

1:1 LAPTOP INITIATIVES AND TEACHER PRACTICE CHANGE: AN EXPLORATORY STUDY OF CONSTRUCTIVIST TEACHING PRACTICE

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ABSTRACT

This exploratory study poses a number of important questions regarding the costly reform movement of 1:1 laptop programs. The study seeks to evaluate the extent to which teachers are genuinely adopting the educational reform movement of 1:1 laptop initiatives. The extent to which teachers are genuinely adopting (represented by constructivist teaching practice) versus symbolically adopting (represented by traditional teaching practice) is measured by a survey instrument, the 1:1 Constructivist Learning Environment Survey (1:1 CLES), with follow up interviews conducted to gain additional insight. The study was conducted with teachers in a mid-sized suburban district in the Midwest, which had recently begun implementation of a 1:1 initiative. The results indicated that there is a wide spectrum of traditional and constructivist practice among teachers of the district. Teachers which the survey identified as being constructivist in their use of laptops clearly saw their role as that of a facilitator and consistently used the laptops in methods that applied student-centered instructional approaches. Traditional teachers used the laptops as more of a replacement, communication, and efficiency device, and did not show frequent application of constructivist approaches to how the laptops were used. While there was some variance, the majority of teachers were implementing the 1:1 reform with fidelity as demonstrated by their constructivist instructional practice. This study provides a new lens through which to evaluate the extent of genuine adoption of 1:1 initiatives, looking at the level of adoption of the reform movement as measured by the level of constructivist practice. This lens provides rich opportunities to better understand the extent to which 1:1 laptop initiatives are being adopted. In order to gauge the effectiveness of the reform movement, the level of adoption must first be evaluated.

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DEDICATION

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CHAPTER 1

INTRODUCTION

1.1 Overview

1:1 laptop initiatives are championed as a reform effort that will change teacher practice in profound and lasting ways (Christensen, Horn, & Johnson, 2008). The laptop devices are viewed as tools to move teachers towards more student-centered, constructivist instructional practice. The current emphasis in education promotes student-centered, constructivist teacher practice. This calls for a change in the way teachers assess, the learning objectives, the way technology is used, and the way class is structured. However, the shift in teacher practice along these constructivist methods has been slow (Christensen, et al., 2008; Hermans, Tondeur, van Braak, & Valcke, 2008; Swallow, 2015). This exploratory study looks at teachers in a suburban district that has adopted a 1:1 initiative with the goal of evaluating whether teachers are genuinely adopting the initiative by engaging in constructivist teaching or if they are symbolically adopting while retaining traditional teacher practices.

The purpose of this study is not to evaluate the effectiveness of the reform, or to place a value judgment on constructivist versus traditional teaching practice. This study takes a step back from evaluating the effectiveness of the reform and seeks to look at the adoption pattern by seeking to answer the question, are teachers genuinely or symbolically adopting the 1:1 laptop reform as measured by constructivist teaching practice? In order to eventually answer the question as to whether the reform is effective, the determination must first be made of whether the reform is, in fact, being implemented with fidelity. Once that question is answered, then additional questions can be posed regarding the effectiveness of the reform.

1:1 laptop initiatives have become very popular in school districts across the country. For this study, Penuel's (2006) definition of 1:1 laptop programs is applied, which consists of three core components: providing students with laptop computers loaded with contemporary software, internet accessibility for students through the schools' networks, and using the laptops to complete coursework. These programs come at a tremendous cost in terms of human and financial resources, but are championed as a way to shift education to a truly student-centered environment (Dunleavy, Dexter, & Heinecke, 2007). Computer usage is widespread as evidenced by a study conducted by the United States Department of Education which found that 40% of teachers report they or their students often use computers during instructional time in their classroom, and 93% of teachers report having computers with internet access in their classroom every day (Gray, Thomas, & Lewis, 2010). Educational reform efforts of the last century and a half have created little change in terms of classroom instructional practice (Tyack & Cuban, 2009). Technology reforms have been particularly ineffective, often serving to reinforce traditional teacher practice (Cuban, 1982, 2006). Despite this long track record of the ineffectiveness of technological reforms in education, 1:1 laptop initiatives are being offered as a way to improve instruction and reform education. Research on these initiatives has thus far focused on the impact on student engagement, and how much teachers are using the technology (Fleischer, 2012; Holcomb, 2009; Maninger & Holden, 2009). Perhaps the greatest way 1:1 initiatives are going to represent a true shift in education, is through the use of the devices to provide student-centered, individualized instruction. Information and communication technologies (ICT) are often tied to a belief in the transformative capability of the new technology, enabling new and complex learning environments (Hermans, et al., 2008). However, as Weston & Bain (2010) argued in order for technology to bring about a genuine change in

education, it requires a shift in philosophy towards a more constructivist, student-centered learning environment. While this argument merits further investigation, this exploratory study seeks to focus on the extent to which teachers genuinely adopt the reform in their classrooms as reflected by constructivist use of the computing devices.

Teachers may well use the laptops extensively while still retaining traditional practice. Despite the connection between teacher practice and learning, existing research on the impact of 1:1 laptop initiatives largely ignores how these programs impact teacher practice. It is necessary to examine whether or not teachers are implementing laptops into their daily instruction with fidelity to the reform. Research has shown that the transformative impact of ICT must be accompanied by a comprehensive change process if it is to truly shift teacher practice (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). There are plenty of ways technology can be integrated in a manner that accommodates traditional teaching practice (Petko, 2012). 1:1 programs are problematic to study and compare as there are so many variables. Often times, researchers have focused on technology access and not necessarily on how it is being used to promote learning (Downes & Bishop, 2015). Looking at teacher practice through the lens of constructivist versus traditional pedagogy offers a framework for assessing the genuine or symbolic adoption of the 1:1 laptop reform movement that focuses on constructivist teaching methods. As researchers have argued, true change in educational practice through the use of technology requires a shift in philosophy to a student-centered, constructivist learning environment. (Christensen, et al., 2008; Dunleavy, et al., 2007; Weston & Bain, 2010).

Constructivist practices, also referred to as student-centered teaching, focus on a role for the teacher as a coach, with activities that engage students in problem solving scenarios which allow for greater depth of learning and connect to students beyond the classroom (Becker, 2000;

Cuban, 2009). Traditional teacher practice is teacher-centered, often lecture driven, content delivery which involves students passively receiving pre-determined information which demands only surface level understanding and knowledge regurgitation (McCarthy & Anderson, 2000). This study applies a new method for understanding how 1:1 laptop initiatives are (or are not) shifting teacher practice. A tool was developed to examine the extent to which teachers are using laptops in a constructivist or traditional manner. This study applies a framework to determine whether or not teachers are implementing the 1:1 laptop technology with fidelity through using the work of Rogers (2003) to examine the adoption of reforms, and the work of Meyer and Rowan (1977) to view this practice as representative of genuine or symbolic adoption. This insight is a critical first step in assessing the efficacy of this expensive educational reform effort.

1.2 Background

1:1 laptop initiatives have been championed as a reform movement which will help to create a paradigm shift in education the likes of which have not been seen in over a century and a half. The laptops are seen as a tool which can bring about a new classroom which is student-centered and the role of the teacher shifts to that of a learning coach or facilitator (Christensen, et al., 2008). This shift in practice requires an accompanying shift in thinking from teachers, and the belief that the laptops are cognitive tools that enable students to take ownership of their own learning and become integrated into the work of the student in the classroom (Weston & Bain, 2010).

Critical to this shift is the ability and desire of the teacher to apply constructivist pedagogy into practice. This is referred to in the literature as the will and skill of the teachers. Agyei & Voogt (2011) refer to the will as the attitudes teachers hold towards the usefulness of

technology, and the skill as the teachers' technology competencies. They emphasize that this will and skill of teachers ultimately plays a large part in determining how technology is used.

Additional research has shown that will and skill directly influenced laptop integration (Inan and Lowther, 2010). With the significance of teachers' ability and attitudes playing such a critical role in laptop integration, the importance of effective teacher preparation, continued support, and professional development are important factors associated with the successful integration of laptop initiatives. Numerous studies have linked education and professional development to increased use of technology (Donnelly, McGarr, & O'Reilly, 2011; Gray, et al., 2010; Kopcha, 2012; Paraskeva, Bouta, & Papgianni, 2008). Although the work of Kopcha (2012) sought to evaluate how the technology was being implemented, the vast majority of other studies focused solely on how much the technology was used. This gap in the literature, the lack of understanding the extent to which 1:1 laptop reforms are being genuinely adopted, is the area of emphasis in this study.

There is a large body of literature that addresses the idea of teacher practice change. This literature argues that despite numerous reform efforts, teacher practice has not really changed since the mid-19th Century. Tyack & Cuban (2009), and Seymour Sarason (2000) are some of the key figures in this body of literature, speaking respectively of a "grammar of schooling" (Tyack & Cuban, p. 5) which has not changed and an intractability of schools that would doom all future reforms to fail as previous efforts had unless a fundamental change to the way schools operate were to occur. There is evidence, however, of a gradual evolution in pedagogical beliefs and practice and a shift towards more constructivist classrooms (Hennessy, et al., 2005; Hooper & Reiber, 1995; Levin & Wadmnay, 2005; Mills & Tischner, 2003; Windschitl & Sahl, 2002, as cited in Ertmer, 2010). Although there is a large body of research in the area of educational

technology in general, there is a lack of subsequent research into teacher practice and the adoption of constructivist teaching practice relative to technology.

Technological reforms have been present in education for more than two centuries (Cohen, 1988), but the reforms typically follow a similar pattern first, these are: high hopes for a new technological innovation, such as the use of radio, film, and television, followed by the realization that teachers are not utilizing the technology, which brings about criticism regarding the intractability of teachers (Cuban, 1986). Modern technological reforms, aimed at educational transformation, have fallen under the same pattern according to Cuban (Cuban, 2006, 2009). . Champions of technologically driven 1:1 reform efforts have argued that they would ultimately transform education through the creation of a more student-centered, constructivist classroom (Christensen, et al., 2008; Dunleavy, et al., 2007). One major challenge in historical technology-centered educational reforms, which also may be the case in 1:1 reform efforts, is that often times the technology has merely served to reinforce traditional practice rather than transform it (Cuban, 2009).

Evaluating teacher practice as being traditional or constructivist provides a powerful framework for understanding how the laptops are being used in 1:1 environments. Student-centered, constructivist learning environments are at the heart of the 1:1 reform movement. Proponents argue that the laptops enable teachers and students to interact with each other, with information, and with the outside world in ways that were never before possible (Hermans, et al., 2008). These new opportunities, therefore, foster a shift in the teacher's role away from the keeper of knowledge to a facilitator of learning. Constructivist teachers see learning as nonlinear and seek to foster individuals making their own meaning and to consider students' prior knowledge in order to create interactive learning activities and alternative methods of assessing

learning (Null, 2004). Traditional teacher practice, on the other hand, is teacher-centered, often involving direct instruction, with students passively receiving pre-determined information (McCarthy & Anderson, 2000). This study does not seek to evaluate the efficacy of constructivist versus traditional teaching practice, but rather seeks to explore questions around the level of adoption of the reform.

Teachers' use of traditional or constructivist teaching approaches can be seen as representing symbolic versus genuine adoption of the 1:1 reform. The application of constructivist teaching practices are central to the purpose of the reform, and genuine adoption of constructivist pedagogy is critical to being able to then look at the impact of the reform. Downes and Bishop (2015) state that "Even when promising interventions are designed and implemented, the integrity of implementation, not surprisingly, seems to strongly affect the ultimate impact" (p. 3). This points to the importance of the willingness of teachers, along with the ability of teachers, to implement technology in a constructivist manner to determining the success of the reform effort. The field of organizational sociology provides a framework for understanding how new practices are assimilated into formal organizations, like school districts. In order to maintain legitimacy, many school districts feel pressure to adopt popular reform movements (like the 1:1 initiatives) (Meyer & Rowan, 1977). This pressure to maintain legitimacy means that as surrounding districts adopt a new program, such as 1:1 laptop initiatives, it can put pressure on a district to follow suit, even if it is only to provide the appearance that they are progressing. Districts have applied varying methodologies to implementation. Some teachers and some districts will symbolically adopt the reform, as evidenced by the maintenance of traditional practice, as opposed to genuinely adopting the reform by using constructivist teaching methods. Rogers (2003) refers to adoption as making full use of an innovation and rejection (or in the case

of this study, symbolic adoption) as choosing not to implement it. The literature suggests there is a gap in our knowledge of exactly how teachers are using technology, and what elements of successful implementation, as determined by genuine adoption, may be.

1.3 Purpose of this Study

The purpose of this study is to understand how teachers are using laptops in their classroom. The study seeks to understand whether the laptops are being used in a constructivist manner consistent with the intentions of the reform movement, signifying genuine adoption of the reform, or they are being used in a traditional manner, signifying symbolic adoption of the reform.

1.4 Significance of this Study

This study provides valuable insights into understanding how teachers are using laptops in their instruction. Laptop initiatives are among the most common and expensive educational reform movements of recent years (Holcomb, 2009). As the number of districts investing in technology in the form of laptops for all students is increasing, it is critical that the efficacy of the reform be evaluated. While there is a large body of research looking at 1:1 reforms, the vast majority look at the extent of use of laptops as a measure for effectiveness of the reform (Downes & Bishop, 2015). If true, positive change is to happen in education, it must happen in the classroom. Previous reform efforts have failed as they tend to focus on broad policy, and have not inspired change in the classroom (Fullan 1993). 1:1 reform is based in classrooms, but in order to exact any true change, will require a shift in teacher perspective and practice (Weston

& Bain, 2010). The importance of the success of educational reform is that it is seen as the key to answering many of society's problems (Cuban, 2009). If this study is able to provide a new method for understanding the 1:1 reform, and thereby for finding ways to improve the way laptops are utilized, or to show that the faith placed in this movement is misplaced, then resources can be allocated in a manner that will best impact implementation of the reform.

The key contribution to the literature this study seeks to make is the introduction of an instrument that can be used to better understand and evaluate the efficacy of 1:1 laptop programs. The instrument is used to identify the extent to which teachers and students are using laptops in a constructivist manner. The survey, the 1:1 Constructivist Learning Environment Survey (1:1 CLES), was developed using Johnson and McClure's (2004) Constructivist Learning Environment Survey 2 (CLES 2) as a model. That widely used survey was adjusted to account for the frequency with which laptops specifically were used in a constructivist manner. For the purposes of this study, that survey was administered to teachers in 1:1 classrooms in a single suburban district. Follow up interviews were conducted with a number of teachers from varying places on the constructivist-traditional practice spectrum. The follow up interviews served to provide additional insights into how the laptops were being utilized. While the scope of this study is modest, the potential applications for the instrument, and the implications for future research are numerous. The instrument could be used to look at longitudinal data to evaluate if teachers' practice have changed over time. It could also be used to compare districts and evaluate the effectiveness of various treatments on levels of genuine adoption (for example: professional development, professional learning communities, teacher preparation programs, mentorship programs, or other trainings). This type of research could help to inform best practice and help to

improve efficiency in the allocation of scarce resources. The instrument would also potentially be used as a method for assessing the effectiveness of professional development.

1.5 Research Questions

The research focuses on three main research questions:

1. To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?
2. What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?
3. How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

1.6 Limitations of this Study

There are a number of limiting factors with this study. One limitation of this study is the sample size. Only one grade level in one school district was used in this research, which limited the number of teachers and classrooms to be studied. The reason for this limitation was due to the school district beginning 1:1 implementation at that grade level before expanding to other grades. While this limits the number of teachers both surveyed and interviewed, and the

generalizability of any results, it does provide for a consistency in terms of the treatments around 1:1 preparation provided to the subjects.

Another limitation was the fact that the study looks at a single suburban district. All the data in the study were based on self-report through the survey instrument and interviews. There was no observation of practice. There would be benefits to looking at the implementation of the initiatives longitudinally to see if and how teacher practice shifts over time.

The impact of professional development on 1:1 implementation is another potential question for future research. This question is limited by the fact that only one district, and therefore one treatment in terms of professional development is applied for the subjects in this study.

1.7 Summary

Districts across the country and around the world are increasingly devoting scarce resources to the implementation of 1:1 laptop programs in schools. The existing literature on 1:1 laptop initiatives focuses primarily on the amount of laptop use as a measure of laptop integration. This approach fails to look at the critical aspect of how laptops are used in the classroom. Proponents of providing each student with a laptop argue that it provides a tool to shift the traditional role of the teacher away from the keeper of knowledge and towards the role of a facilitator of student-centered learning. This study provides a tool that enables the examination of the extent to which teachers are genuinely adopting the reform, as represented by using the laptops in a constructivist manner.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction to the Literature

While there is an extensive body of literature on the subject of 1:1 laptop initiatives, this study offers a new framework from which to assess the extent to which the reform effort is having its desired effect. 1:1 laptop classrooms are seen as a way to bring about a more student-centered, constructivist instructional approach. Critical to this more constructivist approach is the will and skill of teachers, which requires extensive support and professional development. Technological reform efforts are based on a new definition of what good teaching practice looks like, which is based on teachers utilizing educational technology tools to facilitate student learning (Ertmer, et al., 2012). There is a long history of resistance to change on the part of teachers, particularly regarding educational technology, which presents challenges to this reform effort. According to Ertmer, et al. (2012), technology use in the classroom has shown that we have yet to reach high levels of use, and that when educational technology is used, it “typically is not used to support the kinds of instruction (e.g., student-centered) believed to be most powerful for facilitating student learning” (p.256). Existing research on 1:1 initiatives has returned mixed results regarding the efficacy of the reform movement. Looking at the reform through the lens of constructivist versus traditional practice as representing either genuine adoption (constructivist practice), or symbolic adoption (traditional practice), provides an opportunity to better understand the way laptops are being used in classrooms.

This review is broken into seven sections: 1:1 Laptop Initiatives, 1:1 Initiatives as Potential Paradigm Shift, Teacher Will and Skill, Adult Learning and Professional Development,

Teacher Practice Change, Traditional vs. Constructivist Teaching, and Symbolic vs. Genuine Adoption. The literature review shows that there is a body of research on 1:1 laptop initiatives and their potential to lead to a paradigm shift, and the importance of teacher abilities with and attitudes toward technology which can be supported through effective professional development. This shift, however, has a long history of failed reform efforts to overcome. There is a body of literature on traditional and constructivist teaching practice, as well as symbolic versus genuine adoption of reforms. This study builds upon these existing bodies of research and offers a new way to evaluate the efficacy of 1:1 laptop programs through the lens of viewing teacher practice as representing symbolic or genuine reform as represented by traditional or constructivist teaching.

2.2 1:1 Laptop Initiatives

1:1 laptop initiatives have been championed as a transformational reform the likes of which have not been seen in education. There is much research available on 1:1 laptop initiatives and their impact on education. That research has focused primarily on the impact 1:1 programs have had on students and has returned mixed and often contradicting results. On one hand, research supports the promise of how the technology can positively impact teaching and learning (Fleischer, 2012; Holcomb, 2009; Maninger & Holden, 2009; Mouza, 2008; Penuel, 2006; D. L. Silvernail, & Lane, D. M., 2004; Weston & Bain, 2010). Other research indicates a lack of wide spread adoption in practice on the part of teachers (Becker, 2000; Cuban, 2006, 2009; Cuban, Kirkpatrick, & Peck, 2001; D. L. Silvernail & Pinkham, 2011). In a study of schools with widespread access to computers, Cuban (2009) found that less than 5 percent of teachers

integrated computer technology into their regular instructional practice. A plausible explanation for why laptop initiatives have experienced such varying degrees of success is that this success is largely dependent on teacher practice. There is an obvious link between teacher practice and student learning, but despite this fact very little research has been conducted to evaluate what kind of impact laptop programs have had on the instructional practice of teachers. For the purposes of this study, Penuel's (2006) widely accepted definition of 1:1 laptop programs is applied, which offers three core features: providing students with laptop computers loaded with contemporary software, internet accessibility for students through the schools' networks, and using the laptops to complete coursework.

The number of districts employing 1:1 laptop initiatives has grown dramatically over the last decade (Stanhope & Corn, 2014). There has been an accompanying growth in the body of research around various aspects of 1:1 programs in schools. Earlier research focused on factors associated with successful implementation, such as teacher professional development, access to technical support and positive teacher attitudes towards technology use as well as clear evidence that laptop initiatives can improve technical literacy and writing skills (Penuel, 2006). More recent research has focused on those aspects as well as others: the varying levels of effectiveness of technology integration, low levels of use tied to weak implementation plans, and teacher use of the technology (Lee, Spires, Wiebe, Hollebrands, & Young, 2015). A key area that is lacking in the literature is a focus on identifying the extent of teacher practice that is consistent with expectations for how the laptops are to be used.

Much of the initial research on these laptop initiatives indicated that the use of technology will increase collaboration among students and between teachers and students in addition to increasing engagement, but there is conflicting evidence regarding instruction

utilizing laptops increasing student achievement (Fleischer, 2012). Fleischer's (2012) review of 605 research articles on 1:1 shows that much of the existing body of research looks at the amount of usage of devices in the 1:1 environment with four clear themes in terms of the how the laptops are frequently used:

1. Exploration: primarily for conducting research using the internet.
2. Expression: utilization of the device for students to produce work, often through the use of Microsoft Office suite products such as Word, PowerPoint and Excel.
3. Communication: used for increased communication both with peers and teachers.
4. Organization: to collect and organize student work.

Fleischer (2012) also found a second main theme in the literature was experiences of learning, including evidence of increased knowledge formation and increased student motivation and engagement. These potential gains make the benefits of the increased use of technology very attractive, but the technology comes with a very high price tag. Laptop initiatives are among the most expensive and widespread educational initiatives of recent years (Holcomb, 2009). Little of the existing research offers insights into the way teachers utilize laptops beyond measuring how much they use the laptops. Fleischer (2012) goes on to say, however, that "When considering the thematic aspects of the results, there is an extended focus on activities, but less focus on the qualities and processes of knowledge formation inspired by one-to-one" (p. 119). This leaves a gap in understanding how teachers implement the technology and if they are utilizing laptops as constructivist or traditional tools. A significant and untapped area of research in the 1:1 realm is whether or not teachers are implementing the laptops into instruction with fidelity to the intended reform of shifting instruction to be more student-centered. That is, are they genuinely adopting

the constructivist reform effort, or are they using the technology while maintaining traditional practices, thus symbolically adopting the reform.

2.3 1:1 Initiatives as Potential Paradigm Shift

Information and communication technologies (ICT) are often tied to a belief in the transformative capability of the new technology, enabling new and complex learning environments (Hermans, et al., 2008). Proponents of 1:1 initiatives argue that this particular technology provides a vastly different opportunity from all previous technological innovations. Technology ideally can create a true shift where education moves away from monolithic teacher-centered instruction to a student-centered environment where teachers take a decidedly different role. This new reality will be a technology driven classroom that is student-centric and where teachers now serve more as learning coaches which will require a different role and a different mentality from educators (Christensen, et al., 2008). Indeed, Dunleavy et al (2007) argued that 1:1 classrooms could cultivate the principles of a learner centered environment.

There are a number of critical components necessary to ensure the successful integration of technology into instructional practice. Key aspects include: frequent computer use which is dependent upon access, with classrooms being equipped with multiple computers (ideally a 1:1 ratio); teachers having at least average technical expertise; teachers having flexibility in curriculum; and, teachers with a constructivist teaching philosophy (Becker, 2000). The first three conditions seem to have been met in large part in many schools and are more easily measured. They are what would be considered first order change (Waters, Marzano, & McNulty, 2003) whereas the fourth condition is much more difficult to assess and to make happen as it is a second order change (Ertmer, 2005) . This fourth condition, teachers having a constructivist

teaching philosophy, is a difficult condition to realize. For many, it would require a dramatic shift in teaching practice and the philosophy undergirding it.

Even for believers in the potential benefits of 1:1 laptop initiatives, it is clear that the solution is more complicated than just putting laptops into the hands of each student. The way that teachers use them will ultimately determine the effectiveness of laptop initiatives (Holcomb, 2009). Weston & Bain (2010) argued that in order for laptops to initiate significant change, it requires a shift in perspective to view computers as cognitive tools with a corresponding shift in teaching philosophy:

The result is a school full of classrooms that are differentiated in genuine ways for all students, with teachers who gather and mine just-in-time data about the effects of differentiation for each student. Further, students, parents, and teachers use the cognitive tools every day to collaborate about what to do next in their collective pursuit of learning... That is why, if asked about the value of using a laptop computer in school, each would struggle to see the relevance of such a question because computers have become integrated into what they *do*. They have become incapable of thinking in the old binary worldview of medium and message that techno-criticism sustains (p.11).

Viewing computers as cognitive tools requires a significant shift in the traditional perceptions of teachers, as well as all other stakeholders, of computers and instruction. One indicator of success of the reform effort lies in the extent to which it helps to realize a new classroom where educational practice is transformed and where teachers use the devices to form a student-centered, constructivist learning environment are created (Christensen, et al., 2008; Dunleavy, et al., 2007).

2.4 Teacher Will and Skill

There is a body of research which explains the extent of technology integration in instruction through the framework of what is referred to as the will and skill of teachers (Agyei & Voogt, 2011; Inan & Lowther, 2010; Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). The will refers to the attitudes teachers hold towards the usefulness of technology while skill refers to the teachers' technology competencies. These characteristics can have tremendous influence on how teachers use technology in the classroom (Agyei & Voogt, 2011). Some subsequent research has evaluated the impact of not only the will and skills of teachers, but has examined the extent to which tools, that is access to technology, have impacted the extent to which teachers integrate technology. Petko (2012) evaluated the factors that most account for the variance in intensity of integration of Information and Communication Technologies (ICT) in classrooms, and found that the will, skill, tools model explained the majority of the variance. Specific findings found that teacher beliefs, skills and access to technology are clearly correlated to ICT integration (2012). The highest impact in terms of teacher will is how strongly teachers believe in the potential benefits of digital media in improving students' learning. For skill, teachers' own estimation of their skills for using ICT are of greatest importance. The student-computer ratio is the greatest determinant in the tools department (Petko, 2012).

Inan & Lowther (2010) conducted a study utilizing an estimated path model and found that teacher beliefs and readiness (will and skill) directly influenced laptop integration, and that school-level factors such as support for school technology, technical support and professional development had an indirect, but positive influence on teacher will and skill. But like many other studies, they cited a key limitation is that the research focused on the amount of laptop integration, but failed to evaluate the effectiveness or quality of that integration. This is a

common challenge in much of the existing literature, and it has been found that many of the existing studies indicate that teacher practice, especially in regards to classroom technology practices, frequently does not align to teachers' espoused beliefs (Ertmer, et al., 2012). For example, Mueller et al (2008) stated that "Although the computer has the potential to support a constructivist style of teaching and learning, it may be that teachers are using the computer to enhance current practice and whatever philosophy they currently teach under is being supported by the technology"(p. 1534).

Teacher attitude towards technology is clearly a key determinant in how computers are used in the classroom. Teachers' attitude towards use was significantly impacted by their belief about the usefulness and ease of use of technology (Teo, 2011). If teachers saw it as an enhancement and relatively easy to implement, they would have a positive attitude which would in turn mean increased use (Teo, 2011). Teachers used technology in order to address professional needs and to address student needs. Ottenbreit-Leftwich et al (2010) found that in their study of teachers who had been recognized for their integration of technology a consistent belief that technology could be used to engage and motivate students, as well as a belief that technology use could enhance student understanding and critical thinking skills. Mueller et al's (2008) study offered valuable insights into understanding the role of will in technology integration, finding that attitude towards technology, along with experience with computer technology, are important variables that predict the level of success of teachers' technology implementation. They emphasized that in order to come to believe in the efficacy of technology integration in instruction, positive experience with technology implementation often happen before teachers will believe.

Teacher belief alone does not determine the extent and technique of technology integration, teacher ability is an equally critical factor. Teachers' technological abilities and comfort level with technology are key for determining classroom practice with computers. Numerous studies have been conducted with similar findings regarding the correlation between teacher skill and use. Comfort with technology and higher frequency of use were key factors distinguishing teachers who integrated technology from those who did not (Mueller, Wood, Willoughby, Ross, & Specht, 2008). Teacher readiness to integrate technology was a critical factor in determining teacher laptop integration (Inan & Lowther, 2010). A United States Department of Education study found that public school teachers reported that independent learning played a moderate or major role in preparing them to make effective use of educational technology for instruction (Gray, et al., 2010), which indicates a skill level with technology. Teacher preparation and skill development was critical, as Mouza, et al's (2014) study showed, with a significant positive influence in preservice teachers' ability to combine content, pedagogy and technology in the design of technology integrated lessons for students who had completed an educational technology course. Prestridge's (2012) study showed a clear relationship between Information and Communication Technologies competence, confidence and practice. They found that as teachers reported higher levels of competency with ICT, they had greater confidence and levels of implementation of ICT in the classroom. It is of note, however, that level of competency and confidence did not necessarily correlate to types of ICT practices. Teachers with the necessary will and skill to effectively utilize technology in instruction can be limited if there is not adequate access to the technology.

Greater computer access is an obvious factor related to successful technology integration. The highest determining factor of teacher practice is the number of computers accessible in the

classroom. Computer access dependent on mobile computer carts that are shared, or access to a computer lab, show much lower impact on integration than computer access in the classroom (Petko, 2012). The National Center for Education Statistics found much more frequent use for teachers with access to computers in their classrooms than use in other locations in the school (Gray, et al., 2010). It is interesting to note that the same study showed that 97% of teachers have access to computers every day, so the specific location of the computers seems to differentiate use of the technology.

With so much access to computers, and clear evidence as to the significance of teacher will and skill, teacher education and professional development are important components in shaping teachers' abilities and willingness to effectively integrate technology into instruction. Teacher readiness (skill) and beliefs (will) are the most important factors in technology integration, and technical support and professional development substantially influenced teacher beliefs and readiness (Inan & Lowther, 2010). Agyei & Voogt (2011) called for addressing teachers' technology competencies and reducing fears about technology through teacher preparation and professional development. Providing teachers with training for technology as an educational tool can improve both will and skill, and those with experience in technology-aided teaching in their training are more likely to integrate technology in their classrooms (Donnelly, McGarr, & O'Reilly, 2011; Paraskeva, Bouta, & Papagianni, 2008).

It is clear from the research that schools looking to implement 1:1 programs to impact teacher practice must have a comprehensive professional development plan to support teacher skill development and develop greater capacity in terms of will by helping in the evolution of teachers' belief systems about the role for technology in the classroom. Kopcha (2012) studied the impact of a technology education mentorship program and observed nearly a year after the

mentorship program that teachers were using technology in a constructivist manner with an emphasis on problem solving and critical thinking. 61% of teachers in the United States reported that professional development activities and training provided by staff responsible for technology support had a moderate or major impact on the extent to which they were prepared to make effective use of educational technology for instruction (Gray, et al., 2010). Although Kopcha (2012) sought to evaluate how the technology was being implemented, the vast majority of other studies focused solely on how much the technology was used.

The combination of an emphasis on the limits of much existing literature's emphasis on quantity of use as opposed to quality of use, and the challenges with the aforementioned teachers declared beliefs not necessarily representing their actual practice, shows there is a need for additional research which examines how exactly teachers are using the laptops. Ertmer, et al.'s (2012) evaluation of twelve teachers who have won awards for technology shows that these teachers did enact practices that closely aligned with their beliefs, and argued that "second-order (internal factors), not first-order (external factors), barriers are the true gatekeepers (to technology integration)" (p. 433). These second-order belief systems about Information and Communication Technology as a teaching tool and their own skill set merge with teachers' existing pedagogical beliefs to determine how teachers implement (Petko, 2012). This combination of belief systems and abilities determines the kind of practice teachers apply to computer use in their instruction.

There is widespread criticism that there is a significant gap between the abundant access to technology in the classroom and the dearth of effective use of technology by teachers. As Cuban (2013) explained "For the most part, teachers have tamed the technological innovations seeking fundamental reforms in pedagogy to fit their classroom practice since the early twentieth

century” (p. 112). This gap can be better understood through the framework of will, skill, and tools. While access to technology can be a barrier, technology is becoming more readily available for more teachers and students. The greater challenge is in the will and skill of teachers. Teachers who have experience with technology, are integrating it into their instruction, and believe that it will be of benefit to their students, are likely to have a high degree of technology implementation (Agyei & Voogt, 2011). Teachers lacking in either will (Mueller, et al., 2008; Teo, 2011) or skill (Mouza, et al., 2014; Prestridge, 2012) are far less likely to embrace the role of technology in education. While professional development has been shown to be effective in the will and skill development of teachers (Gray, et al., 2012), this aspect of technology integration is often lagging behind the tools component. The existing literature in this area is limited in respect to evaluating the extent to which the technology is implemented in a way that is consistent with the expectations for computer use in the classroom. The constructivist methodologies typically associated with technology access are often not assessed, rather just the amount of laptop use is the focus. The reticence of teachers to change practice is another key aspect of understanding the adoption of 1:1 laptop initiatives.

2.5 Adult Learning and Professional Development

The literature on teacher change, adult learning, and the role of professional development provide important insights into key aspects of 1:1 laptop integration. According to Fleischer’s (2012) study of more than 600 research articles on 1:1 initiatives, schools which take significant measures to provide support to teachers in an effort to alter the learning environment experience more success than schools which do not take comprehensive approaches to supporting the initiative. The study finds that aspects of particular importance include strong leadership, the

importance of how the laptops are introduced to teachers, and access to good support and professional development.

Silvernail & Lane (2012) also found that teachers who have had more professional development use laptops with higher frequency. Inan & Lowther (2010) found that “school-level factors (overall support for school technology, technical support, and professional development) positively influence teacher beliefs and teacher readiness” (p. 941). Two questions remain, however: What does this professional development look like and how extensively is it implemented? There is widespread concern that existing professional development for teachers in integrating technology into instruction is lacking (Lawless & Pellegrino, 2007). An important distinction in looking at professional development for educational technology is that there is a difference between focusing on integrating technology into instruction versus simply learning about technology or a specific tool (Lawless & Pellegrino, 2007). Learning only about how to use a tool, without support provided for thinking about how that tool can be integrated into instruction in a way that enhances student learning can create a scenario where teachers use instructional technology to reinforce traditional practices (Cuban, 2013). Ertmer, et al. (2012) asserted that professional development must go beyond simply training teachers how to use a technological tool but must also provide information about how tools can be used within the context of the content to improve student learning outcomes. This is not a simple undertaking, and requires a shift in the way teachers view educational technology and technology tools, and how professional development is typically provided.

Holcomb (2009) argued that in order to successfully integrate 1:1 laptops, teachers will be required to change their instructional practices, and that in order to make that happen, extensive professional development and support will be needed. Ertmer and her colleagues

(2012) put it this way: “Specifically, we must focus our change efforts on helping teachers understand how student-centered practices, supported by technology, affect student learning outcomes. This, then, has the potential to affect substantial changes in knowledge, beliefs, and culture” (p. 278). Indeed, Ertmer, et al. (2012) provided four specific keys for professional development to support a change in teacher practice regarding technology integration;

1. Align experiences with existing pedagogical beliefs and knowledge
2. Provide examples of other teachers’ successes emphasizing student outcomes
3. Provide support for risk-taking and experimentation
4. Expand the definition of “good teaching” to include technology integration (p. 276).

One intriguing method of providing support and professional development specifically for 1:1 initiatives that has been found to be effective is the utilization of teacher facilitators. Research has shown that the presence of a teacher facilitator (TF) has a positive impact on teacher attitudes towards the use of 1:1 implementation, and on teaching and learning in a 1:1 environment (Stanhope & Corn, 2014). The role of the TF is to provide professional development to teachers to augment their technology related will and skill and to assist in the creation of a culture that is committed to the 1:1 initiative (Stanhope & Corn, 2014) The International Society for Technology in Education (ISTE) has established standards for the role of Technology Facilitator which include items such as; applying and implementing curriculum plans with an emphasis on the use of technology in order to support student problem solving and critical thinking; engaging in ongoing professional development; and, helping to create a vision and culture for the school community which supports the effective application of technology in instruction (Technology Facilitation Standards, 2015).

Stanhope & Corn (2014) looked at the impact of affective engagement, that is “attitudinal, motivational, and emotional aspects of commitment” (p. 255), as well as the behavioral commitment as characterized by teachers integrating educational technology into their planning and instruction. Stanhope & Corn (2014) found that the presence of TFs in schools increased teachers’ affective engagement and behavioral commitment and utilized educational technology utilization versus schools without a TF. These findings offer evidence of the benefits of professional development and support for teachers in 1:1 classroom environments.

This section addressed the need for extensive professional development and support to support the successful integration of technology in the classroom. While several studies have shown the potential for positive change through professional development, there is a large body of literature that has shown teachers’ reticence to alter their instructional practice and provides an understanding for the difficulty associated with initiating a shift in instructional practice in the classroom.

2.6 Teacher Practice Change

Educational reforms are seen as the key to answering many of society’s problems, and as a result, reformers have looked at most every aspect of education in order to find a way for it to operate more effectively (Cuban, 2009). There is abundant literature that argues that despite the consistent and varied major reform efforts, very little has changed in how schools have operated in the last 150 years since the development of the common school. Tyack & Cuban (1995) speak of a “grammar of schooling” (p. 5) that has not been altered despite numerous major reform efforts. Sarason (1990) predicted that all future educational reform efforts would fail due to the

intractability of schools and reforms would be unsuccessful until they created some fundamental changes in the way schools operate.

Research focuses on the failure of reform efforts to have an impact at the ground level, where all meaningful change needs to occur. In the case of education, that ground level is the classroom. Teachers are not adequately prepared for reforms and bring with them resistant attitudes which are the main cause of the intractability of educational reforms (Sarason, 1995). Historically, many reform efforts have focused on broad policy and funding reforms, which have failed to inspire change in the classroom (Goodlad, 1991). As a result, these reforms have often only superficially impacted education and have not realized the change they had originally sought. The failure of these reforms may well lie in the fact that often times teachers do not attempt to implement new methods of instruction. In order to change instructional practices, teachers need to have experience with positive events (Mueller, et al., 2008).

Given this historical lack of impact major reform efforts have had at the classroom level, and the understanding of the connection between teacher practice and student learning, it is curious that research looking at the effectiveness of 1:1 initiatives as a major reform in education has largely lacked a focus on how initiatives have impacted teacher practice and how teachers are implementing this reform. The little research that does exist presents varying views on the efficacy of 1:1 reform initiatives.

In a study of technology integration into teacher practice, Hennessey, Ruthven, & Brindley (2005) found that teacher technology use was consistent with what prior research findings: that teachers tend to assimilate instructional technology tools into existing instructional

practice as opposed to changing their pedagogies (Cuban, et al., 2001; Goodson & Mangan, 1995). That is to say, technology is used to support existing classroom practice.

Technological developments have been at the forefront of educational reform efforts for two centuries and often with tremendous fanfare. The problem has been that the technological advances have not always been implemented in schools, and when they have it has not been in a way that maximizes their potential as hoped for by the technology's sponsors (Cohen, 1988). Educational reformers who have championed the idea of technology believe that if it is implemented in the classroom then it will ultimately transform teaching (Cuban, 2009). The challenge with educational technology has historically been that despite advances, the technology has tended to only reinforce traditional teacher practice, not transform it (Cuban, 2006). This is certainly the case in many classrooms currently outfitted with 1:1 laptops. Many teachers are simply using them in a way that reinforces traditional teaching practice and does little to transform the student learning experience. As Petko (2012) explained, "There are growing indications that teachers primarily use ICT for functions that fit their pre-existing pedagogical practices"(p. 1353). Even for those teachers who report high amounts of usage for the laptops, if the learning is still teacher directed then it would represent only a symbolic adoption of the initiative. Genuine adoption of the 1:1 reform effort requires a student-centered, constructivist approach to instruction.

Technological innovations through the years, including the introduction of radio, television, and film have followed a similar cycle according to Cuban (1986): began with excitement and exhilaration about the potential educational implications of a new technology. This was then followed by academic studies to show the potential effectiveness of the innovation, and then surveys would show how infrequently teachers were actually utilizing the

new technology to undergird their instruction, this results in criticisms directed at the intractable teachers.

There is a body of research, however, that supports there has been a gradual evolution in pedagogical beliefs and practice and a shift towards more constructivist classrooms (Hennessy, et al., 2005). Other researchers reported similar findings (Hooper & Rieber, 1995; Levin & Wadmany, 2005; Mills & Tincher, 2003; Windschitl & Sahl, 2002). Hokanson & Hooper (2000) argued that the shift from traditional practice to more constructivist practice is the major watershed in pedagogy over the last half century.

There is evidence that teacher beliefs and attitudes towards technology are critical in determining how they will use technology (Ertmer, 2005; Hermans, et al., 2008). Furthermore, teachers who are more constructivist in their teaching philosophies have been found to use laptops in instruction with higher frequency than their more traditionalist colleagues (Silvernail & Pinkham, 2011).

For much of the last century and a half, there has been little change in how schools operate (Tyack & Cuban, 1995). Much of the literature on technology's impact on the classroom has found that it has limited, if any, impact, and teachers simply integrated technology into existing instructional practice (Cuban, 2006; Cuban, et al., 2001; Goodson & Mangan, 1995). Others disputed this, finding that technology in the classroom has created a shift in pedagogical beliefs and instructional practice towards a more constructivist classroom (Hennessy, et al., 2005; Windschitl & Sahl, 2002). It is intriguing that there has been so little subsequent research into teacher practice and the adoption of constructivist teaching practice relative to technology. If, as Hennessy (2008) posited, there has begun an evolution in teacher practice with technology

at the core, then it merits further examination of the impact 1:1 initiatives have had in further evolving teachers' instructional practice.

2.7 Traditional vs. Constructivist Teaching

There is a clear and consistent link between the ideal for what good instruction utilizing technology looks like and constructivist teacher practice. While constructivist teaching practice is not a new idea, the use of technology in the form of 1:1 laptops provides a new expression of old ideas. If 1:1 initiatives are going to represent a true reform to education, then they must be accompanied by a shift on the instructional continuum from traditional to constructivist practices. There is a body of research that supports the assertion that the educational beliefs of teachers are a critical component to understanding how computers are used in the classroom (Hermans, et al., 2008). The argument from constructivist centered reformers is that computers offer ways of motivating students and allow for deeper understanding. The ideal maintained for laptops by these reformers is that "they can revolutionize classroom practice and prepare the next generation for an emerging workplace whose texture and boundaries few can predict with confidence" (Cuban, 2009, p. 15).

A detailed description of constructivist practice including examples of what constructivist practice looks like are included in the definition of constructivism for the purpose of this study so that specific practices can be evaluated. Constructivist practice is defined as student-centered teaching as characterized by; the role of the teacher is that of a facilitator of learning rather than a keeper of knowledge (Becker, 2000; Cuban, 2009; Scheurman, 1998; D. L. Silvernail & Pinkham, 2011), the use of formative assessment to inform instruction (Null, 2004), an emphasis on student critical thinking and problem-solving skill development (Becker, 2000; Cuban, 2009;

Duffy & Jonassen, 1992), a focus on individualized instruction(Null, 2004), an emphasis on student engagement (Fleischer, 2012; Holcomb, 2009; Maninger & Holden, 2009), and the view of laptops as cognitive tools (Christensen, et al., 2008; Weston & Bain, 2010).

Constructivist practices, also referred to as student-centered teaching, focus on a role for the teacher as a coach, with activities that engage students in problem solving scenarios which allow for greater depth of learning and connect to students beyond the classroom (Becker, 2000; Cuban, 2009). Instructional constructivists see learning as nonlinear, with individuals making their own meaning as critical to learning and an emphasis on teachers striving to understand students' points of view and posing questions that are relevant to students' daily lives. Additionally, teachers should consider students' prior knowledge and create interactive activities in their lesson planning and develop alternative forms of assessment (Null, 2004).

On the other end of the pedagogical spectrum are traditional practices. Traditional teacher practice is teacher-centered, often lecture driven, involves content delivery which involves students passively receiving pre-determined information which demands only surface level understanding and knowledge regurgitation (McCarthy & Anderson, 2000).

Scheurman (1998) refers to constructivist teachers as facilitators and collaborators, while traditional teachers are transmitters. Transmitters' instructional practice is based on a belief in knowledge acquisition coming as a result of a bond between stimulus and response. Effective instructional techniques for this style of teaching and learning would be what are considered traditional forms of teaching such as having students respond to questions in a book or take notes from a teacher lecture (Scheurman, 1998). Constructivists argue that traditional (transmission model) teaching fails to meet the key requirement for knowledge acquisition which is through

students making connections with new ideas to what they already know (Richardson, 1997; Scheurman, 1998; D. L. Silvernail & Pinkham, 2011). Constructivist teaching would be much more student driven and collaborative in order to have students work to make connections to what they already know (Scheurman, 1998). Silvernail & Pinkham (2011) summarize the distinction between traditional and constructivist teaching philosophies as follows:

So-called Traditionalist teachers maintain more teacher-directed classrooms.

Teachers tend to be very much in control of the teaching and learning environment. They most often decide what is taught, how it is taught, and at what speed students will learn.

Constructivist teachers, on-the-other hand, are described as more facilitators and guides of learning than their counterparts, and believe students should play a larger role in directing more of their own learning (p. 14).

While the focus of this study is on the extent to which teacher practice is constructivist in the use of laptops in 1:1 initiatives and not on the efficacy of a shift to more constructivist practices, there is evidence that more constructivist teaching practice leads to improved student learning. A study of high school, college and university physics courses revealed an improvement of test scores in courses using interactive engagement (constructivist) methods two standard deviations above scores in courses utilizing traditional methods (Hake, 1998).

Lowther, Ross & Morrison (2003) found that 1:1 access did not create a shift in teaching methods, but did result in increased computer usage. Windschitl & Sahl (2002) found that how teachers used laptops were based on their belief about how students learned, what good teaching practice in their institutional culture consisted of, and the role of technology for their students' lives. The mere presence of 1:1 computing in early research was not sufficient for creating a shift

towards constructivist teaching, but was a catalyst for teachers already dissatisfied with traditional instructional practices (Windschitl & Sahl, 2002).

Duffy & Jonassen (1992) argued in favor of the need for a shift towards more constructivist practice through technology integration, saying that traditional models of teaching and learning were based on mastering the information in the content domain, but that in the information age, given our technological capabilities, this is no longer possible or reasonable. The skills businesses seek and that education must provide are to understand and use information in order to solve real world problems, and the constructivist approach is far better suited to this approach than traditional teaching methods (Duffy & Jonassen, 1992).

Constructivism is growing in popularity at the same time that 1:1 laptop programs are being implemented with increasing frequency. Evidence of constructivist approaches can even be found in state and local policies and a number of professional organizations including national teacher organizations in the fields of mathematics, science, English and reading (Woolley, Benjamin, & Woolley, 2004). This widespread shift towards constructivist instruction helps garner additional support for laptop reforms which emphasize the devices as tools enabling more constructivist instruction. Constructivist teacher beliefs were a strong predictor of high use of ICT in the classroom and traditional beliefs had a negative impact on computer integration (Hermans, et al., 2008). Petko (2012) found that a teachers' level of constructivism as measured by the Constructivist Learning Environment Scale (CLES) had a small but significant correlation to the level of computer use in teaching.

Constructivist teaching is student-centered and focuses on the role of teacher as facilitator or guide to student learning while traditionalist teaching is teacher-directed with the teacher in

control of the learning environment (Silvernail & Pinkham, 2011). This study looks at the extent to which teachers are constructivist or traditional in their practice. A student-centered approach to instruction is a key component of 1:1 laptop initiatives and adherence to this approach and constructivist teaching practices signifies fidelity to the 1:1 laptop reform effort.

2.8 Symbolic vs. Genuine Adoption

The field of organizational sociology provides a powerful framework for understanding how new practices are assimilated into formal organizations like school districts. Organizations are driven to adopt new practices and procedures which have been institutionalized in society. Organizations do so in order to maintain their legitimacy and help ensure their survival, regardless of the efficacy of the new adopted practice (Meyer & Rowan, 1977). In the case of 1:1 laptop initiatives, it is likely that some districts have made this investment due primarily to isomorphic pressures. That is, districts may adopt 1:1 laptop initiatives in order to give the appearance of remaining competitive with other districts, regardless of the immediate efficacy of the program. A failure to adopt the popular reform of increasing student access to technology via individual laptops could give the appearance of remaining stuck in the 20th Century and could result in the loss of students to neighboring districts. Organizations often will create a buffer for new practices in order to protect their operational integrity. In the case of school districts and 1:1 laptop programs, they may provide students with computing devices without genuinely seeking to provide a more student-centered instructional model. As Meyer & Rowan (1977) explain, “Institutionalized products, service, techniques, policies, and programs function as powerful myths, and many organizations adopt them ceremonially” (p. 340). Districts may only

symbolically adopt the reform in order to maintain legitimacy. Furthermore, even in districts attempting to initiate true reform, individual teachers may resist the reform and constructivist teaching.

Teachers or districts that resist using the laptop devices in creating student-centered instruction could give the appearance of adopting the reform while only using the laptops in a superficial manner. Teachers can maintain traditional teaching practice, based mostly on teacher directed instruction, while using the laptops extensively. In other words, the laptops could be used and integrated into the classroom and look for all intents and purposes as though they are transforming education, without any real shift in instructional practice. Research has shown that the transformative impact of ICT must be accompanied by a comprehensive change process if it is to truly shift teacher practice (Petko, 2012). There are plenty of ways technology can be integrated in a manner that accommodates traditional teaching practice (Petko, 2012). Computer access in the classroom has been connected to a constructivist style of instruction. It is possible, however, that teachers are using technology to reinforce current practice and their existing teaching philosophy (Mueller, et al., 2008). This utilization of traditional practices would represent symbolic adoption.

Genuine adoption of the laptop devices would be represented by constructivist, student-centered instruction. According to Christensen, Horn, & Johnson (2008), the new technology driven classroom will require teachers to be facilitators and learning coaches for a student-centered learning environment. Teachers who genuinely adopt the laptop reform will be those who utilize the laptops as tools that enable a constructivist learning environment. The push to provide each student with their own laptop computing device in an attempt to provide a more student-centered education is still a relatively new innovation. Whether or not teachers embrace

the use of technology as a tool for providing a more constructivist model versus traditional practice is critical in determining the long term efficacy of 1:1 laptop programs. If laptop use could bring about a more student-centered classroom and the reform was genuinely adopted, it would represent a unique reform effort. The last century and a half of major education reform efforts have sought to shift the teacher-centered traditional instructional practices into more flexible, student-centered instruction. In the past, as technologies have been introduced into the classroom in an attempt to facilitate this change, teachers have taken the technologies and assimilated them into their traditional practices (Cuban, 2013). Research has shown there are individual factors such as teacher attitudes and computer self-efficacy and proficiency which correlate to the degree of ICT adoption. This research offers insight into why there is a gap between the objectives of technology integration and the level of integration in teacher practice (Hermans, et al., 2008). While some teachers are genuinely adopting the reform by applying constructivist practice in their 1:1 laptop classrooms, other teachers are symbolically adopting the reform by maintaining traditional practices.

An examination of how innovations diffuse in organizations provides additional insight into the adoption of laptop initiatives. 1:1 laptop reform is still a relatively new phenomenon. It is in these early stages of diffusion that adoption is likely to be more symbolic rather than genuine. According to Rogers (2003), "Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system... Diffusion is a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system" (pp. 5,6). There is a gap in the literature in the area of how teachers are using the technology and whether or not their usage represents a genuine adoption of the constructivist, student-centered reform effort built on the idea that laptop

computers being placed in the hands of each student enable teachers to implement constructivist practice.

Rogers (2003) described five stages in the innovation-decision process. Looking at laptop reform efforts through the lens of Rogers' stages offers critical insight into understanding the adoption process of the 1:1 laptop innovation and allows for the assessment of the long term viability of the reform effort. Rogers' (2003) five stages are:

1. Knowledge Stage: involves individuals discovering an innovation's existence and developing knowledge of how it functions.
2. Persuasion Stage: the individual forms a favorable or unfavorable opinion of the innovation.
3. Decision Stage: the individual decides whether to adopt or reject an innovation.
4. Implementation Stage: the innovation is put into practice.
5. Confirmation Stage: reinforcement is sought for the innovation-decision and adoption continues or the innovation-decision is reversed.

The first two stages in the innovation-decision process tie in to the will and skill of teachers, as well as their professional development, which are discussed in previous sections. Because the decision to introduce 1:1 laptops into classrooms happens at the district level, individual teachers are left out of the innovation-decision process of whether or not to place laptops in the hands of each student. These first two stages are significant, however, in terms of how teachers decide to implement (and therefore the extent to which they genuinely or symbolically adopt the reform) the 1:1 technology in their classrooms

The third and fourth stages are where the initial innovation-decision is made and is subsequently implemented. In the case of educators working in a school that has adopted a 1:1 initiative, they do not typically have the option to outright reject the innovation, so the question becomes whether or not teachers implement the use of laptops with fidelity. Teachers must have, and often must use the laptops, and they decide how the laptops will be used, either as a tool that better enables constructivist practice (Christensen, et al., 2008), or as a tool that reinforces traditional practice (Cuban, 2013). Districts and teachers must maintain legitimacy and the perception that they are implementing technology through the use of laptops. That use may be genuine, using the laptops as cognitive tools that enable a more student-centered environment. Teachers may, however, only symbolically adopt the use of laptops, utilizing the machines in a way that supports their traditional teaching practice. By maintaining traditional practice, teachers decouple themselves from the philosophical undergirding of the reform (Meyer & Rowan, 1977).

In the final stage of adoption, teachers will then seek confirmation for their adoption decision. Regardless of the level of fidelity to the reform in the initial adoption, teachers will seek reinforcement for their practice and determine whether to continue with their initial adoption decision or reverse course.

Rogers (2003) offered a series of attributes of innovations that impact the rate of adoption. Three attributes which are particularly insightful to understanding laptop adoption in instruction are: compatibility, trialability, and observability. Individuals and organizations are far more likely to perceive an advantage to an innovation and quickly adopt it if it is similar to the existing values, experiences and needs already held. This is what Rogers refers to as compatibility, and he argues that if an innovation adoption requires adopting new values, it will be a relatively slow process (2003). It is conceivable that laptop integration for many requires the

adoption of a new set of values, inclusive of that set of values is a belief in the efficacy of student-centered instruction at the core of constructivist teaching. It is important to keep this consideration in mind when evaluating how 1:1 initiatives might alter the way teachers teach. Before expecting teachers to change their practice, it is important to understand their beliefs about constructivist teaching (Isikoglu, Basturk, & Karaca, 2009). This is critical as research has shown that there is a link between beliefs and teacher practice (Richardson, 1996). This also helps to explain why results of research on the effectiveness of laptop programs have been varied as much of the research has failed to address the role of teacher beliefs and teacher practice on the implementation.

Trialability is the degree individuals or organizations can experiment with or try a new innovation. In the case of laptops, teachers may or may not have flexibility in how they integrate laptops into instruction, depending on the district. Generally speaking, innovations that can be gradually experimented with tend to be adopted more quickly (Rogers, 2003). If districts do not provide adequate opportunity for experimentation, as well as sufficient professional development and technological support in the early stages of implementation, it will likely lead to only symbolic adoption from the vast majority of teachers.

Observability is the final attribute and is the source of much controversy surrounding 1:1 initiatives. This represents how much results of an innovation can be observed by others (Rogers, 2003). Observability creates a tremendous challenge with regards to laptops. Current assessment methods for student learning are mostly in the form of standardized tests that are based on traditional modes of instruction. As a result, many of the greatest benefits championed by constructivist educators are not able to be easily observed in the form of assessment results.

In order to understand the process of how 1:1 laptop programs are impacting teacher practice, it is helpful to look at how innovations diffuse. Rogers (2003) described five key stages of the innovation process. Rogers also offered key attributes that impact the speed with which innovations are adopted. In the case of laptop initiatives, teachers at the classroom level are typically not able to outright reject the innovation and may therefore choose to symbolically adopt rather than genuinely adopt the reform. Meyer & Rowan (1977) argued that often times organizations adopt innovations symbolically, giving an outward appearance of adoption, without genuinely adopting the innovation by changing practice. This phenomenon can be applied to individual teachers and the use of laptops in 1:1 classrooms. Symbolic adoption would be signified by maintaining traditional practice, and teachers could do this even while using laptops extensively. Genuine adoption would involve the use of the technology as a cognitive tool that helps to create a student-centered classroom.

2.9 Summary of Literature Review

Little has changed in teacher practice over the last 150 years, and scholars such as Sarason (1990) and Tyack & Cuban (2009) contend there is little hope that any reform effort will emerge that will have significant impact at the classroom level. Technological innovations which have been used in an attempt to change teaching and learning have changed the look of classrooms, but have not fundamentally changed teacher practice. Technological innovations have often reinforced traditional practice rather than transformed it. Champions of 1:1 laptop initiatives, such as Christensen, et al. (2008), argue that the laptops are a tool which will create a paradigm shift in classrooms away from the traditional, teacher-centered approach to a student-

centered classroom where the teacher's role evolves into that of a facilitator of learning. Much research has been conducted on 1:1 classrooms, but the focus has primarily been on the impact on student learning or the frequency of use. There is a growing body of literature led by the work of Agyei & Voogt (2011), and Ertmer, et al. (2012) that examines the impact of teachers' attitudes and beliefs on technology implementation. The greater challenge to effective technology implementation in education is no longer access to technology but rather the need to address the will, skill and beliefs of teachers (Ertmer, et al., 2012). Much of this research (Kopcha, 2012; Petko, 2012) connects that will and skill of teachers to the frequency of use. A gap exists in looking at how the laptops are used in terms of instructional methodology. This study seeks to provide a new approach to understanding how laptops are used in 1:1 classrooms by evaluating the extent to which teachers are using laptops as constructivist tools in their instruction, or as tools that reinforce traditional teaching roles. This use of laptops in traditional versus constructivist ways represents symbolic versus genuine adoption of the reform effort.

CHAPTER 3

METHODOLOGY

3.1 *Overview*

The major goal of this study is to determine if the costly reform effort of districts providing students with personal laptop devices is being genuinely adopted by classroom teachers, as measured by the extent to which teachers are using the devices in a constructivist manner. The research questions of this study are:

- To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?
- What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?
- How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

In order to effectively answer these questions, a mixed methods approach was applied. Quantitative data were collected through a survey instrument, a modified version of the Constructivist Learning Environment Survey (Johnson & McClure, 2004). The results of this survey were subsequently analyzed and also used to identify interview subjects that could represent the sample population and to provide additional rich data that could help answer the research questions. A grounded theory approach was utilized to analyze the data and produce insights into how laptops are being utilized in instruction. In a grounded theory approach, the investigator seeks to derive meaning from the data by assuming an inductive stance towards both

data collection and data analysis (Merriam, 2009). A key focus of grounded theory is on a substantive theory which emphasizes the specificity of the data and a focus on everyday situations. Interviews are a common tool used in data collection in substantive theory (Merriam, 2009).

3.2 Survey Instrument

For this study a survey instrument was developed to measure the level of constructivism teachers employed in the use of laptops in their instruction. The survey was created by adapting the Constructivist Learning Environment Survey 2 (CLES 2) to focus on the use of laptops in the 1:1 classroom environment. Johnson and McClure (2004) revised and shortened the original CLES developed by Taylor, et al, (1995), and this version was the basis for the survey instrument developed for the purposes of this study. The CLES 2 survey instrument has been used widely in studies to evaluate both teacher and student perceptions of the classroom learning environment and to assess the level to which that environment is constructivist in nature. For the purposes of this study, the CLES 2 was adapted to focus specifically on classrooms with access to 1:1 laptops and to emphasize the following aspects of constructivist practice; the role of the teacher is that of a facilitator of learning rather than a keeper of knowledge, the use of formative assessment to inform instruction, an emphasis on student critical thinking and problem-solving skill development, a focus on individualized instruction, an emphasis on student engagement, and the view of laptops as cognitive tools. Table 1 below shows the CLES 2 questions that were adapted for the survey instrument utilized in this study.

Table 1: CLES 2 and 1:1 Constructivist Learning Environment Survey (CLES) Creation

	Original CLES 2 Question(s)	1:1 CLES
Survey Heading	What Happens in My Science Classroom	This year, on average, how frequently are the 1:1 devices used in your classroom in order to perform the following tasks?
Answer Options	A: Almost Always B: Often C: Sometimes D: Seldom E: Almost Never	A: Never B: Less Than Once a Week C: Once a Week D: A Few Times a Week E: Once a Day F: Often During the Day
	1. Students learn about the world inside and outside of school. 2. New learning relates to experiences or questions about the world inside and outside of school.	1. Students find real world examples that apply to what they are learning in class.
	18. Students explain their ideas to other students.	2. Students share information they found with the rest of the class.
	1. Students learn about the world inside and outside of school. 13. Students help me plan what they are going to learn.	3. To help you determine student interests either outside of school or relative to something they are learning about in class.
	13. Students help me plan what they are going to learn. 14. Students help me to decide how well they are learning. 15. Students help me to decide which activities work best for them. 16. Students let me know if they need more/less time to complete an activity.	4. To help you adapt an activity to students' individual needs (i.e. differentiate instruction for your students).
	17. Students talk with other students about how to solve problems. 18. Students explain their ideas to other students.	5. Students communicate with other students either inside or outside the class in order to solve a problem or complete an assignment.

	<p>19. Students ask other students to explain their ideas.</p> <p>20. Students are asked by others to explain their ideas.</p>	
	<p>13. Students help me plan what they are going to learn.</p> <p>14. Students help me to decide how well they are learning.</p> <p>15. Students help me to decide which activities work best for them.</p> <p>16. Students let me know if they need more/less time to complete an activity.</p>	<p>6. You use laptops in order to help you assess student knowledge (i.e. formative assessments).</p>
	<p>13. Students help me plan what they are going to learn.</p> <p>14. Students help me to decide how well they are learning.</p> <p>15. Students help me to decide which activities work best for them.</p> <p>16. Students let me know if they need more/less time to complete an activity.</p>	<p>7. You use feedback from formative assessments in order to help inform your teaching.</p>
	<p>9. Students feel safe questioning what or how they are being taught.</p> <p>10. I feel students learn better when they are allowed to question what or how they are being taught.</p> <p>11. It's acceptable for students to ask for clarification about activities that are confusing.</p> <p>12. It's acceptable for students to express concern about anything that gets in the way of their learning.</p> <p>14. Students help me to decide how well they are learning.</p> <p>15. Students help me to decide which activities work best for them.</p>	<p>8. To provide students increased options or choices in the work they complete.</p>
	<p>11. It's acceptable for students to ask for clarification about activities that are confusing.</p> <p>12. It's acceptable for students to express concern about anything that gets in the way</p>	<p>9. Provide you an opportunity to work more with individual students</p>

	of their learning. 13. Students help me plan what they are going to learn.	
	9. Students feel safe questioning what or how they are being taught. 10. I feel students learn better when they are allowed to question what or how they are being taught. 13. Students help me plan what they are going to learn. 14. Students help me to decide how well they are learning. 15. Students help me to decide which activities work best for them.	10. Provide you an opportunity to give students timely feedback.

The 1:1 CLES that was utilized for this study was developed through a number of iterations. To ensure the survey was accurately assessing the extent to which the laptops were used in a manner consistent with a constructivist learning environment, the initial survey was created and subsequently administered to two middle school teachers currently serving as pilot instructors for the 1:1 program. The teachers were given the survey to complete, and then follow up interviews were conducted with those teachers in order to make modifications. The purpose of the survey and what it intended to measure were shared with the teachers. The teachers were then asked a number of questions to ascertain additional insight into a number of key aspects of the survey. Teachers were asked if any questions were unclear or confusing, how questions could be adjusted to provide greater clarity and ensure the questions would be understood and answered in a manner which provides insight into the level of constructivism in the learning environment, and if any questions were not asked which would provide additional insight. The initial survey consisted of two sections, one that represented the frequency with which teachers

used the laptops and a second section focusing on how students used the laptops. The teachers who were surveyed first found this confusing and redundant, so the questions were combined into one section on frequency of how laptops were used in the classroom. The feedback received from the initial survey also included a number of suggestions for additional adjustments: a need for inclusion of examples to provide greater clarity (which resulted in the inclusion of formative assessments being provided as an example for question 6), the need for questions that targeted being able to work more with individual students (question 9), as well as feedback on rewording a number of questions to make them more easily understood to eliminate potential confusion.

The updated version was then given to two different middle school teachers piloting 1:1 classrooms. Again, the purpose of the survey and details regarding what information was sought by the survey were shared with the two teachers, and follow up interviews were conducted. The follow up discussions with these teachers indicated the survey was much stronger than the initial survey in measuring the level of constructivist versus traditional practice. The only significant adjustment came from a suggestion to include a question about the devices enabling teachers to provide more timely feedback (question 10). The final survey instrument can be found in the Appendix A.

Once the 1:1 CLES was developed, survey responses were solicited from all 35 5th grade teachers teaching in the Park Hill School District in 1:1 classrooms. There were 10 questions which were scored on scale of 1 to 6 with a score of 6 reflecting the most frequent use of constructivist instructional practice.

3.3 Survey Data Collection

The sample selection for teachers surveyed was based on teachers in the Park Hill School District, located in Kansas City, Missouri, at the 5th grade level who were currently teaching in a 1:1 environment. The 5th grade level was selected as this was the largest population of teachers available in the district currently teaching in 1:1 classrooms. All 35 of the 5th grade teachers in the district currently teaching in a 1:1 classroom were contacted to complete the survey. The surveys were administered using the website www.surveymonkey.com in the spring of 2014, the first year of full implementation at the 5th grade level. For those teachers who were part of the pilot program, it was the second year of implementation. Teachers were sent multiple requests over the course of two months in the spring of 2014 to complete the survey, personalized follow up requests were sent to teachers who had not responded asking them to complete the survey. The 5th grade teachers who responded varied widely in age, highest level of educational attainment, and years of teaching experience. Of the 35 5th grade teachers in the district, 29 teachers responded, while 25 respondents completed the survey in its entirety and 23 completed the demographic information portion of the survey. Below is a chart that outlines the demographic characteristics of the district's 23 5th grade teachers who completed the survey in its entirety including demographic information. See Table 2 for information regarding the demographics of the teachers who responded to the survey in its entirety, including demographic questions.

Table 2: Distribution of Respondents by Demographic Group

Demographic Group	Frequency (# of Respondents by Group)	Percentage of Respondents	Demographic Breakdown of Elementary Teachers in the District	Demographic Breakdown of Teachers in the District
Gender				
Female	19	83	91	74
Male	4	17	9	26
Age				
Under 25	1	4	5	4
26-35	12	52	26	27
36-45	5	22	38	35
46-55	5	22	22	22
56 and above	0	0	9	9
Years of Teaching Experience				
Less than 5	3	13	16	15
6 to 10	12	52	17	18
11 to 15	3	13	25	18
16 to 20	3	13	15	21
21 to 25	1	4	17	15
26 to 30	1	4	10	8
More than 30	0	0	2	5
Education Level				
Bachelors	2	8	51	48
Masters	17	74	43	45
Ed Specialist	3	13	5	5
Doctorate	1	4	1	2
Years of Experience Teaching in a 1:1 Classroom				
2 years	4	83	NA	NA
1 year	19	17	NA	NA

The teachers surveyed were representative in many ways of the elementary teachers across the district as well as the teaching force of the district as a whole. While the percentage of female teachers was higher than the district average, it was lower than the elementary average. The age distribution of 5th grade teachers was skewed towards the younger end of the spectrum, with a much higher number of teachers in the 26-35 year old range. The other main distinction between the sample group and the district's teaching force was that a significantly higher percentage of the 5th grade teachers had Masters Degrees versus the district average.

The teachers surveyed were predominantly female and age 35 and under. Many of them had 10 years or less teaching experience and the vast majority had a Masters or other advanced degree. The demographics for the district's certified teaching force as a whole are as follows: 76% of the district's teachers are female, 29% have been teaching 10 years or less, and 34% are aged 35 and under.

A Cronbach's Alpha test was run on the 25 collected survey responses (note: while 23 respondents gave demographic information, two additional teachers answered all questions regarding laptop use in their classrooms, but chose not to answer the demographic questions). The Cronbach's Alpha score for the collected responses was 0.6975, indicating the survey is acceptable.

3.4 Sample Selection

This study selected one district to evaluate in order to look at the extent to which teachers are using 1:1 laptops in a constructivist manner. The sampling was purposeful, which is appropriate for the scope and purpose of this study. According to Merriam (2009), purposeful sampling is used when an investigator wants to discover and gain insight into understanding

what occurs in a given setting. Although there are limitations with looking at one district, this study can provide tremendous insight into understanding how 1:1 laptop initiatives are being implemented on a much larger scale, and it establishes a framework for additional future research. . Purposeful sampling's power lies in the selection of information rich samples for close examination and in depth study and can provide tremendous amounts of information about issues of critical import to the inquiry (Patton, 2002 as cited in Merriam, 2009). The Park Hill School district provides an information rich case study for 1:1 laptop initiatives as a result of its size, the stated goals of the initiative, and the vast supports for and comprehensive approach to its 1:1 laptop initiative. As a mid-sized district, the approaches and findings can potentially relate to both small and large districts in addition to other mid-sized districts. Given the extensive supports provided to teachers in terms of professional development and technical support, the district's approach provides an opportunity to evaluate the extent to which teachers use laptops in a constructivist manner when that is a clear goal of the initiative implementation in the district.

The focus of this study is on a single Midwestern suburban district, the Park Hill School District. The district is in the process of implementing a 1:1 laptop initiative for all students, grades 5-12. The district was selected as it can readily be used as a good comparison district for many other districts around the country and beyond, and for the comprehensiveness of its approach to the implementation of a 1:1 laptop initiative. The district is located in a suburb just north of Kansas City, Missouri. The district has 10,713 students grades Kindergarten through 12. The district has a 29.5% minority population, including 10.7% African American and 9.3% Hispanic, as well as 3.2% Asian. Twenty-nine point five percent of its students are on free or reduced lunch programs (Department, 2015). Park Hill is a high performing district and boasts high expectations for all district stakeholders.

The implementation of the 1:1 program has included widespread technological and instructional support. The district advertises that it is taking a measured, research based, and gradual approach to 1:1 implementation. This approach is consistent with Roger's (2003) assertion that innovations will be adopted more quickly when they can be gradually experimented with. The program began with 3 elementary schools' 5th grade classrooms piloting the program. The following year, the program was extended to all ten of the district's elementary schools' 5th grade classrooms, a total of 35 classrooms. The pilot teachers were provided three days of professional development and technology training before the school year and there was a dedicated staff of four instructional coaches that continued to provide support to the 35 5th grade teachers in the 1:1 classrooms through both professional development sessions and through guest teaching in the teachers' classrooms to model effective instruction integrating the student laptops.

The instructional coaches, referred to as Instructional Technology Facilitators (ITFs), created and delivered professional development sessions for the 1:1 teachers which focused on the use of the device as a tool that could enable teachers to create a more student-centered environment, and engage students in problem solving and critical thinking skills. The four stated goals of the district's program were to improve students' 21st Century skills, increase student engagement, improve students' technology skills and improve academic achievement (Kimbrel & Rizzo, 2013). Stanhope & Corn's research (2014) has shown that the use of Technology Facilitators (TFs) increases laptop use and teachers in schools with TFs have more positive attitudes towards technology integration than do teachers in schools without TFs. Extensive resources were dedicated to the infrastructure and technological support to ensure the laptops would function and the internet and various programs could be accessed without frequent

technological challenges. The district budgeted \$2,771,963 for the laptop initiative for all 5th grade classrooms, of which \$653,203 went to IT staffing and infrastructure capacity. \$625,000 went to professional development staffing and training costs (Springston, Kelly, & Klein, 2012). This means approximately half the cost went to the devices, while about one quarter went to technical support and another quarter went to professional development.

Extensive research was conducted to evaluate the effectiveness of the laptops at the conclusion of the first year of the initiative. Both qualitative and quantitative methods were employed to evaluate the effectiveness of the program in the district's classrooms. According to the district's own research findings comparing the pilot classrooms in three schools in the first year of implementation to the "traditional classrooms" in the district's other seven schools, teachers reported a significant shift in their roles as educators towards being more of a facilitator of student learning creating a classroom that involved more student decision making and problem solving (Kimbrel & Rizzo, 2013, p. 8). Student survey results supported the teachers' results, "students reported significantly higher levels of problem solving, communication, collaboration, creativity, needs being met, relevancy, and engagement in FLiP classrooms than non-FLiP classrooms" (Kimbrel & Rizzo, 2013). In addition, students in the pilot 1:1 classrooms showed greater improvements in the acquisition of technology skills than students in the non 1:1 classrooms. Academic measures such as standardized assessments showed statistically significant gains in Communication Arts and Math for the students in the 1:1 classrooms as compared to their peers in non 1:1 classrooms (Kimbrel & Rizzo, 2013). Based on these data, the district expanded the 1:1 initiative to all 5th grade classrooms the following school year. The district's data for the next school year appeared very similar in most categories, particularly in the areas of 21st Century skills and engagement, with reported continued increases in the shift

towards a more facilitative role for teachers and a continued improvement in student technology skills (Kimbrel & Rizzo, 2014).

It should be noted that the Park Hill School District's philosophy undergirding its 1:1 laptop initiative is to emphasize student laptops as a tool to help support a student-centered learning environment. According to the district's report on its 1:1 program (Kimbrel & Rizzo, 2013) "Although devices are extremely important in the FLiP program, the main focus is in on learning and understanding the core curriculum. Student-centered learning practices are utilized to increase relevancy, understanding of the content, and engagement" (p. 5). The district provided widespread supports and took a gradual, measured approach to laptop integration. The general literature has shown mixed results for the effectiveness of most 1:1 laptop programs, one potential reason for this may be that perhaps not all districts take such a comprehensive approach to 1:1 laptop initiatives. It seems plausible that many districts may provide far less professional development and technology support to teachers. The Park Hill School District was selected as a result of the comprehensive approach it took to 1:1 implementation. With the emphasis placed on professional development and technical support, as well as the philosophical commitment to the idea of creating a more student-centered learning environment, the district provides an opportunity to see what potential shifts in teacher practice could occur. The district's approach, due to its grounding in current research, provides a rich case study of the efficacy of 1:1 classrooms.

3.5 Interview Data Collection

The survey provided data in analyzing the extent to which teachers were genuinely or symbolically adopting the 1:1 laptop reform as measured by constructivist versus traditional

practice. In order to fully understand exactly how teachers were using the laptops in instruction, however, additional information was required. This information was best gathered by conducting follow up interviews with teachers. This approach is based on the assumption that while the survey can provide information on general orientations towards the use of laptops, richer information could be found through extensive interviews with teachers where more specific questions could be posed. The questions asked of the interviewees were focused on answering the three research questions:

- To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?
- What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?
- How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

Additional probing questions were asked under these broad questions. For a list of the interview questions, including probing questions, please refer to appendix B. These qualitative data serve to illuminate greater meaning from the quantitative data provided by the survey.

The interview subjects were selected based on the survey responses, with eight teachers interviewed, three from the constructivist end of the spectrum, three from the middle of the spectrum, and two from the traditional end of the spectrum. There were eight teachers interviewed in the study, all of whom went through district training on how to implement the laptops into instruction. All were willing participants in the interview.

The scored survey results formed the basis for the selection of subjects for the follow up interviews. Teachers from the extreme ends of the spectrum were selected as they provided the greatest opportunity to compare and contrast constructivist and traditionalist orientations. In maximizing the contrast, the interviews provided additional information to that gained from the survey instrument and the interviews provided additional insight into how the use of the laptops varies in teachers' classrooms on opposite ends of the spectrum. Additional interviews with teachers in the middle of the sample group were conducted in order to gain further insights into general aspects of teacher implementation of laptop devices in the district. The interviews provided greater insight into understanding how the laptops were being used and showed that this use reflects genuine adoption of the reform (as indicated by constructivist practice) or symbolic adoption (as indicated by traditional practice).

The interview questions were developed through the combination of two approaches to developing main interview questions; in part based on the experience and knowledge of the researcher and in part through the literature. These are common approaches utilized in qualitative interviews (Rubin & Rubin, 2011). The questions were broken into three main categories, focusing on: the extent to which 1:1 laptops are being used in a constructivist manner, the factors that are associated with the extent to which teachers apply traditional versus constructivist teaching practices, and how the laptops were used being used in the classroom by teachers applying constructivist practices versus those applying more traditional practices. In order to evaluate the extent to which the laptops are being used in a constructivist manner, a number of experience and behavior questions were asked, which were used to understand teachers' behaviors, actions and activities, as well as hypothetical questions which asked what teachers might do in a different situation (Merriam, 2009). One main question asked of all

interviewees was, “How does how you teach now differ from how you taught before you had the laptops in your classroom?” This question was utilized in order to ascertain how teachers are using the laptops, and how their classrooms look different now with laptops as opposed to what it looked before each student had a computing device. This gets to the core of how the laptops are being utilized.

A number of probing questions were used throughout the interviews to ensure that the information the researcher was receiving was clear and what was intended by the interviewee. Confirmation probes, used to restate something the interviewee said to ensure it is accurately interpreted, clarification probes, used to gather more detail based on an initial statement, and elaboration probes, used to gain more detail of a concept touched on by the interviewee, (Rubin & Rubin, 2011) were used frequently to gain additional information and probe further into the data.

Questions about the perception of the district provided professional development and perception of colleagues, as well as comfort with technology offer insight into some of the factors that may be associated with teachers’ instructional approaches to the use of laptops in the classroom. In order to offer insight into the question of “How are laptops used in the classrooms of teachers applying constructivist versus those applying traditional teaching practice”, a key question asked of all interview subjects was “How does this new approach alter the classroom experience for your students?” This question again gets to the core of what the experience is like for students and how the laptops have changed that experience.

By focusing on the essence of the shared experiences of the teachers implementing the program, we can understand what impact the laptops had on the instructional methods of

teachers on both ends of the spectrum, from the most constructivist to the most traditional. The process used involved conducting the initial two interviews (one constructivist and one traditional), and then coding the data to identify trends in the data and to analyze if the interview questions were effective in answering the research questions.

Location for the interviews was selected both as a matter of convenience for the interviewee and in order to ensure comfort and openness in the interview. All interviews were held in the teachers' classrooms. Extensive notes were taken during each of the interviews, with quotes significant to the scope of the study being scripted. Six of the interviews were audio recorded, two interviews (one traditional and one constructivist) were not recorded due to technical issues. Each participant was informed of the purpose of the study. The interviews were each approximately 30 minutes in duration. A total of eight interviews were conducted with teachers at various points on the spectrum in terms of the level of constructivist practice.

3.6 Interview Data Analysis

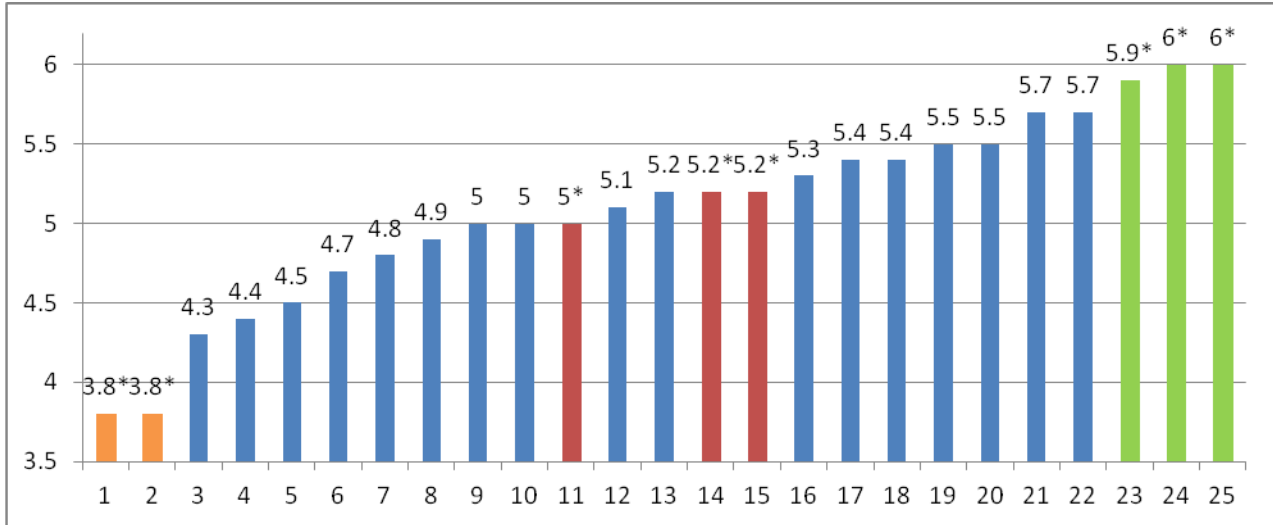
In order to analyze the interview data, the constant comparative method was employed. According to Merriam, this method (2009) “involves comparing one segment of data with another to determine similarities and differences. Data are grouped together on a similar dimension. The dimension is tentatively given a name; it then becomes a category” (p. 30). This method of analysis allows for the identification of patterns in the data. The process used involved conducting initial interviews and then transcribing and subsequently coding the data to identify trends in the data and to analyze if the interview questions were appropriate and could answer the research questions. The main questions were not altered for the subsequent interviews based on

this data analysis, the analysis did, however, provide appropriate follow-up questions to ensure the procurement of the data necessary to respond to the research questions. The subsequent 6 interviews were conducted and coded through the use of an application called OneNote which was utilized to audio-record the interviews and allowed for key quotes to be noted in the program while listening to the audio recording. The remaining interviews were coded and key data were labeled and categorized. This categorization was then used to analyze the entirety of the data and to draw conclusions and connections among all the data to gain a deep and rich understanding of experiences of teachers in the 1:1 environment.

3.7 Interview Sample Selection

Survey responses were solicited from all 35 5th grade teachers teaching in the Park Hill School District in 1:1 classrooms. Twenty-nine teachers responded and the results were scored to determine who was most constructivist and most traditional in the use of the laptops in instruction. Four of the respondents failed to answer all questions on the survey providing 25 complete survey responses. The mean composite score for all the questions on the survey for the 25 participants was 5.08, the median score was 5.18 and the standard deviation was .60. Figure 1 is a histogram depicting the distribution of scores among the 25 teachers with complete survey responses. The teachers who were interviewed have an asterisk next to their number.

Figure 1: Histogram of Teacher Survey Results Showing Frequency of Scores



* = interview subjects

The scored results were used to select the subjects for the follow up interviews. Teachers from the extreme ends of the spectrum were selected as they provided the greatest opportunity to compare and contrast constructivist and traditionalist orientations. In maximizing the contrast, the interviews help to provide additional insight into how the use of the laptops varies in teachers' classrooms on opposite ends of the spectrum. Interviews were conducted with the three teachers with the highest scores reflecting constructivist practice (6.0, 6.0, 5.91), and the two teachers with the scores most reflective of traditional practice (3.72, 3.81). Three additional interviews were completed with teachers in the middle of the spectrum, two teachers with scores of 5.18 (representing the median score), and one teacher with a score of 5.0. The interviews provided greater insight into understanding how the laptops are being used and to show that this

use reflects genuine adoption of the reform (as indicated by constructivist practice) or symbolic adoption (as indicated by traditional practice). All interviewees were asked the same basic questions with follow up questions used to probe deeper into their responses.

3.8 Coding Scheme for Analyzing Interview Data

In order to gain a deeper understanding of the data provided by the interviews, a coding system for the responses from the interviewees was developed. The method utilized is laid out in Rubin's & Rubin's work (2011):

1. Interviews were transcribed and summarized (a few interviews experienced technical issues and were not recorded, extensive notes were kept for these interviews. There were 3 pages of single spaced hand written notes taken during those interviews).
2. Excerpts were found, marked and defined (coded) that have relevant concepts, themes, or examples.
3. Interviews were examined and similar codes from various interviews were sorted and summarized.
4. The data were then sorted and the comparisons were made between the subgroups of teachers, the constructivist, traditional and the middle of the spectrum teachers.
5. Finally the different versions were weighed and the descriptions from the different groups integrated in order to form a comprehensive picture.

Table 3 provides a detailed description of the themes that emerged with an abstract description, coding guidelines, and sample responses for the number of times items fitting that description were mentioned by teachers on various points on the constructivist spectrum. The coding and table emphasize the presence of constructivist practice much more than traditional practice. The survey instrument sought to identify the level of constructivism as well. The reason constructivist data was emphasized is that the goal was to understand the level of genuine adoption of the reform. An absence of constructivist practice would equal the presence of traditional practice.

Table 3: Guide for Interview Coding

Category: code that was utilized in analyzing data	Abstract Description: a brief description of the key features that summarize that code	Coding Guidelines: the types of comments that were placed in this code	Sample Quotes from the interviews	Indicator: are these codes indicative of Constructivist or Traditional Practice?
Role of Teacher/ Teacher as Facilitator	The teacher’s role is that of facilitator of student learning as opposed to the keeper of all knowledge.	Teacher mentions their role as that of a facilitator or as that of a guide to students. Student-centered instruction, teaching based on what the student needs.	“I feel like much more of a facilitator because of the access to the technology” – Teacher 2 “I’ve given up being keeper of the knowledge” – Teacher 2	Constructivist
Formative Assessment	The teacher uses formative assessment in order to gain information and understanding into student knowledge and to adjust instruction/ provide feedback to the student.	Teacher mentions the use of formative assessment to: (a) adjust instruction, (b) provide feedback to students so they can adjust their own learning, or (c) group students according to current need.	“I get immediate feedback, they don’t do the same thing wrong over and over” – Teacher 1 “I get immediate feedback and can shift around more easily” – Teacher 3	Constructivist
Critical Thinking/ Problem Solving	Constructivist philosophy emphasizes the importance of activities that involve students in problem solving skills. Problem solving activities	Teacher makes a statement regarding the development of problem solving skills and/or the development of critical thinking.	“Our kids take their thinking to a much deeper level. I mean, they are critical thinkers and they constantly want to know more and are	Constructivist

	serve as a method of allowing for increased depth of learning and creating a connection.		constantly researching to find that out” – Teacher 1	
Individualized Instruction, Attention, and Focus	The teacher emphasizes the idea of individualizing instruction according to the students’ needs. Constructivist philosophy argues that the student must be the owner of his or her learning and teachers should facilitate knowledge acquisition for each student on an individual basis.	Teacher mentions the ability to: (a) shift instruction based on student needs, (b) focus attention on students who are struggling, (c) differentiate instruction, (d) give individual students more attention, (e) be intervention based in instruction.	“We go in different directions, I can’t anticipate where we will go” – Teacher 2 “Differentiation is so much easier (with the laptops)” - Teacher 3	Constructivist
Engagement	The laptops serve as a tool to increase student engagement.	Teacher mentions the role the laptops play in impacting student engagement in the content.	“The computer increases engagement” – Teacher 3 “There is more fun, more energy with the laptops” – Teacher 1	Constructivist
Laptops as Tools	Laptops are viewed as tools, for communication or cognitive purposes.	Note: within the category of Laptops as Tools, different codes were given dependent upon how they were viewed.		Constructivist or Traditional

	Management Tools	Teacher mentions management issues or concerns around laptops.	“Biggest challenge is making good choices” – Teacher 7	Not inherently Constructivist or Traditional
	Cognitive Tools	Teacher mentions the laptop as a cognitive device, or a tool that allows for the creation of a more student-centered classroom.	“(The key is) getting them to shift their brains, to open eyes to the professional aspect of the device, see it as more of a professional device than entertainment” – Teacher 2	Constructivist
	Ownership Tools	Laptops as tools that empower students to take ownership of their learning.	“I notice they take more ownership of their learning” – Teacher 2	Constructivist
	Communication	Teacher mentions the role of the laptops as communication devices.	“(laptops provide) instant communication with parents and kids” – Teacher 7	Not inherently Constructivist or Traditional

3.9 Summary of Methodology

In order to study the extent to which teachers are implementing constructivist teaching practice in 1:1 classroom environments, as well as factors that are associated with this practice, and how the laptops are being used, the Park Hill School District’s 1:1 laptop program was used

to examine 1:1 teacher practices. The 1:1 CLES survey was developed and administered to the district's 35 5th grade teachers who were teaching in 1:1 classrooms. Based on the results of that survey, eight interview subjects were selected and interviews conducted. The findings of the survey and interview data can be found in chapter 4.

CHAPTER 4

FINDINGS

4.1 Overview

The purpose of this exploratory study is to evaluate the extent to which teachers are genuinely or symbolically adopting the 1:1 laptop reform movement. Measuring the level of constructivist versus traditional teaching practice is not an indication of the effectiveness of instruction, but rather simply an indication of genuine or symbolic adoption to the reform. In order to determine how teachers are using the laptops in their instruction, the Constructivist Learning Environment Survey was modified to focus on the use of laptops. Specifically, the survey was adapted to evaluate the frequency with which teachers used the laptops in a constructivist manner. The survey was administered to 5th grade teachers in the Park Hill School District, all of whom taught in classrooms where each student was provided a laptop. The survey results identified teachers who were utilizing the laptops in the most constructivist manner and those who were more traditional in their instructional methodology with the laptops. Follow up interviews were conducted to gain further insight into how teachers on both ends and the middle of the constructivist-traditionalist spectrum were using the laptops. For the purposes of this study, the teachers were referred to as the constructivist teachers, middle of the spectrum, or traditional teachers. While there is a continuum of teaching practice, and teachers fluctuate on that continuum in their day to day practices, the purpose of the survey and of the subsequent interviews was to determine a general disposition of teachers in terms of the way they use technology in their instruction. The research questions the study sought to answer were:

1. To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?
2. What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?
3. How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

4.2.1 Extent of Constructivist vs. Traditional Practice

1. To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?

There was a clear difference in the types of responses between teachers identified by the survey as being on the ends of the constructivist spectrum. The constructivist teachers spoke with much higher frequency to using constructivist teaching methods in their classrooms. Traditional teachers spoke of a very limited number of ways they were using laptops that were consistent with constructivist practice. In all, three groupings were created (constructivist, middle of the spectrum, and traditional) as an exploratory exercise. In the absence of objective criteria, an inferential procedure was adopted in order to classify groups. This is intended to be exploratory and to provide a guidepost to look at actual teaching practice. Table 4 provides a frequency chart to help evaluate the extent to which teachers comments were consistent with either traditional or

constructivist items. A more detailed description of these indicators with coordinating research literature follows in the subsequent sections, along with an analysis of teacher responses around these themes. Also included in those sections is a summary, including quotes, and analysis of teacher responses from the interviews, and explanations from the existing literature of these constructivist and traditional teacher practice indicators.

Table 4: Frequency of Comments from Teachers Coded as Constructivist Indicators

Theme/ Person	Constructivist Teachers			Middle of the Spectrum Teachers			Traditional Teachers	
	Teacher 1	Teacher 2	Teacher 3	Teacher 4	Teacher 5	Teacher 6	Teacher 7	Teacher 8
Total Responses	8	8	8	5	5	6	2	1
Representative of Constructivist Practice								

Frequency of comments provides one way of evaluating the extent to which teachers are employing constructivist teaching practice in their 1:1 classrooms. No teacher is purely constructivist or traditional in his or her practice, but the frequency of teacher comments that are consistent with constructivist or traditional practice does provide insight. It is interesting to note that teachers who were identified as the most constructivist by the 1:1 CLES spoke with high

frequency in the interview of ways in which they used the laptops in a constructivist manner. Teachers from the middle of the spectrum spoke to constructivist uses, but with a slightly lower frequency than the constructivist teachers. In many areas coded as constructivist indicators the middle group was very similar to the constructivist group; the use of formative assessment, critical thinking and problem solving, individualized instruction, attention and focus, and engagement. The one indicator where there is a stark contrast is the role of the teacher as facilitator. The constructivist teachers mentioned this with three times the frequency versus the middle of spectrum teachers. The traditional teachers spoke of only one and two ways respectively in which they use the laptops in a constructivist manner. The type of constructivist statement that was made with the highest frequency by the constructivist teachers was speaking of the role of the teacher as that of a facilitator.

4.2.2 Teacher as Facilitator

Constructivist instruction consists of student-centered teaching practices with an emphasis on the role for the teacher as a guide where students are engaged in problem solving scenarios (Becker, 2000; Cuban, 2009). Instructional constructivists focus on the role of the students in learning and emphasize the connection of classroom instruction to the students' daily lives. According to Null (2004), teachers should consider what students' knowledge in the content area is and create interactive activities in their lesson planning and develop alternative forms of assessment based on that knowledge level. Traditional teacher practice, on the other hand, is teacher-centered, with an emphasis on information delivery which involves students passively receiving pre-determined content (McCarthy & Anderson, 2000).

The most consistent theme that emerged in the interviews with the constructivist teachers was an emphasis on viewing themselves as facilitators. This concept is central to the constructivist philosophy and is commonly referred to as seeing the role of the teacher as that of a guide on the side versus a sage on the stage. This philosophy was evident throughout the interviews with the three constructivist teachers. As Teacher 2 stated, “I feel like much more of a facilitator because of the access to the technology...I’ve given up being keeper of the knowledge”. She went on to emphasize the shift in the role away from the teacher being responsible for knowing everything and imparting that wisdom to the students, and explained how technology has even compelled this shift to take place, “You have to be ok with kids showing you things, how to do things with technology”.

Teacher 3 emphasized the shift as one that the students must undertake, with the laptops serving as a key, once they are guided to see it that way, to unlocking their power and control over their own learning:

(Before computers) We were bound inside of the classroom walls, whatever was happening inside of these walls of the classroom, that’s where the knowledge was. I was still the holder of knowledge. I would work with kids in the back of the classroom, I would work on specific learning targets with them, um we would work on skills that they’re missing. So I was still that keeper of knowledge. Now the kids see me as a facilitator almost. Um, so I think that might be a big paradigm shift for me, is the kids, as soon as you help them to realize the potential of what they have on these computers, and they really, truly, understand. Because I can tell the kids all day “Take control of your learning, take control of your learning”. They don’t really understand that, they still need that guidance. But as soon as it starts to click that “Hey, I can go figure this out on my

own”, that’s when this becomes a huge, a hugely powerful tool for them. Because I truly went from the keeper of all the knowledge to the facilitator in the classroom.

This statement represents the ideal that is held up by reformers for the potential for laptops as transformational tools that enable teachers to shift their roles and empower students to become active participants in their learning rather than passive recipients.

Teacher 1 summed up the difference in teaching since the introduction of laptops as follows:

For me, it (the role of the teacher) has shifted personally, I mean tremendously. I am very intervention based now, having the laptops. I don’t believe it’s that way across the board. It takes some intense training, and a comfort, how comfortable you are with it... but if you use it effectively, your children will gain, your students will gain so much more knowledge and so much more curiosity with things that are going on in the world.

That concept of students connecting their learning and individualizing their learning is at the heart of the constructivist teaching philosophy.

Another key aspect of constructivist instruction that was repeatedly cited by the constructivist teachers was the change in interaction between the teacher and students, specifically the ability to interact with students more frequently in a manner that supports the students constructing their own knowledge. The constructivist teachers were consistent in emphasizing that it enabled them to work more with students individually and in small groups to meet the needs of each individual rather than relying more heavily on large group instruction as they did before access to 1:1 laptops. Teacher 3 described it this way, “The increase in attention

that I give to them is much greater. And you wouldn't think that having the laptops, cause you think it's a barrier, but it's really not".

The traditional teachers had a different view of the role of laptops in instruction. They did not view the laptops as transformational to their role as a teacher. While they shared many of the same sentiments as the constructivist teachers in the role of laptops in some areas that will be discussed later, such as the role of laptops in: access to information, communication, and assessments, there was a clear and distinct difference in how they viewed the laptops in terms of transformation of instruction. This is a critical distinction that much previous research on 1:1 initiatives has failed to address. While many studies have looked at the quantity of use of the device, or at student achievement, there has been little research on how the laptops are used instructionally. The responses of the traditional teachers in this study varied greatly from those of constructivist teachers in terms of how the laptops have changed their instruction and their role.

The traditional teachers tended to view the laptops as tools that aided them in doing things they had already done. They emphasized efficiencies gained, and greater access to information, but did not see the laptops as tools that transformed their role. For example, Teacher 8 said the big difference in teaching after laptops versus before is:

A lot more, like work time, rather than instruction time. There are some things that I only teach if the kids aren't progressing. But I do things, they learn through the laptop. Things like on the internet and stuff, but I only step in if they aren't progressing. So that's new and awesome, cause I hate teaching grammar and the laptop is teaching grammar for me... It (the laptop initiative) adds more preparation...new ways of just teaching the same things we've been teaching.

Although instruction looks different with the introduction of laptops in this teacher's classroom, it is still traditional in nature, the mode of instruction has slightly changed, but it is still primarily direct instruction. This illuminates a flaw that persists in much existing research. When research examines only evidence of increases in student learning (such as through the use of test scores) as a result of the laptop initiative, it misses a critical aspect of what is happening in terms of the use of instructional methodology. Furthermore, if research only looks at the quantity of use of laptops as representing a commitment to the laptop reform, it misses a key component in understanding whether or not teachers are genuinely adopting the reform. It is quite possible to use the laptops extensively, yet use them in a way that reinforces traditional instructional practice.

Teacher 7, another traditional teacher, stated that little had changed since the introduction of laptops for each student, arguing that if the laptops were taken away, "there would not be a drastic change, there are some things we do digitally that we would go back to paper and pencil". He emphasized that the laptops made it easier to collaborate on a finished digital product, and enabled an increase in shared knowledge between students. He added that the key change with the laptops is that the information piece has changed, emphasizing that "The laptop is a tool, it is not the instruction. People get concerned and overwhelmed with the technology, it cannot replace the instruction itself... it provides a better way to get to the end, it is more efficient".

There is a clear distinction in the way the laptops were viewed by the constructivist teachers and the traditional teachers. While both groups viewed the laptops as tools, constructivist teachers saw them as a transformational tool that enabled a shift in the role of the teacher to that of facilitator. Traditional teachers viewed laptops primarily as a tool that enabled greater efficiency in traditional tasks and served to reinforce traditional practice.

4.2.3 Impact on Student-centered Learning (Formative Assessment, Individual Attention, Critical Thinking, Problem Solving, Engagement)

There were a number of consistent themes that emerged through the discussions with constructivist teachers. The role of the teacher as a facilitator was one theme which has already been addressed. The other major themes were the power of the laptops in: enabling teachers to more effectively administer and use information from formative assessments in order to guide instruction; allowing teachers to provide more individualized instruction; attention and focus; enhancing critical thinking and problem solving skills in students; supporting collaboration amongst students; and, an increase in student engagement. Each of these themes represents a key component of constructivist teaching.

It is interesting to note that the middle of the spectrum teachers were very similar to the constructivist teachers in the frequency of comments in all these areas. However, there was a stark contrast in the frequency of comments from the traditional teachers. This distribution of frequency of comments could be a reflection of the types of constructivist practices of the teachers interviewed. The most constructivist teachers' instruction is undergirded by a core philosophy that they are facilitators of learning rather than keepers of knowledge. This belief comes through throughout their discussions of instruction in their classroom. The middle of the spectrum teachers are implementing the laptops in their classroom in the constructivist ways mentioned above, but do not fully identify themselves and all they do in the classroom through that lens of teacher as facilitator. The traditional teachers, on the other hand, continue to practice traditional instructional methods, using the laptops in a manner that is still largely teacher-centered. A brief discussion of each theme is included here.

Formative assessments

Constructivist teaching is centered on the idea that instruction must be focused on the individual. Each student's background knowledge and experiences should inform instruction and teachers should strive to connect learning activities to each student (Null, 2004). In order to aid teachers in this process, it is essential that they know what students' knowledge levels are, and be able to regularly assess progress. This is why formative assessments are so critical to constructivist instruction. As Teacher 1 put it, "Before laptops, it was a lot of whole group instruction. Here's a worksheet, you do problems 1-20, and then I'll get it back. My problem with that is, if a kid gets something wrong, and they are doing it wrong 20 times in a row, they are developing that habit. So, having a digital portion, it is automatic feedback". This automatic feedback empowers the student to quickly assess where misunderstandings are occurring and enables him or her to increase ownership in learning. This feedback also makes it possible for the instructor to inform instruction in a way that is tailored to the needs of each individual student. This then ties into the next theme, individualization.

Critical Thinking and Problem Solving Skills

Becker (2000) and Cuban (2009) emphasized the importance of activities that involve students in problem solving skills in constructivist instruction. Problem solving activities serve as a method of allowing for increased depth of learning and creating a connection. Duffy and Jonassen (1992) also argued that the constructivist approach is better than the traditional in developing skills that business seeks in terms of how information is used to solve real world problems. An emphasis on critical thinking and problem solving emerged in each of the

interviews with the constructivist teachers. As Teacher 1 put it, “Our kids take their thinking to a much deeper level. I mean, they are critical thinkers and they constantly want to know more and are constantly researching to find that out”. Teacher 2 said of the laptops, “It is not just getting on websites, students must do something productive... and there is lots of problem solving”. Teacher 3 mentioned the role of laptops in facilitating not only problem solving, but collaboration as well, “Kids work together on the computer, problem solving with other kids”.

The middle of the spectrum teachers also noted the impact that the laptops had on their instruction. Teacher 6 stated, “Thinking differently about what students are producing reformulated how I approach the instructional process... it is a deeper level of learning (for the students)”. The traditional teachers interviewed did not make any mention of problem solving or critical thinking.

Individualized Instruction, Attention and Focus

The idea of being intervention based, and able to adjust instruction based on the needs of the individual was a key benefit cited by all of the constructivist teachers when talking about the impact of the laptops. Constructivist philosophy argues that the student must be the owner of his or her learning and teachers should facilitate knowledge acquisition for each student on an individual basis. Formative assessment plays a key role in this individualized instruction. As Teacher 3 put it:

The kids are able to get that feedback for themselves, and they can see, it'll show them which area they are missing in each of those lessons... I can shift around the groups more easily, rather than waiting for a big unit assessment or something like that. The computer

is telling me, based on my report... I can put the kids into a group that they are all missing that skill. So I can pull those kids back really quickly and we can go over individually to see what exactly it is that they are missing.

This individualization can be very challenging, but laptops can serve as a tool to support the individualism of each student. This requires a different instructional approach which is new to many teachers. This approach is student-centered and requires tremendous flexibility on the part of the teacher. Teacher 2 described it as, “We go in different directions, I can’t anticipate where we will go... I notice they take more ownership of their learning”.

Engagement

Engagement is a commonly cited benefit of 1:1 laptop initiatives, with the argument being that access to technology greatly increases engagement. With increased engagement, students are able to become more active participants in the learning process. Increased student engagement has been a consistent finding of research on 1:1 (Fleischer, 2012; Holcomb, 2009; Maninger & Holden, 2009; Mouza, 2008; Penuel, 2006; D. L. Silvernail, & Lane, D. M., 2004). Two of the constructivist teachers mentioned the role of laptops in increasing engagement, Teacher 3 stated, “the computer was such a valuable resource... the computer makes that engagement piece soar”. Increased engagement with the laptops did not come up in any of the discussions with traditional teachers. However, Teacher 5, a middle of the spectrum teacher, said, “(the work they have) has meaning, they have ownership (of it)”. The middle of the spectrum teachers also emphasized engagement.

Summary of the Themes of Student-centered and Teacher Directed Learning

There is a stark contrast in the interviews held with the constructivist and the traditional teachers on these constructivist and traditional themes. All interviewees were asked the same basic questions, with some variance in follow up questions. For a list of the basic interview questions, please refer to appendix B. The interviews were all coded, labeled and categorized. The categories for responses specific to items that represented constructivist use of the laptops were: Formative assessments, critical thinking and problem solving, collaboration, individualized attention, and engagement, role of teacher/ teacher as facilitator. The categories for responses specific to items that represented traditional practice being teacher-centered and content-delivery focused.

4.3.1 Factors Associated with the Extent of Constructivist vs. Traditional Practice

2. What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?

A few findings emerged from the research as to what factors are associated with the extent to which teacher practice reflected constructivist or traditional practice. The 1:1 CLES data provided a number of trends in terms of demographic influences on the survey score. The data indicated that factors included: gender, age, years of teaching experience, and years of experience teaching in a 1:1 environment. The interviews found one major trend that emerged amongst constructivist teachers, and was not mentioned at all by traditional teachers.

Professional collaboration was cited by all the constructivist teachers as an important aspect of

preparing for classroom instruction and was integral to their job. A more thorough discussion of these factors follows.

4.3.2 Demographic Factors

There are a handful of interesting trends that appear in the survey data regarding potential factors that may be associated with the extent to which teachers apply constructivist versus traditional teaching practices in 1:1 classrooms. There are some intriguing potential differences in the scores of women and men, and between teachers with two years experience teaching in a 1:1 environment as opposed to teachers in their first year. A summary of the key demographic information is provided in Table 3 below. A discussion of key differences follows the table. Please note that although 29 respondents completed the survey questions for the purposes of scoring, only 23 completed the demographic information included below, even fewer provided their names as willing participants for the follow up interviews.

Table 5: Distribution of 1:1 CLES Scores and Number of Respondents by Demographic Group

Demographic Group	Score on the 1:1 CLES	Frequency (# of Respondents by Group)
Gender		
Female	5.09	19
Male	4.82	4
Age		
Under 25	5.36	1
26-35	5.14	12
36-45	4.85	5
46-55	4.96	5
Years of Teaching Experience		
Less than 5	5.75	3
6 to 10	4.86	12
11 to 15	5.48	3
16 to 20	4.54	3
21 to 25	5	1
26 to 30	5.45	1
Education Level		
Bachelors	4.81	2
Masters	5.15	17
Ed Specialist	4.75	3
Doctorate	4.72	1
Years of Experience Teaching in a 1:1 Classroom		
2 years	5.32	4
1 year	5.03	19

The average score for females on the 1:1 CLES was significantly higher than males. Females scored on average .27 higher than males. Age also appears to correlate with the score as teachers under 35 scored higher than teachers above age 35. Teachers aged 35 and younger

averaged a score of 5.16, while teachers 36 and older averaged 4.91. The scores by years of teaching experience fluctuate within the various 5 year windows. One intriguing result regarding the years of teaching experience is that teachers with 5 years or less teaching experience averaged 5.75. It is interesting, but it should be noted that there are only three teachers scored in this group. One more finding is that teachers who have taught with the laptops for 2 years had a much higher average (5.32) than did teachers in their first year of using laptops (5.03).

All of these results provide insight into potential factors that are associate with the ways which teachers utilize laptops in instruction. While there are some limitations in terms of the sample size, the findings provide opportunities for future research around the impact of these factors on the way teachers teach. There are potential studies that would prove very informative, such as; the potential transformation of practice over time with the higher average for teachers with more experience, or the impact of teacher preparation programs influencing the constructivist practice of new teachers, or even potential gender influences. The interviews provided insight into other factors that may be associated with the extent to which the laptops are being used in a constructivist manner.

4.3.3 Professional Collaboration

One interesting and unexpected theme that was consistent among all the constructivist teachers was the role of professional collaboration in the success of 1:1 implementation. The significance of professional collaboration was not mentioned by the traditional teachers, but the constructivist teachers all cited the importance of working with a team in the development of

curriculum for the 1:1 classroom. Teacher 1 described the role of professional collaboration as follows:

I think at first, (colleagues) were like, “oh, your gonna sit at your desk and not do anything”. And then, we needed a lot of help, I mean, last year, transferring things and getting ideas, and they saw our team meet every day last year, every single day. And every single day this year to work out little issues... and we just pull together. We all joke that we need doors that lead to each other because we are in each others’ rooms constantly. You have to have that open communication and collaboration with your team or it’s not going to work, it’s really not.

Teacher 2 summed it up by saying, “Teacher attitude is the most important thing, the reason it has been successful is we worked together as a grade level team. Teacher collaboration is so critical to success. Kids felt that sense of community”.

4.4 How are the Laptops Used in Constructivist vs. Traditional Classrooms (Laptops as Tools)

3. How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

If 1:1 laptop initiatives are to bring about transformative change in education, then it is going to be through the use of the laptops as cognitive tools that enable teachers to create a student-centered learning environment (Becker, 2000; Christensen, et al., 2008; Dunleavy, et al., 2007; Weston & Bain, 2010). The challenge with this transformation is that it requires a paradigm shift for educators where they see the laptops as tools that aid in shifting the role of the

teacher from the traditional keeper of knowledge to a facilitator of student learning driven by the background knowledge, interests, and learning of each individual pupil.

Every teacher interviewed discussed the importance of the access to information provided by the laptops. Teachers emphasized the impact for students on having so much access to information. The view differed, however, between traditionalist teachers and constructivist teachers in how they used and felt about this access to information.

Traditional teachers emphasized the ease of communication, particularly in regards to contact with parents. Both types of teachers stressed the instant communication with parents and students, and the ability to constantly share student work with parents. Teacher 7 stressed the challenge of managing the laptop devices, “The biggest challenge (with the laptops) is making good choices. (The students) don’t come as digital citizens. Some kids have a hard time managing the distractions of internet access... (it is an issue) not being able to see what they are doing”.

The view among the constructivist teachers differed. The constructivist teachers downplayed the challenges of managing the laptops and emphasized viewing the laptop as a cognitive tool. “Students do misuse the device, but that happened before too... (The key is) getting them to shift their brains, to open eyes to the professional aspect of the device, see it as more of a professional device than entertainment” (Teacher 2). Teacher 1 said, “I’m sure there are teachers that use it as a gaming tool, or “here’s a project” and use it as a one project thing. We don’t do that, it is a tool, it’s just like a textbook, scissors, glue...it depends how the teacher is using it”. The belief in the laptop as a communication tool is consistent among the traditional and constructivist teachers. Where the groups differ is in how they view the tool and the

challenges of managing that tool. Table 5 identifies the frequency of comments from the interviewees in the respective categories. At the bottom of the chart is a description of the themes as indicators of constructivist or traditional practice.

Table 6: Frequency of Comments from Teachers Coded as Indicators of the Laptops as Tools (Management, Cognitive or Communication Tools)

Theme/ Person	Constructivist Teachers			Middle of the Spectrum Teachers			Traditional Teachers	
	Teacher 1	Teacher 2	Teacher 3	Teacher 4	Teacher 5	Teacher 6	Teacher 7	Teacher 8
Laptops as Tools that Create Classroom Management Challenges*		1		1		1	2	1
Laptops as Cognitive Tools that Enable a more Student-centered Classroom#	1	2	1	1	1	1		
Laptops as Tools that Increase the Sense of Ownership for Students of their own Learning#		1			2	1		1
Laptops as Communication Tools+	1					1	2	1

*- While not inherently an indicator of traditional practice, an emphasis on concerns regarding classroom management issues associated with laptops indicates a potential negative orientation towards the device.

#- Laptops as cognitive tools enabling a more student-centered classroom or as tools enabling a greater sense of ownership for students over their own learning are indicators of constructivist orientation.

+ - Using the laptops as tools to aid in communication with students or parents is not inherently associated with constructivist or traditional practice.

4.5 Responses of Teachers from the Middle of the Constructivist Spectrum

The primary purpose of the research conducted was to focus on the extent to which teachers are genuinely or symbolically adopting 1:1 reforms as measured by the level of constructivist or traditional practice reflected in their teaching. Much of the data analysis in this paper, therefore, is centered on the disparities between the two extreme ends of the spectrum. There are additional insights to be drawn from the teachers on the middle of the spectrum. For the Park Hill School District, these teachers were those that scored around the 5.0 range on the 6.0 scale of the 1:1 CLES. This would indicate that these teachers lean towards the constructivist end of the spectrum, but were selected as representative of teachers across the district as a whole (as being near average in terms of both the mean and median scores of all teachers in the district). The data confirm that these teachers lean more towards the responses of the constructivist teachers than those of the teachers more at the traditional end of the spectrum. The frequency chart (Table 6, p. 85) reflects this, but it is interesting to note that there is a similar

distribution across the various coding categories for constructivist indicators, and that the middle of the spectrum teachers consistently have slightly lower frequency of comments than the constructivist group on the issues coded as constructivist indicators (5.33 for the middle of spectrum teachers, 8.0 for constructivist teachers, and 1.5 for traditional teachers). Of note from the frequency chart is that the biggest differentiator appears to be the lack of persistence from middle of the spectrum teachers in comments regarding their role as being that of a facilitator. Each middle of the spectrum teacher mentioned their role in a constructivist manner one time, while constructivist teachers mentioned it on average three times. Comments in the other constructivist coding categories were relatively consistent among the two groups. With a small sample size, one should be careful in generalizing too much from the data, but the finding is intriguing and merits further study.

The transcription and coding of the interviews show similar ideas and concepts being mentioned, and many quotes from the middle of spectrum educators mirror those of the constructivists. The difference comes in the consistency and enthusiasm for constructivist methodologies. Teacher 4, for example, utilizes flipped methodology where students watch lectures she creates at home, and come into class to complete homework, “I’m more of a coach, I would rather they have practice time with me coaching... and more access to me one on one.” Teacher 4 also emphasized that computers enabled for richer, quicker formative assessments, “they can see instantly, I can see instantly... if 35% of the class doesn’t get this, I need to re-teach it.” Teacher 5 mentions the benefit of increased engagement and ownership, “they have work, they have meaning... that ownership of that computer, and that, it’s up to me to learn.” Teacher 5 also spoke to a shifting role for her as a teacher in a 1:1 classroom, “being able to say – I don’t know the answer to that, being able to let go of that control is valuable.” Teacher 6 also

speaks to that shifting role, saying the laptops have “reformulated how I approach the instructional process.” Teacher 6 also mentioned that the computers led to “a deeper level of learning... a lot more problem solving.” While these sentiments echo those of the teachers at the constructivist end of the spectrum, there were in total fewer comments of this nature. This group of teachers did emphasize collaboration and utilizing the laptops as a tool to support constructivist instruction.

4.6 Summary of Findings

There were a number of findings discovered through the data analysis of both the survey results and the interview data. A summary of key findings for each of the three research questions follows below:

1. To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?

The analysis of the interview data shows a clear difference in instructional approach between the teachers identified by the 1:1 CLES as constructivist and the teachers identified as traditional. The constructivist teachers, as identified by the survey, clearly showed an approach to teaching that was consistent with constructivist practice. Constructivist teachers viewed themselves as facilitators of student learning as opposed to keepers of knowledge. Their practice was consistent with the constructivist approaches of using formative assessments, emphasizing critical thinking and problem solving, providing individualized instruction, and focusing on high

levels of student engagement. Traditional teachers mentioned these approaches only once or twice and emphasized that the computers had not altered their instruction.

2. What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?

Factors such as age, gender, years of experience, and years of 1:1 teaching experience all were associated with the extent to which teachers utilized constructivist teaching practices.

While the sample size is limited, the patterns do provide some opportunities to future research.

The interviews found that constructivist teachers emphasized the importance of collaborating with other 1:1 teachers on how they are using the laptops in their instruction. The traditional teachers did not mention that collaboration was an important part of their class preparation.

3. How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

Trends emerged in the data as to how constructivist teachers used the laptops in their instruction versus how traditional teachers used them. The constructivist teachers clearly see the laptops as a tool that provides them with an opportunity to shift their role in the classroom to that of a facilitator or coach rather than a keeper of knowledge. The traditional teachers utilize the technology as more of a replacement tool for activities they have previously engaged in. The middle of the spectrum teachers use the laptops in many constructivist ways, but place less emphasis on the shifting role of their instruction.

The 1:1 CLES identified the extent to which teachers were constructivist in their teaching practice. Follow up interviews with eight teachers, three constructivist, three middle of the spectrum, and two traditional teachers provided additional data that showed differences in instruction between these groups of teachers. The interviews also were consistent with the survey in identifying the extent of constructivism adhered to by these groups of teachers. Based on the data from both the survey and the interviews, the teachers at the constructivist end of the spectrum were identified as genuinely adopting the 1:1 laptop reform. Those labeled as “traditional” were found to be symbolically adopting; using the laptops while maintaining far less constructivist teaching methods. In addition, teachers were identified as being “middle of the spectrum”. They were found to be implementing a number of key aspects constructivist practice, but without a clear vision of serving as a facilitator of knowledge as compared to the constructivist teachers. Various demographic factors seemed to relate to constructivist practice, as did an emphasis on collaboration. While all teachers were using the laptops as tools with their students, the way they were used differed between the groups, with traditional teachers seeing them largely as tools that are used for communication, with a focus on problems generated by the laptops. Constructivist teachers viewed the laptops as cognitive tools that allowed the role of the classroom teacher to shift. The implications of these findings, along with potential future research topics are discussed in chapter 5.

CHAPTER 5

DISCUSSION

5.1 Introduction

This exploratory study examines the extent to which teachers are genuinely or symbolically adopting 1:1 laptop initiatives. There is a long history of education reforms consuming tremendous resources while having little to no impact on instruction in the classroom (Sarason, 1995). The question of the effectiveness of constructivist teaching as opposed to traditional teaching is a matter for other studies. The extent to which teachers use laptops in a constructivist manner is examined in this exploratory study as a way of measuring fidelity to the reform, with constructivist practice equating to genuine adoption of the reform, as previous educational technology innovations have resulted in little change to teaching practice. This is particularly true of reforms driven by new technology, which often further enforce traditional teaching methods rather than driving genuine change (Cuban, 2006). 1:1 laptop initiatives are seen as a way to transform the classroom from a traditional, teacher directed model, to a constructivist student-centered model (Hennessy, et al, 1993). If 1:1 laptop initiatives are to bring about transformative change in education, then it is going to be through the use of the laptops as cognitive tools that enable teachers to create a student-centered learning environment (Becker, 2000; Christensen, et al., 2008; Dunleavy, et al., 2007; Weston & Bain, 2010). The challenge with this transformation is that it requires a paradigm shift for educators where they see the laptops as tools that aid in shifting the role of the teacher from the traditional keeper of knowledge to a facilitator of student learning driven by the background knowledge, interests, and learning of each individual pupil.

In order to evaluate whether the 1:1 laptop reform effort truly impacts instruction, a survey instrument, the 1:1 CLES, was used to determine teacher practices regarding the use of laptops in instruction and to ascertain how constructivist or traditionalist those teacher practices were. Follow up interviews were then conducted with teachers throughout the spectrum in order to gain deeper insight into how instruction varied in the traditional and constructivist teachers' classrooms. This study is exploratory in nature, and is intended to provide a guidepost for future research to look at actual teaching practice. The 1:1 CLES needs refinement and needs to be applied to a larger sample size. The measurement properties of the 1:1 CLES need further examination. This study does provide a valuable tool that with further development could be applied to examine teacher practice in 1:1 environments.

Genuine adoption would be signified by practice consistent with student-centered instruction. Teachers who are genuinely adopting the reform emphasized the role of the teacher as that of a facilitator of knowledge acquisition, and saw the laptops as a tool to help them individualize instruction, often through the use of formative assessments, stress critical thinking and problem solving skills, and emphasize collaboration. Teachers who did not stress the individualization of curriculum and student-centered strategies were seen as adopting the initiative symbolically, regardless of how much they used the devices.

5.2 Summary of Findings

Clear patterns emerged in the data analysis. The constructivist teachers consistently emphasized to a much higher degree than the traditional teachers the characteristics associated with constructivist instruction. The area of greatest distinction between constructivist, middle of

the spectrum, and traditional teachers was the view of teachers' roles shifting to that of a facilitator rather than the keeper of knowledge. This idea of teacher as facilitator is seen as a key indicator of constructivist practice (Becker, 2000; Cuban, 2009). Of note is the finding that this strong connection to the philosophy of teacher as facilitator is unique to the constructivist teachers. While middle of the spectrum teachers spoke with similar frequency to the constructivist teachers in other indicators of constructivist practice, the identification of the role of teachers as facilitators was three times more frequent in discussions with constructivist teachers than the middle of spectrum teachers. Christensen, et al. (2008), expected a new reality in the classroom to take form, a student-centric environment that would require teachers to serve as learning coaches. The constructivist teachers in this study, with their belief in the role of teachers as facilitators, appear to be adopting the reform in line with the aforementioned ideal set out by Christensen, et al. (2008). The educational philosophy of these constructivist teachers is undergirded by a belief in the role of teacher as facilitator. While middle of the spectrum teachers use the laptops as constructivist tools, they do not seem to emphasize this view of teacher as facilitator. Traditional teachers placed greater significance on the laptops as tools to increase communication and efficiencies rather than viewing them as transformational tools.

There was also an emphasis on other key indicators of constructivist practice: the development of problem solving and critical thinking skills, the use of formative assessments to drive instruction, increases in collaboration and student engagement, and the increased opportunities to provide individual attention and individualized instruction. Both constructivist and middle of the spectrum teachers indicated with similar frequency that their instruction included practices of this nature. Traditional teachers, on the other hand, spoke infrequently of

using laptops in a constructivist manner. Traditional teachers maintained what Silvernail and Pinkham (2011) described as a teacher-centered and controlled learning environment.

These differences in the implementation of the laptops represent a differentiation in the adoption of the laptop reform. Meyer and Rowan (1977) spoke of organizations adopting new practices due to isomorphic pressures. In the case of 1:1 adoption, districts may be pressured into implementation due more to political pressure than genuine desire for reform. This could impact the manner in which reforms are adopted and subsequent professional development and support are provided to teachers. Silvernail and Pinkam (2011), Inan and Lowther (2010), and Cuban (2013), all speak to the importance of professional development to support teacher practice in the implementation of educational technology. While the district level approach and level of fidelity to the reform will impact the professional development and support provided to teachers, it is at the classroom level that the level of adoption is ultimately determined. Rogers (2003) discussed five stages of the innovation-decision process. A district's professional development program will impact the knowledge and persuasion stages, along with the existing will and skill of the teacher (Agyei & Voogt, 2011). Since teachers cannot choose whether or not laptops are in their classrooms, they cannot outright reject the innovation. At the next two stages of Rogers' (2003) innovation-decision process, the decision and implementation stage, teachers will begin to put their knowledge and skills into practice. Teachers may genuinely adopt, as signified by constructivist practice, or symbolically adopt, as characterized by traditional practice, the 1:1 reform. Teachers who are genuinely adopting the reform are using the devices as tools to enable them to serve as facilitators of student learning. They are using the laptops to implement constructivist teaching practice. Teachers using the devices in a way consistent with symbolic adoption are using the devices as replacement tools for instructional practices they previously

used, but are maintaining a traditional teaching role. This type of use of technology by teachers has been a common theme in technology based educational reform efforts (Cuban, 2006, 2009). While they are using the laptops extensively, instructional practices have not changed, just the mode of delivery has. At the last stage, teachers will then seek reinforcement and will continue with their initial decision to genuinely or symbolically adopt, or will reverse course (Rogers, 2003).

Several important findings emerged regarding factors that are associated with the extent of constructivist practice. A number of demographic factors correlated to higher levels of constructivist practice according to the 1:1 CLES data. Females were much more likely to be constructivist than males, as were teachers aged 35 and under as compared to teachers older than 35. The gender finding may well be a result of a small sample size, there is really no precedent in the literature for this finding. Silvernail and Pinkham (2011) found that teachers under aged 40 used laptops in instruction slightly more frequently than teachers over 40, and that teachers with 10 years or less of experience used laptops slightly more than teachers with more than 10 years. Mueller, et al. (2008), found, however, that years of experience did not have a statistically significant impact on technology integration. Koh, Chai, & Tsai (2014) found that there was small correlation that younger teachers and teachers newer to the profession were more constructivist in their technology integration. A possible explanation for this is the greater emphasis being placed in recent years in teacher preparation programs on technology integration. Hughes (2013) found that pre-service teachers who were recent graduates held moderate constructivist teaching philosophy and moderate digital technology self-efficacy, as well as positive attitudes towards learning technologies. With a small sample size, it is difficult to generalize that this is the case, but it seems plausible that pre-service teacher preparation

programs are placing greater emphasis on constructivist technology integration and recent graduates are more likely to be constructivist in 1:1 environments.

Teachers in their second year of 1:1 implementation were more constructivist than teachers in their first year. This indicates that the additional experience may be tied to more student-centered use of the device. Again, with such a small sample size, it is very difficult to generalize, but this finding is an intriguing option for future research. Other plausible reasons for this difference could include the additional professional development provided over an additional year of implementation. Also, it is possible that teachers who were more enthusiastic about the laptops were selected for the initial pilot group and had a higher predisposition towards constructivist use of the devices. A key finding from the interviews was that there is a greater likelihood of higher degrees of constructivism and collaboration amongst 1:1 teachers. This is consistent with the findings of Wastiau, et al. (2013), that teacher collaboration is a key component of effective professional development. The constructivist use of laptops emphasizes the collaboration amongst students and between teachers and students (Fleischer, 2012), so it fits that this would be a common practice amongst the most constructivist teachers.

Teachers on the traditional and constructivist ends of the spectrum differed in how they used the laptops in their classroom. All teachers spoke of the increased communication with students and parents as a result of increased computer access. Whereas traditional teachers saw that as the primary use of the computer, constructivist teachers viewed the laptops as cognitive tools that enabled them to alter the way their classroom operated by allowing students to drive much more of their learning. According to the research laptops can be cognitive tools that enable teachers to create a student-centered learning environment (Christensen, et al., 2008; Dunleavy, et al., 2007; Weston & Bain, 2010). The constructivist teachers downplayed the challenges of

making sure students used the laptops appropriately and spoke to the importance of viewing the laptops as tools that enable teachers to assume the role of facilitator. Traditional teachers, however, spoke to the efficiencies gained in communication, but raised issues with the challenges of managing appropriate use in the classroom.

5.3 Contributions to Literature

The level of constructivist versus traditional practice of teachers is a critical distinction in evaluating of the level of adoption of 1:1 laptop initiatives. Previous research has focused primarily on student outcomes or the quantity of use, and has not sought to understand the instructional philosophy of teachers in 1:1 classrooms (Downes & Bishop, 2015). If the role of laptops in reforming teaching and learning is to be fully understood, the instructional practice of teachers with access to 1:1 laptops must be accounted for.

Research that does not account for teaching philosophy and practice, and the level of adoption of the reform, cannot provide a complete picture of what is happening in 1:1 classrooms. Existing studies on the impact of the reform on student assessment results are varied (Fleischer, 2012; D. L. Silvernail & Pinkham, 2011; Weston & Bain, 2010). There seems to be no consistency or predictability of what impact 1:1 laptop initiatives may have on student achievement. This may in part be associated with how inconsistent the initiatives are in terms of how they are implemented, and the varying levels of adoption. It may well be as a result of student achievement being tied to test scores that may be largely impervious to the difference in constructivist and traditional instruction. The will and skill of teachers, professional development, technical and instructional support, teacher background, student background, and

other factors will be associated with how the reform is adopted and ultimately the success of the laptops in shifting instructional practice. The results of this study, and the instrument developed here offer a new method for explaining the varied results and for evaluating the association of the aforementioned factors. The survey also allows for a new method for the evaluation of professional development programs and other factors longitudinally and across districts, states, and regions.

5.4 Contributions to Practice

The Park Hill School District has provided extensive and continued professional development and technical and instructional support to teachers and it is reflected in the survey results showing that most teachers are using the devices in a constructivist manner. The fact that a district which heavily emphasizes the professional development component of 1:1 laptop implementation has a staff that is constructivist in the use of those laptops is consistent with expectations that would be drawn from existing literature. The will and skill, or attitudes and competencies of teachers are critical to the way technology is used in the classroom (Agyei & Voogt, 2011; Petko, 2012). Ertmer , et al. found that professional development and the development of teacher will and skill are the key to effective technology implementation (2012). The district has evidence in the early years of implementation that the laptops have had a positive impact on student achievement as well. These supports appear to be an important determinant in the ultimate success of the initiative. Many surrounding districts have implemented 1:1 programs with far less emphasis on professional development and continued instructional support. Though data was not collected from those districts, it seems likely that teachers would be more traditional

in those districts where the emphasis was placed more on having the device rather than how the device was used.

An important implication for practice from this study is that it is possible to have a staff of teachers that are highly constructivist in their teaching practice. This provides evidence of the potential for genuine adoption of the reform, and gives insight into potential determinants of that genuine adoption. The Park Hill School District has a staff of teachers, at least at the 5th grade level according to the data collected in this study, that use 1:1 laptops in a constructivist manner. The district has adopted a comprehensive professional development plan that focuses on how the laptops are used and shifting practice towards a student-centered environment. While the scale of the study is small, the results are convincing that large numbers of teachers are genuinely adopting the reform in the Park Hill School District. Other districts could benefit by looking at the comprehensive professional development methods used by successful districts. The instrument developed to determine that level of success was further supported by the follow up interviews conducted as part of this study. The instrument enables researchers to evaluate various components of 1:1 programs and allows for comparisons across districts and for longitudinal studies of changing teacher practice. Further research implications are discussed in section 5.6.

5.5 Limitations of this Study

The scale of this study was modest and there are inherent limitations due to that limited scale. The scope of the study was also limited, and future studies could benefit from the collection of data that is not dependent on teacher self-reporting. In order to maintain the integrity of the intended target of this research study, the sample group was limited to a single

district. The sample group size was further limited by the gradual approach to implementation this district was utilizing, which allowed for only one grade level to be studied, thus limiting the number of teachers surveyed to 35. The voluntary nature of participation in the survey further limited the sample size, though a high percentage of teachers were willing to respond and completed the survey. Eight follow up interviews were conducted as this allowed for a representative sample of three distinct points on the 1:1 CLES spectrum.

A further limitation is that the study focuses primarily on the extent to which teachers are using laptops in a constructivist manner in instruction. There are many other important questions around the use of laptops in the classroom which were not addressed by this study. The limitations do not discount the findings that a comprehensive implementation of 1:1 initiatives, including technical support and professional development targeted at developing constructivist, student-centered methodology, can lead to genuine adoption of the laptop reform. The potential for using the 1:1 CLES for larger scale studies provides many opportunities for future research.

5.6 Research Implications

The findings of this study create some opportunities for future research to answer a number of important questions. The survey instrument could be used on a larger scale to compare districts and gain insights into what level of constructivism, and therefore adoption, districts represent. Additionally, there are potential uses for the 1:1 CLES to be used to look at how teachers' practices evolve over time. Such studies could be a powerful tool in examining the impact 1:1 laptop initiatives have on the classroom level, and therefore the efficacy of the reform itself.

Another question which could be addressed by future research is: What role does the allocation of district resources have on the level of constructivist versus traditional practice? Evaluating the level of constructivism and adoption of the reform, and how districts allocate funds could provide valuable information into the role of professional development and instructional support in genuine adoption of the laptop reform. The variance in results districts see after implementing 1:1 laptop reforms could partially be explained in the resource allocation for the initiatives and the level of support provided to the professional development of the districts' teachers.

One more intriguing possibility for the application of this instrument is to look at the extent to which constructivist practice in 1:1 laptop classrooms impact student learning. With the tremendous variance in existing literature on 1:1 reform and the impact of this movement on student achievement, this instrument potentially provides a powerful tool in the examination of the efficacy of the reform movement as it pertains to student achievement.

Using this survey instrument to measure how teachers are using laptops in instruction provides the opportunity to look at the laptop reform through a new lens and to analyze across districts whether or not the reform is being genuinely adopted, the extent to which laptops are shifting teaching roles, and ultimately the efficacy of this costly reform movement. Laptop initiatives are among the most common and expensive educational reform movements of recent years (Holcomb, 2009). The costs go far beyond just the price of the device itself, as technical support and infrastructure, as well as professional development for teachers add significantly to the bottom line. If so much is going to be invested financially, as well as politically in order to make that financial investment, then it is critical that we can evaluate the return on the investment. The 1:1 CLES provides a tool for being able to do just that.

5.7 Summary

The Park Hill School District has employed a comprehensive and gradual implementation of its 1:1 laptop initiative. It has provided extensive professional development to both help develop the technical skills of its teachers and to build the will of staff to implement the reform with the intent of creating a constructivist, student-centered learning environment. This support was provided prior to the laptops arriving in the classroom, and has continued throughout the time the laptops have been used. This exploratory study sought to pose questions, including, can we evaluate the extent to which teachers in the district provided with this training, and with the tools of a laptop for every student, are using constructivist practices in their instruction? The findings of this study show that the majority of teachers in the district are in fact utilizing constructivist practice with high frequency. While some teachers maintain more traditional practice, many more speak to a shift in their practice towards a more facilitative role. The 1:1 CLES instrument developed for the purpose of evaluating this practice was supported by the follow up interviews conducted with district teachers, and provides a valuable tool for additional research to look at many aspects of 1:1 laptop reform. Though conducted on a limited scale, this study's findings provide promising potential results for a new approach to looking at 1:1 laptop reform.

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Appendix A

Survey Instrument

This year, on average, how frequently are the 1:1 devices used in your classroom in order to perform the following tasks?

	Never	Less than once a week	Once a week	A few times a week	Once a day	Often during the day
1. Students find real world examples that apply to what they are learning in class.						
2. Students share information they found with the rest of the class.						
3. To help you determine student interests either outside of school or relative to something they are learning about in class.						
4. To help you adapt an activity to students' individual needs (i.e. differentiate instruction for your students).						
5. Students communicate with other students either inside or outside the class in order to solve a problem or complete an assignment.						
6. You use laptops in order to help you assess student knowledge (i.e. formative assessments).						
7. You use feedback from formative assessments in order to help inform your teaching.						
8. To provide students increased options or choices in the work they complete.						
9. Provide you an opportunity to work more with individual students.						
10. Provide you an opportunity to give students timely feedback.						

Appendix B

Base Interview Questions

1. To what extent are teachers genuinely adopting 1:1 reforms by applying constructivist teaching practices versus symbolically adopting the reforms by using traditional teaching practices in their 1:1 classroom environments?
 - 1.2 Describe how you teach now:
 - 1.2.1 How does how you teach now differ from how you taught before you had the laptops in your classroom?
 - 1.2.2 Have these changes altered the way you prepare for class? Explain how...
 - 1.2.3 How would you teach now if the laptops were taken away?
 - 1.2.3.1 How would that differ from how you used to teach without laptops?
 - 1.2.3.2 OR
 - 1.2.3.3 How did you used to teach?
 - 1.3 How does this new approach alter the classroom experience for your students?
 - 1.4 What are the advantages and disadvantages to this new approach?
2. What factors are associated with the extent to which teachers apply constructivist versus traditional teaching practices to their 1:1 classroom environments?
 - 2.2 What is the perception among your colleagues of the 1:1 initiative?
 - 2.3 How comfortable with technology were you before you had laptops? How comfortable are you now?
 - 2.4 Did you have training before you began your teaching career on using technology in the classroom?

2.5 What impact has the district provided professional development had on how you use the laptops?

2.5.1 What professional development do you need to be more effective?

3. How are laptops used in the classrooms of teachers applying constructivist teaching practices versus teachers applying traditional teaching practices?

3.2 Are there things that you used to do in class that were beneficial that you no longer do since you have the laptops?

3.2.1 Are there things that the laptops allow you to do that you could not do before/ allow you to do better than you could before?

3.3 How do you utilize the laptops in your instruction?

3.4 Has your role as a teacher been changed by the introduction of laptops?

3.5 Have the laptops changed the way you view your classroom? If so, how?