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Using one-to-one computing for differentiated instruction in Iowa: An investigation of the impact of teachers' perceptions of teaching and learning

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USING ONE-TO-ONE COMPUTING FOR DIFFERENTIATED INSTRUCTION IN

IOWA: AN INVESTIGATION OF THE IMPACT OF TEACHERS' PERCEPTIONS

OF TEACHING AND LEARNING

An Abstract of a Dissertation

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

Approved:

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Dr. Timothy Gilson, Chair

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ABSTRACT

The 1983 seminal work entitled *A Nation at Risk* recommended that all high school graduates be proficient in the Five New Basics: English, mathematics, science, social studies, and computer science. To address the No Child Left Behind mandates, educators and administrators are evaluating the theory and practice of Differentiated Instruction (DI). One-to-one computer initiatives became an element of DI strategy due to the well-documented advantages in the use of technology to address individual learning needs. The purpose of this qualitative case study was to examine administrators' and teachers' perceptions of using one-to-one computing to differentiate instruction and to identify potential obstacles to adoption. Data was collected from semi-structured interviews with four administrators and eight teachers from a suburban Midwestern secondary school and content analysis was used to identify themes. Teachers reported the consistent use of one-to-one computing to deliver differentiated instruction to students based on needs and abilities. Obstacles to one-to-one adoption in the classroom included time availability, appropriate applications, difficulty in monitoring students, and avoiding distraction. Future research is needed to identify best practices for one-to-one computing for differentiated instruction and to identify opportunities for improvement.

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Dr. Timothy Gilson, Chair

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CHAPTER 1

INTRODUCTION

<u>Introduction</u>

The 1983 seminal work entitled A Nation at Risk (Department of Education [DOE], 1983) recommended that all high school graduates be proficient in the Five New Basics - English, mathematics, science, social studies, and computer science. The No Child Left Behind (NCLB) Act of 2002 mandates that eighth graders be computer literate. Near ubiquitous Internet access, and rapid increases in classroom diversity, created the opportunity for individualized instruction programs for students with mixed abilities, cultures, and learning styles (NCLB, 2002). To address the NCLB mandates, educators and administrators evaluated the theory and practice of Differentiated Instruction (DI; Tomlinson, 2008). One-to-one computer initiatives became an element of DI strategy due to the well-documented advantages in the use of technology to address individual learning needs (Fullan, 2013). Effective pedagogy integrated web-based applications and improved critical thinking, collaboration, oral and written communication, analysis, and creativity (Wagner, 2008).

Adoption of one-to-one computing has been significantly slower than expected, despite the proven benefits and NCLB mandate (Bebell & O'Dwyer, 2010). Technology-assisted differentiated instruction accelerates student achievement and deepens knowledge. Teacher's negative perceptions of differentiated instruction included insufficient classroom time, lack of training, lack of administrative support, and a substantial increase in time required to create individualized lesson plans. Research

suggested that a teacher's perception may be an obstacle to successful adoption (Joshi et al., 2009).

To meet NCLB mandates, many schools across the country incorporated a one-to-one computer initiative into their curriculums (Weston & Bain, 2010). The one-to-one computer initiative provided teachers an additional resource to promote students' computer proficiency. This premise resulted in millions of dollars being spent on technologies to bring computers to the classroom. The Maine Learning and Technology Initiative (MLTI) is one of the highest profile one-to-one efforts. Launched in 2001 with a price tag totaling nearly $120 million, MLTI was the first statewide one-to-one initiative in the USA (Weston & Bain, 2010).

Many studies have been completed regarding one-to-one laptop initiatives around the country and the results are mixed. Why use computers at all in the classroom or school? Much of the lack of confidence in one-to-one computer programs comes from the "lack of empirical evidence on the effectiveness of one-to-one computing on student learning" (Lei & Zhao, 2008, p. 99). The purpose of this qualitative case study was to examine administrators' and teachers' perceptions of one-to-one computing to identify potential obstacles to adoption. The theory and practice of Differentiated Instruction (DI) described in the literature review served as the primary source for the research questions.

Background

During the 1980's, the deleterious effect of tracking on lower functioning students became apparent in terms of grades, dropout rates, and college attendance (Tomlinson, 2004). Teachers and administrators reacted to the negative outcomes

associated with tracking by restoring the heterogeneous classroom, and/or creating

mixed-ability groups. The term "heterogeneous classroom" refers to the inclusion of all

students in a single classroom based on grade without regard to ability, language

fluency, or other factors (Tomlinson, 2008). Instruction in the heterogeneous classroom

can be conducted using a "whole-class" method or with Differentiated Instruction.

Whole-class instruction is characterized by the use of a traditional, textbook-

dominated curriculum with movement through the curriculum at a single pace for all

students in the classroom, using the same methods and materials (Tieso, 2005). The

whole group, or whole class, method teaches at a level of instruction adequate to

challenge all students without losing a segment of the poor performers. Better students

could act as role models and share tasks with weaker students as a mechanism for

elevating weaker student performance (Tomlinson, 2003). The reversion back to

heterogeneous classrooms positively affected the self-esteem of poor performing

students but failed to improve their performance.

Subsequent research on heterogeneous classrooms found that struggling student

achievement was similar in both whole-class and tracked classrooms (Poole, 2008). Poole

suggested that unless there was a change in the instruction for struggling students,

improvement was unlikely. Alexander and Alexander (2008) similarly found that

providing the identical curriculum, peers, and texts, did not produce equality of

outcomes.

Differentiated Instruction employs a variety of instructional approaches to

modifying content, process, and instructional materials to meet the individual needs of

diverse learners, including one-to-one computing (Wiersma & Jurs, 2009). DI requires that teachers adapt varying instructional methods to meet individual student's needs. DI attempts to find the best fit between instruction and learners who differ in readiness, background, language, culture, student interest, and socio-economic status to maximize learning achievement. However, DI is not always easy to implement because teachers must individualize each lesson to meet the needs of each student (Wiersma & Jurs, 2009). Moving from whole class instruction to DI presents many challenges for teachers (Joshi et al., 2009). Some of the challenges associated with differentiated learning include individual lesson planning, varying student interests, and coordination (Corley, 2005).

Bergmann and Sams (2013) contended that one-to-one computing enables differentiated instruction that engages students. "Education is for everyone, but the way in which we deliver education, and the way in which students receive it, is not the same for everyone" (p. 20). Integration of technology and pedagogy "can be designed to create learning experiences that operate to produce high, natural yield in what is learned" (Fullan, 2013, p. 17). Goodwin (2011) observed that the one-to-one computing environment created high student engagement, improved technology skills and provided a cost-effective method for delivering differentiated instruction. However, both one-to-one computing and DI face obstacles to adoption by teachers in the classroom.

<div align="center">Statement of the Problem</div>

The U.S. Congress passed the NCLB Act of 2002 and made it law that the learning needs of students' with disparate levels of language fluency, cultural norms, socioeconomic status, physical maturity, social behavior, and level of cognitive

development, all be met (NCLB, 2002). More specifically, the purpose of the Act was to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessments.

Researchers, educators and administrators roundly criticized the NCLB mandates as counter-productive. The Act's conceptual problems include the following (Lawrence, 2006):

1. The NCLB Act dumbs down the curriculum by emphasizing standardized tests to measure teacher success. Therefore, learning means memorizing information and regurgitating facts needed to pass the standardized test, rather than acquiring skills for critical thinking and creating meaning.

2. The NCLB Act fossilizes an obsolete curriculum. In the name of reform, the standards movement is "freezing in bureaucratic place the worst aspects of traditional education and rewarding educators not for creativity but compliance" (p. 705).

3. The NCLB Act reduces academic achievement to a single, high stakes test. Achievement should be multi-faceted to reflect individual diversity and unique expressions of intelligence.

4. The NCLB Act wrongly assumes that the sole purpose of education is academic achievement. Education is also about self-identity, creativity, and community.

Wide disparities in achievement persisted twelve years after NCLB enactment among American schoolchildren (Petrilli, 2011). The National Assessment of

Educational Progress (NAEP) reported in 2010 that the top 10% of 4th grade students read more than six grade levels higher than the bottom 10%. DI requires an assessment of each student's ability, learning, and communication style. Rather than a single lesson plan, as many as six separate lesson plans must be prepared each day, thereby increasing class preparation time exponentially. Teaching more than one lesson plan simultaneously in a single classroom requires new, and complex, classroom management skills (Hargreaves, 2003). Negative perceptions of DI, when coupled with irregular implementation of DI, has had adverse effects on student achievement.

Differentiated Instruction involves the systematic modification of standard instructional methods to address individual needs while creating a safe and welcoming educational environment (Tomlinson, 2003). For many educators, DI means a dramatic change in both teaching practice and in classroom culture. Instruction previously involved a single lesson plan delivered in a uniform manner. Now each child, or groups of children, requires a separate lesson plan each day. Those sub-groups must be taught in the confines of a single classroom. This creates significant challenges for teachers.

Although teacher perceptions on DI vary, studies have shown that until a teacher embraces an instructional practice, implementation will most likely not occur in the classroom (Latz, Neumeister, Adams, & Pierce, 2009). Even when a research-based practice has been modeled, transference into classrooms is not guaranteed (Edwards, Carr, & Siegel, 2006). Studies revealed that teachers tend to teach how they were taught or feel most comfortable and confident (Hargreaves, 2003; Tomlinson, 2008). While teachers undoubtedly embrace the idea that meeting students' diverse learning needs is

critical, actually meeting those needs appears to be problematic. Therefore, teachers value the perceived importance of DI, but do not necessarily know how to handle or incorporate it into their own classrooms. One way to address this discrepancy is to incorporate more modeling of DI in teacher preparation programs and in-service programs, along with teacher mentoring (Edwards et al., 2006; Latz et al., 2009).

Hawkins (2009) and Tomlinson (2008) suggested that teacher's lack of self-confidence and perseverance created obstacles to successful DI implementation. Tomlinson (2008) indicated that teachers perceive significant obstacles to successful DI implementation, including insufficient classroom time, lack of training, lack of administrative support, and fear that inequities may result from the assessment of minority students against differing standards. Some research suggests that teachers received inadequate preparation time and training for DI (Joshi et al., 2009). Another study examined teachers' perceptions of DI outcomes for math student's grades 3 through 5, using before and after evaluations (Bosier, 2007).They found that teachers' positive perception of DI were associated with improved math scores. In summary, research indicates a significant correlation between teacher's perception of DI and both probability of implementation and student learning outcomes.

Tomlinson (2003, 2008) suggested that further research is needed to identify teacher's negative perceptions of DI in the classroom to accelerate DI implementation for the youngest students where the greatest impact can be made. Students' needs are best served by schools with flexible teaching methods that tailor instruction to heterogeneous communities of learning (Tomlinson, 2008). In summary, Tomlinson (2003, 2008)

demonstrates the significance of positive teacher's perceptions in successful DI implementations.

<div align="center">Purpose of the Study</div>

The purpose of the qualitative case study was to examine administrator's and teacher's perceptions of one-to-one computing as a differentiated instruction method. The research design used a qualitative case study examining teacher's perceptions using data from interviews. Participants were a convenience sample of eight secondary school teachers and four school administrators from a suburban school district located in the Midwest. Teachers and administrators were interviewed regarding their perceptions of adopting one-to-one computing as a means of differentiated instruction. More information as to the specifics of methodology is found in Chapter 3 of this research.

<div align="center">Research Questions</div>

The following research questions addressed the study and identified potential obstacles by using differentiated instructional methods, through a one-to-one computing initiative as perceived by a group of secondary teachers at the subject school:

Q1. What are teachers' perceptions regarding adoption of one-to-one computing as a differentiated instruction method?

Q2. What are teachers' perceptions regarding obstacles to one-to-one implementation and integration in the curriculum?

Q3. What are teachers' perceptions regarding the amount of time, resources, and administrative support necessary and available for successful one-to-one implementation as a differentiated instruction method?

Nature of the Study

The qualitative phenomenological case study research approach and content analysis were used to address the research questions. Content analysis, as defined by Leedy and Ormrod (2012) "is a detailed and systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes, or biases" (p. 142). Consistent with the research questions, the research design used the small group case study method to derive insights about teacher perceptions of DI use in the classroom (Yin, 2009).

Semi-structured interview transcripts were coded using content analysis along with a journal of observations of the researcher during interviews. Triangulation was used accomplished by collecting data from administrators, teachers, and researcher observations regarding the interviews to maximize validity and reliability for the case study method. The small group case study method was appropriate in the research, seeking insights into a given phenomenon where factors, theories, and causality are speculative. The study was non-scientific; no control groups, standardized measures, or treatment groups were used (Yin, 2009).

Significance of the Study

Literature from Petrilli (2011) and Tomlinson (2008) suggests that DI can be effective in meeting diverse learning needs. The case for the differentiated instruction strategy is supported by the research, including studies with special needs students (Poole, 2008) and gifted students (Petrilli, 2011). Tieso (2005) conducted a study of 31 teachers of 4th and 5th grade gifted students to evaluate the efficacy of flexible

grouping practices combined with a differentiated curriculum on mathematics achievement scores. The results suggest that a modestly enhanced curriculum unit in a whole class setting can positively affect student's learning outcomes. The differentiated curriculum group reported the most significant increase in math test scores from the pre-test to the post-test. The results confirm that students taught from a differentiated curriculum demonstrated significantly greater learning as measured by math score improvement than the two study groups that did not, and flexible grouping contributed to the improvement (Tieso, 2005).

<div align="center">Definition of Key Terms</div>

Complex instruction. A cooperative learning strategy that requires students of varying academic levels to work as teams (Carolan & Guinn, 2007).

Differentiated instruction. The practice of tiering-up or down learning tasks based on student needs, abilities, and preferences (Tomlinson, 2004). This requires the teacher to assess each student individually and adjust the tasks that he or she is asked to perform in light of this assessment.

Learner strategies. Steps, behaviors, specific actions, and techniques, which are used by students intentionally in order to improve their learning. These strategies help learners in facilitating the storage, retrieval, internalization, memorization, reasoning, logical and rational use of new knowledge (Carolan & Guinn, 2007).

Mainstreaming. The practice of providing equal access to English as a Second Language and learning disabled children (Ankrum & Bean, 2007)

One-to-one computing. One-to-one computing refers to academic institutions, such as schools or colleges, issuing each enrolled student an electronic device in order to access the Internet, digital course materials and digital textbooks (Bebell & O'Dwyer, 2010).

Parallel curriculum. A design that helps a student identify their interests or abilities and focus on them, thus making a connection to the curriculum (Tomlinson et al., 2006).

Whole group. A teaching process that encourages using the same materials, lessons, and pacing for all students (Ankrum & Bean, 2007)

<div align="center">Summary</div>

The literature refers to a substantial number of potential factors delaying, or creating difficulty in, one-to-one computing adoption (Hawkins, 2009; Tomlinson, 2008). The purpose of this qualitative case study was to examine administrators' and teachers' perceptions of one-to-one computing as a differentiated instruction method that may serve as a barrier to adoption. Qualitative research methodology was used to evaluate teacher's perceptions of DI theory and practice as a potential source of resistance to one-to-one computing adoption. This dissertation addressed a gap in the literature regarding the potential for teacher perceptions of differentiated instruction as a barrier to one-to-one computing adoption. Understanding how teachers perceive the role of one-to-one computing may serve to improve their adoption of this initiative.

CHAPTER 2

LITERATURE REVIEW

<u>Introduction</u>

The No Child Left Behind (NCLB) Act of 2002 created a need for individualized computer instruction programs to ensure all students are computer literate. As the quantity and complexity of technology increases both within and out of schools, educators are evaluating and implementing strategies to promote student's computer literacy, including differentiated instruction constructs. There is a gap in the literature on the use of one-to-one computing as a form of differentiated instruction to improve learning outcomes.

Differentiated instruction involves tailoring lesson plans, materials, and instructional methods to the needs of individual students (Tomlinson, 2003). The purpose is to maximize learning outcomes by taking into account the students' socio-economic backgrounds, academic abilities and other factors that can influence the learning process. A variety of different approaches can be used to adapt educational materials and teaching practices to the diverse characteristics and needs of individual learners (Wiersma & Jurs, 2009). Bergmann and Sams (2012) highlight the importance of accommodating different learning styles using this one-to-one approach: "Education is for everyone, but the way in which we deliver education-and the way in which students receive it-is not the same for everyone" (p. 20).

Despite the potential benefits of differentiated instruction, a move from whole class instruction to this method of teaching can be problematic for instructors (Joshi et al.,

2009; Wiersma & Jurs, 2009). Researchers have found that challenges relating to differentiated instruction include the time and effort involved in planning individual lessons, addressing the diverse interests of learners, and co-ordinating activities (Corley, 2005).

There are well-documented advantages to the use of technology in addressing individual learning needs. Fullan (2013) observed that the integration of technology and teaching methods could produce high quality learning experiences generating "high, natural yield in what is learned" (p. 17). To take advantage of the benefits of technology in education and the potential for facilitating differentiated instruction, administrators and educators in many U.S. states have recently adopted one-to-one computer initiatives. The purpose of the study was to investigate the adoption of one-to-one computer initiatives by school districts in Iowa, to provide information that could help inform the successful development of similar initiatives across the nation. For the purpose of this study, a one-to-one computing environment was defined as one in which every teacher and student has access to a laptop, Internet service, printers, and computer software within a school system.

<div align="center">Literature Search Strategy</div>

The literature review was based on peer-reviewed journal articles, books, related dissertations, periodicals, and federal law related summaries, and covered the period from 1999 to 2014, with the additional inclusion of some earlier works in education theory and psychology. A review and analysis of 117 individual works was conducted, 77 were included in the references, and 15 served as background material. Approximately 40% of

the peer reviewed journal articles studies were based on quantitative research, and 60% reported on qualitative studies or summarized previous research.

The literature review was conducted using the following scholarly databases, as well as general Google searches: Academic Search Premier, Google Scholar, JSTOR, and ProQuest, and Springer The following websites were also searched: Center for Science in the Public Interest, National Center for Education Statistics (NCES), Robert Wood Johnson Foundation, and the Department of Education. This review included scholarly journal articles, dissertations, and related research. The period reviewed was from 2000 to 2015, but drew on some earlier work. A total of 134 separate works were reviewed. Ninety-seven were cited and 24 provided context. Approximately 60% of the reviewed works were quantitative and 40% were qualitative or theory.

Keyword and search term development was carried out iteratively, in order to build on the findings of earlier searches and to refine the review based on the outcomes. Initially, the following keywords were used: *one-to-one computer program, one-to-one computer learning, laptop use in school, laptop program, laptops in the classroom, Iowa State regulations and computer learning standard, benefits of using laptops in the classroom,* and t*echnology and learning.* Additional keywords were developed as a result of the initial searches. The following sections discuss literature relevant to the main themes of the study: differentiated instruction, the role of technology in the classroom and empirical evidence of the impact of one-to-one computer initiatives on teachers and students.

Theoretical Framework

The development of differentiated instruction as an educational strategy has been grounded in a number of socio-psychological theories, which are discussed in turn in this section of the literature review. In particular, the main theories that have influenced the development of differentiated instruction are Gardner's (1993, 2006) Multiple Intelligence Theory; Sternberg and Grigorenka's (2004) Triarchic Theory of Intelligence; Vygotsky's Zone of Proximal Development Theory (1978; 1987) and Constructivism (Bruner, 1966; Piaget, 1971).

One of the main theories that has underpinned the development of differentiated instruction is Gardner's (1993, 2006) Multiple Intelligence Theory. Gardner identified eight different forms of intelligence, which interact in various ways to underpin the unique learning styles of different students. These were defined as verbal-linguistic, logical-mathematical, visual-spatial, kinesthetic, musical-rhythmic, interpersonal, intrapersonal, and naturalistic. Using this theoretical framework, instructional materials and practices can be developed that are tailored to the specific needs and learning styles of students, and designed to maximize their learning outcomes.

A similar type of theory that has been influential in the development of differentiated instruction as a teaching strategy is the Triarchic Theory of Intelligence (Sternberg & Grigorenka, 2004). This theory identified three different types of intelligence: analytical, creative, and practical intelligence, which vary in importance between different individuals and states that they learn in different ways. As a result,

students need to be taught using a variety of different activities and methods, tailored to their own dominant form of intelligence in order to achieve effective learning outcomes.

Vygotsky's Zone of Proximal Development Theory (1978, 1987) is a cognitive approach to understanding learning, which has also been an important theoretical framework in the development of differentiated learning. Vygotsky (1978; 1987) defined the zone of proximal development (ZPD) as the area in which learning takes place, and which represents the difference between what a learner can currently achieve, and what he or she can achieve with the assistance of an instructor. The ability of teachers to identify this zone in the case of each of their students is important, because in order to promote learning there is a need to build on the learner's existing knowledge and abilities with activities that bridge the gap between these and the desired learning outcome (Vygotsky, 1987). Tomlinson (2003) refers to this process as scaffolding.

The final main theoretical approach that has been significant in the development of differentiated instruction is constructivism. This became important in the field of education with the shift over time from a teacher-centered, curriculum-dominated approach to a student-centered approach (Bredo, 2000; Yatvin, 2004). Constructivism within education refers to the ways in which learners create meaning through using their previous experiences and knowledge to interpret the new information they receive in the classroom (Bruner, 1966; Piaget, 1971). A constructivist approach underpins differentiated instruction, since teachers using this instructional approach develop teaching strategies and activities that take into account the experiences, interests, and learning styles of individual students (Tomlinson, 2003).

Differentiated Instruction

Definition and overview. Differentiated instruction is the generic term for instructional strategy that is tailored to the individual needs of a diverse student population. It involves instruction that takes into account the individual needs of academically and culturally diverse students within a single classroom (van Garderen & Whittaker, 2006). Each student arrives in the classroom with a particular learning style based on their previous experiences as well as genetic factors. Gremli (1996) defined learning styles as "the way that person begins to process, internalize and concentrate on new material" (p. 24), and argued that tailoring teaching to individual learning styles can make the process of learning easier and more effective. This means, however, that the preferred teaching method of individual teachers may not be most appropriate for every student (Tomlinson, 2008). Because students' learning styles, interests, and speeds vary, multiple teaching methods, activities and tools are needed to address variations and promote effective learning.

Differentiated instruction has become increasingly important in recent decades; particularly as the U.S. student population has become more culturally diverse as a result of immigration and as research has generated new knowledge about the multiplicity of learning styles and forms of intelligence. As a result, differentiated instruction is now often seen as one of the main tools for improving academic performance in a range of subject areas (Darling-Hammond & Brandsford, 2006), and for meeting the challenging academic achievement goals of national legislation such as the NCLB (Tomlinson, 2008). To effectively meet the needs of learners as mandated by the NCLB (2002) Act, teachers

are required to make every possible effort to meet the diverse needs of all students, including technology literacy. Differentiated Instruction is a particularly useful instructional approach for addressing the requirements of NCLB, which include the use of a standards-based curricula as well as individual instruction (van Garderen & Whittaker, 2006). This has been reflected in the approaches of school leadership in the U.S. towards the achievement of the objectives of NCLB (2002). For example, a stated goal of the National Association for Secondary School Principals is to ensure that teachers are able to accommodate individual learning differences.

The starting point for developing differentiated instruction is the teacher's personal evaluation of each student's needs and learning styles, in contrast to traditional instruction, which is developed based on the requirements of the curriculum. This individual assessment is then used to develop a personalized learning plan and trajectory for each student (van Garderen & Whittaker, 2006). In other words, instead of expecting students to adapt to a standardized course content and delivery method, teachers instead modify their own teaching methods and tools to the needs of their students (King-Shaver, 2008).

According to Tomlinson (2003), "Differentiated instruction requires teachers to provide different avenues to acquiring content, to processing ideas, and to developing products so that each student can learn effectively" (p.1). Teachers who adopt this type of instructional strategy take into account a range of student-related factors when planning and implementing instructional activities, including their students' personal experiences,

socio-economic backgrounds, levels of motivation, language abilities, learner styles and preferences and specific interests (Wormeli, 2006).

Differentiated instruction incorporates a number of different approaches, which have in common the premise that students will learn more effectively when multiple instructional methods adapted to their preferences, needs and abilities are used (Tomlinson, 2003, 2008). Underlying this approach is the assumption that all students, even those who are struggling academically and are behind grade level are capable of learning when the right combination of methods and opportunities are made available to them. It is particularly suited for highly diverse classrooms that include a range of ability levels, by helping students to learn in ways that best suit their preferences and current abilities (Wormeli, 2006).

Differentiated instruction in practice. Various researchers have examined the nature of the instructional process and the key elements that comprise this, in order to identify the ways in which differentiated instruction can contribute to improvements in learning outcomes. For example, Tomlinson (2004) identified three aspects of the high school curriculum in which differentiation can generate benefits; defined as content, process, and products. Content, or what is taught by the instructor, can be broken down into a number of constructs; defined by Tomlinson (2004) as acts, concepts, principles, attitudes, and skills (p. 104). Process is defined as the way in which students receive access to the content, and incorporates their individual learning styles; while products are defined as the knowledge and skills being imparted to the students within the learning process (Tomlinson, 2004).

Hall, Strangman, and Meyer (2011) concurred with Tomlinson (2004) and other theorists about the key elements of an education that must be incorporated in a differentiated approach. They built on this by highlighting three main student-related factors that teachers must address in order to develop personal learning profiles and to differentiate instruction: readiness; interests; and learning profile. These were defined as follows: *Readiness* means the skill level and background knowledge of the student. *Interest* refers to the subjects the student seems most ready and willing to investigate, or which seems to provide him or her with the greatest motivation. The students' *learning profile* refers to learning style (auditory, tactile, kinaesthetic or visual), what kinds of classroom groups he or she prefers (alone, pairs, small group, large group, teacher-fronted), and his or her environmental preferences (plenty of open common space or a quiet area to work; Hall et al., 2011, p. 104).

Dodge (2005) provided an overview of some of the most widely used pedagogical methods and tools in differentiated instruction. Specific tools in widespread use within this approach were found to include choice boards, contracts, evaluation rubrics, learning logs, and tiered lessons. In particular, Dodge highlighted the importance of *grouping strategies* within this form of instruction; while some students learn most effectively on their own, many prefer to learn in a group with others who share their learning style. Tomlinson (2004) observed the "organic" nature of a differentiated classroom, and observed the use at different times of individual, group, and whole class instruction. Dodge's overview of differentiated instruction also highlighted examples of "scaffolding," as defined by Tomlinson (2008) based on Vygotsky's (1978; 1987) Zone

of Proximal Development Theory, and illustrated the concept of learning styles (Coladarci, 2007).

VanSciver (2005) identified a number of typical characteristics of a differentiated classroom, based on a synthesis of previous research studies. These included a student-centered environment; the use of group teaching; focusing instruction on student comprehension rather than just content, including assessment of both student readiness and comprehension as part of the curriculum; teachers who regard themselves as facilitators of the self-learning process; and the use of self-assessment and goal setting by students.

Critical success factors in differentiated instruction. Tomlinson (2004) summarized the critical success factors in differentiated instruction in terms of five "non-negotiable" factors: (1) a supportive learning environment; (2) a curriculum focused on mastery; (3) ongoing assessment; (4) modification based on individual student needs; and (5) leadership and flexible classroom management. This represents a holistic approach that involves every aspect of the classroom and school environment. The practice of differentiated instruction cannot just be based on a modest adjustment of existing teaching practices.

Assessment of progress is an important component of any differentiated instruction initiative. Tomlinson (2004) reminds us that it is essential to ensure that appropriate assessment tools to reliably measure progress are available, and that assessment must be integral to the program, ongoing in order to monitor progress against

specific goals, and provide almost real-time feedback to provide information for use in adjusting and improving the effectiveness of the initiative (Tomlinson, 2008).

Research suggests that a positive teacher mindset regarding differentiated instruction is also essential to success (Tomlinson, 2008). This is based on the belief that each student is a unique individual, with his or her own unique learning styles, rates, and motivations, and that it is the responsibility of the teacher to adapt their methods and practices to individual student's needs (Tomlinson, 2008). The focus on teacher mindset was influenced by a study by Blackwell, Trzesniewski, and Dweck (2007) which found evidence of a significant association between a student's beliefs about their intelligence and academic performance, after accounting for differences in background and IQ. This suggests that teachers' attitudes can be instrumental in promoting improved academic outcomes, and that the success of differentiated instruction relies significantly on the attitudes and related behaviors of individual teachers. Tailoring of instruction to individual students requires each teacher to adopt a "whatever it takes" attitude, develop individual learning plans designed to promote content mastery, and create opportunities for students to make linkages between their efforts and the results (Tomlinson & Imbeau, 2010). In this way, differentiated instruction involves the systematic modification of instructional methods to address the individual needs of students while providing them with a secure and caring educational environment (Tomlinson, 2003). For many educators, this requires a change in attitudes, teaching practice, and classroom culture. Conventional education involves a single lesson plan delivered in a uniform manner and targeted at the average level of ability. In contrast, differentiated instruction requires

teachers to understand each child's individual perspective and interests, ideally based on a conversational interview with them, and to develop individual lesson plans that are tailored to these (Tomlinson, 2008). This approach is very different from conventional teaching practice and requires new mindsets on the part of teachers.

Impacts of differentiated instruction on learning. Though there have been a limited number of academic studies into the impacts of differentiated learning, the overall evidence from the body of empirical research in this area is that differentiated instruction has positive impacts on learning, particularly through improving student motivation (Christensen, 2007). Carolan and Guinn (2007) examined the use of differentiated instruction by five middle school teachers in a school district in California, over a one-year period, using observation and in-depth interviews. The following are common success factors in differentiated instruction: (a) the use of personalized scaffolding; (b) the use of flexible groupings of students; (c) the creation of a caring classroom culture; which was supportive of the differences between students; and (d) the possession of relevant expertise by the teachers.

Connor, Morrison and Katch (2004) explored the impact of different teaching methods on student achievement, and found evidence that learning improved when instruction was tailored to the needs of individual students. In another study, Connor et al. (2004) found that differentiated instruction had a greater positive influence on learning than traditional teacher-centered learning among a sample of third grade students. In evaluating the impact of computer-assisted individualized practice on mathematics achievement, Schoppek and Tulis (2010) found considerable gains in skill development

among both low- and high-achieving students, and attributed these mainly to the individualization of teaching.

Barriers to the adoption of differentiated instruction. Despite the requirements of NCLB and the stated intentions of school leadership, differentiated instruction was not widely adopted in schools. According to Tomlinson (2003), this practice remains the exception rather than the rule. Even where differentiated instruction is being used, researchers reported that it was in a very limited manner. Researchers have identified a number of specific barriers to the wider use of differentiated instruction.

For example, Gess-Newsome (2001) highlighted the reluctance of teachers and school administrators to adopt radically new teaching practices. In some cases, this is because of beliefs that it is unfair to give different types or amounts of instruction to different students (Walpole & McKenna, 2007). More generally, there are concerns about the time, effort and resources needed to implement new approaches to teaching, and difficulties among teachers of adapting from the role of direct instructor to the role of facilitator (Corley, 2005). Researchers have found that the workload issue is a common concern of teachers, who have reported that the time and effort required to create and maintain activities tailored to student needs, carry out assessments of progress, and monitor student performance is unrealistic given competing demands on their time (Latz et al., 2009).

Use of One-to-one Computing in Teaching

Researchers found that the effective use of technology in the classroom can have positive impacts on learning outcomes as well as potentially easing teacher workloads when adopting differentiated instruction. Technology can be a possible solution to the practical barriers caused by the use of differentiated instruction by creating databanks with a pool of activities for teachers to add to or draw from (Dodge, 2005). Various software packages are available that allow teachers to easily track the progress of individual students. Computer-aided instruction and virtual learning allow students to learn and practice skills independently, freeing up the time of teachers for the purpose of higher-level areas of instruction.

The ability to integrate the use of computers into teaching largely depends on teachers' attitudes to technology and willingness to change their existing teaching methods, as well as the supportiveness of the organizational environment. Cope and Ward (2002) conducted qualitative research into perceptions of learning technologies among high school teachers and found that a positive attitude towards these technologies is a critical success factor in the ability to integrate technology into teaching. This study provided support for the earlier conclusion of Parr (1999) that the successful use of learning technologies depends on teacher perceptions of them.

Self-efficacy has a significant influence on teacher attitudes and technology use in the classroom. This has been defined as an individual's own judgment of their ability to carry out particular tasks, which researchers have proven to be an important predictor of their behavior in relation to performing the task in question (Bandura, 1997; Hoy &

Miskel, 2001). A number of researchers (Gilakjani, 2013; Zhao & Cziko, 2001) have reported empirical evidence that teacher self-efficacy predicted technology adoption in the classroom. Sang, Valcke, van Braak, and Tondeur (2009) also concluded that based on empirical research, teacher attitudes towards technology are a major predictor of their use of computers in the classroom. These authors conducted research among Chinese student teachers to examine the impact of gender, teaching self-efficacy, computer self-efficacy, computer attitudes, and constructivist teaching beliefs on the likelihood of using computers in teaching. They found a significant relationship between each independent factor studied, with the exception of gender, and the likelihood of using computers in teaching.

Having a supportive organizational environment, which provides adequate levels of training and support for teachers, as well as sufficient resources to underpin the initiative, is equally important, as demonstrated by the findings of various research studies. In particular, the provision of professional development has been shown to have a positive impact on teacher self-efficacy and willingness to use computers. Penuel (2006) found evidence that teachers who participated in nine hours or more of educational technology professional development were more likely to report that they felt well prepared to use technology and the Internet in teaching than teachers who received less professional development in technology. This provided further support for the findings of earlier studies about the importance of professional development, and particularly technology training, in enabling teachers to become more confident in the use of computers and more willing to incorporate them into their teaching practices

(Silvernail & Lane, 2004). Dwyer, Ringstaff, and Sandholtz (1991) explained this in terms of speeding teachers' progress through an "evolutionary process" (p. 47) consisting of five stages: entry, adoption, adaptation, appropriation, and evolution.

Educational leaders and administrators are tasked with ensuring that schools are provided with or to allocate sufficient resources for the purchase and maintenance of computer equipment and software, as well as ensuring the reliability of the Internet service and any wireless network, and then providing adequate technical support for teachers and students alike (Judge, Puckett, & Bell, 2006; Penuel, 2006). Additionally, the curriculum and teaching practices were modified to allow time for independent learning (Judge et al., 2006). In a synthesis of findings from studies conducted internationally on the impact of one-to-one computing initiatives, Penuel (2006) identified a number of critical success factors including professional development for teachers, adequate technical support, and positive teacher attitudes towards the use of technology.

<div align="center">Empirical Research on One-to-One Computing Initiatives</div>

Overview

One-to-one computer programs were first introduced in the United States in 1985 by the Apple Classrooms of Tomorrow (ACOT) project, which provided desktop computers for individual students at five schools for use in the classroom and at home. This meant that students had their own desktop computer at school and a similar one at home. This groundbreaking program was followed by the Anywhere Learning Program (Rockman, 2000), sponsored by Microsoft. This program involved providing students

with laptops that they could transport from school to home. These programs have

gradually been taken up by more and more school districts and states across the nation,

with the involvement of other major technology companies such as Apple. They

generally involve giving each student in specified grade levels a laptop computer that

they are able to utilize whenever they wish, both at school and at home (Penuel, 2006).

Many of these initiatives have been studied empirically by researchers (Dawson,

Cavanaugh & Ritzhaupt, 2008; Gravelle, 2003; Zucker & Hug, 2008) to identify the

impacts of the programs on teaching practice and learning outcomes, among other

factors. Researchers have also synthesized the findings of previous studies in this area,

and examined the impact of one-to-one computer initiatives in other countries such as

Australia, Japan and Singapore (Larkin & Finger, 2011), providing additional useful

information and guidance for educational leaders, administrators and teachers in the U.S.

to draw on.

Impacts on Teaching Practice and Classroom Environment

  One of the main findings of research in this area relates to the ways in which the

use of one-to-one computing enables change in the nature of teaching and the classroom

environment. The main shift is from teacher-centered to student-centered learning

(Donovan, Hartley & Strudler, 2007; Swan, van 'T Hooft, Kratcoski & Unger, 2005;

Zucker & Hug, 2008), as epitomized by the differentiated instruction model more

generally. The role of the teacher has been shown to change from being a "disburser of

knowledge" to a "facilitator of learning" (Swan, van 'T Hooft, Kratcoski, & Schenker,

2007, p. 506). This does have the effect of increasing teacher workloads overall as they

work with individual students, though researchers have observed that the delivery of instructional content via the computer can help ease the teacher's workload in producing content as students increasingly learn through self-directed learning and independently locating information sources (Rockman, 2000; Swan et al., 2007). Based on a review of previous research into one-to-one computing initiatives, Harris (2010) observed that those teachers who integrated computing activities into their teaching as direct instructional tools, rather than just using them to supplement traditional forms of teacher-led instruction, were more likely to report positive attitudes towards the use of technology in education.

Impact on Students

Though few rigorous quantitative research studies have been used (Penuel, 2006), the available evidence suggests that an increase in individualized learning generally occurs when one-to-one computing programs are successfully adopted by classroom teachers (Dunleavy, Dexter, & Heinecke, 2007; Rockman, 2000). In particular, positive impacts on technology literacy and information literacy have been reported, but there have also been reported improvements in students' writing skills (Gulek & Demirtas, 2005; Penuel, 2006). Additionally, a range of other student-related benefits has been reported by researchers that can be expected to contribute to improved levels of academic achievement in schools that adopt these types of initiatives. These include, for example, improved motivation and engagement in learning, higher level thinking skills, better organizational skills, more enthusiasm for school generally, and increased levels of attendance (Bebell, 2005; Lowther, Ross & Morrison, 2003).

On a societal level, such programs are improving access to communities among students of different cultural and socio-economic backgrounds (Hatakka, Andersson, & Grönlund, 2012). Combined with differentiated instructional approaches, they are also providing ways of overcoming the barriers to learning in a conventional academic environment that might be presented by various forms of disability or different learning styles (Hatakka et al., 2012). Researchers have documented particular benefits of one-to-one computing programs for specific groups including special needs students (Harris & Smith, 2004) and minority groups (Hounshell, Hill, & Swofford, 2002).

One issue on which there is little consensus among researchers is whether the use of one-to-one computer initiatives is having a positive impact on standardized test scores. Some researchers have reported evidence that this is the case (Gulek & Demirtas, 2005; Lei & Zhao, 2008), while others were able to find no effect of these programs on test scores (Grimes & Warschauer, 2008; Rockman, 2003). In his synthesis of previous research on the impacts of one-to-one computing programs, Harris (2010) argued that standardized tests are not an appropriate metric for assessing student learning, as they do not adequately capture the types of valuable skills and competencies that are gained from participation in one-to-one computing programs. A number of mixed methods empirical research studies have identified improved quality of work as an important positive outcome of one-to-one laptop programs (Grimes & Warchauer, 2008; Silvernail & Lane, 2004).

Challenges and Problems

Though one-to-one computer initiatives have many documented benefits, researchers have also reported negative effects and implementation challenges associated with such programs. One of the most commonly reported problems related to the use of one-to-one computing initiatives relates to classroom management. Several researchers found evidence that the use of computers by students introduced new distractions and inappropriate classroom behavior, for example the use of social media sites and online games. In one study, 39% of teachers interviewed agreed that their students found it harder to concentrate on their studies after the introduction of laptops to the classroom (Lei & Zhao, 2008). The same study revealed that teachers were concerned about the inability of students to evaluate the information located on the Internet, and about their own lack of knowledge about how to improve students' searching and information retrieval skills. They also reported that technological problems with the computers and the Internet sometimes hindered learning progress (Lei & Zhao, 2008).

Summary

This chapter summarized the findings of a review of literature relating to differentiated instruction, the use of technology in the classroom and one-to-one computing initiatives. Overall, it demonstrated that one-to-one computing and differentiated instruction were associated with significant positive impacts on learning, and other student benefits. However, the realization of these benefits depended heavily on teacher attitudes and the provision of a supportive school environment. Relatively few recent studies have generated practical guidance and information on best practice that can

be used to guide the development of one-to-one computing initiatives to improve academic achievement in the U.S. in the 21st Century. This study is intended to help address this information gap.

CHAPTER 3

METHODOLOGY

<u>Introduction</u>

The purpose of the qualitative phenomenological case study was to examine secondary school teachers and administrators perceptions of one-to-one computer initiatives to identify potential barriers to adoption. Ten secondary school teachers and four administrators were recruited from a single suburban Midwestern school district. Semi structured interviews were used to collect data from teachers and administrators. Participant and administrator interviews focused on perceptions of challenges to adoption of one-to-one computing. The social benefit of the study was to add to the body of knowledge regarding one-to-one computing adoption. Chapter 3 includes (a) a description of the study design, (b) a sampling method, (c) data collection methods, (d) a data analysis plan, and (e) a discussion of the study population, ethical considerations, and limitations.

<u>Research Design and Rationale</u>

A qualitative phenomenological research design was chosen for this study to provide wide latitude in gathering in-depth information and exploring participants' experiences using semi-structured interviews (Savin-Baden & Major, 2013). The qualitative approach is grounded in the need to understand social processes in their native environment, within which the meanings of social events might be derived (Esterberg, 2002). This qualitative study used an interpretive, naturalistic approach to the

phenomenon, including the study of things in their natural settings, and endeavoring to understand the meanings people bring to the experience (Denzin & Lincoln, 2011).

Phenomenological research is an exploration of the human experience by collecting and interpreting the words and behaviors of participants. According to Savin-Baden and Major, (2013), "Phenomenology focuses on the experience itself and how experiencing something is transformed into consciousness" (p. 24). The phenomenological research approach involves engagement of participants at the personal level to understand the experiences that help form perceptions regarding one-to-one computing. Phenomenological studies are aligned with the social constructionist's view of subjectivity and the presence of more than one objective reality (Bess & Dee, 2008).

The qualitative phenomenological research approach requires the researcher to serve as the primary data collection instrument, active participant, and interpreter (Savin-Baden & Major, 2013). The researcher's role in the data collection process requires active engagement during interviews to promote comprehensive responses to question necessary to develop a rich picture of the phenomenon. Glaser and Strauss (1967) and Strauss and Corbin (1990) stressed the need for an introspective evaluation of the researcher's overall readiness to attempt a qualitative inquiry, referred to as theoretical sensitivity. Theoretical sensitivity refers to "the attribute of having insight, the ability to give meaning to data, the capacity to understand, and capability to separate the pertinent from that which isn't" (Strauss & Corbin, 1990, p. 42). The researcher must possess the ability to be objective and sensitive to each participant's individual experience in order to make appropriate decisions in the field which ensures the validity and reliability of the

findings. Theoretical sensitivity is learned over time from comprehensive review of the professional literature, and professional and personal experiences.

The qualitative case study approach is appropriate in research design when factors, theories, and causality for a given phenomenon are speculative (Savin-Baden & Major, 2013). This study was non-scientific as no control groups, standardized measures, or a treatment group was used. The study examined teacher and administrator perceptions, and actual teacher classroom behavior to reveal insights regarding challenges for one-to-one computing adoption. Data for this qualitative case study was collected from semi-structured interviews with administrators and teachers to develop a rich picture of the phenomenon (Savin-Baden & Major, 2013). Triangulation of three sets of data, themes, and patterns served to improve the credibility, validity, and reliability for the findings for qualitative research designs (Guba & Lincoln, 1994).

Information was solicited from the interview questions on the full range of one-to-one computing adoption issues, including participant's background, training and level of professional development. Teacher and administrator semi-structured interview questions (Appendices A & B) were drawn from the Fullerton Laptop Evaluation Report.

Content analysis was used in the study to examine teacher and administrator interviews as a whole. Content analysis, as defined by Leedy and Ormrod (2012), involves the detailed and systematic examination of a body of material for the purpose of identifying patterns, themes, or biases. Consistent with the research questions, the research design used the small group case study method to derive insights about teacher perceptions of one-to-one computing adoption (Stake, 1995; Yin, 2009).

Participants

Participants were recruited from the population of administrators and teachers at a small suburban Midwestern high school located 20 miles from a major metropolitan area. The school has approximately 360 students and 20 teachers. A convenience sample of eight teachers and four administrators were recruited for the study. At least one teacher from each core subject (math, science, social studies, and English) was included, as well as one special education teacher. The four school district administrators are the superintendent of schools, a secondary principal, a technology director, and the curriculum director.

Data Collection

Upon receiving approval and permission to use the premises from the school principal, the teachers received additional information regarding the study purpose, procedures, time required, and assurances regarding safety and confidentiality of the research. Data collection procedures were described and participants were notified that the data would be used solely for research purposes and not recorded or reported for teacher evaluations to school administrators. Consent signatures were collected from administrators and teachers before interviews were scheduled. The semi-structured interviews were conducted in person and recorded using a digital audio recorder with permission of the participants. Semi-structured interviews enable a greater range of expression for participants than surveys and checklists (Savin-Baden & Major, 2013).

Semi-structured interviews. Administrators (Superintendent, Secondary Principal, Technology Director, and Curriculum Director) were the first to be interviewed using a

semi-structured interview which was conducted at the school (Appendix A), after which the secondary teachers were interviewed (Appendix B). Based on the answers to the questions asked and any discrepancies in the answers, a new set of questions were asked of the administrators and teachers in the same order. The interviews lasted from 15 to 60 minutes. All study data was kept confidential and made anonymous using codes. All interviews were audio recorded and transcribed. Interviews focused on assessment of the obstacles to the one-to-one computing program.

Data Analysis Plan

Content analysis. Data was collected from the 12, one-hour-long interviews and was transcribed to enable data coding. Data was coded using the content analysis, which involved carefully searching interviews for recurring words and phrases without preconceived notions to reveal patterns and themes (Savin-Baden & Major, 2013). Words and phrases were coded and linked to general themes derived from the categorical data. By systematically scanning transcript data, recurring words and phrases were flagged, counted, and categorized from which themes emerged (Savin-Baden & Major, 2013).

Data coding. The qualitative phenomenological study is an iterative process (Savin-Baden & Major, 2013). A coding system is necessary to identify patterns and themes for later use in interpretation. Some use was made of the work of Charmaz (2006), and Glaser and Strauss (1967). Content analysis and data coding involve the following processes, frequently done simultaneously:

1. Simultaneous involvement in data collection and analysis;

2. Constructing analytic codes and categories from data, not from preconceived logically deduced hypotheses;

3. Using the constant comparative method, which involves making comparisons during each stage of the analysis;

4. Memo writing to elaborate categories, specify their properties, define relationships between categories, and identify gaps (Glazer & Strauss, 1967.)

Charmaz (2006) posited that Glaser and Struass' (1967) process promoted control of the research, increased the analytic power of the study, and increased validity and reliability of the findings. The prescribed process enables the researcher to manage, and streamline data collection while simultaneously synthesizing data for later interpretation. Chavez (2008), and Glaser and Strauss (1967) legitimized qualitative research as a credible methodological approach rather than simply as a precursor for developing quantitative research questions.

Analysis. Content analysis involves sifting through data to identify patterns and themes, a process of refinement and synthesis of data categories from the coding stage (Lincoln & Guba, 1985). Content analysis is not necessarily a distinct and separate action from coding, as the intuitiveness of the first stage morphs into the more exacting nature of the second stage. As analytical time passes, efforts are directed more specifically at "fleshing out categories, filling in gaps in the larger taxonomy or category set, clearing up anomalies or conflicts, and extending the range of information that can be accommodated" (Lincoln & Guba, 1985, p. 343).

Ethical Considerations

The researcher received approval from the University of Northern Iowa (UNI) Institutional Review Board (IRB) before contacting teachers or collecting any data for the study. The UNI-IRB policies and procedures maintain the integrity of the university and protect human subjects and students from harm, and these rules were followed exactly and explicitly. The superintendent of the school district received an outline of the study and provided a Letter of Cooperation indicating the district's willingness to participate.

Teachers and administrators signed the informed consent form (Appendix C) prior to any data collection effort. The Consent Form includes researcher and UNI-IRB contact information. Data was kept confidential and anonymized to protect participant privacy. Hard copy of all study data was kept for five years in a locked file cabinet and digital data with access only by the researcher. Teachers and administrators were contacted privately by email about participating in the study to allow an informed decision without feeling publicly pressured to do so. Administrators and teachers received a full description of the study purpose, study procedures, possible benefits and risks, time required, and how to contact the researcher with questions or concerns. The informed consent form provided formal assurances of confidentiality and anonymity. Participation was voluntary and participants received assurance that they could terminate involvement at any time.

Limitations

       The research method did not seek to develop precise quantitative data, but met qualitative research design standards of validity, dependability, and credibility. Study findings may not generalize to other school districts or even other schools in the same school district. Nonetheless, the study developed tentative conclusions about participating administrator and teacher perceptions of the challenges in one-to-one computing adoption. The conclusions relied on content analysis and to provide dependability and reliability (Lincoln & Guba, 1985).

<div align="center">Summary</div>

       The purpose of the qualitative phenomenological case study was to examine teacher's perceptions of one-to-one computing that may serve as a barrier to adoption. Chapter 3 presented study goals, research design, and procedures, describing how, where, and with whom the research was conducted. An overview of the study population, sample selection, instruments, and procedures for data collection, measurement, and analysis has also been presented. In summary, the research plan was to collect interview data from both teachers and administrators to develop a rich picture of administrators and teachers' views, experiences, and perceptions of the challenges to successful one-to-one computing adoption.

CHAPTER 4

REPORT OF RESEARCH FINDINGS

<u>Introduction</u>

The purpose of this qualitative case study was to examine administrators and teachers perceptions of one-to-one computing as a differentiated instruction method and to identify potential obstacles to adoption. Data was collected using semi-structured interviews protocol that enabled participants to offer rich narrative responses. Rich data was analyzed to capture participants' perceptions regarding of one-to-one computing as a differentiated instruction method. Individual interviews lasted approximately 90 minutes and a brief email follow-up was initiated to clarify background data. The researcher maintained a handwritten journal to record noteworthy observations regarding participants, including body language, and facial expressions, which may not be heard on a voice recording. Chapter 4 begins with an overview of the setting, participant demographics and characteristics, a brief overview of portions of each participant's life story germane to study, and the study findings organized by themes.

<u>Setting</u>

The research site was a Midwestern high school instructing in grades 9-12 and located 20 miles from a major metropolitan area with 360 students and 20 teachers. Participants answered semi-structured interview questions regarding demographics, economic status, family of origin, academic achievement, and a number of open-ended questions depending on each participant's degree of response. Interview duration was up to 90 minutes, depending on the participant's level of interest.

<u>Participants</u>

A purposeful sampling strategy and case study research approach were used to identify and recruit eight teachers and four administrators from a single public high school located in Iowa. Study data from semi-structured interview questions were organized into two categories: (a) demographic information, and (b) experiential data organized around themes. Demographic information included age, gender, ethnicity, educational attainment and teaching experience. Of the 12 study participants, three were females (25%) and nine were males (75%), which was different than the U.S. secondary school teacher industry average which was 76% female in 2014 (NCES, 2015). In addition, all study participants were Caucasian, which is somewhat similar to the U.S. secondary school teacher industry average of 82% Caucasian (NCES, 2015). As shown in Table 1, five (42%) participants were ages 30-39, five (42%) were ages 40-49, and two (16%) were ages 50-59. The study sample was slightly older than the national average for U.S. high school teacher age (NCES, 2015).

Table 1

Participant Age Range

Age Range	N	%	National Averages
30 - 39	5	42%	29%
40 - 49	5	42%	25%
50 – 59	2	16%	23%

N= 12,

As shown in Table 2, the study sample included six individuals (50%) with master's degrees or higher educational attainment. Study participants total years of teaching experience ranged from seven years to 34 years with a mean of 16.7 years ($SD=7.6$) Study participants tenure at the participating highs school ranged from five years to 27 years with a mean of 11.5 years ($SD=6.0$). In terms of one-to-one experience, participants' had between six to eight years of direct experience.

Table 2

Educational Attainment and Teaching Experience

Participant	Position	Degree Earned	Teaching Experience	1-1 Experience	Years at Maryville
Paula	Administrator	M.A.	12	7	7
Peter	Administrator	M.A.	21	8	6
Philip	Administrator	M.A.	7	6	6
Thad	Administrator	B.A.+30	19	8	9
Andrea	Teacher	M.Ed.	14	7	12
James	Teacher	B.A.	12	7	5
John	Teacher	B.S.	12	7	12
Julie	Teacher	B.A.+45	25	7	11
Levi	Teacher	B.A.	18	7	18
Max	Teacher	M.A.	9	7	9
Nathan	Teacher	M.Ed.	22	--	16
Simon	Teacher	B.A.	34	7	27
Mean			16.7	7.1	11.5
SD			7.6	0.4	6.0

$N=12$.

<div align="center">Findings and Analysis</div>

Study findings are organized into the following three superordinate themes: (1) one-to-one computing as a differentiated instruction method, (2) obstacles to one-to-one implementation and integration, and (3) requirements for successful one-to-one implementation as a differentiated instruction method. Superordinate themes were further divided into subordinate themes that served to further focus the findings.

One-to-One Computing as a Differentiated Instruction Method

Teachers leveraged one-to-one computing capability as a tool to deliver differentiated instruction. Differentiated instruction refers to the practice of creating individual lesson plans to meet the diverse learning needs in a heterogeneous classroom. One-to-one programs enabled students to work on multiple tasks and modalities while allowing the teacher to monitor their progress. Self-paced learning was one of the largest benefits of the program and not only allowed students to pace themselves inside of the classroom, but outside as well. Teachers were able to record themselves and put their videos on YouTube, and students would take advantage of that inside the classroom and outside as well. Teachers were also able to upload critical documents using software such as Google Docs. Teachers were able to guide learning and problem solving in this way. Teachers exhibited a fondness for the fact that students could learn in a variety of ways, and noted the fact that students could learn at different times. Special education students also benefited from systems such as auditory books, and speech-recognition software allowed students with speech difficulties to communicate.

> We are able to individualize the way the students receive instruction and they are able to show understanding. But keeping a solid monitoring on that when students

are doing things when you have students at eight different places in your classroom all at the same time. And they are working on multiple different things, multiple different modalities, trying to keep track which ones are on pace (John, personal communication, May 27, 2016).

Definitely some self-paced learning that's something that we do a lot here just in case a student works a little slower or the occasional student that also wants to work at their own speed ahead but I'll video my lectures I'll also do, I'll do certain practice problems and video them and then put them on YouTube so I know, I know kids are usually...when they have time, you know they're sometimes watching the video again on how I did a particular problem (James, personal communication, May 20, 2016).

Administrators noted from the start that the goal of adopting the laptop program was to personalize learning. This could be accomplished by increasing the resources allowed to students and giving them a variety of ways of approaching their tasks. These resources benefited the students directly by giving them access to the tool itself. Teachers benefited from better being able to tailor instruction to a variety of students. Administrators emphasized the goal of the program was to focus on increasing student learning, which involved tailoring the pace to the types of activities students could participate in. Administrators noted the personalization of coursework could be diverse, and include recording of lessons for students to use on their laptops, or the simple ability for students to access learning materials easily outside of the classroom. Units and coursework could be completed without having to accomplish it within the class, and administrators seemed satisfied with the flexibility of the program and its ability to expand learning beyond school walls.

Administrators noted that these resources were to enhance learning and that the new tools were designed to assist in differentiated instruction. Administrators also noted the benefit of allowing students to progress through materials at their own pace.

Personalized learning was a noted benefit of the technology, and both the online

platforms and online tools allowed students not only to pace themselves, but to receive

better feedback as well as more immediate feedback. Other administrators noted the fact

that adoption of new technology had to occur in the face of modern trends. Other schools

were adopting similar technologies, and to keep their classrooms competitive,

administrators of this school felt technology adoption was necessary. Technology

allowed students to explore beyond the limits of a classroom or library when it was used

appropriately.

> Personalizing education is more of just giving kids the chance to learn on their own. We have some flipped classrooms, where the teachers actually record their lessons and the students can use their laptops, or any technology outside to do the lessons and learn. The global is taking down the walls of the classrooms, there are no barriers anymore (Thad, personal communication, May 26, 2016).

> Short-term computer-related learning goals help students continue to move in a direction that allows teachers to better differentiate instruction, allows our students more opportunities to show what they know in a variety of ways (Peter, personal communication, May 26, 2016).

Preparation for the future. Participants noted that one-to-one computing prepares

students for the needs of the 21ˢᵗ century. Such technology was beneficial not only as a

means of increasing tailored instruction for students, but also adapting them to the sort of

tools they might find in the modern workforce. Becoming familiar with the technology

itself as a tool was necessary in order to enhance their lives moving forward in the

modern working environment. Use of computers in the classroom and at home:

> Gets them ready for the 21st century, by using those 21st century skills. It is making them, showing them that they are adaptable that they are able to, you've got a new platform we have to use and so they have to adapt to towards their needs (Andrea, personal communication, May 23, 2016).

Means of achieving standards*.* At some level, the technology also served the concrete purpose of meeting standards set for the school. While a number of notable benefits could arise from the use of the technology, one concrete goal of adopting this technology was giving the teachers a better chance of meeting their goals. The combination of one-to-one computing and differentiated instruct makes more engaging because the computer uses multimedia, but more importantly interesting news-elated content is available every day to all reading levels, as is the case with Smithsonian-sponsored Tween Tribune, which has a daily edition drafted at every reading level from K-12. In this instance each individual can read at his or her own level, do tailored assignments, and the whole class can discuss the same news event (James, personal communication, May 20, 2016). "So again technology ends up being a tool we use to meet academic standards and help our students reach their goals" (Max, personal communication, May 18, 2016).

 Impacting student achievement*.* Teachers noted that the use of new technology had allowed students who were struggling to reinforce what they had learned. This was not necessarily a reference to only students who had a learning difficulties, but with advanced students who might lack confidence in their ability to perform. The technology acted as a tool allowing them more flexibility and creativity in the way they approached their work. Two NCLB standards met by one-to-one computing combined with differentiated instruction are mastering computer skills and ability to conduct research independently. The following quote supports that finding.

Students were given the choice between a traditional test sequence for the semester or project work based using online research tools. Students gravitated toward the how they learned best and their grades reflected it (John, personal communication, May 27, 2016). For students such as those in the special education program, the technology helped put the students on more even footing to start each lesson. The technology allowed for new ways of communicating. Individuals who could not speak might be able to communicate by touching words on an iPad. The technology allowed students to be flexible not only in how they approached their work but also in how they shared and communicated, leading to increased performance.

Administrators noted the fact that the use of the technology helped meet standards set by the state and federal government. These core standards often emphasized higher level thinking and the technology better enabled students to perform at that level. The laptop program acted as a tool to better enable learning and allowing students to access information and perform more effectively. A second goal administrators noted was that achievement was not limited to school performance, but setting up students to be effective in a 21st century environment. The tools included as part of the program and the technology utilized acquainted students with skills they would need beyond the classroom. Administrators noted there was no dedicated technology class, but rather technology was a constant part of student use. Students were enabled to achieve in ways that went beyond academic measurement and in ways that would impact them throughout life.

For our special education kids it has kind of evened that starting line so for those that are really disabled it has opened up a whole new world that they didn't have before of communication so those who have no ability to speak at all being able to touch words like on an iPad and use some of that technology has been opening a huge totally you know bring that starting line up to not having such a high handicap part piece to it (Julie, personal communication, May 26, 2016).

Obstacles to One-to-One Implementation and Integration

The participating high school began implementing one-to-one computing programs more than seven years prior to this research study, and successfully overcame many of the important obstacles to adoption in the scholarly research into both one-to-one computing (Norris, & Soloway, 2011) and differentiated instruction (Tomlinson, & Imbeau, 2010). Obstacles for differentiated instruction overcame included: (1) excessive time required to create individualize lesson plans, (2) learning complex classroom management skills to juggle students learning a spectrum of content, (3) insufficient time and resources to constantly assess individual progress, and (4) identifying appropriate content and integrating into curriculum (Tomlinson, 2000). In terms of one-to-one computing adoption, participants reported a few issues identified below.

When teachers struggled with one-to-one computing, it was often in the area of tracking students and monitoring what they did. Teachers were concerned with student pacing some students require the entire class period, while others finished quickly, even with different lesson plans. Pacing issues sometimes proved disruptive, with the faster students becoming restless and bothering the slower students.

Another obstacle was finding a balance between unlimited access to social web sites and maintaining attention on school work. Online websites such as YouTube and Facebook offered ways for students to easily get off course. The school prioritized open

access to the internet, and so such sites could easily threaten to get students distracted.

Teachers had to be vigilant in order to prevent excess distractions that might arise due to

these conditions. This proved difficult given the number of students they could have at

times and the inability to monitor all the screens effectively. Some took this as an

opportunity to develop better lessons than the distractions that could be potentially

offered, and teachers fought to ensure the lessons they developed were not simply fluff or

busy work. Another reason teachers felt they should strive for better lesson planning was

the speed with which some students could complete the work., and teachers had to

develop robust lesson plans in response.

Administrators noted that the access given to the students did pose a potential

problem. They questioned whether the amount of freedom given to students was wise,

but felt that they had to trust the students to be responsible in avoiding distractions. They

emphasized the need to balance freedom with responsibility in the classroom. However,

administrators were sympathetic to the needs of teachers and acknowledged it could

create a struggle with regard to a teacher's ability to monitor the classroom adequately.

Effective classroom management was a concern among administrators, who felt a widely

open internet environment would make classroom monitoring difficult for instructors.

The following three quotes summarize teachers and administrators thoughts on obstacles

to one-to-one adoption as a differentiated instruction method:

> Trying to keep track which ones are on pace and which students are not, which
> ones you really need to go in and do intervention and then those that are really
> sort of doing okay...That has been the challenge (John, personal communication,
> May 27, 2016).

> Well the obvious challenge is some students have that device and get very

distracted just because, you know, they are able to access so many other things at the same time and you can't keep your eye on all their screens so I mean that's an obvious one but you know the goal there is to make sure they are doing something that they feel is productive (James, personal communication, May 20, 2016).

There's a lot of distractions on the computer especially with the free open kind of unfiltered internet we have. We have basic protections like YouTube and Facebook, things like that, they're all open here and so I know a lot of students will tend to get distracted with those (Max, personal communication, May 18, 2016).

Requirements of Successful One-to-One Computing Implementation as a Differentiated Instruction Method

Time. Teachers noted that the amount of time required to set up the technology initially could take a heavy time investment. The recording of videos and lectures for uploading to YouTube constituted a major time investment, and was difficult to keep organized. The outset of the program was the most difficult time period with regard to setting up the technology. Teachers also had to adapt to the new process of teaching through the new technology. However, following the initial set up period, teachers felt that the workload was no higher than their previous methods of instruction. In some cases, it was a lower workload. Once the learning curve had been overcome and materials created, teachers could build on what they had developed with only minor tweaks over time. In the post-setup period, lesson planning either required roughly equal time as before the program, or less time. There were cases when increased time did result due to the need to identify appropriate online resources. In the end, while time investment was heaviest during the setup period of the program, the time required for lesson planning relied on the context of what the teacher was attempting to accomplish.

Initially, for me, it increased it, to you know create all these videos, these lecture videos, to post them to YouTube and to kind of organize everything (James, personal communication, May 20, 2016).

Resources. Teachers noted that internet resources provided a wide variety of

options for delivering differentiated instruction content

For example, news sites such as the Smithsonian sponsored site Tween Tribune is a daily news periodical with every article written at all grades K-12. An assignment relating to the news can be comprehended by each learner at their current level of learning (James, personal communication, May 20, 2016).

Some resources are not available 24/7, but teachers made resources available by

recording content and posting lectures on YouTube for later viewing in class. Resources

did not have to be in the form of either video or audio, but could be in basic texts

available in PDF form. Teachers noted that finding appropriate curriculum can sometimes

be confusing and changing too quickly to implement. Some programs were geared

toward younger students and were not appropriate for classes including older individuals.

At other times, the abundance of resources could be detrimental, as students had such

easy access to previously written work. Students would find websites allowing them to

complete their lessons as quickly as possible, therefore defeating the intention of the

teacher to teach critical approaches to the material.

Administrators viewed ono-to-one resource requirements through the lens of the

teachers' needs. Their responsibility is to create opportunities for teachers to learn new

ways to integrate one-to-one computing and DI. Teachers were sometimes sent to

education-related technology conferences such as the ITEC conference, as professional

development. Other means of providing resources to the teachers came in the form of

professional development, which they attempted to personalize to the needs of the teacher

as much as possible. Administrators were supportive of bringing in any technology and pushing training that would assist in differentiated instruction.

> We have instant access to technology and we have multiple ways to represent learning than we have ever had before. Whether it be as the laptop or could be without it (Nathan, personal communication, May 23, 2016).

Incremental Staff. For the purposes of this subordinate theme, staff refers to non-faculty direct and indirect people support in a number of ways. Technical support for participants was reported to include (1) computer repair, software training, and installation for all related computers, (2) Google Classroom education and cyber safety procedures, and (3) librarians provided some of the learning resources to teachers and assisted in how to properly use web 2.0 tools. The teaching staff also supported one another, mastery passed from one teacher to another.

Administrators noted that they felt confident the teachers working at the school cared about their students and wanted to see improved growth. They noted that their staff was not working merely for a paycheck, but instead were good people who wanted to make a difference in the lives of the students. The administrators noted that they could see the positive impact of their teaching staff via the improvements among students of earlier ages through graduation at 12th grade. The new technology gave teachers new tools with which to work and enabled them to continue instructing effectively. The staff also creatively adapted to the technology and used it in ways the administration had previously not conceived. "Our teacher librarian certainly, over the years, has provided resources for us to learn and utilize different tools" (Levi, personal communication, May 20, 2016).

Administrative support. Teachers felt that the administration was attempting to provide the best opportunities possible for the staff to learn new techniques for instructing their students. Teachers felt confident in bringing their ideas to administration, sitting down, and talking the ideas through. Because of this, teachers felt they could attempt new things that might be conventionally supported. Teachers felt free to innovate due to support from administration. Administration was itself actively engaged in attempting to get teachers to incorporate new techniques into the classroom.

While remaining supportive of teachers' current efforts, administration continuously pushed their staff to be innovative in their approach to the students. Teachers felt as if the school was unique in the relationship between its staff and the support they received from administration, and felt excited about the prospect that they could attempt new things. Teachers felt they would rarely be turned down from what they proposed, and administration attempted to provide a range of technological tools for their staff.

Administration encouraged the Director of Technology, Librarian, and technical support staff to identify application and tools to improve one-to-one computing. Administration felt ready to learn new things that would benefit the school. In addition, Administrators felt they were attempting to provide the best opportunities they could for the staff not only through the technology they brought in for use in the school, but also in the opportunities they provided staff to receive training in that technology. However, they also took care not to push too hard any one form of technological instruction. Understanding that teachers, like students, were effective in different ways, the

administration gave teachers the opportunity to use the technology they were best suited to and not necessarily integrate all the new tools being brought into the school.

As with administration in general, the teaching staff expressed confidence in their ability to go to the superintendent and discuss ideas they felt might benefit the school. This same sort of openness fostered the confidence that teachers could attempt new things and innovate within their classrooms. A strong vision benefited the school, and leadership clearly communicated their mission and vision for where the school was heading. This type of leadership in turn affected the teachers, who were encouraged by the clear sense of vision and empowered the staff to provide feedback to leadership. The staff gave credit to their leaders with regard to the professional nature of the school staff, the implementation of the new technology program, and the improvements seen within the school.

Administrators mirrored the need to communicate a strong vision and a belief in that vision. They emphasized the need to collectively build on that vision. They also mirrored statements that a strong vision could in turn benefit teachers and empower them, and felt that this secondary effect was a positive result of the type of leadership demonstrated by administration. The administrators noted that the superintendent supported and encouraged them to be innovative in their approaches. There was a sense of cumulative trickle-down effect. The superintendent and school board empowered their administrators via their vision, and administrators in turn empowered the teaching staff by adhering to and communicating that vision. Positive benefits began from the very top of school leadership and made its way throughout the entire staff. "I think our

administration right now is trying to provide the best opportunities for our staff to go outside of the school to integrate the computer into the classroom" (Thad, personal communication, May 26, 2016).

> I think the most important piece is the creating a belief and a vision everybody knows and understands and that's behind them. That's ultimately the first step; if you don't have that, no matter what you do after then it truly does become kind of this initiative or the next thing (Peter, personal communication, May 26, 2016).

> I feel like I have a really supportive school board and boss, in the superintendent, to be innovative (Paula, personal communication, May 24, 2016).

Community. Teachers expressed a belief that the size of the school helped generate a close community for the staff and administration. This was partly attributed to the training desired to foster a sense of closeness, but the teachers at the school felt they maintained quality relationships with their students. There was a belief that the school fostered a sense of moral compass in the student body and that openness and communication was encouraged. The town itself was small and administration believed the school community benefited from kids being highly engaged in many school activities and the support they received from staff.

> I think our size makes a difference with that. I think our administration makes a huge difference with that as well. The trainings we've been provided that foster a sense of community here within the school (Nathan, personal communication, May 23, 2016).

Summary

The purpose of this qualitative case study was to examine administrators' and teachers' perceptions regarding one-to-one computing as a differentiated instruction method. A convenience sample of eight teachers and four administrators was drawn from

a population at a small suburban Midwestern high school located 20 miles from a major metropolitan area. Demographic data was collected. The sample consisted of three females (25%) and nine males (75%) all of whom were Caucasian, which was a distinct difference from the U.S. secondary school teacher average of 76% female (NCES, 2015). With regard to educational attainment, 50% held master's degrees and 50% held bachelor's degrees. Teaching experiences ranged from seven to 34 years with a mean of 16.7 years, and 44% were beneath the age of 40.

Participant narratives reflected three superordinate themes: (1) one-to-one computing as a differentiated instruction method, (2) obstacles to one-to-one implementation and integration, and (3) requirements for successful one-to-one implementation as a differentiated instruction method. Teachers reported that the technology program allowed them to better differentiate their instruction and four subordinate themes were found beneath the larger superordinate theme of adoption of one-to-one computing as a differentiated instruction model. The first was *Preparation for the future*. Teachers and administrators felt the technology improved not only school performance, but better enabled students to meet challenges outside of school. *Meeting goals as a means of achieving standards* was a second goal. Teachers reflected on the fact that the technology enabled them to meet standardized requirements. *One-to-one computing as a means of individualizing instruction* was slightly differentiated from the larger subordinate theme. It was distinguished by the reflection of administrators that they set out with the goal of using the technology as a means of differentiating instruction. Finally, *means of student achievement* was characterized by reflections that

the technology allowed all ranges of students to increase performance and learn more effectively.

Obstacles to one-to-one implementation and integration formed the second superordinate theme and dealt with teacher struggles with the technology. A prevailing theme among teachers was the difficulty in monitoring students and keeping their classrooms free of distraction. Administrators agreed with teachers in this regard and acknowledged that an open internet without restrictions proved to be a risk in the classroom. However, they felt it was necessary to keep the internet open in order to give students the tools necessary to best address their coursework.

Requirements for successful one-to-one implementation as a differentiated instruction method formed the final superordinate theme and consisted of five subordinate themes. *Time* formed the first subordinate theme and consisted of the time necessary to prepare work for the classroom. The initial setup period was seen as the most difficult area in terms of time investment, but future lesson planning time was contextual and based on what teachers were attempting. Administrators perceived this from the perspective of granting greater collaboration time for teachers to strengthen one another's skills.

Resources made up the second subordinate theme and was characterized by the amount of resources available. Teachers rarely lacked resources for students, but were frustrated when students took advantage of that to complete their work in the least amount of time. Administrators attempted to make as many resources available as possible to teachers.

With regard to the third subordinate theme, *staff*, teachers were often assisted by both administration and library staff with regard to the use of technology.

The fourth subordinate theme, *administrative support*, reflected this assistance on the part of administration. Teachers expressed confidence in school leadership and the support they received, and administrators expressed the desire to help their teachers however possible. *Community* made up the fifth subordinate theme, and both administration and staff reflected on the school's support of its students and the benefit of being a relatively small community. However, administration in turn expressed confidence in the guidance they received from the school board and superintendent. This leadership had a trickledown effect to administrators and finally teachers.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

<u>Introduction</u>

The purpose of the qualitative case study was to examine administrators' and teachers' perceptions of one-to-one computing as a differentiated instruction method. A study sample of eight teachers and four administrators from a single Iowa high school were participated using semi-structured interviews for data collection. Differentiated instruction via one-to-one computing has previously been demonstrated to assist in accelerating student achievement and can form an important part of meeting the NCLB mandate (Bebell & O'Dwyer, 2010). Despite the advantages of using this technology, adoption has been slow and educators' perceptions of the use of technology has often been negative (Gunn & Hollingsworth, 2013). The reasons for this phenomenon are many, including a lack of training, a lack of administrative support, a lack of appropriate classroom time for this form of instruction, and the significant increase in time that would be required to create individualized lesson plans. Such perceptions can act as obstacles to successful adoption of a new instructional method (Joshi et al., 2009).

<u>Interpretation of Primary Findings</u>

Insights were obtained into how teachers and administrators perceived the adoption of one-to-one computing as a differential instruction method, what obstacles they perceived to the use of computing in this context, and what combination of time, resources, and administrative support factored into successful implementation.

One-to-One Computing as a Differentiated Instruction Method

   Teachers perceived one-to-one computing as a differentiated instruction method. Administrators reported that the goal of adopting the laptop program was to personalize learning. The technology program, as implemented at their school, was used in a variety of ways in their lessons for individual students, ranging from pre-recorded lectures uploaded to YouTube to the use of online software to aid in learning. Participants' use of technology to individualize instruction is consistent with previous research and theory on differentiated instruction, which requires personalized learning plans rather than a standardized set of instructions (van Garderen & Whittaker, 2006; King-Shaver, 2008). Instructors were able to deliver their lessons in a variety of ways that could potentially address the individual needs of students. The underlying assumption behind differential instruction is that even struggling students have the potential to succeed when the right opportunities are made available (Wormeli, 2006). Teachers in this study noted that students were able to communicate in new ways using the technology, learn outside the restrictions of a library or classroom, and relearn material through the persistent availability of lessons. Administrators in this study noted that from the outset, the goal of the technology program was to individualize instruction in a way that maximized learning for all students. This was consistent with the views of van Garden and Whittaker (2006) that learning should be tailored to meet individual needs.

   The view of King-Shaver (2008) that all students could benefit from differentiated instruction was confirmed in this study via teacher reflections that individualized instruction helped them meet achievement standards as well as aided both struggling

students and advanced students alike. This discovery that students of all learning stages

benefited mirrored the findings of Schoppek and Tulis (2010), who found notable skills

development in their study of both low- and high-achieving students. The individualized

content in this study and its availability allowed new ways for students to express

themselves or to attempt to complete work, allowing for greater flexibility and creativity.

Administrators confirmed that the technology was assisting the school to meet both state

and federal standards. Peter, an administrator, admitted as much when he said:

> When you look at the Iowa Core and the Common Core, it's getting kids to think
> at the higher levels and to have a higher level of understanding of those standards.
> Clearly, technology better enables you to do those things. (personal
> communication, May 26, 2016).

Other administrators addressed the fact that differentiated learning helped

personalize learning and make classrooms more effective. Teachers noted a number of

ways the technology helped benefit students. In some cases, this was due to the number

of resources available to an instructor. In other cases, teachers believed the new

technology helped them meet standards in a way that might be impossible without

technological aid. In addition, both teachers and administrators noted the benefit to the

acquisition of technological skills that are beneficial both in the classroom and outside of

it. A teacher, James, noted as much in saying "It definitely probably enhances them as far

as 21st century skills as far as state standards are concerned." (personal communication,

May 20, 2016).

Although not a major presence in the literature review, the use of technology and

student success in grasping modern skills was a constant point of emphasis among both

teachers and administrators alike. However, the positive results as a whole in this study

reflected previous findings in the research. Connor et al. (2004) found that differentiated

instruction was a more effective means of delivery instruction than a traditional, teacher-

centered learning model, and the teachers and administrators alike included in this study

noted multiple positive benefits of differentiated instruction via technology.

Obstacles to One-to-One Implementation and Integration

The differentiated instruction used by teachers was facilitated by technology, and

the findings of this study, among both teachers and administrators alike, was that wide

access to the internet and other technology based distractions posed the greatest difficulty

to instruction. Teachers praised the great availability of resources that the technology

allowed while also noting that a number of distractions, such as YouTube and Facebook,

made instruction difficult. Administrators confirmed that such distractions posed a

problem for teachers, who couldn't monitor all screens in a large classroom

simultaneously. Thad, an administrator, confirmed as much when saying:

> I would say classroom management would be my number one thing. Sometimes I
> think it's tough for the teachers, we don't give our teachers access to app remote
> desktop or different types of things to watch what the kids are doing the entire
> time. (personal communication, May 26, 2016).

The responses in this study heavily revolved around the difficulties that come

with maintaining differential instruction in a classroom designed with technology at the

core. In contrast, the literature surrounding barriers to differentiated instruction

emphasized teacher reluctance to adopt new technology (Gess-Newsome, 2001),

sometimes due to the belief that differentiated instruction was unfair to students (Walpole

& McKenna, 2007). These studies focused on the human element and the barriers created

by teacher resistance. These barriers included teacher hesitation due to concern regarding

the time needed to invest into new technology (Corley, 2005). This study did not highly reflect these levels of concern however this may have been partly due to the length of time that the technology program had been in place at the school. However, there was at least one statement indicating some hesitation to the implementation of the program at its inception. As Simon, a teacher; stated: "When we first got into it, it was like you were really being pushed to do something with the laptops all the time and you really probably caused more time to try to find a way to incorporate it into the rehearsal classes." (personal communication, May 20, 2016). This was one of the few instances in which teacher statements in this study hinted at the hesitation indicated in the literature review, however it still partly confirms the findings of previous studies. It may be that differentiated instruction possesses a unique set of difficulties to implement when it is attempted using technology, and the timeframe in which that program has been in place should be considered as well. The onset of a program may include a set of difficulties not found seven to eight years after the program has been in place.

<div align="center">Recommendations for Future Research</div>

The study findings suggest several opportunities for future research. The case study qualitative research method employed required a small sample of teachers and administrators recruited from a single school. This small study sample limited the generalizability of the findings. Future research on larger samples of teachers and administrators from private, urban, and primary schools would serve to increase confidence in the study findings presented in this study and reveal themes not uncovered during this initial study. Future studies may also consider different variables. Expanding

the number of participants would enable observations based on subject matter being taught, student's grade, type of technologies applied, and gender of teacher and student.

Another set of potential research could include shifting the focus from teaching to learning. Researchers could collect data regarding student's perceptions of the efficacy of varying technologies to promote and ease learning. Research might also include determining best methods for addressing the obstacles to the use of one-to-one computing as a means of differentiated instruction. These are only a few of the types of questions that could be addressed moving forward.

<p align="center">Conclusions</p>

This study used a qualitative case study research design and semi-structured interviews to enable collection of rich, narrative data. The participants were drawn from a single high school in Iowa and consisted of licensed teachers and administrators. Participants were allowed to embellish responses and avoid any questions that made them uncomfortable over a 90-minute interview. Study findings confirmed and reflected theory and prior research on one-to-one computing and differentiated instruction. Obstacles to successfully using one-to-one computing for differentiated instruction was a source of frustration for participants. However, teachers and administrators remained committed to continuing efforts to take advantage of the benefits afforded by one-to-one computing.

The most important study finding was that a single high school in Iowa was able to successfully implement one-to-one computing to meet its differentiated instruction needs. The finding was particularly surprising given the small body of research on the use of one-to-one computing for differentiated instruction, in fact, the first research question

was whether it happens at all. It occurred to me that this school could act as a model for

how to implement one-to-one computing and integrate it with differentiated instruction

needs.

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APPENDIX A

ADMINISTRATOR INTERVIEW PROTOCOL

The following are some of the some of the main themes, which will be explored in semi-structured interviews. Follow-up questions will be asked depending on the nature of responses.

1. Why was the use of laptops implemented in the school?

2. What are the goals (long-term/short-term) for the laptop program?

3. What have been and/or continue to be the major challenges in the implementation of laptops for learning?

4. Do you anticipate the expansion of the laptop program in your school?

5. What type of professional development to you provide for all staff involved with the laptop program, e.g. teachers, teachers' aides, peer-tutors.

6. What type of support do you receive at the District level?

7. How does the use of laptops fit into site and district goals?

8. How does the use of laptops align to State standards?

APPENDIX B

TEACHER INTERVIEW PROTOCOL

The following are some of the some of the main themes, which will be explored in semi-structured interviews. Follow-up questions will be asked depending on the nature of responses.

1. How long have you taught in the laptop program in the classroom?

2. Can you remember a classroom teaching event when you were using technology where is all came together for you and the students? What was happening? What did it feel like? How did the students respond? How did you respond?

3. Discuss the challenges that you have encountered incorporating the use of laptops in the curriculum.

4. What do you see as the benefits of using laptops in the classroom?

5. How does the use of laptops enhance or hinder the implementation of State standards?

6. Has the implementation of laptops increased or decreased lesson planning time?

7. Do you feel that you are teaching the same content in a different way or teaching new content in a different way?

8. Describe course objectives in the core content areas as it may relate to the use of the laptops.

9. What have you accomplished using laptops in the classroom?

10. How has instruction differed using laptops over the course of its implementation?

11. How has student achieve differed using laptops over the course of its
implementation?

12. What type of support do you receive for the implementation of laptops in the
classroom?

13. What dreams do you hold for the students you teach as they relate to applying
technology to their learning?

14. If you had an opportunity to talk with parents who were thinking about enrolling
their children at your school, what would you tell them about the use of
technology?

15. What makes teaching at your school unique when compared to other schools?
Why is it different?

APPENDIX C

CONSENT FORM AND EMAIL RECRUITMENT

One-to-one Computers in Iowa: An Investigation of the

Impact of Teachers Perceptions of Teaching and Learning

You are invited to participate in a research study being conducted for a dissertation at _____. The study is about your thoughts and opinions on teaching. You were selected because you are a grade school teacher. There is no deception in this study.

What will be asked of me? You will be asked questions about teaching for about 60 minutes and you will be observed in class for about 1 hour.

Who is involved? The following people are involved in this research project and may be contacted at any time: _____.

Are there any risks? Although there are no known risks in this study, some of the questions might be personally sensitive since some of the questions ask about your perceptions of teaching. This can be distressing to some people. However, you may stop the study at any time. You can also choose not to answer any question that you feel uncomfortable in answering.

What are some benefits? There are no direct benefits to you of participating in this research. No incentives are offered. The results will have scientific interest that may eventually have benefits for people who procrastinate.

Is the study anonymity/ confidential? The data collected in this study are confidential. Your name or personal information is not linked to data. Only the researchers in this study will see the data.

Can I stop participating the study? You have the right to withdraw from the study at any time without penalty. You can skip any questions on any questionnaires if you do not want to answer them.

What if I have questions about my rights as a research participant or complaints? If you have questions about your rights as a research participant, any complaints about your participation in the research study, or any problems that occurred in the study, please contact the researchers identified in the consent form. If you prefer to talk to someone outside the study team, you can contact _____.

We would be happy to answer any question that may arise about the study. Please direct your questions or comments to _____.

Signatures

I have read the above description for the *One-to-one Computers in Iowa: An Investigation of the Impact of Teachers Perceptions of Teaching and Learning study*. I understand what the study is about and what is being asked of me. My signature indicates that I agree to participate in the study.

Participant's Name: _____   Researcher's Name: _____

Participant's Signature: _____ Researcher's Signature: _____

Date: _____