Students’ use of information and inquiry skills to solve problems of personal relevance influences the types of instructional materials used in my classroom. □
- Q32. I rely heavily on my students’ questions and previous experiences when designing learning activities that address the content that I teach.
- Q41. My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.

- Q50. I consider how my students will apply what they have learned in class to the world in which they live when planning instruction and assessment strategies.

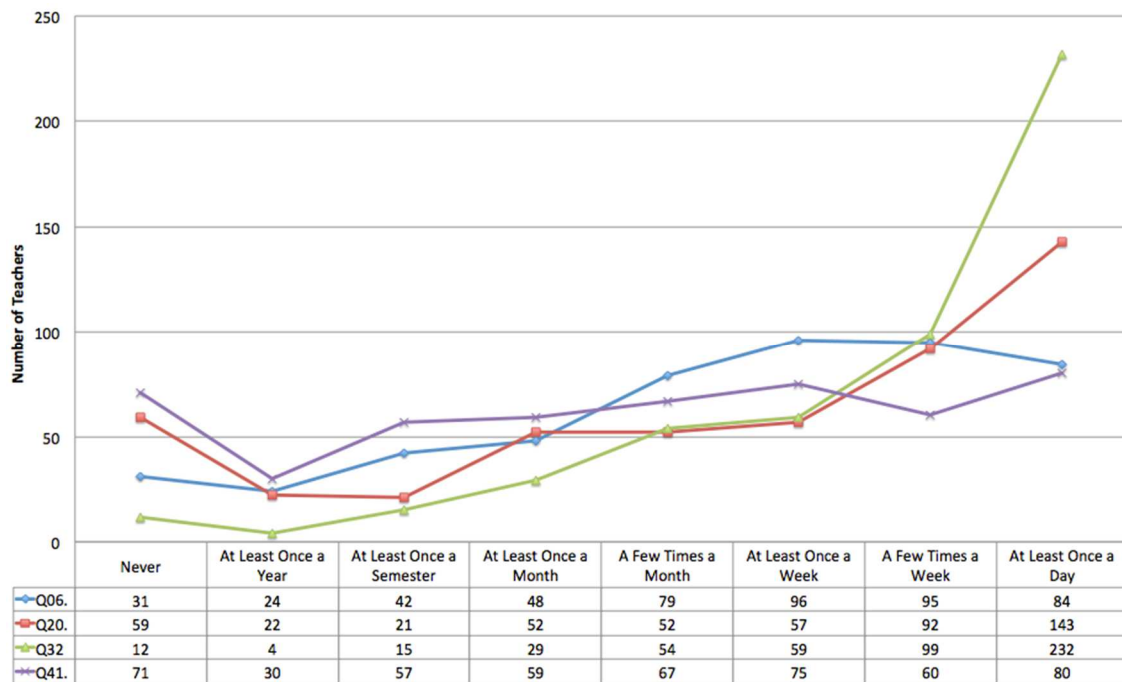


Figure 39. Assessments: Q6, Q20, Q32, Q41, & Q50.

To obtain a clear understanding of the impact of the iPad on student engagement, the researcher created composite variables based on the questions dealing with digital-age learning (DigiAge), learner-centered activities (LearnCtr), self-directed activities (SelfDirected), and assessments. Table 7 shows the components of each composite variable and the corresponding Cronbach's alpha.

Table 7. *Composite Variables for Student Engagement*

Composite variable	LoTi survey questions	Cronbach's Alpha
DigiAge	= Q10	n/a
LearnCtr	= Q19	n/a
SelfDirected	= average(Q14, Q22, Q36)	.810
Assessment	= average(Q06, Q20, Q32, Q41, Q5	.808

The researcher ran regressions with the composite variables for student engagement as the dependent variables and the following independent variables: MES Phase 1, MES Phase 2, a STEM teacher dummy variable, and a dummy variable for teachers who had taught more than 20 years (20plus). Table 8 displays the results of those regressions.

Table 8. *Regressions of Student Engagement Composite Variables from LoTi*

	DigiAge	LearnerCenter	Self-Directed	Assessments
Phase 1	1.755*** (0.000)	1.813*** (0.000)	1.540*** (0.000)	0.675*** (0.000)
Phase 2	0.893*** (0.001)	0.643** (0.018)	0.567** (0.014)	0.160 (0.375)
STEM	-0.001 (0.997)	-0.284 (0.220)	0.359* (0.070)	0.082 (0.599)
20Plus	0.216 (0.453)	0.113 (0.686)	0.366 (0.124)	0.080 (0.669)
N	502	499	508	508
R <sup>2</sup>	.101	.110	.130	.042

Notes. This chart depicts the regression of the composite variables called DigiAge, LearnerCenter, Self-Directed, and Assessments. The top number represents the coefficient, and the number in parentheses reports the *p*-values. \*Statistically significant at the 10% level (.051-.10); \*\*statistically significant at the 5% level (.011-.05); \*\*\*statistically significant at the 1% level (0-.01). Sample size varied because some participants chose not to answer some questions.

**RQ3. How is the iPad being used in the education environment?.** Who better to answer this question than the participants themselves? Figures 40 to 42 display the results from the MES surveys, which asked the participants if they used the iPad for collaboration, communication, and research.

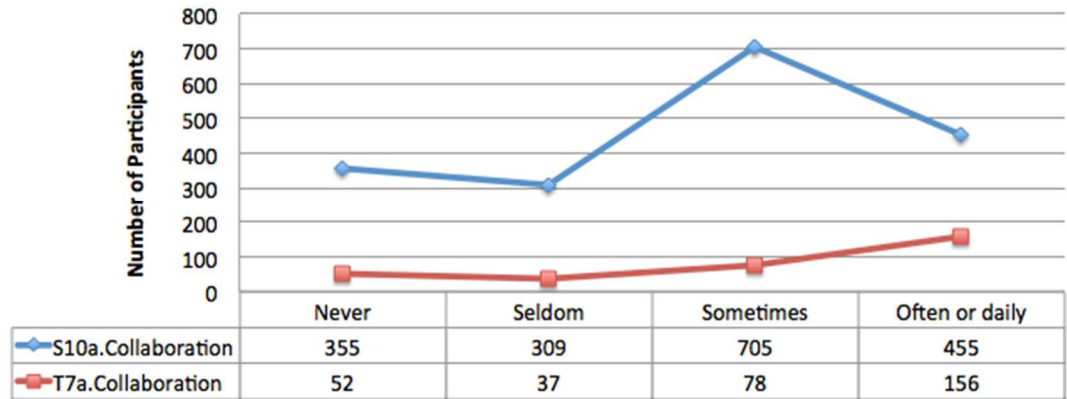


Figure 40. Comparison of teacher and student responses – Collaboration.



Figure 41. Comparison of teacher and student responses – Communicate.

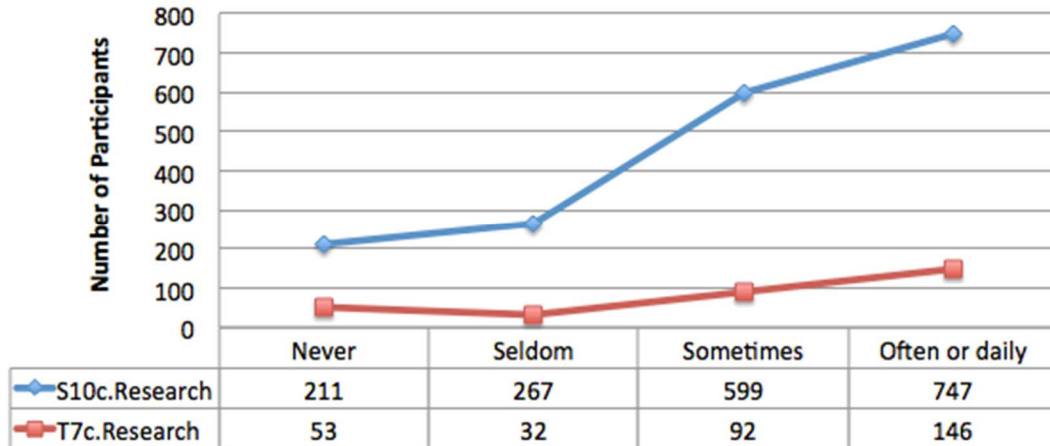


Figure 42. Comparison of teacher and student responses – Research.

The researcher conducted another *t*-test to analyze the student and teacher responses to the questions about using the iPad for collaboration, communication, and research. Table 9 displays information from the *t*-test.

Table 9. *T-test Comparing Student and Teacher MES Survey Responses Showing how the iPad Is Being Used in the Education Environment*

	Student			Teacher			<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>		
Collaboration	2.690	1.050	1824	2.849	1.053	323	2.451	0.015
Communicate	2.437	1.139	1824	2.667	1.081	323	3.583	0.000
Research	3.031	1.009	1824	2.854	1.048	323	2.883	0.004

Note. The following are the meanings of the letters: mean (*M*), standard deviation (*SD*), sample size (*N*), test statistics (*t*), and *p*-level for two-tailed test (*p*).

The LoTi survey provides comparison data from MES teachers and non-MES teachers. Figures 43 through 47 show the varying LoTi scores for all of the teachers.



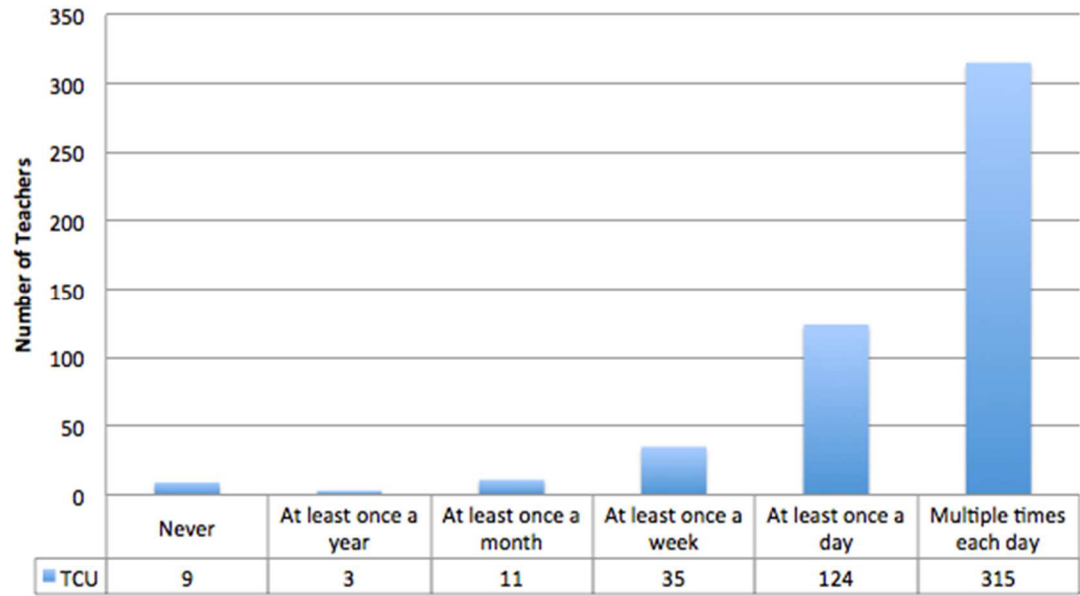


Figure 43. Teacher Computer Use (TCU). How often are you (the teacher) using digital tools and resources during the instructional day?

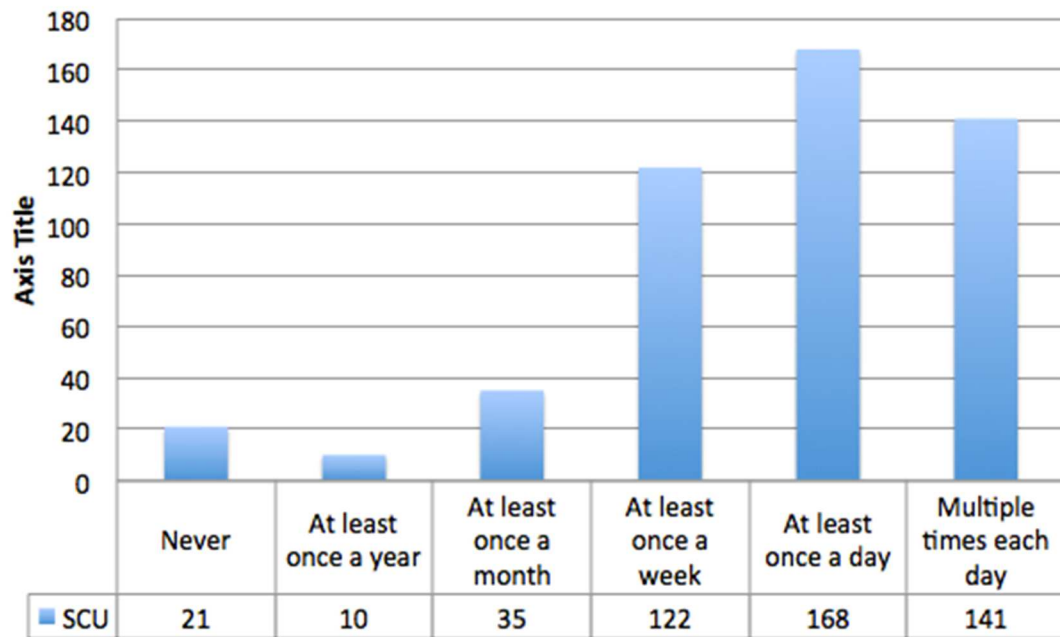
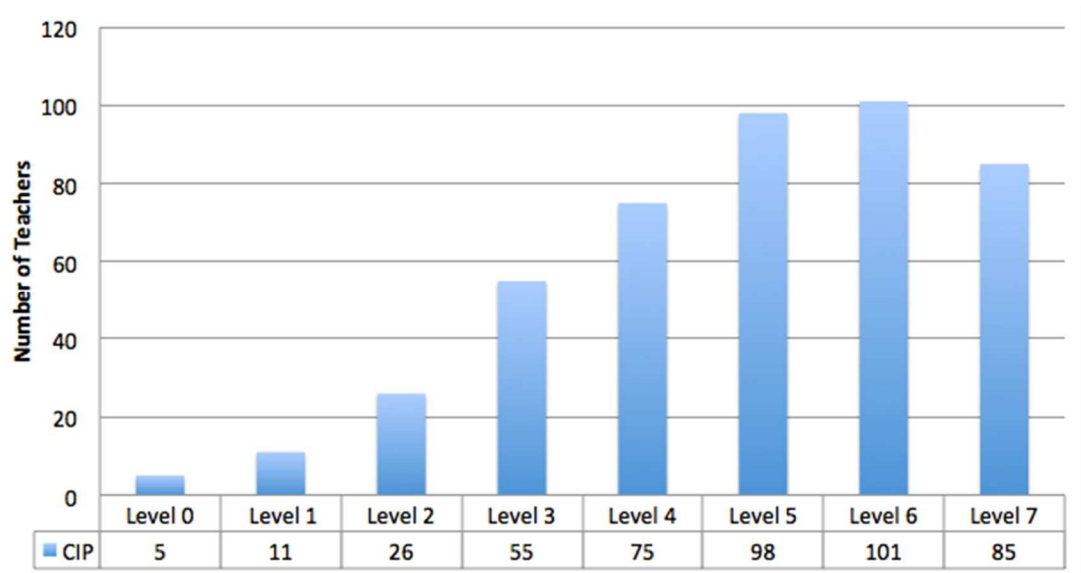
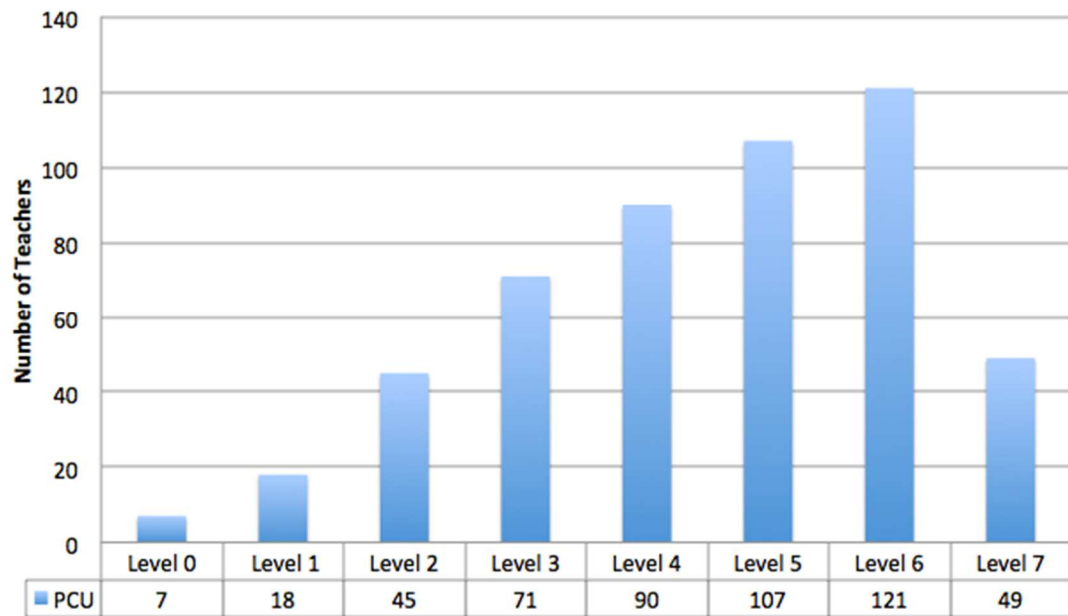


Figure 44. Student Computer Use (SCU). How often are your students using digital tools and resources during the instructional day?



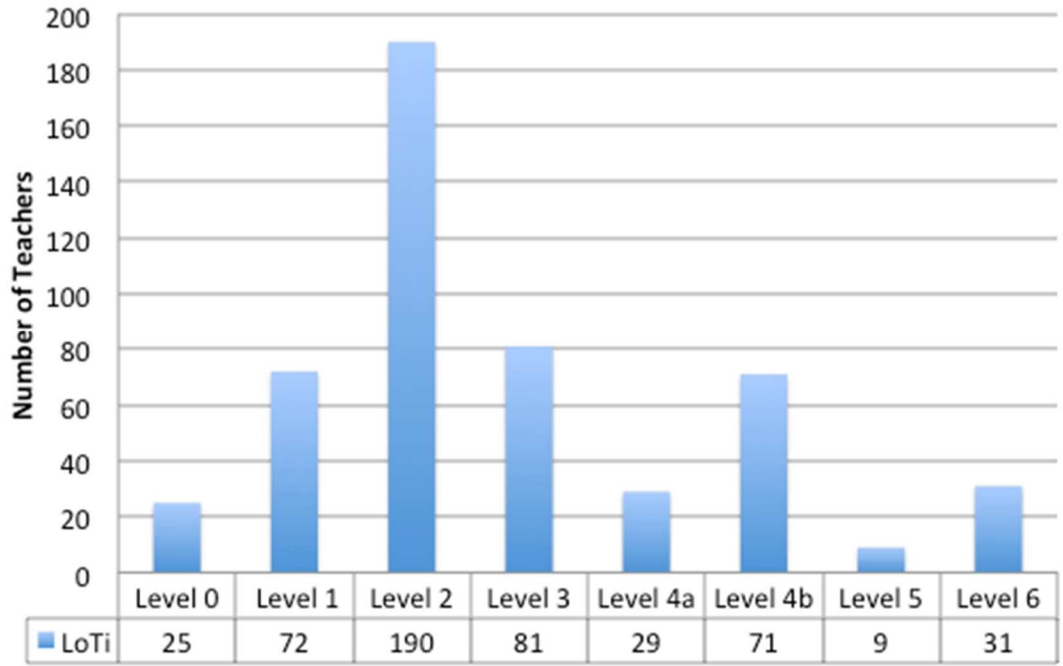
*Figure 45.* Current Instructional Practices (CIP) Framework measures classroom teachers' current instructional practices relating to a subject-matter versus a learner-based instructional approach in the classroom.

See Appendix F for explanation of CIP Levels.



*Figure 46.* Personal Computer Use (PCU) measures classroom teachers' fluency level with using digital tools and resources for student learning.

See Appendix G for an explanation of the PCU levels.



*Figure 47.* Levels of Teaching Innovation (LoTi) measure classroom teachers' implementation of the tenets of digital-age literacy as manifested in the National Educational Technology Standards for Teachers (NETS-T).

See Appendix C for explanation of LoTi Levels. The teacher's LoTi level is calculated by comparing the teachers' TCU, SCU, CIP, and PCU, which is detailed in Appendix H. Table 8 displays the results of a regression test run on the LoTi, TCU, SCU, CIP, and PCU scores.

*Table 10. Regressions of Levels of Teaching Innovation from the LoTi Survey*

	TCU	SCU	CIP	PCU	LoTi
Phase 1	-0.23808** (0.021)	0.36656*** (0.006)	1.37785*** (0.000)	0.71813*** (0.000)	0.57883*** (0.000)
Phase 2	-0.41496*** (0.001)	0.05922 (0.688)	0.93974 (5.629)	0.39237** (0.044)	0.19443 (0.260)
STEM	0.12258 (0.214)	0.07093 (0.574)	0.07059 (0.689)	0.05348 (0.749)	0.42772*** (0.004)
20Plus	-0.08084 (0.503)	0.19985 (0.193)	0.07625 (0.719)	0.18014 (0.370)	0.32194 (1.807)
<i>N</i>	497	497	508	508	508
<i>R</i> <sup>2</sup>	.031	.025	.113	.039	.063

Notes. This chart depicts the regression of the TCU, SCU, CIP, PCU, and LoTi. The top number represents the estimated coefficient, and the number in parentheses reports the *p*-values. \*Statistically significant at the 10% level (.051-.10); \*\*statistically significant at the 5% level (.011-.05); \*\*\*statistically significant at the 1% level (0-.01). Sample size varied because some participants chose not to answer some questions.

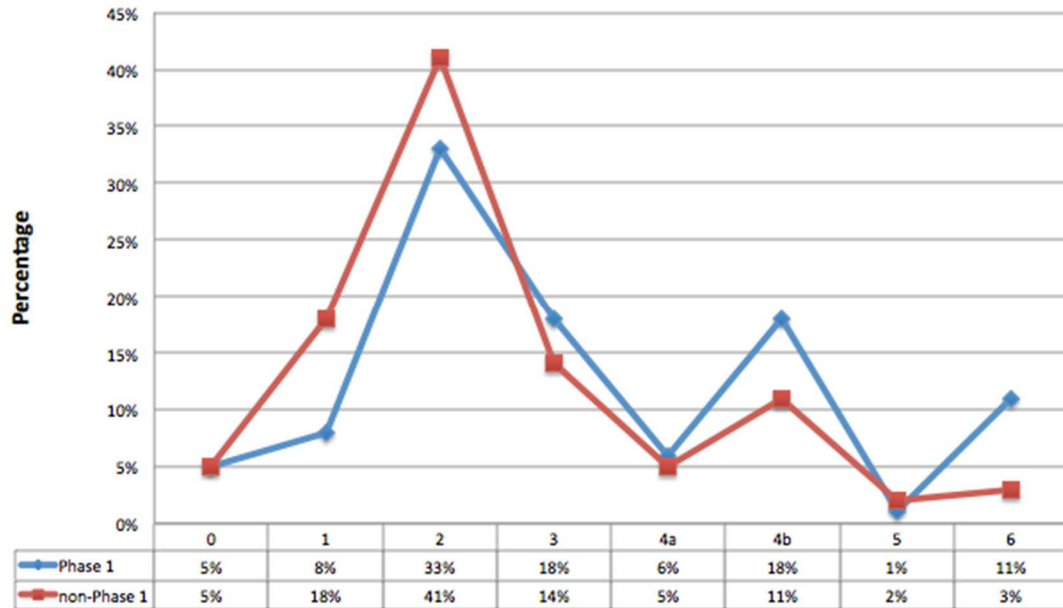


Figure 48. Phase 1 versus Non-Phase 1 LoTi Levels



Figure 49. STEM versus Non-STEM LoTi Levels

## Section 2: Conclusions

Based on the descriptive statistics, the sample size of the MES survey and LoTi survey met a satisfactory representation of the MES participants. Most of teachers participating in the MES initiative took the MES and LoTi surveys (89%).

A much smaller percentage of students took the MES survey (29%), which is probably due to the age appropriateness of the survey; the majority of students who answered the survey were 4th through 8th graders. Removing the K-3rd graders, the percentage of students who took the survey increases to 37%.

Examination of the distribution across schools reveals that the results for teachers were evenly distributed. The majority of student responses came from the middle schools, with the exception of Middle School D. There was no data collected from students who attended Middle School D.

According to SurveyMonkey's sample size calculator, the confidence level for the sample size of teachers and students would be 95%, giving the survey responses a 2% margin of error. Even though Middle School D had no student representation, the overall sample for this research study represents the MES participants (students and teachers) well.

**RQ1. What impact do iPads have on instruction?** Based on the data collected from the students and teachers, the iPad appears to have had an impact on instruction. Based on the MES Survey, 31% of students reported that they read more now that they had the iPad. An additional 15% said they read more digital print now with the iPad than prior to having the iPad.

Although the student percentages are modest, 85% of teachers reported that the iPad impacted instruction. Drilling deeper reveals that 69% of teachers' reporting that the iPad increased their teaching delivery strategies. The same percentage (69%) of teachers also reported that the iPad had increased their personal and professional growth. This perception may be due to the high volume of professional development

focused on how to use the iPad as an instructional tool. In addition, 30% of teachers reported witnessing an increase in student attendance. Further, 52% of teachers stated that the iPad had an impact on student behavior. Given that 43% of teachers reported an increase in behavior of students and 9% of the teachers reported a decrease in behavior of students, the researcher can conclude that there was a significant impact on student behavior. However, because the way the question is worded, it is not clear if the change is positive or negative.

Examination of the LoTi data reveals additional information about the impact of the iPad. Figures 19 through 21, with Cronbach's alphas greater than 0.70, show that the composite variables follow the same patterns, thereby confirming that the grouping of the survey questions produced reliable metrics of the underlying construct. As displayed in Table 5, the LoTi data show a significant difference between the MES teachers and the non-MES teachers with regard to the composite variables of InnovateSkills, TechSkills, and LifeSkills. The differences between Phase 1 and Phase 2 teachers' InnovateSkills, TechSkills, and LifeSkills and those of the non-MES teachers are significant at the 1% level. Even comparing the Phase 1 schools to the Phase 2 schools reveals a significant difference. This difference may be due to Phase 1 teachers' using the iPad as an instructional tool for a longer period of time. Teachers in schools who had access to an iPad in a 1:1 environment for a longer period of time tended to reflect InnovateSkills, TechSkills, and LifeSkills at a significantly higher rate than their counterparts.

**RQ2. What impact does the iPad have on student engagement?** Of the 1,824 students completing the MES survey, not one of them said the iPad did not

motivate them to come to school. As a matter of fact, when given the option of *never*, *seldom*, *sometimes*, or *often/daily*, 66% said that the iPad was an influential factor that motivated them to come to school. A significant majority (70%) of teachers reported seeing an increase in their students' engagement and motivation since they had implemented the iPad. In comparing the mean of the students' response (2.968) to the teachers' mean (3.184), it should be noted that, in both cases, 3 meant that the iPad increased student engagement.

Conclusively, it is clear that students and teachers believed that the iPad had an impact on student engagement. When comparing the various graphs of iPad usage for investigating issues (Figure 29), taking a position (Figure 30), making a decision (Figure 31), seeking a solution (Figure 32), and ethical use (Figure 33), there is a similarity and consistency between the students and teachers. These graphs indicate that the majority of both groups used the iPads *sometimes*. Nevertheless, looking at the graphs for real world (Figure 27), classroom content (Figure 28), creativity (Figure 34), and effective use (Figure 35) reveals that the majority of students and teachers differed in their answers regarding iPad usage. There is a noticeable pattern: The majority response for the teachers was *sometimes*, whereas the majority responses for the students were *often* or *daily*.

Examination of the *t*-test comparing students and teachers with regard to measuring the impact on engagement reveals that the average mean of the teachers' answers was 2.868 versus the students' 2.978. When the researcher studied the p-levels of impact on student engagement the RealWorld, Investigate, TakePosition, MakeDecision and EthicalUse all had a p-value greater than 0.05 as displayed in Table

6. Having p-values larger than 0.05 indicated weak evidence against the null hypothesis thus the researcher accepted the null hypothesis. The large p-values means that we cannot reject the null hypothesis that the mean scores of the student and teachers were the same. When the researcher looked at the relationship between the students' and teachers' perceptions of iPad usage for RealWorld, Investigate, TakePosition, MakeDecision and EthicalUse, in each case, the mean score of the student and teacher were close in value. Both students and teachers agreed to the following:

- students *sometimes* engage in planned activities that involve the use of the iPad to solve real world problems.
- teachers *sometimes* promote, monitor and model the ethical use of mobile technologies in the classroom.

The mean values for Investigate, TakePosition and MakeDecision fall between 2 and 3 (Investigate 2.8, TakePosition 2.5 and MakeDecision 2.7), meaning students and teachers had an average score between *seldom* and *sometimes* to answer the questions. Both students and teachers agreed that students *seldom/sometimes* use the iPads for research that requires:

- the investigation of issues/problems
- taking a position, and
- making a decision.

Table 6 also showed that the *p*-values for SeekSolution, Creativity and EffectiveUse were less than 0.05, which signifies strong evidence against the null hypothesis and allows us to reject the null hypothesis. The small p-values gave



strong evidence that the mean scores of the student and teachers are different. When the researcher looked at the relationship between the students' and teachers' perceptions the researcher found the following varied responses:

- Students said that they *sometimes* use the iPad for research that required seeking a solution, with a 3.01 mean. Teachers mean was a little lower than the students at 2.86.
- Teachers said that they *sometimes* encourage students to use the devices to promote creativity and innovative thinking. However the students had a lower mean, which said that teachers *seldom* encourage students to use the devices to promote creativity and innovative thinking.
- Teachers and students both agree that teachers *sometimes* model and facilitate the effective use of current and emerging mobile devices, applications and learning in the classroom.

Finally, table 6 displays p-values for Content right at 0.05, which is considered to be marginal. The mean of Content for the student was 3.022 and the mean for the teacher was 3.143. The mean suggest that students and teachers agreed that teachers *sometimes* encouraged students to use the iPad to supplement the curriculum and reinforce specific classroom instruction.

Further, looking at the LoTi line graphs that compare the composite variables of Self-Directed (Figure 38) and Assessment (Figure 39), the results of those questions have a similar pattern. The high Cronbach's alphas support the graphic evidence that the questions in each composite variable are moving in the same direction.

The regression analysis (Table 8) reveals more information about the impact of the iPads on student engagement. Teachers in MES schools reflect a statistically significant difference in the DigiAge, LearnCtr, SelfDirected, and Assessment composite variables compared to non-MES schools. There is even a significant difference between Phase 1 and Phase 2 schools, which again, lead the researcher to believe that time using the device influenced how teachers used the device. The only composite variable in Phase 2 that did not show a significant difference was assessment. STEM teachers also reflected a statistical significance at the 10% level.

**RQ3. How is the iPad being used in the education environment?** Figure 40 displays that the majority of teachers say they use the iPads often/daily for collaboration, while students say that they *sometimes* use the iPad for collaboration. Figure 42 reveals that the teacher and student lines tend to follow the same pattern, a majority of students and teachers use the iPad often/daily for research. Figure 41, however, indicates that the majority of students said they lacked the opportunity to use their iPad as a communication tool. The *t*-test confirms the difference between teacher and student perceptions: the mean for the students was lower than the mean for the teachers and this difference is statistically significant.

The question still remains: “How is the iPad being used?” Examination of Figure 40, 41 and 42, reveals that the majority of students and teachers agreed that they have used the iPad for collaboration, communication, and research. Table 9 displays that the means of the teacher and students hover around 3 for collaboration, communication and research. This means that both groups of participants agree that they have used the device for collaboration, communication, and research.

Looking at the previous data presented for research questions one and two can also answer how the iPads are being used in the classroom. Figure 33 show that the majority of both teachers and students agreed that teachers were modeling ethical use of the iPad daily. Table 6 indicates that the majority of teachers and students were in agreement that they used the iPad *sometimes* to solve real-world problems, supplement the curriculum and reinforce content, investigate issues or problems, take a position, make a decision, seek a solution, and promote creativity and innovative thinking.

The  $p$ -values in Table 9 are all less than 0.05, which signifies strong evidence against the null hypothesis allowing the researcher to reject the null hypothesis. The small  $p$ -values give strong evidence that the mean scores of the student and teachers are different. When the researcher looked at the relationship between the students' and teachers' perceptions of iPad usage for collaboration, communication, and research, in each case the mean score of the student was less than the mean score of the teachers.

When reviewing the LoTi data, the teacher computer use (TCU) chart (Figure 43) shows that the majority of the teachers who took the LoTi survey said they used digital tools and resources multiple times during the instructional day. The TCU regression data reveal a significant difference between the MES teachers and non-MES teachers; however, it is interesting to compare the Phase 1 teachers and the Phase 2 teachers. The negative estimated coefficients on the Phase 1 and Phase 2 dummy variables indicate that teachers who have had the devices tend to use the devices less themselves and those differences are statistically significant. This can be

interpreted to mean that the longer teachers have the technology the less they use it until you look at the student technology usage (STU) data. When we move over to the STU column of Table 10, the results showed that the estimated coefficient of the Phase I dummy variable was statistically significant at 1% level. This is a higher SCU than any of the other groups. Therefore, teachers who have access to technology in a 1:1 environment for a longer period of time have a higher rate of student usage. This shows that there is a direct correlation between the teacher's familiarity of the device and the student's usage of the device.

Another group whose estimated coefficient was negative was the 20plus group of teachers. The estimated coefficient for the 20Plus group was negative; however, the 20Plus group did not reflect a statistically significant difference, as did Phase 1 and Phase 2. This is still a relevant finding with regard to dispelling the myth that older teachers do not want to use the technology.

In comparing the SCU chart (Figure 44) to the TCU chart (Figure 43), it appears that teachers were using the technology more frequently than the students. Figure 45 displays the results of CIP, which shows that the majority of teachers were moving toward a student-directed approach. Again the MES Phase 1 schools show a statistically significant difference at the 1% level.

As was the case with the CIP, the teachers seemed to be moving in the right direction with the PCU. The majority of teachers fall in the 4, 5, and 6 PCU Intensity level, which means that the teachers had a high fluency level in using digital tools and resources for student learning. Again the MES Phase 1 schools show a statistically

significant difference at the 1% level and Phase 2 a statistically significant difference at the 5% level.

Even though the majority of teachers had high CIP and PCU levels, they did not reflect a high LoTi level. Figure 45 indicates that the majority of teachers fell on LoTi Level 2, Exploration. At the exploration level, “the instructional focus emphasizes content understanding and supports mastery learning and direct instruction. Student learning focuses on lower levels of cognitive processing” (Moersch, 2014, p.108). However the Phase 1 and STEM teachers LoTi level was statistically significant at the 1% level. As a matter of fact, Figure 48 shows that 54% of Phase 1 LoTi levels fall above LoTi level 2, while only 36% of non-Phase 1 teachers’ levels are above LoTi level 2. The same holds true for STEM teachers; the majority of STEM teachers fall between LoTi level 3 through 6, while the majority of their counter parts are at a LoTi level 2 and below (Figure 49).

### **Section 3: Impact for School District**

The MES and LoTi data reveal a great deal about the state of the district’s iPad initiative. This study showed that the iPad had a positive impact on the educational environment, indicating that the MES initiative should continue with the following recommendations.

#### **Recommendations.**

**Align professional development program with the LoTi Digital-Age Levels.** Aligning the professional development program with the LoTi Level will give the district a common language and focus. Teachers will be able to create their individualized professional development plans based on their LoTi levels, thereby

enabling them to move to the next level. As a whole, the district was identified as a LoTi Level 2, which means that the district needs to offer more professional development that focuses on teaching strategies that incorporate higher order thinking skills while integrating the digital tools that are available for students' use. Offering professional development with this focus could move the district from LoTi Level 2 to Level 3.

**Embed classroom management tips into professional development.**

The data indicate that teachers could benefit from professional development surrounding classroom management in the digital age. An indicator that this type of professional development is needed is the fact that the teacher usage rate is higher than the student usage rate. Teachers should also be equipped and empowered with classroom management strategies to help them focus and redirect unwanted behavior; however, this step must be implemented in conjunction with the first recommendation, which focuses the training on the teachers' pedagogy. The professional development should also focus on educators' making better connections between technology use and student problem solving in the classroom. If students are participating in student-centered problem-solving activities, the discipline rate should automatically decrease because the students are fully engaged.

**Develop sustainability plan that includes continued monitoring.** Important data were collected through these tools. The MES teacher survey tool should be updated by bringing clarity to Question 9d, which was the question about teaching strategies. This question should not be grouped with the other sub-questions of Question 9 because the response options are unclear with regard to what the survey is

asking and how to interpret what the teachers are saying. Also the voices of the younger students were not heard. A separate survey tool should be developed to capture the K-3<sup>rd</sup>-grade students.

### **Recommendations for Future Research.**

The researcher recommends further research should be conducted in effort to understand the academic achievement of students with iPads compared to students who don't have access to the devices in a 1:1 environment. The following should be considered for future research:

1. Approximately 32% of MES students reported that they read more now that they have access to the iPad. HDSD should design a study to investigate what is creating the increase in reading habits for students.
2. Due to the advent of the national PARCC test, students in K-12 can be compared to their counterparts in other states. Research should be conducted to investigate if using the iPad as an instructional tool has an impact on academic achievement across the country.

### **Conclusion**

It has been shown statistically that there is a significant difference between the teachers who participated in the MES 1:1 iPad initiative and those who did not (Tables 5, 8 and, 10). The t-tests (Tables 6 and 9) based on the MES surveys show that the means of the teacher and students hover around 3 for activities that impact student engagement and well as collaboration, communication, and research. This means that both students and teachers agree that they have used the iPad to solve real world problems, supplement the curriculum and reinforce instruction, investigate

problems, take a position, make a decision, seek a solution, model ethical and effective use, spark creativity, collaborate, communicate and research all are skills needed to be successful in the 21st century (Partnership for 21<sup>st</sup> Century Skills, 2011). The data also showed that there was an increase in student engaged because of the MES initiative.

Across the board there was a statistically significant difference between the teaching styles of the teachers who participated in MES and those who did not. MES teachers who participated in MES had higher LoTi scores, indicating an impact on the instruction being delivered to the students. The difference seen in the MES teachers and the non-MES teachers does not come from the teachers and students just having the device. The difference could be due to the professional development the MES teachers received with how to use and implement the iPad as an instructional tool. Each of the MES teachers received on an average 151 hours of professional development, which included hands-on workshops on how to use the device and professional learning communities that focused on the pedagogy shifts. The data also showed that the Phase I teachers was consistently at the 1% level of statistical significance, with the exception of TCU (statistically significant at the 5% level), which shows that familiarity with using and teaching with the device makes a difference.

Therefore, given the data provided by the research the iPad is no longer an “Unproven Innovation.” The results speak for themselves. Along with the fact that the surveys showed that the 21<sup>st</sup> century skills were being developed, there was also



an increase in the professional growth of the teachers, and an increase in student engagement that both the teachers and students reported.

The goal of the MES initiative was to create an environment that would motivate students to be engaged in their work so that student achievement improves. Through the purchase of the iPads, this goal has been met. There is an opportunity for the education community to harness and leverage the power of mobile devices. Thus, allowing students to become innovative problem solvers who thrive in the 21<sup>st</sup> century economy.

## Appendices

## Appendix A: LoTi Digital Age Survey for Teachers

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# LoTi Digital-Age Survey for Teachers

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Version 2013

# LoTi Digital-Age Survey for Teachers

Using the LoTi Digital-Age Survey for professional development planning is part of an ongoing nationwide effort to sharpen educator skillsets as defined by the Partnership for 21st Century Skills. Individual information will remain anonymous, while the aggregate information will provide various comparisons for your school, school district, regional service agency, and/or state. Please fill out as much of the information as possible.



The LoTi Digital-Age Survey takes about 20-25 minutes to complete. The purpose of this questionnaire is to determine your current professional development priorities related to technology and instruction based on your current position (i.e., pre-service teacher, inservice teacher, building administrator, instructional specialist, media specialist, higher education faculty).



Completing the questionnaire will enable your educational institution to make better choices regarding staff development and future technology purchases. The questionnaire statements were developed from typical responses of educators who ranged from non-users to sophisticated users of technology in the classroom.

Survey statements will represent different uses of technology that you currently experience or support, in varying degrees of frequency, and should be recorded appropriately on the scale.

Please respond to the statements in terms of your present uses or support of technology in the classroom. Use the scale to determine your response based on how frequently you experience the activities described in the statement.

**Instructional Environment**

How often are your students involved in standards-based learning experiences during the instructional day?

- 0  Never
- 1  At least once a year
- 2  At least once a month
- 3  At least once a week
- 4  At least once a day
- 5  Multiple times each day

**Teacher Computer Use (TCU):**

How often are you (the teacher) using digital tools and resources during the instructional day?

- 0  Never
- 1  At least once a year
- 2  At least once a month
- 3  At least once a week
- 4  At least once a day
- 5  Multiple times each day

**Student Computer Use (SCU):**

How often are your students using digital tools and resources during the instructional day?

- 0  Never
- 1  At least once a year
- 2  At least once a month
- 3  At least once a week
- 4  At least once a day
- 5  Multiple times each day

Page 3

## LoTi Digital-Age Survey for Teachers

- 0 Never
- 1 At least once a year
- 2 At least once a semester
- 3 At least once a month
- 4 A few times a month
- 5 At least once a week
- 6 A few times a week
- 7 At least once a day

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- Q1: I engage students in learning activities that require them to analyze information, think creatively, make predictions, and/or draw conclusions using the digital tools and resources (e.g., Inspiration/Kidspiration, Excel, InspireData) available in my classroom.
- Q4: Students in my classroom use the digital tools and resources to create web-based (e.g., web posters, student blogs or wikis, basic webpages) or multimedia presentations (e.g., PowerPoint) that showcase digitally their research (i.e., information gathering) on topics that I assign more than for other educational uses.
- Q5: I assign web-based projects (e.g., web collaborations, WebQuests) to my students that emphasize complex thinking strategies (e.g., problem-solving, decision-making, experimental inquiry) aligned to the content standards.
- Q6: I provide multiple and varied formative and summative assessment opportunities that encourage students to "showcase" their content understanding in nontraditional ways.
- Q8: I use the digital tools and resources in my classroom to promote student creativity and innovative thinking (e.g., thinking outside the box, exploring multiple solutions).
- Q10: My students identify important real world issues or problems (e.g., environmental pollution, elections, health awareness), then use collaborative tools and human resources beyond the school building (e.g., partnerships with business professionals, community groups) to solve them.
- Q12: I promote, monitor, and model the ethical use of digital information and technology in my classroom (e.g., appropriate citing of resources, respecting copyright permissions).
- Q13: I use different digital media and formats (e.g, blogs, online newsletters, online lesson plans, podcasting, digital documents) to communicate information effectively to students, parents, and peers.
- Q14: My students propose innovative ways to use our school's advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems) and resources (e.g., publishing software, media production software, advanced web design software) to address challenges/issues affecting their local and global communities.
- Q15: I model and facilitate the effective use of current and emerging digital tools and resources (e.g., streaming media, wikis, podcasting) to support teaching and learning in my classroom.
- Q16: Our classroom's digital tools and resources are used exclusively for classroom management and professional communication (e.g., accessing the Internet, communicating with colleagues or parents, grading student work, and/or planning instructional activities).
- Q17: The digital tools and resources in my classroom are used by me during the instructional day and *not* by my students.
- Q18: I use different technology systems unique to my grade level or content area (e.g., online courseware, Moodle, WAN/LAN, interactive online curriculum tools) to support student success and innovation in class.
- Q19: I employ learner-centered strategies (e.g., communities of inquiry, learning stations/centers) to address the diverse needs of all students using developmentally-appropriate digital tools and resources.
- Q20: Students' use of information and inquiry skills to solve problems of personal relevance influences the types of instructional materials used in my classroom.
- Q21: My students participate in collaborative projects (e.g., Jason Project, GlobalSchool-Net) involving face-to-face and/or virtual environments with students of other cultures that address current problems, issues, and/or themes.
- Q22: My students use the available digital tools and resources for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of personal interest that address specific content standards.
- Q23: I model for my students the safe and legal use of digital tools and resources while I am delivering content and/or reinforcing their understanding of pertinent concepts using multimedia resources (e.g., PowerPoint, Keynote), web-based tools (e.g., Google Presentations), or an interactive whiteboard.

Page 4

## LoTi Digital-Age Survey for Teachers

0

Never

1

At least  
once a year

2

At least  
once a semester

3

At least  
once a month

4

A few  
times a month

5

At least  
once a week

6

A few  
times a week

7

At least  
once a day

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- Q25: My students model the "correct and careful" (e.g., ethical usage, proper digital etiquette, protecting their personal information) use of digital resources and are aware of the consequences regarding their misuse.
- Q26: I participate in local and global learning communities to explore creative applications of technology toward improving student learning.
- Q27: I offer students learning activities that emphasize the use of digital tools and resources to solve "real-world" problems or issues.
- Q30: I prefer using standards-based instructional units and related student learning experiences recommended by colleagues that emphasize innovative thinking, student use of digital tools and resources, and student relevancy to the real world.
- Q31: I seek outside help with designing student-centered performance assessments using the available digital tools and resources that involve students transferring what they have learned to a real world context.
- Q32: I rely heavily on my students' questions and previous experiences when designing learning activities that address the content that I teach.
- Q36: My students use the classroom digital tools and resources to engage in relevant, challenging, self-directed learning experiences that address the content standards.
- Q37: I design and/or implement web-based projects (e.g., WebQuests, web collaborations) in my classroom that emphasize the higher levels of student cognition (e.g., analyzing, evaluating, creating).
- Q38: My students use the digital tools and resources in my classroom primarily to increase their content understanding (e.g., digital flipcharts, simulations) or to improve their basic math and literacy skills (e.g., online tutorials, content-specific software).
- Q40: My students use digital tools and resources for research purposes (e.g., data collection, online questionnaires, Internet research) that require them to investigate an issue/problem, take a position, make decisions, and/or seek out a solution.
- Q41: My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.
- Q42: I promote global awareness in my classroom by providing students with digital opportunities to collaborate with others of various cultures.
- Q43: My students apply their classroom content learning to real-world problems within the local or global community using the digital tools and resources at our disposal.
- Q45: My students and I use the digital tools and resources (e.g., interactive whiteboard, digital student response system, online tutorials) primarily to supplement the curriculum and reinforce specific content standards.
- Q46: Problem-based learning occurs in my classroom because it allows students to use the classroom digital tools and resources for higher-order thinking (e.g., analyzing, evaluating, creating) and personal inquiry.
- Q47: My students use all forms of the most advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems, handheld devices) and resources (e.g., publishing software, media production software, advanced web design software) to pursue collaborative problem-solving opportunities surrounding issues of personal and/or social importance.
- Q48: I advocate for the use of different assistive technologies on my campus that are available to meet the diverse demands of special needs students.
- Q49: I promote the effective use of digital tools and resources on my campus and within my professional community and actively develop the technology skills of others.
- Q50: I consider how my students will apply what they have learned in class to the world they live when planning instruction and assessment strategies.

## Appendix B. Permission for Use of the LoTi Framework



**LoTi Connection, Inc.**

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February 23<sup>rd</sup> 2015

### Permission for Use of the LoTi Framework

To: University of Maryland, College Park  
Dissertation Review Boards

Please accept this letter as notification that Meri Robinson is hereby granted permission to utilize the LoTi Framework and corresponding Digital-Age Survey to collect data for her doctoral dissertation study. Meri is permitted to use the Digital-Age Survey and the LoTi Framework for purposes of the study only. In addition, Meri has permission to review all available LoTi Digital-Age results on the individuals taking place in her study.

The guidelines for using LoTi Connection copyrighted material as part of this dissertation study are as follows:

1. Permission to reprint the LoTi Framework is granted provided that the content remains unchanged and that attribution is given to LoTi Connection.
2. Permission to reprint selected results including graphs and tables in the Appendices of the study is granted provided that the content remains unchanged and that attribution is given to LoTi Connection.
3. Permission to reprint selected questions from the Digital-Age Survey in the Appendices of the study is granted provided that the content remains unchanged and that attribution is given to LoTi Connection.
4. LoTi Connection holds the right to restrict usage of any intellectual property if LoTi Connection finds that the content is being used in an inappropriate manner.

Sincerely,

Dennee Saunders  
Assistant Executive Director

Date 02/23/2015

## Appendix C: LoTi Framework

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### *LoTi Framework*

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<b>LoTi Level</b>	<b>Description</b>
<b>Level 0 - Non-use</b>	Level 0 (Non-Use), the instructional setting—including the use of digital and/or environmental resources—does not support or promote purposeful learning aligned to academic standards/expectations.
<b>Level 1 - Awareness</b>	Level 1 (Awareness), the instructional focus is exclusively direct instruction. Student learning focuses on lower levels of cognitive processing (e.g., Bloom Levels - remembering, understanding, applying; Webb’s Levels – recall & reproduction, working with skills & concepts). Digital and/or environmental resources are either (1) non-existent or (2) used by the classroom teacher to enhance teacher lectures or presentations (e.g., multimedia presentations)
<b>Level 2 - Exploration</b>	Level 2 (Exploration) the instructional focus emphasizes content understanding and supports mastery learning and direct instruction. Student learning focuses on lower levels of cognitive processing (e.g., Bloom Levels - remembering, understanding, applying; Webb’s Levels – recall & reproduction, working with skills & concepts). Digital and/or environmental resources are used by students for extension activities, enrichment exercises, or information gathering assignments that reinforce lower cognitive skill development relating to the content under investigation.
<b>Level 3 - Infusion</b>	<p>Level 3 (Infusion), the instructional focus emphasizes student higher order thinking (e.g., Bloom Levels – analyzing, evaluating, creating; Webb’s Levels – short-term strategic thinking) and teacher-directed problems. Though specific learning activities may lack authenticity, the instructional emphasis is, nonetheless, placed on higher levels of cognitive processing and in-depth treatment of the content using a variety of thinking skill strategies (e.g., problem-solving, decision-making). The concept attainment, inductive thinking, and scientific inquiry models of teaching are the norm and guide the types of products generated by students.</p> <p>Digital and/or environmental resources are used by students and/or the teacher to execute teacher-directed tasks that emphasize higher levels of student cognitive processing relating to the content under investigation.</p>

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<b>Level 4a – Integration: Mechanical</b>	<p>Level 4a (Integration: Mechanical) students are engaged in exploring real-world issues and solving authentic problems using the available digital and/or environmental resources; however, the teacher may experience classroom management (e.g., disciplinary problems) or school climate issues (lack of support from colleagues) that restrict full-scale integration. Heavy reliance is placed on prepackaged materials and/or outside resources (e.g., assistance from other colleagues) that aid the teacher in sustaining engaged student-directed learning. Emphasis is placed on the constructivist, problem-based models of teaching that require higher levels of student cognitive processing (e.g., Bloom Levels – analyzing, evaluating, creating; Webb’s Levels – short-term strategic thinking, extended strategic thinking) and in-depth examination of the content.</p>
<b>Level 4b – Integration: Routine</b>	<p>Student use of digital and/or environmental resources is inherent and motivated by the drive to answer student-generated questions that dictate the content, process, and/or products embedded in the learning experience.</p> <p>Level 4b (Integration: Routine) students are fully engaged in exploring real-world issues and solving authentic problems using the available digital and/or environmental resources. The teacher is within his/her comfort level with promoting an inquiry-based model of teaching that involves students applying their learning to the real world (e.g., Webb’s Levels – extended strategic thinking). Emphasis is placed on learner-centered strategies and the constructivist, problem-based models of teaching that promote personal goal setting and self-monitoring, student action, and issues resolution.</p>
<b>Level 5 - Expansion</b>	<p>Students’ use of digital and/or environmental resources is inherent and motivated by the drive to answer student-generated questions that dictate the content, process, and products embedded in the learning experience.</p> <p>Level 5 (Expansion), student collaborations extending beyond the classroom are employed for authentic problem-solving and issues resolution. Emphasis is placed on learner-centered strategies that promote personal goal setting and self-monitoring, student action, and collaborations with other groups (e.g., another school, different cultures, business establishments, and governmental agencies).</p> <p>Student use of digital and/or environmental resources is inherent and motivated by the drive to answer student-generated questions that dictate the content, process, and products embedded in the learning experience. The complexity and sophistication of the digital and environmental resources and collaboration tools used are commensurate with (1) the inventiveness and spontaneity of the teacher’s experiential-based approach to teaching and learning and (2) the students’ level of complex</p>

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<b>Level 6 - Refinement</b>	thinking (e.g., problem-solving, decision-making, experimental inquiry) and in- depth understanding of the content experienced in the classroom.  Level 6 (Refinement), student collaborations extending beyond the classroom that promote authentic student problem-solving and issues resolution are the norm. The instructional curriculum is entirely learner-based involving the content, process, and product of instruction. The content emerges based on the needs of the learner according to his/her interests and/or aspirations and is supported by pervasive access to the most current digital resources.
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## Appendix D: 2015 MES Student Survey Questions

### *2015 Student Survey*

	<i>Question</i>	<i>Type of Question</i>	<i>Options</i>
1	School	Multi-Choice	List of MES Schools
2	Grade Level	Multi-Choice	K, 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> , 5 <sup>th</sup> , : 6 <sup>th</sup> , 7 <sup>th</sup> , 8 <sup>th</sup> , Other
3	Do you have internet access at home?	Multi-Choice	Yes, No
4	How do you access the Internet?	Select All that Apply	Laptop, Cell Phone, Desktop/Computer, iPad or other mobile device, Library, Other
5	Does using the iPad in class motivate you to come to school?	Multiple Choice	Yes, Most of the time, Not at all
6	Since you started using the iPad, what are your reading habits?	Multiple Choice	I read more now that I have the iPad, I read as much with the iPad as I did without it, I read more digital materials than printed materials, I read more printed materials than digital materials
7	How often do you use the iPad in the following subjects? <ul style="list-style-type: none"> <li>• Art</li> <li>• Music</li> <li>• Foreign Language</li> <li>• Health</li> <li>• Reading/Language Arts</li> <li>• Arts</li> <li>• Math</li> <li>• Science</li> <li>• Social Studies</li> <li>• Physical Education</li> <li>• ESOL</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never

8	<p>Rate the following statements:</p> <ul style="list-style-type: none"> <li>• In some of my classes, I engage in learning activities that involve the use of mobile devices to solve real-world problems or issues.</li> <li>• I use mobile technologies in the classroom and/or to study classroom content.</li> <li>• In some of my classes mobile technologies are used only by me (the student) and not by my teachers.</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never
9	<p>In class we use the iPads to:</p> <ul style="list-style-type: none"> <li>• Investigation of issues or problems</li> <li>• Taking a position</li> <li>• Making a decision</li> <li>• Seeking a solution</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never
10	<p>In class we use the iPads to</p> <ul style="list-style-type: none"> <li>• Collaborate with others</li> <li>• Communicate with others</li> <li>• Research problems of personal interest that address specific content areas</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never
11	<p>Rate the following statements:</p> <ul style="list-style-type: none"> <li>• My teachers promote, monitor, and model the ethical use of mobile technologies in their classrooms.</li> <li>• My teachers encourage me to use mobile devices while in the classroom to learn and to spark my creativity.</li> <li>• My teachers model and facilitate the effective use of current and emerging mobile devices, applications, and</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never

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	programs to support teaching and learning in their classrooms.	
12	How has the iPad impacted your learning?	Open Ended

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Note: Other in the options column denotes that participant can input their own answer not included in the choices.

**Appendix E: SY 2015 MES Teacher Survey**

	<i>Question</i>	<i>Type of Question</i>	<i>Options</i>
1	School	Multi-Choice	List of MES Schools
2	What subject area(s) do you teach?	Select All that Apply	Art, Music, Foreign Language, Health, Reading/Language Arts, Math, Science, Social Studies, Physical Education, ESOL, Other
3	Do you have internet access at home?	Multi-Choice	Yes, No
4	What grade level(s) do you teach?	Select All that Apply	K, 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> , 5 <sup>th</sup> , : 6 <sup>th</sup> , 7 <sup>th</sup> , 8 <sup>th</sup> , Other
5	Rate the following Questions: <ul style="list-style-type: none"> <li>• Students in my class engage in planned activities that involve the use of the iPad to solve real-world problems.</li> <li>• I encourage my students to use the iPad to supplement the curriculum and reinforce specific classroom instruction.</li> <li>• I promote, monitor and model the ethical use of mobile technologies in my classroom.</li> <li>• I encourage students to use the devices in my classroom to promote creativity and innovative thinking.</li> <li>• I model and facilitate the effective use of current and emerging mobile devices, applications and programs to support teaching and learning in my classroom.</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never

6	<p>In my class, students use the iPad for research that requires:</p> <ul style="list-style-type: none"> <li>• the investigation of issues/problems</li> <li>• taking a position</li> <li>• making a decision</li> <li>• seeking a solution</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never
7	<p>I encourage my students to use the iPads in the classroom to:</p> <ul style="list-style-type: none"> <li>• collaborate with others</li> <li>• communicate with others</li> <li>• research problems of personal interest that address specific content areas</li> </ul>	Likert Scale	Often or daily, Sometimes, Seldom, Never
8	I use my iPad for	Select All that Apply	<p>Planning, research and development of classroom materials, Delivery of classroom curriculum, Access and management of student data, SchoolMax, Communicating and collaborating with peers and experts, Access to professional digital content to enhance my classroom curriculum, The development of multimedia content, Edmodo, Distribution of classroom content, Video creation, Access of multimedia content (Khan Academy, YouTube, etc.), Classroom management, Other</p>
9	<p>How has the iPad impacted:</p> <ul style="list-style-type: none"> <li>• Student engagement and motivation</li> <li>• Student behavior</li> <li>• Student attendance</li> <li>• Your teaching and delivery strategies</li> <li>• Your personal and professional growth</li> </ul>	Likert Scale	Increased, No Change, Decreased, N/A

10	Which Apps do you find most effective in achieving your curricular goals and objectives? <ul style="list-style-type: none"> <li>• Pages</li> <li>• Numbers</li> <li>• iMovie</li> <li>• Atlas</li> <li>• Creative Book Builder</li> </ul>	Likert Scale	Highly effective, Effective, Not effective, Do not use it
11	If you had to recommend an App to a peer, which App would you choose?	Open Ended	
12	Has the iPad impacted your instruction?	Multi-Choice	Yes, No
13	Please explain (How has the iPad impacted or not impacted your instruction)	Open Ended	

Note: Other in the options column denotes that participant can input their own answer not included in the choices.



## Appendix F: Current Instructional Practices Framework



### Current Instructional Practices (CIP) Framework

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#### CIP Intensity Level 0

At a CIP Intensity Level 0, the student is not involved in a formal classroom setting (e.g., independent study).

#### CIP Intensity Level 1

At a CIP Intensity Level 1, the participant's current instructional practices align exclusively with a teacher-directed approach relating to the content, process, and product of instruction. Teaching strategies tend to lean toward lectures and/or teacher-led presentations. The use of curriculum materials aligned to specific content standards serves as the focus for student learning. Learning activities tend to be sequential and uniform for all students. The use of differentiated strategies is non-existent. Evaluation techniques focus on traditional measures such as essays, quizzes, short-answers, or true-false questions. Student projects are teacher-directed in terms of identifying project outcomes as well as requirements for project completion.

The use of research-based best practices focuses on basic classroom routines (e.g., providing homework and practice, setting objectives and providing feedback, students summarizing and note taking, providing adequate wait time).

#### CIP Intensity Level 2

Similar to a CIP Intensity Level 1, the participant at a CIP Intensity Level 2 supports instructional practices consistent with a teacher-directed approach relating to the content, process, and product, but not at the same level of intensity or commitment. Teaching strategies tend to lean toward lectures and/or teacher-led presentations. The use of curriculum materials aligned to specific content standards serves as the focus for student learning. Learning activities tend to be sequential and uniform for most students. The use of horizontal differentiated strategies are sometimes employed based on the teacher's interests, modality strengths, and/or learning profile. Evaluation techniques focus on traditional measures such as essays, quizzes, short-answers, or true-false questions. Student projects tend to be teacher-directed in terms of identifying project outcomes as well as requirements for project completion.

The use of research-based best practices focuses on basic classroom routines (e.g., providing homework and practice, setting objectives and providing feedback, students summarizing and note taking, providing adequate wait time).

#### CIP Intensity Level 3

At a CIP Intensity Level 3, the participant supports instructional practices aligned somewhat with a teacher-directed approach—an approach characterized by sequential and uniform learning activities for all students, teacher-directed presentations, and/or the use of traditional evaluation techniques. However, the participant may also support the use of horizontal differentiated strategies that provide opportunities for students to determine the "look and feel" of a final product based on student's interests.

Evaluation techniques continue to focus on traditional measures with the resulting data serving as the basis for curriculum decision-making. The use of research-based best practices expands beyond basic classroom routines (e.g., providing opportunities for non-linguistic representation, offering advanced organizers).

#### CIP Intensity Level 4

At a CIP Intensity Level 4, the use of a teacher-directed approach is the norm, but there is an increased frequency of student-directed decision-making or input into the content, process, or product of instruction. In a student-directed approach, learning activities are diversified and based mostly on student questions, the teacher serves more as a co-learner or facilitator in the classroom, student projects are primarily student-directed, and the use of alternative assessment strategies including performance-based assessments, peer reviews, and student reflections are the norm. The use of limited horizontal and/or vertical differentiated strategies are present based on student interests, modality strengths, learning profile and/or readiness levels.





### CIP Intensity Level 4 (continued)

Although traditional learning activities and evaluation techniques are used, students are also encouraged to contribute to the assessment process when appropriate based on the content standards. The use of research-based best practices expands beyond basic classroom routines (e.g., providing opportunities for non-linguistic representation, offering advanced organizers).

### CIP Intensity Level 5

At a CIP Intensity Level 5, the participant's instructional practices tend to lean more toward a student-directed approach. The essential content embedded in the standards emerges based on students "need to know" as they attempt to research and solve issues of importance to them using critical thinking and problem-solving skills. The types of learning activities and teaching strategies used in the learning environment are diversified and driven by student questions. Both students and teachers are involved in devising appropriate assessment instruments (e.g., performance-based, journals, peer reviews, self-reflections) by which student performance will be assessed. The use of expanded horizontal and vertical differentiated strategies are present based on student interests, modality strengths, learning profile and/or readiness levels.

Although student-directed learning activities and evaluations are the norm, the use of teacher-directed activities (e.g., lectures, presentations, teacher-directed projects) may surface based on the nature of the content standards and at the desired level of student cognition. The use of research-based best practices delves deeper into complex classroom routines (e.g., students generating and testing hypotheses, implementing cooperative learning, students identifying similarities and differences).

### CIP Intensity Level 6

The participant at a CIP Intensity Level 6 supports instructional practices consistent with a student-directed approach, but not at the same level of intensity or commitment as a CIP Intensity Level 7. The essential content embedded in the standards emerges based on students "need to know" as they attempt to research and solve issues of importance to them using critical thinking and problem-solving skills. The types of learning activities and teaching strategies used in the learning environment are diversified and driven by student questions.

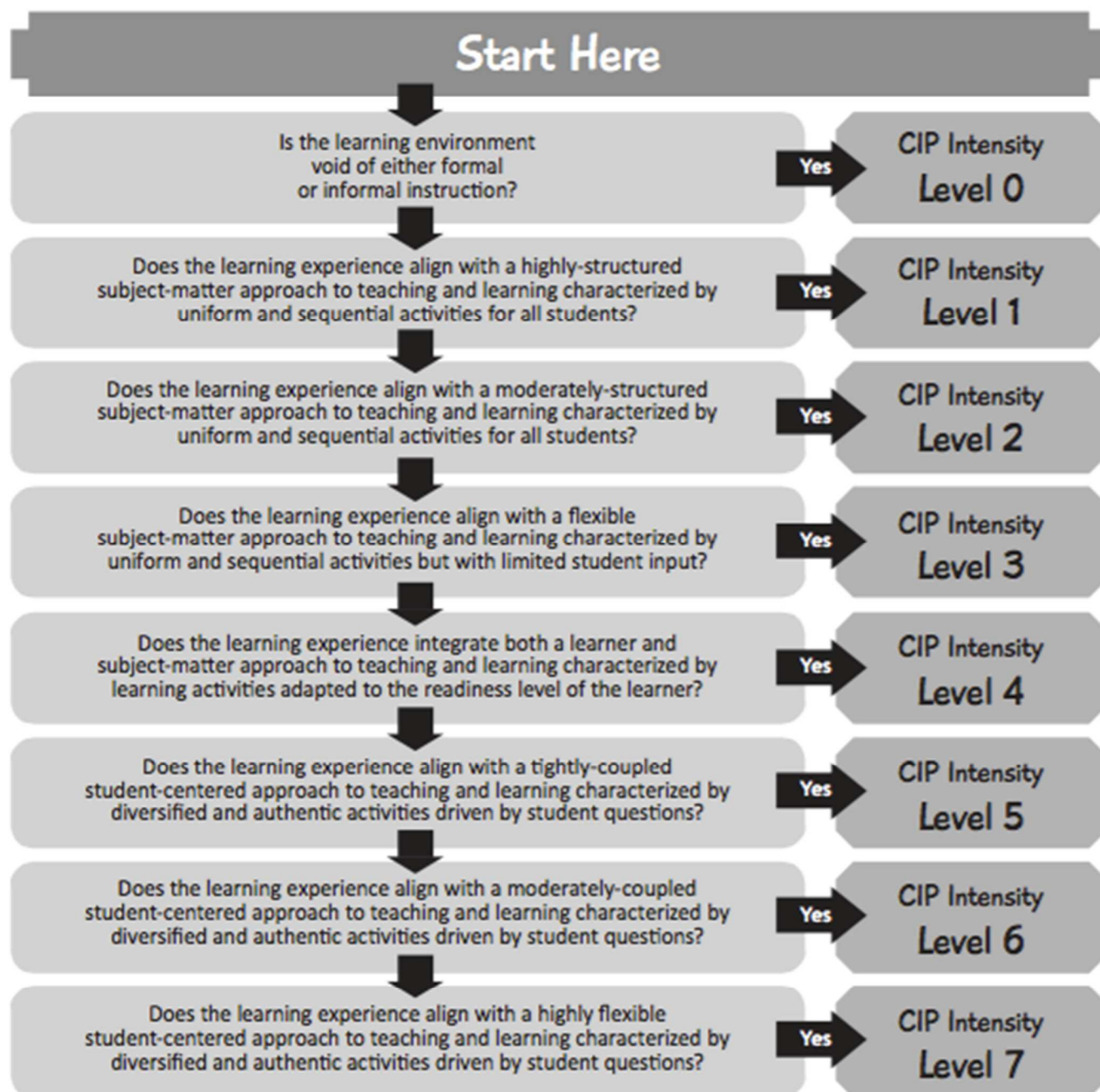
Students, teacher/facilitators, and occasionally parents are all involved in devising appropriate assessment instruments (e.g., performance-based, journals, peer reviews, self-reflections) by which student performance will be assessed. The amount of differentiation is substantial based on the readiness level, interests, learning styles, and readiness levels of the students. The use of research-based best practices delves deeper into complex classroom routines (e.g., students generating and testing hypotheses, implementing collaborative problem-solving).

### CIP Intensity Level 7

At a CIP Intensity Level 7, the participant's current instructional practices align exclusively with a student-directed approach to the content, process, and product of instruction. The essential content embedded in the standards emerges based on students "need to know" as they attempt to research and solve issues of importance to them using critical thinking and problem-solving skills. The types of learning activities and teaching strategies used in the learning environment are diversified and driven by student questions.

Students, teacher/facilitators, and occasionally parents are all involved in devising appropriate assessment instruments (e.g., performance-based, journals, peer reviews, self-reflections) by which student performance will be assessed. Differentiation is ubiquitous since students completely guide the pace and level of their learning. The use of research-based best practices delves deeper into complex classroom routines (e.g., students generating and testing hypotheses, implementing collaborative problem-solving).

## CIP "Sniff" Test





## Appendix G: Personal Computer Use Framework



### Personal Computer Use (PCU) Framework

Digital tools and resources represents a variety of technologies to augment and restructure student learning including social learning apps (EduBlogs, Skype, Ning), productivity apps (Edmodo, Google Apps, Socrative, Animoto), content apps (Kahn Academy, BrainPop, Smithsonian Channel), and support apps (Prezi, Wordle, Quizlet, Google Earth, YouTube).

#### PCU Intensity Level 0

A PCU Intensity Level 0 indicates that the participant does not possess the inclination or skill level to use digital tools and resources for either personal or professional use. Participants at Intensity Level 0 exhibit a general disinterest toward emerging technologies relying more on traditional devices (e.g., use of overhead projectors, chalkboards, paper/pencil activities) than using digital tools and resources for information gathering, management tasks, or student learning.

#### PCU Intensity Level 1

A PCU Intensity Level 1 indicates that the participant demonstrates little fluency with using digital tools and resources for student learning. Participants at Intensity Level 1 may have a general awareness of conventional digital resources including word processors, spreadsheets, or the internet, but generally are not using them. Participants at this level are generally unaware of copyright issues or current research on the impact of existing and emerging digital tools and resources on student learning.

#### PCU Intensity Level 2

A PCU Intensity Level 2 indicates that the participant demonstrates little to moderate fluency with using digital tools and resources for student learning. Participants at Intensity Level 2 may occasionally browse the internet, use email, or use a word processor program; yet, may not have the confidence or feel comfortable using existing and emerging digital tools and resources beyond classroom management tasks (e.g., online grade book and attendance program) or substitution activities (e.g., accessing the Kahn Academy website to introduce a standards-based math concept, administering an online test). Participants at this level are somewhat aware of copyright issues and maintain a cursory understanding of the impact of existing and emerging digital tools and resources on student learning.

#### PCU Intensity Level 3

A PCU Intensity Level 3 indicates that the participant demonstrates moderate fluency with using digital tools and resources for student learning. Participants at Intensity Level 3 may begin to become "regular" users of conventional digital-age media and formats (e.g., internet, word processor, multimedia) to (1) communicate with students, parents, and peers and (2) augment an existing lesson with technology. Participants at this level are aware of copyright issues and maintain a moderate understanding of the impact of existing and emerging digital tools and resources on student learning.

#### PCU Intensity Level 4

A PCU Intensity Level 4 indicates that the participant demonstrates moderate to high fluency with using digital tools and resources for student learning. Participants at Intensity Level 4 commonly use a broader range of digital-age media and formats to modify lessons in support of their curriculum and instructional strategies. Participants at this level model the safe, legal, and ethical uses of digital information and technologies and participate in local discussion forums that advocate the positive impact of existing digital tools and resources on student success in the classroom.

#### PCU Intensity Level 5


A PCU Intensity Level 5 indicates that the participant demonstrates a high fluency level with using digital tools and resources for student learning. Participants at Intensity Level 5 are commonly able to use an expanded range of existing and emerging digital-age media and formats to modify existing lessons in support of their curriculum and instructional strategies. Participants at this level advocate the safe, legal, and ethical uses of digital information and technologies and participate in local and global learning that advocate the positive impact of existing digital tools and resources on student success in the classroom.

2

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Framework Resource

# Personal Computer Use Framework



The header features a dark grey background with a small number '2' in the top left and a copyright notice '© 2015 LoTi' in the top right. Below this, the text 'Framework Resource' is in a light green font. The main title 'Personal Computer Use Framework' is in a large, white, sans-serif font. To the right of the title is the LoTi logo, which consists of a stylized sun with rays above the letters 'LoTi'. Below the header is a horizontal bar with three colored segments: red, orange, and green.

### **PCU Intensity Level 6**

A PCU Intensity Level 6 indicates that the participant demonstrates high to extremely high fluency level with potentially using digital tools and resources to redefine student learning. Participants at Intensity Level 6 are sophisticated in the use of most, if not all, existing and emerging digital-age media and formats. They begin to take on a leadership role as advocates for technology infusion as well as the safe, legal, and ethical uses of digital resources in the schools. Participants at this level continually reflect on the latest research discussing the impact of digital tools on student success.

### **PCU Intensity Level 7**

A PCU Intensity Level 7 indicates that the participant possesses an extremely high fluency level with potentially using digital tools and resources to redefine student learning in ways not possible without technology. Participants at Intensity Level 7 are sophisticated in the use of any existing and emerging digital-age media and formats. Participants at this level set the vision for technology infusion based on the latest research and continually seek innovative uses of digital tools and resources that impact learning. They actively participate in global learning communities that seek creative uses of digital tools and resources in the classroom.

## Appendix H: LoTi Digital Age Survey Scoring Calculation Key

### LoTi Digital-Age Survey Scoring Calculation Key

Record the corresponding scores from the LoTi Digital-Age Quick Scoring Device (e.g., High Score, High Level, PCU, CIP) and the Raw Data (e.g., SCU, TCU) in the table below:

High Score	High Level	PCU	CIP	SCU	TCU

Use the following calculation key to arrive at a finalized LoTi score. Start at the top of the calculation key and test each statement against the scores recorded in the table above. If ALL conditions in a statement do not match the recorded scores, continue on to the next statement. Once ALL conditions in a statement match the recorded scores above, record the LoTi score.

#### Calculation Key Statements

If the *High Score*  $\leq 1$ ; then the final LoTi score is **LoTi Level 0**.

If the *High Score*  $< 2$ ; then the final LoTi score is **LoTi Level 1**.

If the *High Score*  $< 3$ ; then the final LoTi score is **LoTi Level 2**.

If *SBL*  $\leq 2$ ; then the final LoTi score is **LoTi Level 0**.

If the *High Score*  $\geq 6$  and the *HighLevel* = 4 and (*PCU*  $\geq 4$ ) and (*CIP*  $\geq 6$ ) and (*SCU*  $\geq 3$ ) and (*TCU*  $\geq 3$ ); then the final LoTi score is **LoTi Level 6**.

If the *High Score*  $\geq 5$  and the *HighLevel* = 4 and (*PCU*  $\geq 3$ ) and (*CIP*  $\geq 5$ ) and (*SCU*  $\geq 2$ ) and (*TCU*  $\geq 2$ ); then the final LoTi score is **LoTi Level 5**.

If the *High Score*  $\geq 5$  and the *HighLevel* = 4 and (*PCU*  $\geq 3$ ) and (*CIP*  $\geq 4$ ) and (*SCU*  $\geq 2$ ) and (*TCU*  $\geq 2$ ); then the final LoTi score is **LoTi Level 4b**.

If the *High Score*  $\geq 5$  and the *HighLevel* = 3 and (*PCU*  $\geq 3$ ) and (*CIP*  $\geq 5$ ) and (*SCU*  $\geq 2$ ) and (*TCU*  $\geq 2$ ); then the final LoTi score is **LoTi Level 4b**.

If the *High Score*  $\geq 5$  and the *HighLevel* = 3 and (*PCU*  $\geq 2$ ) and (*CIP*  $\geq 4$  and *CIP*  $\leq 5$ ) and (*SCU*  $\geq 2$ ) and (*TCU*  $\geq 2$ ); then the final LoTi score is **LoTi Level 4a**.

If the *High Score*  $\geq 4$  and the *HighLevel* = 3 and (*PCU*  $\geq 2$ ) and (*CIP*  $\geq 4$ ) and (*SCU*  $\geq 2$ ) and (*TCU*  $\geq 2$ ); then the final LoTi score is **LoTi Level 4a**.

If the *High Score*  $\geq 4$  and the *HighLevel* = 3 and (*PCU*  $\geq 1$ ) and (*CIP*  $< 4$ ) and (*SCU*  $\geq 1$ ) and (*TCU*  $\geq 1$ ); then the final LoTi score is **LoTi Level 3**.

If the *High Score*  $\geq 4$  and the *HighLevel* = 3 and (*PCU*  $< 1$ ) and (*CIP*  $< 4$ ) and (*SCU*  $\geq 1$ ) and (*TCU*  $\geq 1$ ); then the final LoTi score is **LoTi Level 2**.

**LoTi Digital-Age Quick Scoring Device to obtain a LoTi Score**

Use this Quick Scoring Device to calculate the "High Score" and "High Level" numbers for scoring, then use the calculated values on the LoTi Digital-Age Survey Calculation Key to obtain a final LoTi Score from the 37-question LoTi Digital-Age Survey.

DCR	Level 1/2	Level 3	Level 4a/4b	Level5/6	PCU	CIP
Q12 _____	Q4 _____	Q1 _____	Q27 _____	Q10 _____	Q13 _____	Q6 _____
Q19 _____	Q16 _____	Q5 _____	Q30 _____	Q14 _____	Q15 _____	Q20 _____
Q25 _____	Q17 _____	Q8 _____	Q31 _____	Q21 _____	Q18 _____	Q32 _____
Q42 _____	Q23 _____	Q37 _____	Q36 _____	Q22 _____	Q26 _____	Q41 _____
Q48 _____	Q38 _____	Q40 _____	Q43 _____	Q47 _____	Q49 _____	Q50 _____
	Q45 _____		Q46 _____			
<b>STEP 1:</b> Add for Raw Scores						
<b>STEP 2:</b> Divide to find Averages	/ 6	/ 5	/ 6	/ 5	/ 5	/ 5
<b>High Score</b>						
<b>High Level</b>	1	2	3	4	<b>PCU</b>	<b>CIP</b>

**STEP 3:** Record the largest High Score that was calculated (e.g., 6.2) =  = High Score

**STEP 4:** Record the High Level that corresponds with the High Score from STEP 3 (e.g., 2) =  = High Level

**LoTi Digital-Age Quick Scoring Device to create LoTi Digital-Age Professional Development Priorities Graph**

<b>Digital-Age Work and Learning</b>	<b>Digital-Age Learning Experiences and Assessments</b>	<b>Student Learning and Creativity</b>	<b>Professional Growth and Leadership</b>	<b>Digital Citizenship and Responsibility</b>
Q13 _____	Q6 _____	Q1 _____	Q16 _____	Q12 _____
Q15 _____	Q20 _____	Q4 _____	Q17 _____	Q19 _____
Q18 _____	Q32 _____	Q5 _____	Q27 _____	Q23 _____
Q26 _____	Q41 _____	Q8 _____	Q30 _____	Q25 _____
Q43 _____	Q50 _____	Q10 _____	Q31 _____	Q42 _____
Q46 _____		Q14 _____	Q37 _____	Q48 _____
Q49 _____		Q21 _____	Q45 _____	
		Q22 _____		
		Q36 _____		
		Q38 _____		
		Q40 _____		
		Q47 _____		
/ 49	/ 35	/ 84	/ 49	/ 42
_____ %	_____ %	_____ %	_____ %	_____ %
Report inverted percentage from above	Report inverted percentage from above	Report inverted percentage from above	Report percentage above	Report inverted percentage from above
<b>Digital-Age Work and Learning</b>	<b>Digital-Age Learning Experiences and Assessments</b>	<b>Student Learning and Creativity</b>	<b>Professional Growth and Leadership</b>	<b>Digital Citizenship and Responsibility</b>

Use this Quick Scoring Device to get the percentages to graph each category of the LoTi Digital-Age Survey. Graph either the percentage or inverted percentage as described.

- When creating the graph:
- 0% to 33% equals "Low-level Priority"
  - 34% to 66% equals "Mid-level Priority"
  - 67% to 100% equals "High-level Priority"



## Appendix I: Data Journey

Step 1: Map out data sources to research questions		
<b>Created a table that mapped similar questions/themes for MES teacher vs student questions:</b>		
	Student Question	Teacher Question
School	1	1
Grade Level	2	4
Subject	7	2
Real-World	8a	5a
Ethical Use	11a	5c
Effective Use	11c	5e
Supplement and Reinforce Instruction	8b	5b
Creativity and Innovation	11b	5d
Who Uses the Device	8c	
Investigation and Seeking a solution	9a	6d
Take a Position	9b	6b
Make a Decision	9c	6c
Collaboration	10a	7a
Communication	10b	7b
Research	10c	7c
Attendance	5	9c
Impact on Instruction		12
Reading Habits	6	
<p><b>Mapped out for RQ1. What impact does the iPads have on instruction?</b>            21<sup>st</sup> Century Teaching and Learning</p> <ul style="list-style-type: none"> <li>• <b>Data Source: MES Survey</b> <ul style="list-style-type: none"> <li>○ Impact               <ul style="list-style-type: none"> <li>▪ <b>TQ9.</b> How has the iPad impacted:                   <ul style="list-style-type: none"> <li>• Student behavior</li> <li>• Student attendance</li> <li>• Your teaching and delivery strategies</li> <li>• Your personal and professional growth                       <ul style="list-style-type: none"> <li>○ Multiple Choice responses                           <ul style="list-style-type: none"> <li>▪ Increased</li> <li>▪ No Change</li> <li>▪ Decreased</li> <li>▪ N/A</li> </ul> </li> </ul> </li> </ul> </li> <li>▪ <b>TQ12.</b> Has the iPad impacted your instruction?                   <ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul> </li> </ul> </li> <li>○ <b>Reading Habits</b></li> </ul> </li> </ul>		

- **SQ6.** Since you started using the iPad, what are your reading habits?
      - I read More now that I have the iPad
      - I read a much with the iPad as I did without it
      - I read more digital materials than printed materials
      - I read more printed materials then digital materials
- **Data Source: LoTi Survey**
  - Student Learning and Innovation Skills
    - Q1. I engage students in learning activities that require them to **analyze information, think creatively, make predictions, and/or draw conclusions using the digital tools and resources** (e.g., Inspiration/Kidspiration, Excel, InspireData) available in my classroom.
    - Q8. I use the digital tools and resources in my classroom to promote student **creativity and innovative thinking** (e.g., thinking outside the box, exploring multiple solutions).
  - Information, Media and Technology Skills
    - Q4. Students in my classroom use the digital tools and resources to **create web-based** (e.g., web posters, student blogs or wikis, basic webpages) **or multimedia presentations** (e.g., PowerPoint) that showcase digitally their research (i.e., information gathering) on topics that I assign more than for other educational uses. □
    - Q5. I assign web-based projects (e.g., web collaborations, WebQuests) to my students that emphasize **complex thinking strategies** (e.g., problem-solving, decision-making, experimental inquiry) aligned to the content standards. □
    - Q38. My students use the digital tools and resources in my classroom primarily to increase their content understanding (e.g., digital flipcharts, simulations) or to improve their basic math and literacy skills (e.g., online tutorials, content-specific software).
  - Life and Career Skills
    - Q21. My students participate in **collaborative projects** (e.g., Jason Project, GlobalSchool- Net) involving face-to-face and/or virtual environments with students of other cultures that address current problems, issues, and/or themes. □
    - Q40. My students use digital tools and resources for research purposes (e.g., data col- lection, online questionnaires, Internet research) that require them to investigate an issue/problem, take a position, make decisions, and/or seek out a solution.
    - Q47. My students use all forms of the most advanced digital tools (e.g., digital media authoring tools, graphics programs, probeware with GPS systems, handheld devices) and resources (e.g., publishing software, media production software, advanced web design software) to pursue collaborative

problem-solving opportunities surrounding issues of personal and/or social importance.

**Mapped out for RQ2. What impact does the iPads have on student engagement?**

- **Data Source: TEDL Surveys**
  - SQ5. Does using the iPad in class motivate you to come to school?
    - Yes
    - Most of the Time
    - Not at all
  - T9a. How has the iPad impacted student engagement and motivation?
    - Increased
    - No Change
    - Decreased
    - N/A
- **Data Source: LoTi Survey**
  - Digital Aged Learning Experiences
    - Q10. My students **identify important real world issues or problems** (e.g., environmental pollution, elections, health awareness), then use collaborative tools and human resources beyond the school building (e.g., partnerships with business professionals, community groups) to solve them.
  - Learner-Centered
    - Q17: The digital tools and resources in my classroom are used by me during the instructional day and *not* by my students.
    - Q19: I employ learner-centered strategies (e.g., communities of inquiry, learning stations/centers) to address the diverse needs of all students using developmentally-appropriate digital tools and resources. □
  - Self-Directed
    - Q14. My students propose **innovative ways to use our school's advanced digital tools** (e.g., digital media authoring tools, graphics programs, probeware with GPS systems) and resources (e.g., publishing software, media production software, advanced web design software) to address challenges/issues affecting their local and global communities. □
    - Q22: My students use the available digital tools and resources for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of personal interest that address specific content standards.
    - Q36: My students use the classroom digital tools and resources to engage in relevant, challenging, self-directed learning experiences that address the content standards. □
  - Assessments
    - Q6. I provide multiple and varied formative and summative assessment opportunities that encourage students to “showcase” their content understanding in nontraditional ways.

- Q20. Students' use of information and inquiry skills to solve problems of personal relevance influences the types of instructional materials used in my classroom. □
- Q32. I rely heavily on my students' questions and previous experiences when designing learning activities that address the content that I teach.
- Q41. My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.
- Q50. I consider how my students will apply what they have learned in class to the world they live when planning instruction and assessment strategies.

**Mapped out for RQ3. *How is the iPad being used in the education environment?***

- **Data Source:** TEDL Surveys
  - TEDL Teachers vs TEDL Students
    - TQ5ab vs SQ8ab
    - TQ6 vs SQ9
    - TQ7 vs SQ10,
    - TQ5cde vs SQ11abc
- **Data Source: LoTi Survey**
  - Are there any differences in TEDL Classrooms vs non-TEDL?
    - Current Instructional Practices (CIP) Framework measures classroom teachers' current instructional practices relating to a subject-matter versus a learner-based instructional approach in the classroom (Moersch, 2010).
    - Personal Computer Use (PCU): measures classroom teachers' fluency level with using digital tools and resources for student learning (Moersch, 2010).
    - Student Computer Use (SCU)
      - How often are your students using digital tools and resources during the instructional day?
    - Teacher Computer Use (TCU)
      - How often are you (the teacher) using digital tools and resources during the instructional day?
    - Levels of Teaching Innovation (LoTi): measure classroom teachers implementation of the tenets of digital-age literacy as manifested in the National Educational Technology Standards for Teachers (NETS-T) (Moersch, 2010).

**Step 2: Organization and Coding of Responses**

- Created the following a Data Dictionary for survey answers.
  - MES Survey
    - Schools
      - Middle School A = 1
      - Middle School B = 2
      - Middle School C = 3

- Middle School D = 4
- Academy A = 5
- Elementary School A = 6
- Elementary School B = 7
- Middle School E = 8
- Questions Dealing with frequency
  - Often or Daily = 4
  - Sometimes = 3
  - Seldom = 2
  - Never = 1
- LoTi Survey
  - Schools
    - MES Schools = Same as above
    - Non-MES schools = 9
  - Questions Dealing with frequency
    - Never = 0
    - At Least Once a Year = 1
    - At Least Once a Semester = 2
    - At Least once a Month = 3
    - At Least a few times a Month = 4
    - At Least Once a Week = 5
    - A Few Times a Week = 6
    - At Least Once a Day = 7
- Cleaned the Data
  - Truncated student subject area data
  - MES Data was recoding Variables. Data for MES Survey was recoded so that the larger number represented the highest frequency or occurrence, to keep consistent with the LoTi data. Above dictionary is reflective of the recoding.

### Step 3: Identify variables

#### Dependent/Composite Variables

A PCA was run and two components appeared (one in yellow the other in pink). The chart below displays the results of the PCA. Q17 in the rotated component matrix below did not load very well onto either component, so Q17 was dropped.

**Rotated Component Matrix<sup>a</sup>**

	Component	
	1	2
Q14	.842	.147
Q04	.816	.105
Q10	.794	.220
Q47	.793	.332
Q05	.791	.270

Q21	.790	.136
Q22	.788	.260
Q40	.780	.363
Q19	.716	.394
Q08	.701	.470
Q41	.546	.435
Original Q17	.265	.190
Q50	.040	.815
Q32	.042	.807
Q38	.425	.626
Q36	.557	.618
Q20	.404	.612
Q01	.572	.599
Q06	.521	.563

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Page 3 of Appendix H (p.104) groups the LoTi Questions into themes. These themes are what the researcher used to group the composite variables listed below:

#### Composite Variables

InnovateSkills = average(Q01 and Q08) [alpha = .835]

TechSkills = average(Q04, Q05, Q38) [alpha = .762]

LifeSkills = average(Q21, Q40, Q47) [alpha = .853]

DigiAge = Q10 [no alpha value]

LearnCtr = Q19 [no alpha value]

SelfDirected = average(Q14, Q22, Q36) [alpha = .810]

Assessment = average(Q06, Q20, Q32, Q41, Q50) [alpha = .808]

All of the Cronbach's alphas are higher than .7. That means that there is a high reliability among the survey questions for each composite variable.

=countif(\$A\$2:\$A\$21,C2)

Identified and Coded the Independent Variables. The Independent variables below were coded as 1 and everything else 0:

- Phase 1
- Phase 2
- STEAM
- 20Plus

#### Step 4: Data Analysis

Downloaded the STAT Plus Add-on to Excel to Run T-Test and Regressions

- Performed T-Test on MES comparing the following Student vs teacher questions:
  - RealWorld
  - Content
  - Investigate
  - TakePosition
  - MakeDesition
  - SeekSolution
  - EthicalUse
  - Creativity
  - EffectiveUse
  - Collaboration
  - Communication
  - Research
- Ran Regression Test on the following composite variables comparing the independent variables
  - Student Engagement Composite Variables from LoTi data
  - Impact on Instruction Composite Variables from LoTi data
  - Levels of Teaching Innovation from LoTi data

	Composite Variables	LoTi Questions Used to Create Variable	Example of using the iPad
RQ1. What impact do iPads have on instruction?	InnovateSkills	<ul style="list-style-type: none"> <li>• Q1. I engage students in learning activities that require them to analyze information, think creatively, make predictions, and/or draw conclusions using the digital tools and resources available in my classroom.</li> <li>• Q8. I use the digital tools and resources in my classroom to promote student creativity and innovative thinking</li> </ul>	<ul style="list-style-type: none"> <li>• Use apps like Inspiration or Numbers</li> <li>• Use to think outside the box, exploring multiple solutions</li> </ul>
	TechSkills	<ul style="list-style-type: none"> <li>• Q4. Students in my classroom use the digital tools and resources to create Web-based or multimedia presentations that showcase digitally their research on topics that I assign more than for other educational uses. <input type="checkbox"/></li> <li>• Q5. I assign Web-based projects to my students that emphasize complex thinking strategies aligned to the content standards. <input type="checkbox"/></li> <li>• Q38. My students use the digital tools and resources in my classroom primarily to increase their content understanding or to improve their basic math and literacy skills.</li> </ul>	<ul style="list-style-type: none"> <li>• Use Internet to blog or publish an iBook created using iBooks Author</li> <li>• Use iPad to complete WebQuests or use Google docs to collaborate with classmates on an experimental inquiry</li> <li>• Create flipchart using NaviGate app or Quizlet app for flashcards</li> </ul>
	LifeSkills	<ul style="list-style-type: none"> <li>• Q21. My students participate in <b>collaborative projects</b> involving face-to-face and/or virtual environments with students of other cultures that address current problems, issues, and/or themes. <input type="checkbox"/></li> <li>• Q40. My students use digital tools and resources for research</li> </ul>	<ul style="list-style-type: none"> <li>• Use face-time app to connect with students of other cultures and address current events</li> <li>• Use of google forms to</li> </ul>



		<p>purposes that require them to investigate an issue/problem, take a position, make decisions, and/or seek out a solution.</p> <ul style="list-style-type: none"> <li>• Q47. My students use all forms of the most advanced digital tools and resources to pursue collaborative problem-solving opportunities surrounding issues of personal and/or social importance.</li> </ul>	<p>collect data or use the Internet for research</p> <ul style="list-style-type: none"> <li>• Use software and apps like iBook Author and /or iMovie software)</li> </ul>
RQ2. What impact does the iPads have on student engagement?	Learner-Centered	<ul style="list-style-type: none"> <li>• Q17: The digital tools and resources in my classroom are used by me during the instructional day and <i>not</i> by my students.</li> <li>• Q19: I employ learner-centered strategies to address the diverse needs of all students using developmentally-appropriate digital tools and resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Only teacher uses the iPad</li> <li>• Use communities of inquiry, learning stations/centers</li> </ul>
	Self-Directed	<ul style="list-style-type: none"> <li>• Q14. My students propose innovative ways to use our school's advanced digital tools and resources to address challenges/issues affecting their local and global communities. □</li> <li>• Q22. My students use the available digital tools and resources for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of personal interest that address specific content standards.</li> <li>• Q36. My students use the</li> </ul>	<ul style="list-style-type: none"> <li>• Use apps like iMovie, Keynote or iBook Author to address challenges affecting their communities</li> <li>• Use of Google Docs and Google sites to collaborate and publish work</li> <li>• Students are</li> </ul>

		classroom digital tools and resources to engage in relevant, challenging, self-directed learning experiences that address the content standards.	able to self select learning experiences and able to select technology most appropriate to use
	Assessments	<ul style="list-style-type: none"> <li>• Q6. I provide multiple and varied formative and summative assessment opportunities that encourage students to “showcase” their content understanding in nontraditional ways.</li> <li>• Q20. Students’ use of information and inquiry skills to solve problems of personal relevance influences the types of instructional materials used in my classroom. □</li> <li>• Q32. I rely heavily on my students’ questions and previous experiences when designing learning activities that address the content that I teach.</li> <li>• Q41. My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.</li> <li>• Q50. I consider how my students will apply what they have learned in class to the world they live when planning instruction and assessment strategies.</li> </ul>	

## Glossary

This section defines key terms that may be unique to the educational technology field. As this is a rapidly changing and progressing field, it is important to include this paper? for clarity to the reader.

- ***1:1 Computing:*** Every individual student has his or her own personal computing device.
- ***Best practices:*** Refers to what works in a specific situation.
- ***Classroom Set of iPads:*** Students have shared access to iPads in classrooms.
- ***Cloud computing:*** A new technology platform that can deliver programs, software, access to data, and file storage through an external, Web-based network instead of having the software housed on the user's personal computer hard drive (Tadjer, 2010).
- ***Challenge-based learning:*** A multidisciplinary teaching and learning model that encourages students to use technology to solve real-world problems.
- ***Compatibility:*** The degree to which an innovation is perceived to fit within an individual's or group's respective life or structure (Rogers, 2003)
- ***Common Core:*** "A set of high-quality academic standards in mathematics and English language arts/literacy. These learning goals outline what a student should know and be able to do at the end of each grade" ("About the Standards," 2015).
- ***Communication:*** The act or process of using words, sounds, signs, or behaviors to express or exchange information or to express your ideas,

thoughts, or feelings to someone else (Merriam-Webster, <http://www.merriam-webster.com/dictionary/communication>)

- ***Differentiated Instruction***: An instructional theory that allows teachers to face this challenge by taking diverse student factors into account when planning and delivering instruction. Based on this theory, teachers can structure learning environments that address the variety of learning styles, interests, and abilities found within a classroom (Willoughby, 2005).
- ***Digital text***: Text found on a digital device; may include hyperlinks, videos, and other widgets to make text interactive.
- ***Educational applications (Apps)***: Applications designed specifically to be used on the iPad.
- ***Flipped classroom***: A reversed teaching model through which students receive teacher-prescribed instructional videos for students to watch at home for homework, and during the school day students do traditional homework in the classroom where they can receive assistance and guidance from their teacher. The flipped classroom model allows for teachers to differentiate instruction and spend more one on one time with students.
- ***Framework for 21<sup>st</sup> Century Learning***: “The Framework presents a holistic view of 21st century teaching and learning that combines a discrete focus on 21st century student outcomes (a blending of specific skills, content knowledge, expertise and literacies) with innovative support systems to help students master the multi-dimensional abilities required of them in the 21st century” (Partnership for 21<sup>st</sup> Century Skills, 2011).

- **Gigabyte (GB):** A large unit of data storage. One gigabyte equals 1,000,000,000 bytes. The Apple iPad is available with 16GB, 32GB, and 64GB storage capacity options (University Information Technology Services, 2011a).
- **Instruction:** The transfer of knowledge from one person to another.
- **Instructional strategies:** Teaching and learning strategies that promote learning involving students actively participating and thinking about what they are doing. Instructional strategies are embedded throughout a lesson, including preinstructional activities, presentation of information, practice and feedback, assessments, and application activities.
- **iPad:** Apple's WiFi tablet computing device that offers a touch-screen high-resolution display, Internet access capability, and a picture camera. The iPad functions as a platform primarily for viewing and consuming media rather than as a communication and text creating device (Apple, 2011)
- **Learning strategy:** A person's approach to learning and using information (Center for Research on Learning - <http://www.ku-crl.org/sim/strategies.shtml>)
- **Metacognition:** "Cognition about cognition" or "knowing about knowing" (Metcalfe & Shimamura, 1994). It can take many forms; includes knowledge about when and how to use particular strategies for learning or for problem solving (Metcalfe & Shimamura, 1994).
- **Mobile learning (m-learning):** "Learning across multiple context, through social and content interactions, using electronic devices" (Crompton, 2013)

- **Motivation:** The act or process of giving someone a reason for doing something: the act or process of motivating someone (Merriam-Webster <http://www.merriam-webster.com/dictionary/motivation>).
- **Pedagogy:** The process taken by teachers to present content in the context of learning strategies that connect with a cognitive process of the student (Nish, 2011).
- **High Definition Public Schools(HDPS):** One of the largest school districts in the United States, which serves a diverse student population from urban, suburban, and rural communities in the State of Maryland.
- **Self-regulated learning (SRL):** Learning that is guided by metacognition (thinking about one's thinking), strategic action (planning, monitoring, and evaluating personal progress against a standard), and motivation to learn (Boekaerts & Corno, 2005; Butler & Winne, 1995; Winne & Perry, 2000; Perry, Phillips, & Hutchinson, 2006; Zimmerman, 1990).
- **Technology:** Computers, laptops, tablets/mobile devices, InterActive whiteboards, Websites, online tools, software, videos, and recording devices.
- **Mobilizing Education for Success (MES):** A HDPS Title I Department initiative that equipped four middle schools with iPads for every student and teacher in 2011; a total of 4,000 iPads were distributed.
- **WiFi:** A type of local area network that utilizes high frequency radio signals to send and receive data within a limited space (hot-spot), usually a couple of hundred feet (University Information Technology Services, 2011b).

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