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Evaluation of an Adaptive Reading Program at a Title I Public Elementary School

by
Monica M. Gordon

An Applied Dissertation Submitted to the
Abraham S. Fischler College of Education
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

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Approval Page

This applied dissertation was submitted by Monica M. Gordon under the direction of the persons listed below. It was submitted to the Abraham S. Fischler College of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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Statement of Original Work

I declare the following:

I have read the Code of Student Conduct and Academic Responsibility as described in the *Student Handbook* of Nova Southeastern University. This applied dissertation represents my original work, except where I have acknowledged the ideas, words, or material of other authors.

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Monica M. Gordon
Name

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Abstract

Evaluation of an Adaptive Reading Program at a Title I Public Elementary School. Monica M. Gordon, 2018: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education. Keywords: reading achievement, early reading, computer assisted instruction, teacher guidance

This applied dissertation was designed to evaluate the I-station adaptive reading program and determine its impact on reading proficiency of third-grade students. The school of study was a Title I school with proficiency rates for third-grade students of about 40% annually. The district recommendation for student usage mirrored the recommended minutes per week established by Imagination Station, the I-station parent company. The program evaluation utilized the context-input-process-product model components, measuring process and product. There were two research questions underpinning the study:

1. Process: Is the I-station program being used with fidelity at the school of study to achieve program intended outcome of student reading remediation?

2. Product: Is there measurable growth in the I-station reading scores of third-grade students as measured by the I-Station indicators of progress beginning-of-year, mid-year, and end-of-year test results during 2016-2017 school year?

An analysis of the data revealed that third-grade students did not demonstrate a consistent improvement in reading across the three assessment periods despite average to slightly below average grade-level usage of the program throughout the year. The researcher recommends that the school reassess the use of the program and its impact on reading proficiency and conduct additional research to examine best practices that reinforce more teacher-directed instruction of reading.

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Chapter 1: Introduction

Statement of the Problem

In 2007, nearly 6.2 million young people in the United States, or 16% of the 16 to 24 age group, were high school dropouts, according to Fiester and Smith (2010). The potential cost of not combatting national dropout rates would be exponential to American society. These costs would be felt in terms of future health problems, lost tax revenues due to weak earnings, higher expenses for incarceration, and welfare. These and other transfer costs would amount to over $250,000 per youth who remained on the street and did not earn a high school diploma (Center for Labor Market Studies, 2009).

More than 30 years ago, research began to suggest that children with low third-grade reading test scores were less likely to graduate from high school than children with higher reading scores. Third grade is an important pivot point in a child's education, as it the time when students shift from learning to read and begin reading to learn (Hernandez, 2011). One in six children who are not reading proficiently in third grade do not graduate from high school on time (Hernandez, 2011).

Literacy, which is the ability to access, evaluate, and integrate information from a wide range of textual sources, is a prerequisite for individual educational success and upward mobility both socially and economically (Reardon, Valentino, & Shores, 2012). Educators and researchers have long recognized the importance of mastering reading by the end of third grade. Students who fail to reach this critical milestone falter in the later grades and drop out before earning a high school diploma in most cases (Hernandez, 2011).

In March 2010, the Obama Administration, recognizing the importance of early reading skills, released its blueprint for revising the No Child Left Behind Act, known as

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the Elementary and Secondary Education Act, calling for putting reading first. The original act from the outset required states to test reading skills annually for all students beginning in third grade (Hernandez, 2011). There is considerable interest in the early identification of children who may have difficulties in reading, related in part to public policy initiatives that emphasized the prevention of reading difficulties. Prevention is only possible if those who are at greatest need are identified early in their development (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004).

Description of the setting. The medium to large size district in which the program evaluation was conducted is in the southeastern part of the United States in the state of Florida. This school district is the 19th largest district in Florida and has a population of over 42,000 students being served across 50 school sites in prekindergarten through 12th grade. The school district consists of 21 elementary schools, 10 middle schools, nine high schools, and seven charter schools (Moxley, 2016).

The school of study was a Title I public elementary school with a school population of 689 students in prekindergarten through fifth grade. The faculty and staff consisted of over 90 members. There were 35 general education teachers of prekindergarten through fifth grade, two teachers of students identified as gifted, two teachers of students identified with intellectual disabilities, two teachers of students identified as emotionally and behaviorally disturbed, two teachers of students identified with autism specturm disorders, four teachers of students identified with varying exceptionality inclusion, two potential specialists, five teachers who teach enrichment, one speech-language teacher, four instructional coaches, one specialist for exceptional student education, two guidance counselors, one instructional dean, two assistant principals, 16 teacher assistants, one nurse, six custodians, six cafeteria employees, and

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six clerical employees. In the 2016-2017 school year, the school population consisted of 668 students: 50% were African American, 13% were Hispanic, 29% were White, 1% was Hawaiian, 1% was Asian, 1% was Native American, and 5% were multiracial. The school had a free and reduced-price lunch rate of 92% of all students.

The topic. The topic of this study was related to the underperformance of reading proficiency of students in a Title I school. Title I, Part A (i.e., Title I) of the Elementary and Secondary Education Act provides financial assistance to local educational agencies and schools with high numbers or high percentages of children from low-income families to help ensure that all children meet challenging state academic standards (Torgesen et al., 2007; U.S. Department of Education, 2015).

The research problem. The problem addressed in this study was not all students in the target school met proficiency standards for reading by the end of the third grade. This problem also existed in many other schools in the district and state. In years prior to this study, third-grade students in the school earned a proficiency level of 42% in reading in the 2012-2013 school year, which dropped to 31% proficient in the 2013-2014 school year. The district's third-grade proficiency level for reading was 59% in the 2012-2013 school year and 56% in the 2013-2014 school year during that same time frame. The state's third-grade proficiency level for reading was 58% in the 2012-2013 school year and 58% in the 2013-2014 school year (Florida Department of Education, 2015). The school of study earned additional proficiency scores for third grade of 34% in the 2014-2015 school year and 40% in the 2015-2016 school year.

Background and Significance of the Problem

Closing the gap between proficient and struggling readers is often difficult as students progress through school. As these students progress from kindergarten, those in

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the lower quartile of reading achievement are likely to remain there, and this may not diminish over time (Fiester, 2013). This was supported by the national data collected in 2015, in which the percentages of fourth-grade public school students performing at or above the proficient level in reading ranged from 23% to 50% across the states or jurisdictions. The percentage of fourth-grade public school students performing at or above proficient was 35% nationally (National Center for Education Statistics, 2015).

As stated earlier, third grade is an important pivot point in a child's education, as it is the time when students shift from learning to read and begin reading to learn (Hernandez, 2011). The urgency for increased proficiency in reading was also impacted by the school of study having Title I status. Title I status is an equally important factor in the proficiency levels of the school. Family income is now nearly as strong a predictor of achievement as is parental education (Reardon et al., 2012). Ninety-two percent of the students in the school of study qualified for the free and reduced-price lunch program, placing the school in Title I status. Expanded criteria for determining socioeconomic status now includes additional measures of household, neighborhood, and school resources (Cowan et al., 2013).

Children whose families live in poverty often lack resources for adequate housing, food, clothing, and books, and they often do not have access to high-quality child care and early education or health care. They also are more likely to live in neighborhoods with low-performing schools. Consequently, children in low-income families tend to develop weaker academic skills and achieve less academic success. Many students from low-income families arrive at kindergarten without the language or social skills they need for learning (Hernandez, 2011). Most children who do not learn to read during the primary grades will probably never be able to read well. Children who reach the end of

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third grade with low literacy skills typically have less access to the regular curriculum, require long-term support, and fall further behind their peers in literacy achievement and curricular knowledge (Sloat, Beswick, & Willms, 2007).

Sloat et al. (2007) stated that research strongly supports both the vital role of early identification in the prevention of reading difficulties and the urgent need to teach children to read during the first few years of school so that they can read to learn in third grade and beyond. The school of study was classified as a differentiated accountability school ranked in the bottom 300 in the state of Florida for student proficiency levels. The bottom-300 status mandated that an additional 60 minutes of reading needed to be added to the regular school day and that the school needed to offer a summer remediation program for all students in third, fourth, and fifth grades who scored a Level 1 or 2 on the Florida State Assessment for English Language Arts.

It is vital for students to master early learning literacy skills in kindergarten through third grade (Armbruster, Lehr, & Osborn, 2001; Reardon et al., 2012; Schatschneider et al., 2004; Sloat et al., 2007). The students in these grade levels are tasked primarily with learning how to read and are exposed for the most part to narrative or story-based text. Beginning in fourth grade, however, students are challenged with rapidly accelerating literacy demands that involve progressively more difficult vocabulary and comprehension skills, based on text that is predominantly expository, or informational, in nature (Florida Senate, 2009).

In today's schools, too many children struggle with learning to read. As many teachers and parents will attest, reading failure has exacted a tremendous long-term consequence for children's developing self-confidence and motivation to learn, as well as for their later school performance (Armbruster et al., 2001). The state of Florida has

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successfully implemented research-based reading programs at the elementary level. However, reading interventions for struggling readers and the overall enhancement of literacy skills for all students may need to be revisited (Florida Senate, 2009).

Reading proficiently by the end of third grade can be a make-or-break benchmark in a child's educational development. In 1997, Congress asked the director of the National Institute of Child Health and Human Development and the U.S. Secretary of Education to convene a national panel on reading. In 2000, the Panel issued five essential components of reading instruction, which are included in the best reading instruction programs today: phonemic awareness, phonics, vocabulary, fluency, and comprehension (Cheung & Slavin, 2013; Fiester & Smith, 2010).

Cheung and Slavin (2013) stated that, ideally, struggling readers may receive one-on-one tutoring capable of adapting to their unique needs, and technology has often been proposed as a solution for the needs of struggling readers. In theory, computers can adapt to the individual needs of struggling readers, building on what they can do and fill gaps. Educational technology is defined as a variety of electronic tools and applications that help deliver learning content and support the learning process. The I-Station program is considered an educational technology that was found in a 2011 descriptive study to show measurable and clear improvement among students using the reading software in each grade (Bugbee, 2011).

Deficiencies in the evidence. Reading on grade level by third grade alone is not sufficient for preparing students for success in high school and beyond without attention to continuing literacy instruction and supports beyond third grade (Florida Senate, 2009). The focus on early literacy acquisition must be complemented by ongoing attention to reading instruction in Grades 4 and 5, content-area literacy skills in Grades 6 through 12,

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and effective, targeted interventions for students falling behind at any point in their literacy development (Snow, Martin, & Berman, 2008). Additional studies need to be conducted on the impact of third-grade retention and reading achievement in elementary schools as well (Lorence, 2014).

Audience. Low reading proficiency affects all stakeholders in the educational environment. External stakeholders to the school include parents, other schools in the feeder pattern, and the community. The greatest impact of the success or failure of increasing reading proficiency will be on internal stakeholders: the teachers and ultimately the students. It must be reinforced that the most impactful tool in increasing student achievement and closing the achievement gap is quality teacher directed instruction; however, direct instruction is one part of the process of instruction that should lead to the transfer of knowledge to the students that ultimately manifests in student artifacts or performance demonstrating an increase in proficiency. Stakeholders and researchers of this school district would benefit from research focused on this problem. Because the purpose of the I-station program is to increase students' ability to read fluently with comprehension, and teacher evaluations or effectiveness may be impacted by its student performance data, then all stakeholders in this school district and similar districts would benefit from a study of this kind.

Description of the Program

The I-Station program. I-station, formally Imagination Station, is a comprehensive adaptive reading program. The program uses an animated, game-like interface along with interactive digital curriculum for each student. Its computer-adaptive assessments, known as I-Station indicators of progress (ISIP), place students on personalized instructional paths. From the ISIP assessments, comprehensive reports are

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made available for educators, administrators, and parents to monitor student growth in the reading (Mathes, Torgesen, & Herron, 2014). Students' responses classify them into one of three tier levels: Tier 1, Tier 2, or Tier 3. Tier 1 students function at or near their expected grade level, Tier 2 students function below their expected grade level, and Tier 3 students function two or more levels below their expected grade level (I-Station, 2013, 2016). Teachers also have access to a library of lessons to facilitate whole-group or small-group instruction (Mathes et al., 2014) based on the Tier level classification and remedial needs. The program was implemented at the district level for all elementary schools in the district and for the school of study in January 2015. The 2016-2017 school year represented the first full school year of usage for the school of study.

Program-evaluation standards. The study adhered to the Joint Committee on Standards for Educational Evaluation that set a basis for program evaluations, personnel, and students. These standards require evaluations to meet conditions of utility, feasibility, propriety, and accuracy. Utility standards are intended to increase the extent to which stakeholders find the evaluation process meets their needs. Feasibility standards are intended to increase evaluation effectiveness and efficiency. Propriety standards support what is proper, fair, legal, and just in evaluations. Accuracy standards are intended to increase the dependability of the evaluation's findings, especially those that support judgments about quality. These standards combined encourage adequate documentation of evaluations and a metaevaluative perspective focused on improvement and accountability for evaluation processes and products (Joint Committee on Standards for Educational Evaluation, 2016).

Purpose of the Evaluation

The purpose of this evaluation was to determine the relationship between the

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usage of the I-station adaptive reading program and the program's internal measure of progression toward mastery as demonstrated by increasing student scale scores of reading proficiency in third-grade students in an underperforming Title I elementary school. Similar low-performing students can be found in many schools across the district and the state. Teachers are a valued but limited resource, especially in turnaround schools in which a significant part of the core group of students requires some type of remediation and is performing below grade level. How schools invest in assistive progress monitoring programs will determine the return on investment for those students that schools must work with within a given school year. This study was conducted because reading failure in elementary schools costs the education system and society a great deal, justifying continued efforts to create and validate reliably effective approaches combining the best efforts of teachers and technology (Cheung & Slavin, 2013).

The evaluation model used in this study was the context-input-process-product (CIPP) model for evaluation introduced by Daniel Stufflebeam in 1966. This model is a comprehensive framework for guiding formative and summative evaluations of programs, projects, personnel, products, institutions, and systems (Mathison, 2005). The model's core features involve the evaluation of an entity's contexts, inputs, processes, and products. This study focused on the process and product features of the CIPP model to study the effectiveness of the I-station program.

Definition of Terms

For the purpose of this applied dissertation, the following terms are defined.

Balanced approach. The National Reading Panel (2003) defined the balanced approach as an inclusive instructional approach of both the phonics-based approach and the whole-language approach. The balanced approach includes the five key features of a

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reading program that develop literacy skills: phonological (i.e., phonemic) awareness, alphabetic (i.e., phonics) awareness, orthographic (i.e., vocabulary) awareness, comprehension strategy, and reading (i.e., fluency) practice.

Computerized-assisted assessment. This term refers to the process of utilizing computer technologies for assessing student work (Beatty & Gerace, 2009).

Computerized-assisted instruction. This term usually consists of drill, practice, self-tutorial materials with regular assessments and assignments of student to appropriate materials based on their unique performance levels (Cheung & Slavin, 2013).

Educational technology. This term refers to electronic tools and applications that help deliver learning content and support the learning process (Cheung & Slavin, 2013).

Fluency. The National Reading Panel (2003) defined fluency as the ability to read orally with speed and accuracy in an expressive voice.

Phonemes. The National Reading Panel (2003) defined phonemes as the smallest unit consisting of spoken language.

Phonemic awareness. The National Reading Panel (2003) defined phonemic awareness as the skill to attend to and manipulate phonemes in spoken words.

Phonics. The National Reading Panel (2003) defined phonics as the recognition 10 of letter-sound correspondences and their use in reading and spelling.

Progress monitoring. This term refers to a scientifically based practice that is used to assess students' academic performance and evaluate the effectiveness of instruction. Progress monitoring can be implemented with individual students or an entire class (National Center on Student Progress Monitoring, 2015).

Reading readiness. This term refers to the period of time in which children naturally learn to read (National Reading Panel, 2003).

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Chapter 2: Literature Review

Introduction

In this chapter, the researcher has provided a review of the research that deals with the factors and barriers students face when working toward reading proficiency. In addition, the writer explores the research related to early learning and literacy, and computer adaptive instruction. To begin the chapter, the theoretical framework on which this study was based is discussed. Approaches to program-evaluation methods are also presented. The researcher used the review of the literature to help formulate the research questions presented at the end of the chapter.

Theoretical Framework

Operant conditioning involves reinforcing a behavior and rewarding it and is the most important type of behaviorist learning (Pritchard, 2013). Skinner, a psychologist working in America in the 1930s, is the most famous psychologist in the field of operant conditioning (Pritchard, 2013). When applying models of behaviorism in the classroom, it is necessary to have clear ideas of the behaviors, or operants, to be encouraged and reinforced. The more often a stimulus and response occur in association with each other, the stronger the habit will become. This repetition is seen in the drill-and-practice tutorials often associated with the learning of basic skills.

Pritchard (2013) stated an example of behaviorism taking on a major role in a drill-and-practice situation came with the onset of the introduction of computers into classrooms. With drill-and-practice software, children are routinely presented with several answers to a question, and, with each correct response, they receive some type of positive reinforcement. These types of programs allow children of varying abilities to work on exercises in their own time and at their own pace. Learning that is mediated by

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computers and in the form of an integrated learning system has become a feature of many types of educational technology. Skinner urged educators to focus on reinforcement and success, rather than on punishing failure. By repeatedly presenting information in small amounts and by reinforcing correct responses, the integrated learning system operates in a way that can be traced back directly to Skinner's ideas (Pritchard, 2013).

In social constructivist theory, emphasis is placed upon interaction between the learner and others. When one considers the more knowledgeable other, it is easy to assume that this person will be a teacher or a parent, but this is not always the case (Pritchard, 2013). In the case of this study, the I-station adaptive reading program was examined as the more knowledgeable other that continually adjusts skills based upon the accuracy of student responses. The undertaking of this other role, in a planned way, is known as scaffolding (Pritchard, 2013). The main proponent of this branch of constructivism was Lev Vygotsky.

To fully understand the concept of scaffolding, the notion of a zone of proximal development should be examined. The zone of proximal development is a theoretical space of understanding that is just above the level of understanding of a given individual. It is the area of understanding into which a learner will move next (Pritchard, 2013). Classical education includes instruction, as an interaction between student and teacher, and forms of electronically mediated education may include assisted instruction as an interaction between teacher and student facilitated with a computer or program. The teacher's instruction coupled with assisted instruction designed for a personalized and interactive learning process makes possible implementing Vygotsky's learning theory of the zone of proximal development (Zamfir, 2009).

Additionally, Mayer's cognitive theory of multimedia learning, or multimedia

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elements to enhance the learning experience of a child, may also be applied to this study. Mayer's cognitive theory of multimedia learning (Mayer & Alexander, 2011) allows children to use their auditory and visual channels in the learning process. It involves active use of their sensory, working, and long-term memory to process multimedia elements into logical mental constructs. This theory assumes the following: (a) There are two main channels for processing information: auditory and visual, (b) each channel has a finite capacity for cognitive load, and (c) filtering, selecting, organizing, and integrating information represented an active part of the learning process (Saad, Dandashi, Aljaam, & Saleh, 2015). According to Mayer, there are three important cognitive processes in which the multimedia learner engages. The first one involves selecting verbal and visual information to yield a learning base, the second involves organizing verbal and visual information to form into coherent mental representations, and the third one includes integrating the resulting verbal and visual representations with one another (Saad et al., 2015).

Literacy

Literacy is an important component of educational success and is not acquired easily. Becoming literate is a long, complex, and difficult process that requires the coordination of cognitive and knowledges based skills (Crossley & McNamara, 2016). Literacy encompasses a complex set of skills. At its simplest, it is a combination of word-reading skills and knowledge-based literacy competencies. Word-reading skills, such as decoding and letter-sound awareness, are more procedural in nature and are necessary for reading written text (Reardon et al., 2012). Phonemic-awareness instruction improves children's ability to read words as well as reading comprehension (Armbruster et al., 2001; National Institute of Child Health and Human Development, 2000).

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Teaching phonemic awareness, particularly how to segment words into phonemes, helps children learn to spell as they understand that sounds and letters are related in a predictable way (Armbruster et al., 2001). Knowledge-based literacy competencies include vocabulary knowledge, background knowledge related to the words included in the text, and the ability to integrate these two features with contextual information to make sense of a given text (Reardon et al., 2012). From the first through third grade, most students learn to recognize words by sight, comprehend words in context, and make inferences about text by using cues stated in the text (Reardon et al., 2012). From third through eighth grade, many students acquire knowledge-based literacy competencies, such as inference based on extrapolation, evaluation (i.e., the ability to understand the author's style of presenting information and to make connections between the story and one's life), and evaluation of nonfiction texts (Reardon et al., 2012). Currently, many students struggle to attain proficient levels of literacy, and teachers struggle with having enough classroom time or resources to dedicate to each student (Crossley & McNamara, 2016).

Early Learning and Literacy

Lerner (2012) stated the first big government early education effort, known as Head Start, was launched in 1965 as part of the War on Poverty with the aim to address the achievement gap. Public prekindergarten was initially seen as an alternative for economically disadvantaged children whose parents could not afford private or church schools. Research indicates that high-quality early learning that is universally available would reduce and possibly erase the achievement gap for minority children (Lerner, 2012). A report by the National Institute for Early Education Research suggested that establishing a high-quality universal prekindergarten program is a critical first step

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toward creating equity in access to early education and ensuring that all children begin kindergarten with an equal opportunity. This research found that high-quality preschool would reduce significantly the achievement gaps for African American and Hispanic children in math and erase the reading gap for both groups (Connors-Tadros, 2016).

Despite growing evidence of the benefits of early education, only 28% of 4-year-olds across the United States are enrolled in public prekindergarten. With concerns mounting over rising dropout rates and grim earning prospects for poorly educated Americans, the matter of when and under what circumstances children begin formal schooling is of growing importance. Guided by research that shows that most of the wiring for future academic accomplishment happens in the first 5 years of life, education experts have been exploring how to get children off to a better, and earlier, start (Lerner, 2012).

Ruby Takanishi, president and chief executive officer of the Foundation for Children Developments, stated, “Even if we manage to continue to make progress toward racial-ethnic gaps in children’s well-being at the same rate as we have been, it would take years before Black children caught up with the White children” (Sansui, 2008, p. 6). Families that have social-economic issues usually associated with poverty would benefit most from early education. The designation of poverty-stricken students also suggested that there are fewer resources in the home for children to draw from (Gardner, 2007). Reinforcing the home life or initial foundation of students can give them a head start to become academically proficient as they progress through the public school system. If socioeconomic issues are compounded with other barriers to success, such as not speaking English or being unfamiliar with the American culture, then the problems of the widening achievement gap are magnified greatly (Gardner, 2007).

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Behavior Problems and Literacy

A study conducted by Morgan, Farkas, Tufis, and Sperling (2008) set out to answer if reading and behavior problems were risk factors for each other. In the study, the authors found that children with reading problems in first grade were significantly more likely to display poor task engagement, poor self-control, externalizing behavior problems, and internalizing behavior in third grade. Their findings suggested that the most effective types of interventions are likely to be those that target problems with reading task-focused behaviors simultaneously (Morgan et al., 2008).

Morgan et al. (2008) used one of four causal studies to explain this relationship. The first proposal is that there are common causes (i.e., poor attention) variables that lead to problems in reading and behaviors. The second is that reading difficulties might trigger frustration, agitation, avoidance, and withdrawal from learning tasks. If this is so, instruction that improves reading proficiency should decrease a child's behavioral problems. Third, behavior problems such as off-task behavior and disruptive behavior may lead to reading problems. The fourth states reading and behavior are reciprocally causative over time, leading to a negative feedback cycle (Morgan et al., 2008).

One possibility of this causal relationship is that the negative feedback cycle was set in motion during the time of failure of the child during early literacy skill acquisition. Another possibility may be due to the lack of higher order reasoning skills, impacting planning, initiation, and self-regulation. These factors may lead to frustration and task avoidance, deficits in cognition, motivation, and behavior. As students develop significant deficits in reading or behavior, they are placed at a higher risk for negative long-term outcomes, including delinquency, dropping out, poverty, unemployment, and incarceration (Morgan et al., 2008; Unrau, Ragusa, & Bowers, 2015).

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Socioeconomic Gaps and Literacy

Family socioeconomic status is strongly correlated both with early literacy, as well as other academic outcomes, and literacy later in the school years. When U.S. children enter school, their reading skills vary widely by their socioeconomic status, race and ethnicity, and immigrant status. Because these literacy gaps exist before children enter school, the disparities must arise from conditions outside of schools, or from the children's families and communities, and the same out-of-school factors may continue to influence reading skills as children progress through school (Waldfogel, 2012).

Waldfogel (2012) examined how specific out-of-school factors may contribute to literacy gaps at school entry and to the widening of the gaps for some groups thereafter. Some factors are important across groups. For instance, differences in parenting help explain Black-White literacy gaps as well as gaps associated with socioeconomic status. Other factors differ by group. For instance, key influences on early literacy for immigrant children are the language spoken at home, parental proficiency in English, and whether a child participates in preschool.

The global implications of low socioeconomic status, usually minority students, and dropping out of school are tremendous and gaining more attention from government. Socioeconomic status can be defined broadly as one's access to financial, social, cultural, and human capital resources. Traditionally, a student's socioeconomic status has included, as components, parental educational attainment, parental occupational status, and household or family income, with appropriate adjustment for household or family composition (Cowan et al., 2013). With other studies also showing increases in the number of students from low socioeconomic status who are not graduating, public officials are concerned those numbers will mean rising costs for social programs and

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prisons, as well as lost tax revenue because of the reduced earnings potential of dropouts.

Dropouts are disproportionately represented in the criminal justice system, including about 75% of state prison inmates (Reardon et al., 2012). Because the modern economy increasingly rewards educational success, widening socioeconomic gaps in literacy and math skills may reduce opportunities for social mobility. Not only are these disparities a concern for reason of equity and social justice, but they also may severely limit the U.S. capacity to function effectively as a participatory democracy and to compete in the global economy (Reardon et al., 2012).

Double Jeopardy: Poverty and the Achievement Gap

The No Child Left Behind Act has, from the outset, required states to test reading skills annually for all students beginning in third grade and to report these results for children by poverty status and race or ethnicity, as well as for English-language learners and for children with disabilities. As stated in the No Child Left Behind Act, President Bush had an unequivocal commitment to ensuring that every child can read by the end of third grade. In March 2010, the Obama Administration released its blueprint for revising the legislation by significantly increasing the federal investment in scientifically based early reading instruction (Hernandez, 2011). Children whose families live in poverty face a variety of challenges. They miss school frequently because of health or family concerns. They slip behind in the summer with little access to stimulating educational programs or even regular meals. Consequently, the children in poor families are in double jeopardy, as they are more likely to have low reading test scores, and, at any reading-skill level, they are less likely to graduate from high school (Hernandez, 2011). African American and Hispanic children are not only more likely to live in poverty, but they also are more likely to live in neighborhoods with concentrated poverty and low-performing

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schools (Hernandez, 2011). There is much research regarding the educational achievement gap between minority (i.e., African American and Latino) students and their nonminority counterparts, or Whites (Berends, Lucas, Sullivan, & Briggs, 2005).

With the passage of No Child Left Behind, students, teachers, and schools faced great test-based accountability for ensuring that all students in the United States met rigorous, challenging standards for academic work (Berends et al., 2005). To monitor progress toward this goal, states and districts were required to monitor the achievement gaps between students from different groups, such as socioeconomic, racial-ethnic, language, and disability (Berends et al., 2005). Although African American and Latino students made significant gains in achievement test scores during the 20-year period reviewed from 1977 to 1997 by Berends et al. (2005), there was still an apparent achievement gap when compared to White students. Minority students did make significant progress by earning percentile scores 13 to 27 points higher in the 1990s than they did in the 1970s, but these scores were still about 30 percentile points below nonminority students during the same time frame (Berends et al., 2005).

African American and Hispanic students who have not mastered reading by third grade are 11 to 12 percentage points less likely to graduate from high school than White students with similar reading skills. Only about 4% of White students who read well in third grade fail to graduate from high school, compared to 6% of African American students and 9% of Hispanics (Hernandez, 2011). Waldfogel (2012) published research on this topic that found what happens to early gaps in literacy during the school years does vary by group. Based upon Waldfogel's research, reading gaps for Hispanic children tend to close or stabilize after a few years, but Black-White gaps and gaps between children from socioeconomically disadvantaged and more advantaged families tend to

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widen during the school years. An important challenge for future research is to understand why that is the case.

Computer-Adaptive Instruction and Assessments

Educational technology is defined as a variety of electronic tools and applications that help deliver learning content and support the learning process (Chambers et al., 2011). For over 30 years, one of the most common solutions applied for children who are struggling to learn to read is computer-assisted instruction software. Modern computer-assisted instruction programs adapt to specific children's needs and provide activities with graphics and exciting elements that can supplement classroom instruction. (Chambers et al., 2011). When computer-assisted instruction programs are closely aligned with core instruction that students receive in classes, the alignment may mean that the supplementary instruction better supports the students' learning (Chambers et al., 2011). Technology has often been proposed as a solution for the needs of struggling readers. In theory, computers can adapt to the individual needs of readers and build on what they can do and fill in the gaps (Cheung & Slavin, 2013). This educational technology can help diagnose reading difficulties, individualize instruction, engage children's attention, increase implementation fidelity and provide constant and consistent feedback on students' progress.

Foorman, Espinosa, Wood, and Wu (2016) conducted a study to examine how teachers and school staff administered computer-adaptive assessments of literacy to English-language learners while using the assessments to monitor students' growth in literacy skills. Reliably measuring the literacy skills of English-language learners and other students mastering literacy can be challenging. The study found that assessments typically address only grade-level proficiency and do not provide instructionally relevant

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information to measure change over time. One solution is to administer a computer-adaptive assessment of literacy skills with enough items to measure growth. In a computer-adaptive assessment the selection, order, and number of items administered depend on a student's ability at the time of assessment. Students receive harder or easier items based on their performance, and the system stops administering items once it has enough information about the student's ability (Foorman et al., 2016).

Struggling readers are represented in all subgroups, which is why understanding how to adequately allocate resources to address the needs of this population is important. The challenge is to identify what works in some schools and what does not work in others (Donavan, 2010). Slavin, Lake, Davis, and Madden (2011) conducted an educational research review that focused on a best-evidence synthesis of effective programs for struggling readers ages 5 to 10 (i.e., kindergarten through Grade 5 in the United States) for a 12-week period. The results found that one-to-one tutoring from certified teachers and reading specialists is the gold standard among interventions for struggling readers. The most common form of remedial or supplementary instruction is additional teaching in small groups lasting 30 to 45 minutes daily. The study also found classroom instructional approaches, especially those involving cooperative learning, have strong effects for low achievers. However, computer-assisted instruction programs have little impact on reading used in isolation.

With more struggling readers being integrated into general classrooms and the increasingly prevalent use of educational technology, it is more important that teachers, schools, and districts understand the effectiveness of various types of educational technology applications that are available to improve the reading skills of struggling readers (Cheung & Slavin, 2013). Cheung and Slavin (2013) found that, when adaptive

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programs were well integrated with classroom instruction and these programs became core daily activities for students and not supplements, they were more effective with struggling readers.

Crossley and McNamara (2016) stated that educational technologies have the potential to fundamentally augment and enhance literacy education. However, many of these technologies remain unused, even though numerous studies have indicated their strengths in enhancing learning across a variety of student populations. The authors cited a number of possible reasons, ranging from hesitancy of the teachers, lack of technology support, and a potential digital divide among faculty, students, and administration. The authors listed and detailed multiple adaptive technologies, such as the Text Ease and Reliability Assessor, Dynamic Support of Contextual Vocabulary Acquisition for Reading, Intelligent Tutoring of Structure Strategy, and Interactive Strategy Training for Active Reading (Crossley & McNamara, 2016).

The educational technologies described offer opportunities for supplemental classroom activities to support increased literacy skills because they provide students with deliberate practice, individual feedback, and strategy instruction. In addition, these technologies were shown to lead to learning gains and higher proficiency scores, in summation proving they are effective (Crossley & McNamara, 2016). Further research of the effectiveness of the implementation of computer-adaptive programs such as the aforementioned and the program of study for this evaluation, I-station, would extend the future studies to review barriers of use, stakeholder perception of value, and impact upon increased literacy proficiency.

I-Station

The I-Station reading is a comprehensive computer-based reading program that

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integrates explicit, direct, and systematic instruction into subject-area content while focusing on critical skills within the five key reading areas (I-Station, 2014a, 2014b). The five critical skills or essential elements of reading instruction, which are included in the best reading instruction programs today, are phonemic awareness, phonics, vocabulary, fluency, and comprehension (Cheung & Slavin, 2013; Fiester & Smith, 2010). Patarapichayatham (2014) conducted a research study to investigate the impact of this program on students in Grades 1 through 8 across the state of Texas. In this study, the author defined I-Station as a reading program, developed using scientifically based reading research, that delivers effective computer-based supplemental and intervention reading instruction that teaches students to read fluently with comprehension (Patarapichayatham, 2014).

In a statewide literacy growth study conducted by Southern Methodist University during the 2013-2014 school year, it was found that students in Grades 1 through 8 demonstrated greater gains in overall reading ability with I-Station curriculum than their peers who did not use I-Station (Patarapichayatham, 2014). This study used results from ISIP early reading for Grades 1 to 3 and ISIP advanced reading for Grades 4 to 8 across three data points: September scores as the beginning-of-the-year (BOY) data, February scores as the middle-of-the-year (MOY) data, and May scores as the end-of-the-year (EOY) data.

Patarapichayatham (2014) stated the growth patterns of students could be categorized into three groups: (a) positive growth trajectory, (b) flat growth trajectory, and (c) negative growth trajectory. The results of the Patarapichayatham study (see Appendix A) showed that most students had positive growth trajectories, which means that the more students used I-Station curriculum, the faster they progressed. By

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comparing the number of minutes that students used I-Station curriculum, the study also showed that those spending more time with the I-Station reading curriculum showed greater growth in early literacy skills than those who spent less time on the curriculum (I-Station, 2014b).

The Morgridge International Reading Center at the University of Central Florida's I-Station Research Project investigated students' usage of the I-Station reading program by locale, Title I status, grade, and academic level. During the introductory phase of the research project (i.e., Year 1), Florida school districts and schools, both public and charter, enrolled 353,441 elementary school students in the I-Station reading program throughout the school year, of which 250,853 were studied. This study found the ISIP in early reading has strong concurrent validity to other norm-referenced reading measures (Robinson, Campbell, & Lambie, 2015).

Program-Evaluation Models

Frye and Hemmer (2012) defined the process of educational program evaluation as the "systematic collection and analysis of information related to the design, implementation, and outcomes of a program, for the purpose of monitoring and improving the quality and effectiveness of the process" (p. e289). The authors further proposed that educational programs are rarely static, so an evaluation plan must be designed to feed information back to guide the program's continuing development, and, in that way, the evaluation becomes an integral part of the educational change process.

Educational evaluation is best understood as a family of approaches to evaluating educational programs (Frye & Hemmer, 2012). There are four educational evaluation models that are currently in common use and provide clear contrasts among the possibilities offered by models informed by different theories. These models include the

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experimental or quasi-experimental approach to evaluation, Kirkpatrick's approach, the logic model, and the CIPP model (Frye & Hemmer, 2012). An explanation of these four types of evaluation models and the rationale for CIPP being utilized for the purpose of this study are provided below.

The first evaluation design is the experimental or quasi-experimental model that came into use in the mid-1960s. In this type of evaluation, the validity of findings depends on the validation of the assumption of a linear causal relationship between program elements and desired outcomes These designs isolate individual program elements for study, consistent with the classic reductionist approach of reducing and examining programs by component parts during the evaluation process (Frye & Hemmer, 2012). These types of models have proven less useful in the complex environments of educational programs. Contemporary evaluators shy away from experimental or quasi-experimental designs, citing low external validity due to the study design challenges and point to the highly focused nature of such a study's findings (Frye & Hemmer, 2012).

The Kirkpatrick (1996) four-level approach has enjoyed widespread popularity as a model for evaluating learner outcomes in training programs. Kirkpatrick recommended gathering data to assess four hierarchical levels of program outcomes: (a) learner satisfaction or reaction to the program, (b) measures of learning attributed to the program, (c) changes in learner behavior in the context for which they are being trained, and (d) the program's final results in its larger context (Frye & Hemmer, 2012). Frye and Hemmer (2012) stated that the Kirkpatrick model has been criticized for what it does not take into account, namely intervening variables that affect learning (e.g., learner motivation, variable entry levels of knowledge and skills) and the relationships between important program elements and the program's context.

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The logic model can be strongly linear in its approach to educational planning and evaluation. In its least complicated form, it may oversimplify the program evaluation process and thus not yield what educators need (Frye & Hemmer, 2012). Frechtling (2007) stated the effect of system theory on the logic model approach to evaluation can be seen in its attention to the relationships between program components and the components' relationships to the program's context. This evaluation approach can be very useful during the planning phases of a new educational project or when a program is being revised. Utilizing the logic model requires planners to clearly define intended links between the program resources (i.e., inputs), program strategies or treatments (i.e., activities), the immediate results of program activities (i.e., outputs), and the desired program accomplishments, or outcomes (Frye & Hemmer, 2012). The logic model shares similarities with the fourth program evaluation to be discussed, which is the Stufflebeam (1971) CIPP evaluation model.

First described in print in 1971, Stufflebeam intended the CIPP model evaluations to focus on program improvement instead of proving something about the program (Stufflebeam & Shinkfield, 2007). As stated earlier, it shares components with the logic model, but the CIPP model does not hold the assumption of linear relationships that constrained the logic model (Frye & Hemmer, 2012). Educational programs possess elements that are complex and often nonlinear in relationships, thus making the CIPP model a powerful approach to evaluation. The CIPP approach consists of four complementary sets of evaluation studies. By alternately focusing on program contexts, inputs, processes, and products, the CIPP model can address all phases of an education program: planning, implementation, and a summative or final retrospective assessment (Frye & Hemmer, 2012). This made the CIPP model the best evaluation model for this

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study.

Evaluation Framework

The evaluation model used in this study was the CIPP model, which is a comprehensive framework for guiding formative and summative evaluations of programs, projects, personnel, products, institutions, and systems. This model was introduced by Daniel Stufflebeam in 1966 to guide mandated evaluations of U.S. federally funded projects because these emergent projects could not meet requirements for controlled, variable-manipulating experiments, which then were considered the gold standard for program evaluations (Mathison, 2005). Since then, the model has been widely applied and further developed. It has been employed throughout the United States and around the world and applies to short-term and long-term investigations in the full range of disciplines and service areas (Mathison, 2005). The model's core features are used for evaluations of an entity's contexts, inputs, processes, and products.

Frye and Hemmer (2012) described the CIPP approach as consisting of four complementary sets of evaluation studies that allow evaluators to consider important but easily overlooked program dimensions. Taken together, CIPP components accommodate the ever-changing nature of most educational programs as well as educators' appetite for program-improvement data. Because evaluation should serve decision making, it is necessary to know the decisions to be served. According to the CIPP model, there are four kinds of decisions, called planning, structuring, implementing, and recycling, which respectively are served by context, input, process, and product evaluation (Stufflebeam, 1971).

By alternately focusing on program contexts, inputs, process, and products, the CIPP model addresses all phases of an education program: planning, implementation, and

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a summative or final retrospective assessment if desired. The first three elements of the CIPP model are useful for improvement-focused (i.e., formative) evaluation studies, and the product approach, the fourth element, is very appropriate for summative (i.e., final) studies (Frye & Hemmer, 2012). The Stufflebeam CIPP evaluation model was originally developed as a means to systematically provide timely evaluative information for use in decision making. Therefore, use of the CIPP model is intended to facilitate educational improvement through a proactive approach to evaluation (Stufflebeam, 1971).

A CIPP model context evaluation study is typically conducted when a new program is being planned. Context studies can also be conducted when decisions about cutting existing programs are necessary. A CIPP context evaluation study identifies and defines program goals and priorities by assessing needs, problems, assets, and opportunities relevant to the program. The context study's findings provide a useful baseline for evaluating later outcomes, or products (Frye & Hemmer, 2012).

A CIPP model input evaluation study is useful when resource allocation (e.g., staff, budget, time) is part of planning an educational program or writing an educational proposal. A CIPP input evaluation study formalizes a scholarly approach to program design. When used to plan a new program, an input evaluation study can also set up clear justification for assigning grant funding or other critical resources to a new program (Frye & Hemmer, 2012). Process evaluations assess the implementation of plans to guide activities and later judge program performance and help explain outcomes. Product evaluations identify intended and unintended outcomes, both to help keep an enterprise on track and, ultimately, to gauge its success in meeting targeted needs (Mathison, 2005). This study focused on the process and product features of the CIPP model to study the implementation and outcomes of the I-Station program.

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Research Questions

The following research questions were established to guide this study:

1. Process: Is the I-Station program being used with fidelity at the school of study to achieve the intended outcome of student reading remediation?

2. Product: Is there measurable growth in the I-Station reading scores of third-grade students as measured by the ISIP's BOY, MOY, and EOY test results during the 2016-2017 school year?

Summary

The review of literature research supports that the lack of reading proficiency attained in elementary school, more specifically by third grade, has far reaching detrimental ramifications to students (Hernandez, 2011; Schatschneider et al., 2004; Sloat et al., 2007). These detrimental effects of low student reading proficiency can be correlated to the lack of later success at the middle and high school levels. This lack of success at the high school level has a measurable impact at the societal level and can perpetuate generational cycles of poverty.

The problem of reading failure in elementary schools is important and justifies continued efforts to create and validate reliably effective approaches combining the best efforts of teachers and technology (Cheung & Slavin, 2013). Children's reading failure in the early grades costs the education system and society a great deal in special education, remediation, grade repetition, delinquency, and ultimately dropouts (Chambers et al., 2011). Reading failure is concentrated among schools serving many disadvantaged, minority, and children with limited English proficiency. It is in early elementary grades that gaps in performance among children of different races first appear (Chambers et al., 2011). African American and Hispanic children are not only more likely to live in

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poverty, but they also are more likely to live in neighborhoods with low-performing schools (Hernandez, 2011).

The students of these schools and their families face a variety of challenges. These challenges include having less qualified teachers working with lower achieving students who may not be able to create an optimal learning experience by not having a mastery of the content being presented. Intensive interventions must be in place, such as one-to-one tutoring from certified teachers and reading specialists, which are highly effective among interventions for struggling readers. When computer software or programs are aligned with instruction that students receive in classes, these supplemental programs better support the students' learning especially in small groups or individualized settings.

A review of the literature found that the use of computer-assisted instruction software represented one of the most effective interventions for struggling readers (Chambers et al., 2011; Crossley & McNamara, 2016; Slavin et al., 2011). Teacher-led individualized instruction was also found to be an effective strategy to increase student proficiency. The elementary school at which this evaluation study was conducted was attempting to complement the need for individualization in reading with an adaptive computer reading program called I-Station, which is an adaptive reading computer-based program that integrates explicit, direct, and systematic instruction into subject-area content focusing on five key reading areas. Comparing results on the I-Station's ISIP assessments of students who use the program versus those who do not has shown that the program has a significant impact on early literacy growth, which was the focus of this study. The research also provided evidence that the CIPP model was the appropriate educational evaluation model for performing this study.

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Chapter 3: Methodology

Introduction

The purpose of this program evaluation was to determine the relationship between the usage of the I-Station adaptive reading program and reading proficiency of students in third grade in a Title I elementary school in turnaround status. This chapter discusses the methodology used to evaluate the I-Station program. The program participants, instruments, and procedures for data collection, data analysis, and limitations are also discussed.

Program

The I-Station reading program provides computer-based assessment and instruction in reading and writing for students in prekindergarten through Grade 12. Students complete game-based lessons and activities led by animated characters while the program generates reports on their progress for teachers, parents, and administrators (I-Station, 2016). The program provides independent, computer-assisted instruction that promotes student engagement. Animated instruction and practice activities provide numerous opportunities for student interaction with the curriculum. Engaging instruction is developed by merging best practices in literacy learning with research on effective gaming practices (Patarapichayatham & Roden, 2014).

The school district in which the school of study is located initially implemented the prgram in January 2015 across the district in all elementary schools. Access to the prgram was granted through a partnership with the Univerity of Central Florida's research grant at no cost. The research from this grant provided information for placement of cut scores that best correlate with a Florida Standards Assessment success probability. The district selected the program, and it is used as an Internet-based

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comprehensive intervention program that provides research-based formative instruction and correlates to common core and the state standards. The I-Station program has four components: the ISIP assessment, automated data-driven differentied instruction, comprehensive reports, and teacher tools.

The students in the school of study are initially given the ISIP early reading at the beginning of the school year as a baseline assessment to determine areas of strengths and deficiencies in reading. Subtests from the ISIP early reading vary based upon the grade level that is being assessed. Prekindergarten skills include phonemic awareness, letter knowledge, and vocabulary. Kindergarten includes the same skill assessment with listening comprehension also added. First-grade students are assessed on phonemic awareness, letter knowledge, and vocabulary, alphabetic decoding, comprehension, spelling, and connect text fluency. Second and third grade are assessed on vocabulary, comprehension, spelling and connect text fluency.

The I-Station program generates an ability score based upon the results of the ISIP early reading, which is used to measure students' skill levels. The results are generated into an ISIP summary report, which contains information about how students performed on their respective grade-level subtests and one of three tier classifications based on ability scores. Tier 1 students are considered to be at no risk of below grade-level performance, Tier 2 students are at some risk of below grade-level performance, and students in Tier 3 are at significant risk of performing below grade level and need intensive remediation. From the ISIP assessment, priority reports are also generated for each teacher. These reports identify student groups according to specific need and teacher tools for specific lessons prescribed by the program in portable digital file format to print to use for remediation.

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The teachers at the school of study are also provided the classroom summary report, which identifies overall ability, Lexile levels, usage and current cycle reports, and specific tier groups. From the reports outlined above, teachers are to make data-driven decisions as to the use of the I-Station program to either supplement instruction and progress monitor student growth or use the program as an intervention for remediation. If the program is to be used as a remedial progress monitoring tool, the program usage criteria are as follows: Tier 3 students use the program for 120 or more minutes per week, Tier 2 students use the program for 90 minutes per week, and Tier 1 students use the program for 45 minutes per week. If the program is being used as a supplemental progress monitoring tool, the usage criteria are as follows: Tier 3 students use the program for 90 or more minutes per week, Tier 2 students use the program for 60 minutes per week, and Tier 1 students use the program for 30 minutes per week.

Assessments are conducted in a lab setting for BOY, MOY, and EOY assessments as directed by the school district. On-demand assessments may be administered monthly as needed for additional data for student assignment to the program. The program usage for supplement or intervention can be facilitated during small groups or centers in the 90-minute reading block or additional 60-minute reading block, and it may also be utilized during computer lab days and used from home.

Participants

A convenience sample of students at the researcher's school was selected to participate in this study. Creswell (2003) stated that, in some studies or experiments, only a convenience sample is possible because the investigator must use naturally formed groups, in the case of this study, grade-level classrooms. The participants included all students enrolled in third grade of the studied elementary school. Student enrollment of

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this grade level for the 2016-2017 school year involved 109 students. There was no control group of student participants who did not use the program, as this reading program was mandated to be used with all elementary school students across the district. The 109 students were primarily served in six general education classes in which all of the teachers had 5 or more years of experience and were considered highly qualified. Fourteen of the third-grade students were being served in self-contained classes and also used the I-Station program, three students were in a gifted class, five were in an autistic class, three were in an emotional behavior disability class, and one was in a class for students with intellectual disabilities. All of the teachers for these classes were highly qualified and had the appropriate exceptional student education certifications for their respective instructional assignments.

The third-grade class for the 2016-2017 school year was composed of 53 females and 56 males. The ethnic demographics of these students consisted of the following: 54 (45.67%) African American, 25 (28.81%) White, 22 (18.64%) Hispanic, seven (5.93%) multiracial, and one (.08%) Asian. The ages of the 109 students ranged from 8 years old to 11 years old. Additional demographics included 28 students who had an active individual education plan and received exceptional student education services. Another 20 of the students received interventions for academic or behavior deficiencies through the response-to-intervention's multitiered system of support process, which is a framework supporting differentiating interventions for individual students based on their need. This approach is commonly referred to as a multitiered system of support and is composed of interventions of increasing intensity being used to provide an appropriate level of service matching a student's demonstrated response to designed interventions over time (Greenwood et al., 2011).

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There were three other demographic categories used to identify the sample population of third-grade students. As stated earlier, 28 students received exceptional student education services and 20 received interventions through the response to intervention's multitiered system of support. Additionally, 28 were retained one to two times in third or prior grades, 16 were English-language learners and 16 received accommodations via a 504 plan for students who do not qualify for special education services under the Individuals With Disabilities Education Act but who have an ongoing, documented disability that has been evaluated as requiring accommodations to succeed in school, as provided by the Rehabilitation Act of 1973 (Bryer, Golden, & Logan, 2016).

Evaluation Model

This evaluation study of the I-Station program utilized the process and product elements of the CIPP model. This program was implemented in January 2015 across the district as part of a partnership with the University of Central Florida at no cost to the district. Therefore, the context and input portions of the CIPP evaluation model were not utilized. The third element of this model is a process evaluation study that can be used to assess a program's implementation. Frye and Hemmer (2012) stated that a process evaluation study can be conducted one or more times as a program runs to provide formative information for guiding in-process revisions. A process study was conducted during the school year and included the final EOY assessment to help the researcher answer Research Question 1 addressing fidelity of usage of the I-Station program.

Frye and Hemmer (2012) described a product evaluation study as one that interests most educators because of its focus on program outcomes. This type of study most closely aligns to the traditional summative program evaluations, as it aims to identify and assess the program outcomes, including both positive and negative

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outcomes, intended and unintended outcomes, and short-term and long-term outcomes. A well-conducted CIPP model product evaluation study allows the evaluator to examine the program's outcomes across all participants as well as within relevant subgroups or even for individual participants (Frye & Hemmer, 2012). The product portion of the evaluation model was used to answer Research Question 2, determining the growth of third-grade students as a result of use of the I-Station program.

Instruments

Research Question 1. For the purpose of this study, quantitative data were collected for the first research question from two I-Station reading instruction reports: the usage and trend usage reports. The usage report shows recent student usage by grade level for all students and can be disaggregated by teacher, grade, socioeconomic status, ethnicity, gender, and English-language learner status. This report allows data collection and analysis of teacher-provided access and usage of the program. It is important to note that the determination of good, fair, or insufficient usage for this report is based upon students' online use of the program. Any offline instructional time using I-Station teacher-directed resources is not included in this measurement. The trend usage report is an interactive tool that allows the researcher to collectively track usage of students using the program as a supplement to reading instruction versus as an intervention for reading remediation. The ability to analyze these data was important to this study, as the demographic groups of the third-grade sample determined different usage criteria for the school year.

The University of Central Florida's Morgridge International Center published an executive summary I-Station research project 2014-2015 report outlining the ISIP early reading (Robinson et al., 2015). I-Station was cited in this study to have strong

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concurrent validity to other norm-referenced reading measures, including the Test of Preschool Early Literacy, English Language Skills Assessment, Developmental Reading Assessment, Peabody Picture Vocabulary Test, Stanford Achievement Test 10 in reading, and the Florida Comprehensive Achievement Test.

Mathes (2007) also published an ISIP concurrent and predictive validity study. Reliability and validity are also two important qualities of measurement data. In the Mathes (2009) study, both qualities were examined using ISIP early reading data collected from kindergarten through Grade 3 students in north Texas elementary schools during the 2008-2009 school year. Regarding measures of reliability, the data suggested consistently high levels of internal consistency, both in the subtest ability scores as well in the overall reading ability scores Mathes (2009).

Mathes (2009) stated that the Cronbach coefficient alpha is often used as an indicator of reliability across test items within a testing instance. However, alpha assumes all students in the testing instance respond to a common set of items. Students taking a computer-based assessment, such as ISIP early reading, will receive a custom set of question items based on their initial estimates of ability and response patterns. The result of receiving custom questions means the marginal reliability is a method of combining the variability in estimating the ability of the students at different points on the ability scale into a single index. The ISIP early reading has set criteria based on minimizing errors when estimating the ability of a given student. As such, the marginal reliability of the data for students' scores during any test measured with ISIP will always be approximately 0.90 (Mathes, 2009). Appendix B shows the individual test-retest reliability results for overall reading ability.

Mathes (2009) also showed that concurrent validity evidence was established by

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computing Pearson product-moment correlation coefficients between ISIP early reading subtests and appropriate external measures. Appendix C shows results by grade level. During each of the seven testing sessions, both ISIP early reading and the Dynamic Indicators of Basic Early Literacy Skills were administered to the students in the study. Interrater reliability was ensured during training so that no more than a two-point difference in scoring occurred between testers.

Research Question 2. The quantitative data were collected for the second research question using the ISIP assessment to determine if there was measurable growth in the reading scores of third-grade students as a result of use of the I-Station reading program, as measured internally by the ISIP's BOY, MOY, and EOY test results during the 2016-2017 school year. The ISIP is a computer-adaptive, continuous progress monitoring assessment of critical reading skills. In addition to overall reading ability, ISIP measures abilities in the key reading areas of phonemic awareness, alphabetic knowledge, fluency with text, vocabulary, and comprehension (Mathes, 2009). From the ISIP assessment, students were placed into tiers, which are discussed in the Procedures portion of this chapter. The program generates a tier movement report that was used to analyze data for Research Question 2 to determine growth in reading as identified through tier movement.

Procedures

Design. The researcher used a preexperimental design, in which there was no control group to compare with an experimental group, to answer Research Questions 1 and 2 of the study. This design utilized a one-group pretest-posttest design, which included a pretest measure followed by a treatment and a posttest for the single group (Creswell, 1994; Silva, 2010; Team, 2013).

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Data collection. Based upon the research design, the data were collected from three phases of the school year for Research Question 1 to study the process of the program. Phase 1 took place in the first 2 months of the school year, which was considered the BOY baseline assessment period. In the second phase, the researcher collected and aggregated student data results from the MOY assessment administered in late January. Phase 3 included correlating the results of student proficiency data from the MOY assessment with the final EOY assessment administered in May to determine if expected usage met actual usage of the program. During the three phases described, the researcher used the usage report, usage trend report, and priority-excessive logout and idle time report to collect data for fidelity of usage during the three phases of study. The usage and usage trend report examined the teachers' fidelity of usage with time provided for student access to the program, and the priority report provided data to review the student usage and time on task when logged into the program.

Data to answer Research Question 2 of the study occurred in the same three phases as outlined above for Research Question 1. The researcher more specifically used the tier movement report, which showed a comparison of the number and percentage of students who were categorized at each instructional tier of Tier 1, Tier 2, or Tier 3 through the current month. Academic tier levels indicate the instructional level of a student. Tier 1 students are considered to be at no risk (i.e., above the 40th percentile and performing at grade level). Tier 2 are at some risk (i.e., between the 20th and 40th percentile and are moderately below grade level and need intervention). Students in Tier 3 are at risk and are performing below the 20th percentile and need intensive intervention as defined in the I-Station technical manual (Matheson et al., 2014).

Data analysis. Descriptive statistics were calculated for all study variables. This

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included means and standard deviations for continuous variables and counts and percentages for categorical measures. Statistical comparisons were also made for the dependent variable average usage per minute per month by the demographic measures of (a) gender: male or female, (b) race: African American or White, (c) special education student: yes or no, (d) English proficiency: yes or no, (e) ethnicity: Hispanic or non-Hispanic, (f) homeless: yes or no, and (g) disability: yes or no using Welch *t* tests. Statistical significance was found at $p < .05$. The $R = 3.2.2$ was used for all statistical analysis.

For Research Questions 1 and 2, the program data were supplied in graphs and tables when possible to compare usage, proficiency, and growth over time. For this study, the researcher gathered evidence from three specific reports. The first two reports are the tier movement report, which shows growth across proficiency tiers, and the usage trend report, which measures usage of the sample population of third-grade students. These reports allowed futher analysis of tier movement associated with skill attainment and fidelity of usage for the third-grade students across subgroups. The third report is called a priority-excessive logout and idle time report, which was used to collect data for fidelity of usage during the three phases of study.

The data analysis used for Research Question 1 was descriptive and included graphical representations of evaluation findings, illustrating data tabulations, and data disaggregation to assist in identifying patterns across various subgroups in the sample population of third-grade students. The analysis for Research Question 1 was to look for changes in overall score by the demographic variables. A Welch *t* test was used at each time point for BOY, MOY, and EOY assessments.

Next, to examine changes over time as a function of the demographic variables

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for the variable total score, a mixed general linear model was created and tested. The fixed effects were time and the demographic variables. The random effect was student. To look for the effect of demographic variables on the variables of idle time and tier, a chi-square analysis at each time point for BOY, MOY, and EOY assessments was used. The sample size was not large enough to include all of the variables in a longitudinal mixed model. Pairwise comparisons were employed using a Tukey adjustment.

The data analysis used for Research Question 2 was also descriptive and included graphical representations of evaluation findings, illustrating data tabulations, and data disaggregation to assist in identifying patterns across various subgroups in the sample population of third-grade students. Pairwise comparisons were employed using a Tukey adjustment. A mixed general linear model was created and tested to examine changes over time for the variable of total score for Research Question 1. To look for changes over time for the variables of idle time and tier, two mixed, generalized linear models were created and tested.

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Chapter 4: Results

Introduction

This evaluation study of the I-Station program utilized the process and product elements of the CIPP model. A process evaluation was conducted during the school year and concluded with the final EOY assessment to help the researcher answer Research Question 1 addressing fidelity of usage of the I-Station program. The product portion of the evaluation model was used to answer Research Question 2, determining the growth of reading skills of third-grade students who used the I-Station program. Student growth was measured across three time periods using BOY, MOY, and EOY diagnostic assessments.

Descriptive statistics were calculated for all study variables. This included means and standard deviations for continuous variables and counts and percentages for categorical measures. Statistical comparisons were also made for the dependent variables and included graphical representations of evaluation findings, illustrating data tabulations, and data disaggregation to assist in identifying patterns across various subgroups in the sample population of third-grade students. Two main research questions were used to guide this study:

1. Process: Is the I-Station program being used with fidelity at the school of study to achieve the intended outcome of student reading remediation?

2. Product: Is there measurable growth in the I-Station reading scores of third-grade students as measured by the ISIP's BOY, MOY, and EOY test results during the 2016-2017 school year?

Findings for Research Question 1

Research Question 1 was used to determine if the I-Station program was being

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used with fidelity at the school of study to achieve the program's intended outcome of student reading remediation. It is important to note that the determination of good, fair, or insufficient usage for this report is based upon students' online use of the program and thus will vary requiring the researcher to determine if there were any statistical differences by demographic groups and subsequent tier placement. Results from the mixed model for the variable overall score indicated no significant effect from the demographic variables (see Appendix D). The mean average usage of the software per minute per month was 198.3 (*SD* = 87.0). Statistical analysis revealed that female students (*M* = 217.60, *SD* = 100.73) used the system more than male students (*M* = 177.36, *SD* = 63.82). African American students (*M* = 215.44, *SD* = 107.45) used the system more than Hispanic students (*M* = 168.90, *SD* = 50.48). Hispanic students used the system less than non-Hispanic students (*M* = 205.43, *SD* = 92.60), $p < .05$ (see Table).

An analysis of tier movement associated with skill attainment and fidelity of usage for the third-grade students across subgroups is also necessary to rule out low tier attainment due to limited usage of the program while it was being accessed. Idle time is logged when students are not interacting with the program causing it to time out or abort the current problem. The I-Station program tracks when students log in and how much of that time is spent in an idle mode. The researcher looked at the amount of idle time across the three assessment periods and also across demographic groups (see Appendix E). Results from the mixed model indicated a significant difference across time for the variable of idle time, $C^2(2, N = 109) = 33.01$, $p < .001$. Subsequent post-hoc tests revealed a significant difference between BOY idle time, mean probability of idle time = 53 (*SD* = 16), and EOY idle time, mean probability of idle time = 66 (*SD* = 14), $p < .05$.

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During the middle of the year, a greater percentage of nonspecial education students (66%) reported idle time than special education students (45%), $p < .05$. At the end of the year, a greater percentage of male students (77%) reported idle time than female students (53%), $p < 0.05$.

Table

Average Usage per Minute per Month

Demographic	No. students	Mean	*SD*	Min.	Max.	Results
Gender						
Female	53	217.60	100.73	18	747	
Male	49	177.35	63.82	7	282	$t(88.8) = 2.42$, $p = .017$
Race						
African American	48	215.44	107.45	7	747	
White	50	180.80	60.58	16	301	$t(73.4) = 1.95$, $p = .054$
Special education						
No	83	199.81	94.61	7	747	
Yes	19	191.53	40.43	121	245	$t(67.9) = 0.59$, $p = .554$
English proficient						
Yes	87	200.02	90.64	7	747	
No	15	188.07	63.25	72	301	$t(25.1) = 0.62$, $p = .530$
Hispanic						
Yes	20	168.90	50.48	72	301	
No	82	205.43	92.60	7	747	$t(54.3) = -2.39$, $p = .019$
Homeless						
No	90	196.27	86.95	7	747	
Yes	12	213.25	89.67	72	404	$t(13.9) = -0.61$, $p = .546$

Findings for Research Question 2

The product phase of this study sought to determine if there was measurable growth in the I-Station reading scores of third-grade students as measured internally by the ISIP's BOY, MOY, and EOY test results during 2016-2017 school year. The internal measure of the program has set scale scores to determine proficiency levels month by month. The school district in which the school of study is located defined three common

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assessment periods using the program as a diagnostic test to monitor student progress of reading proficiency.

The first assessment period determined by the district was considered the BOY baseline, and the expected scale score for students in third grade was 241. The second assessment period was referred to as the MOY score and had an expected scale score of 246 to show appropriate progression. The third period was referred to as the EOY score and had an expected scale score of 251 points as determined by the I-Station program to demonstrate skill acquisition at the end of third grade.

Upon reviewing the results from the study regarding overall scale score of the participants during the assessment periods, the researcher found the following. Results of the mixed model indicated a significant difference across time for the variable of overall score, $C^2(2, N = 109) = 36.27, p < .001$, as illustrated in Item 1 in Appendix F. Subsequent post-hoc tests revealed a significant difference between BOY scores (M = 237.54, SD = 13.85), MOY scores (M = 249.18, SD = 19.34) and EOY scores (M = 245.31, SD = 14.64) scores, $p < .05$.

The scale score of students correlated to the placement of tiers within the program. The results from the mixed model indicated a significant difference across time for the variable of tier, $C^2(2, N = 109) = 30.29, p < .001$, as illustrated in Item 2 in Appendix F). Subsequent post-hoc tests revealed a significant difference between the likelihood of being in Tier 1 during the middle of the year, probability of Tier 1 = 70 (SD = 5), versus the beginning of the year, probability of Tier 1 = 36 (SD = 11%), and end of the year, probability of Tier 1 = 40 (SD = 12%), $p < .05$.

A closer analysis of tier placement during the assessment periods by demographic yielded results from the univariate chi-square analyses for the variable of tier (see

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Appendix G). During the middle of the year, a greater percentage of special education students (25%) was in the third tier versus nonspecial education students (7%), $p < .05$. At the end of the year, a greater percentage of special education students (45%) was still in Tier 3 versus nonspecial education students (7%), $p < .05$.

Summary

This chapter reported the results of Research Questions 1 and 2 of this study. Each instrument corresponded to an independent variable. Each variable was reported by percentage or rate to help identify the impact upon reading proficiency correlated with fidelity of usage across many demographic groups of the I-Station adaptive reading program. Research Question 1 was used to determine if the I-Station program was being used with fidelity as measured by the average usage of minutes per month by the students and analyzing idle time for each subgroup during usage. It is again important to note that the determination of good, fair, or insufficient usage for this report is based upon students' online use of the program and thus will vary, requiring the researcher to determine if there were any statistical differences by demographic groups and subsequent tier placement.

The mean average usage of the software per minute per month was 198.3 minutes per month. The study revealed that female students ($M = 217.60$) used the system more than male students ($M = 177.35$). When looking at ethnicity, African American students ($M = 215.44$) used the system more than Hispanic students ($M = 168.90$), and Hispanic students used the system less than non-Hispanic students ($M = 205.43$). During the usage of the program, idle time was also measured by subgroup to provide additional data of what percentage of students' data indicated idle time while on the program or an abort of the current problem.

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Analysis of the data revealed that the only subgroups that remained above the average usage of minutes per month were females (M = 217.60), African Americans (M = 215.44), English-language learners (M = 200.02) and homeless students (M = 213.25). Results from the mixed model indicated a significant difference across time for the variable of idle time. Tests revealed a significant difference between BOY idle time, mean probability of idle time = 53%, and EOY idle time, mean probability of idle time = 66%. The actual net gain of students demonstrating idle time during usage between the BOY and EOY assessment is as follows: females, -2%; males, +25%; African Americans, +6%; Whites, +17%; special education students, +20%; English-language learners, +13%; Hispanics, +13%; and homeless students, +34%.

Results for Research Question 2 indicated a significant difference between the likelihood of being in Tier 1 at the BOY, MOY, and EOY assessment periods. The tests revealed a significant difference between BOY expected score of 241 and actual score of 237.54 versus the MOY expected score of 246 and actual score of 249.18 and EOY expected score of 251 and actual score of 245.31, as determined by the I-Station program to demonstrate skill acquisition at the end of third grade.

The study showed that the baseline scale score between different demographic groups varied. The lowest two groups were non-English-language learners and homeless students, with only 25% scoring in Tier 1 at the BOY test. The highest performing subgroups during this time were in one or more of White, 47%, and special education, 45%. The subgroups with the largest percentage of movement to Tier 1 during the MOY test were African Americans, 38% growth from 41% BOY to 77% MOY, and males with 36% growth from 41% BOY to 77% MOY in Tier 1.

All subgroups experienced a decrease in the number of students in Tier 1

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measured from the MOY to the EOY test. The decrease in percentage of students in Tier 1 by subgroup ranged from -18% to -35%, with an average loss of -26.66% across the grade level between these two assessment periods. The net gain or loss of students' scores correlating to Tier 1 across all three assessment periods, BOY, MOY, and EOY, are as follows: females, +4%; males, +7%; African Americans, +8%; Whites, +2%; special education students, -15%; English-language learners, +4%; Hispanics, ±0%; and homeless students, +8%. In Chapter 5, the researcher elaborates on the results of the findings and provides interpretations, presents conclusions, and discusses implications of the findings. The researcher details the limitations of the study and provides recommendations for future practice and future research.

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Chapter 5: Discussion

Introduction

The purpose of this evaluation was to determine the relationship between the usage of the I-Station adaptive reading program and the program's internal measure of progression toward mastery as demonstrated by increasing student scale scores for reading proficiency in third-grade students. The problem addressed in this study was not all students in the target school met proficiency standards for reading by the end of the third grade. Cheung and Slavin (2013) stated that, ideally, struggling readers may receive one-on-one tutoring capable of adapting to their unique needs, and technology has often been proposed as a solution for the needs of struggling readers.

In theory, computers can adapt to the individual needs of struggling readers, building on what they can do and fill gaps. The I-Station program is considered an educational technology that was found in a 2011 descriptive study to show measurable and clear improvement among students using the reading software in each grade (Bugbee, 2011). The objective of the I-Station reading program was to integrate explicit, direct, and systematic instruction into subject-area content while focusing on critical skills within five key reading areas (I-Station, 2007, 2014a, 2014b). This evaluation's goal was to add to the literature by determining whether continued efforts to supplement teacher instruction with computer adaptive technology makes an impact on reading proficiency of students in third grade.

This evaluation study of the I-Station program utilized the process and product elements of the Stufflebeam CIPP model to evaluate the effect of the I-Station program on student achievement in reading. The process component provided information about implementation of the I-Station program, and the product component assessed the success

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of the program for students in the school of study. The program was implemented at the district level for all elementary schools in the district and for the school of study in January 2015. The 2016-2017 school year represented the first full school year of usage for the school of study.

The medium to large size district in Florida in which the program evaluation was conducted is in the southeastern part of the United States in the state of Florida. The school of study was a Title I public elementary school with a school population of 689 students in prekindergarten through fifth grade. The results of this study will be beneficial to the school of study, researchers, and the school district on how the I-Station program impacts reading proficiency. Because the purpose of the I-Station program was to increase students' ability to read fluently with comprehension and be used as a measure for teacher evaluations, then all stakeholders in this school district and similar districts would benefit from a study of this kind to add to the literature for future consideration.

Review of the Evaluation

This evaluation study of the I-Station program utilized the process and product elements of the Stufflebeam CIPP model. This model is designed to examine contexts, inputs, processes, and products of programs. The process portion of the evaluation utilized data collected during the school year to help the researcher answer Research Question 1 (Is the I-Station program being used with fidelity at the school of study to achieve the program intended outcome of student reading remediation?). The product portion of the evaluation model was used to answer Research Question 2 (Is there measurable growth in the I-Station reading scores of third-grade students as measured by the ISIP's BOY, MOY, and EOY test results?). Both research questions utilized descriptive statistics for all study variables, including usage time and tier placement and

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demographic groups that involved gender, race, special education, English-language learner, Hispanic ethnicity, special education, and homelessness.

Data were collected by the researcher across three phases of the school year for Research Questions 1 and 2. Phase 1 was considered the BOY baseline assessment period. The second phase collected and aggregated student tier data from the MOY assessment period. Research participants were classified by their initial academic tier levels based on the first assessment (i.e., BOY) within the I-Station reading program. Phase 3 concluded with an assessment during the final month of the school year referred to as the EOY period.

The researcher used the usage report, usage trend report, and priority-excessive logout-idle time report for Research Question 1 to collect data for fidelity of usage during the three phases of study. These reports provided data to review the student usage and time on task when logged into the program. The tier movement report showed a comparison of the number and percentage of students who were categorized at each instructional tier of Tier 1, Tier 2, or Tier 3 across the three phases for Research Question 2. These reports provided data to review the student usage and time on task when logged into the program.

Elaboration and Interpretation of Findings for Research Question 1

Research Question 1 was used to determine if the I-Station program was being used with fidelity at the school of study to achieve program intended outcome of student reading remediation. The determination of good, fair, or insufficient usage or fidelity was based upon the average usage of minutes per month by the students and analyzing idle time for each subgroup during times of usage. The school of study used the program as a supplemental progress monitoring tool for reading remediation. The usage criteria for this

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type of usage was as follows: Tier 3 students should have used the program for 90 or more minutes per week, Tier 2 students should have used the program for 60 minutes per week, and Tier 1 students should have used the program for 30 minutes per week.

Usage of the I-Station program per week has many influential factors such as tier placement, teacher fidelity of providing access, and home usage. These factors vary throughout the year, creating difficulty for precise expectations for individual student usage between the three assessment periods. The researcher utilized the average usage per month (i.e., minutes per month) for the study participants to determine the correlation, if any, to the tier placements of students over time from the BOY assessment to the EOY assessment.

The mean average usage of the software per minute per month across all demographic groups was 198.3 minutes per month. The study revealed that female students (M = 217.6) used the system more than male students (M = 177.4). When looking at ethnicity, African American students (M = 215.4) used the system more than Hispanic students (M = 168.9), Hispanic students used the system less than non-Hispanic students (M = 205.4), and Whites (M = 180.80) used the program less than African Americans and Hispanics. The results revealed only females (M = 217.6), African Americans (M = 215.4), English-language learners (M = 200.02), and homeless students (M = 213.25) remained above the average usage of minutes per month. During this time, additional data were used to determine what percentage of students exhibited idle time while on the program or aborted the current problem.

Results from the mixed model indicated a significant difference across time for the variable of idle time. The mean probability of idle time at the BOY assessment was 53%, which rose to 66% by the EOY assessment. The net gain or loss of students in each

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demographic group demonstrating idle time during monthly usage between the BOY and EOY assessment was as follows: Females declined by 2 percentage points, males increased by 25 percentage points, African Americans increased by 6 percentage points, Whites increased by 17 percentage points, special education students increased by 20 percentage points, English-language learners increased by 13 percentage points, Hispanics increased by 13 percentage points, and homeless students increased by 34 percentage points. Correlating the two measured data points with Tier 1 placement revealed the following:

1. Females used the program on average 217.4 minutes per month, and idle time for this demographic group decreased by 2 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement increased from 34% BOY to 38% EOY.

2. Males used the program on average 177.35 minutes per month, and idle time for this demographic group increased by 25 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement increased from 41% BOY to 48% EOY.

3. African American students used the program on average 215.44 minutes per month, and idle time for this demographic group increased by 6 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement increased from 30% BOY to 38% EOY.

4. White students used the program on average 180.8 minutes per month, and idle time for this demographic group increased by 17 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement increased from 37% BOY to 49% EOY.

5. Special education students used the program on average 191.53 minutes per

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month, and idle time for this demographic group increased by 20 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement decreased from 45% BOY to 30% EOY.

6. English-language learners used the program on average 200.02 minutes per month, and idle time for this demographic group increased by 13 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement increased from 40% BOY to 44% EOY.

7. Hispanic students used the program on average 168.9 minutes per month, and idle time for this demographic group increased by 13 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement did not change from 44% BOY to 44% EOY.

8. Homeless students used the program on average 213.25 minutes per month, and idle time for this demographic group increased by 34 percentage points between the BOY and EOY assessment. The corresponding Tier 1 placement increased from 25% BOY to 33% EOY.

Elaboration and Interpretation of Findings for Research Question 2

The product question determined if there was measurable growth in the I-Station reading scores of third-grade students as measured by the ISIP's BOY, MOY, and EOY test results during 2016-2017 school year. When the data from across the three assessment periods were examined, a significant difference between the students scoring high enough to be in Tier 1 at the BOY and MOY assessment increased from 20% to 38% across all demographic groups. Conversely, all subgroups experienced a decrease in the number of students in Tier 1 measured from the MOY to the EOY test. The decrease in percentage of students in Tier 1 by subgroup ranged from -18% to -35% across the

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grade level between the final two assessment periods. These results can be better understood looking at the movement across all three tiers, although the desired tier placement was Tier 1. The scale score of students correlates to the placement of tiers within the program. Tier 1 students are at no risk, Tier 2 are at some risk, and Tier 3 are at risk of reading failure.

The net gain or loss of students' scores correlating to Tier 1 across all three assessment periods, BOY, MOY, and EOY, were as follows: female, +4%; male, +7%; African American, +8%; White, +2%; special education, -15%; English-language learner, +4%; Hispanic, ±0%; and homeless, +8%. Taking a deeper look at the movement for these subgroups across Tier 1, Tier 2, and Tier 3 at each assessment period revealed that demographic groups whose Tier 1 and Tier 2 percentages increased while Tier 3 decreased had positive net growth for the year. This was true for the female, African American, and homeless demographic groups.

There was still positive net growth for males and Whites, although they did not follow this pattern. Males had a positive net growth due to the Tier 1 students in this group increasing from 41% BOY to 48% EOY, which offset a decrease of male students in Tier 2 decreasing from 30% BOY to 25% EOY and Tier 3 decreasing from 29% BOY to 27% EOY. Whites also increased Tier 1 students over the year but only by 2 percentage points of 47% to 49%, had no change in Tier 2 students (i.e., 23% to 23%), and decreased the percentage of students in Tier 3 by 2 percentage points of 30% to 28% as well. English-language learners followed the same pattern as Whites by increasing Tier 1 students 25% BOY to 38% EOY, decreasing Tier 3 students by 6 percentage points, but they also decreased Tier 2 students by 6 percentage points as well. The Hispanic students in this study had no net gain or loss in Tier 1 students, and the special

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education students decreased 15 percentage points during the school year.

Upon reviewing the results from the study regarding overall scale score of the participants during the assessment periods, the researcher found a significant difference across time for the overall scores between the BOY score, versus the MOY and EOY across the demographic groups. Subsequent tests revealed a significant difference between the likelihood of being in Tier 1 at MOY, probability of Tier 1 = 70 (*SD* = 5), versus the BOY, probability of Tier 1 = 36 (*SD* = 11) and EOY, probability of Tier 1 = 40 (*SD* = 12), $p < .05$ as reviewed. The likelihood rose from 36% BOY to 70% MOY but sharply declined to 36% by the EOY assessment.

Research Question 2 results revealed there was a significant difference between the likelihood of being in Tier 1 between the three assessment periods with a positive net growth of students in Tier 1, in which students demonstrated no risk of reading failure, for six of the eight subgroups reviewed. The results of Research Question 2, coupled with the fidelity of usage results from Research Question 1, will allow the researcher to elaborate on the findings in the next section of this chapter.

Summaries

The problem addressed in this study was not all students in the target school met proficiency standards for reading by the end of the third grade. In years prior to this study, third-grade students in the school earned proficiency scores for third grade of 34% in the 2014-2015 school year and 40% in the 2015-2016 school year. The school of study identified deficiencies in reading in 60% of its third-grade students as measured by the 2015-2016 state assessment.

Third grade is an important point in a child's education, as it is the time when students shift from learning to read and begin reading to learn (Hernandez, 2011).

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Children who reach the end of third grade with low literacy skills typically have less access to the regular curriculum, require long-term support, and fall further behind their peers in literacy achievement and curricular knowledge (Sloat et al., 2007). The I-Station program is considered an educational technology that has been found to show measurable and clear improvement among students using the reading software (Bugbee, 2011).

Research Question 2 revealed there was a significant difference in the Tier 1 placement across the three assessment periods, but there was not a consistent positive correlation of growth through all the three time frames. The corresponding net gain that ranged from 4 percentage points to 8 percentage points was demonstrated by six of the eight demographic groups; the remaining two groups ranged from 0 percentage points to a decrease of 15 percentage points in Tier 1. Research Question 1 measured usage minutes per month and the amount of idle time students reported during usage measured within the three assessment periods. The results of the study indicated four of the eight demographic groups used the program with more fidelity; however, neither usage nor idle time had a direct correlation with Tier I placement by the EOY assessment.

The study revealed that the female, African American, English-language learner, and homeless demographic groups on average used the program with more fidelity, measuring at or above the average number of minutes for the third grade as a collective group. The net growth for these four demographic groups was as follows: Females, +4 percentage points Tier 1; African Americans, +8 percentage points Tier 1; English-language learner, +4 percentage points Tier 1; and homeless, +8 percentage points Tier 1. However, the amount of idle time for these four groups increased significantly for the following: African Americans, +6 percentage points; English-language learner, +13 percentage points; and special education, +34 percentage points, except for females, -2

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percentage points.

The study also indicated all the remaining demographic groups demonstrated an increase in the amount of time spent in idle mode or aborting questions while logged into the program and increased anywhere from 13 to 25 percentage points across the following: males, +25 percentage points; Whites, +17 percentage points; special education, +20 percentage points; and Hispanics, +13 percentage points. The EOY Tier 1 growth for these remaining groups is as follows: males, +7 percentage points Tier 1; Whites, +2 percentage points Tier 1; special education, -15 percentage points Tier 1; and Hispanics, ±0 percentage points Tier 1.

This study used three data sources to assist in determining the effectiveness of the I-Station reading program: minutes per month of usage, the number of students demonstrating idle time during usage times, and the percentage of students being placed in Tier 1 through assessment scores. From these results, the researcher determined only one demographic group had a positive correlation across all three data sources. The female (n = 53) group showed higher than average usage per month, a decrease in the number of students idly using the program, and a positive movement of students to Tier 1 at the end of the school year. All remaining demographic groups did not have a positive correlation between the three data sources. However, six of the eight had a positive net growth of Tier 1 students by end of year.

As stated earlier, the school of study used the I-Station program as a supplemental progress monitoring tool for reading remediation. This usage structure implies there were additional remediation tools in use that could have impacted reading remediation and proficiency (i.e., Tier 1 placement). This may have been an uncontrollable variable impacting the data for Tier 1 placement of the eight groups. The researcher found the

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average percentage of students demonstrating idle time across all eight demographics (*N* = 109) increased from 50% (*n* = 55 students) to 66% (*n* = 72 students) with the highest percentages belonging to the following: homeless students, +34 percentage points; males, +25 percentage points; and special education, +20 percentage points. The researcher can only conclude this may have been impacted by the increased rigor of the assessment by the end of the school year, relevancy of the program content, or increased usage of additional supplements to increase reading proficiency outside of the I-Station program.

Linkage of Findings to Relevant Research

The purpose of this study was to determine the effectiveness of using the I-Station adaptive reading program to increase reading proficiency of third-grade students. The review of literature in Chapter 2 supported the importance of early learning literacy, especially by the end of the third grade, when the lack of reading proficiency has long-lasting and detrimental ramifications. The problem of reading failure in elementary schools is important and justifies continued efforts to create and validate reliably effective approaches combining the best efforts of teachers and technology (Cheung & Slavin, 2013). A review of the literature found that use of computer-assisted instruction software to be one of the most effective interventions for struggling readers (Chambers et al., 2011; Crossley & McNamara, 2016; Slavin et al., 2011). This research supports Mayer's cognitive theory of multimedia learning (Mayer & Alexander, 2011), which allows children to use their auditory and visual channels in the learning process via technology.

The elementary school being studied was attempting to complement the need for individualization in reading instruction with the I-Station adaptive reading program. Foorman et al. (2016) stated that computer-adaptive assessments will measure, select,

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order, and number items administered depending on a student's ability at the time of the assessment. This process was facilitated by administering the BOY, MOY, and EOY assessments. Students receive harder or easier items based on their performance, and the system stops administering items once it has enough information about the student's ability. The teacher's instruction coupled with assisted instruction designed for a personalized and interactive learning process makes possible implementing Vygotsky's learning theory of the zone of proximal development (Zamfir, 2009). The literature described incorporating programs such as the I-Station program as electronically mediated education as instruction in which the interaction between teacher and student are facilitated with a computer or program. Currently, many students struggle to attain proficient levels of literacy, and teachers struggle with having enough classroom time or resources to dedicate to each student (Crossley & McNamara, 2016).

In years prior to this study, third-grade students in the school of study scored 42% proficient in reading in the 2012-2013 school year, which dropped to 31% proficient in the 2013-2014 school year. The scores for third grade rose to 34% in the 2014-2015 school year and 40% in the 2015-2016 school year. The I-Station program utilizes diagnostic assessments to calculate a scale score and corresponding Tier placement of students and determines individualized remediation practice for students based upon deficient skill areas. The scale score of students correlated to the placement of tiers within the program. Tier 1 students are at no risk, Tier 2 are at some risk, and Tier 3 are at risk of reading failure. Tier 1 students would be considered proficient on the grade skills being assessed.

In the 2016-2017 school year, the school population consisted of 668 students: 50% were African American, 13% were Hispanic, 29% were White, 1% was Hawaiian,

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1% was Asian, 1% was Native American, and 5% were multiracial. In the school of study, 92% of the students qualified for free and reduced-price lunch, classifying it as Title I, which is a socioeconominc status indicator. Family socioeconomic status is strongly correlated both with early literacy, as well as other academic outcomes, and literacy later in the school years.

The study showed the baseline scale score between different demographic groups varied for Tier 1 by 25 percentage points on the BOY assessment. Non-English-language learners and homeless students were the lowest, and White, 47%, and special education, 45%, were the highest. The subgroups with the largest percentage of movement to Tier 1 during the MOY test were African Americans and males with both 77% of students in Tier 1. All subgroups experienced a decrease in Tier 1 students by the EOY assessment. The decrease in percentage of students in Tier 1 by subgroup ranged from a decrease of 18 percentage points to a decrease of 35 percentage points, with an average loss of 26.66 percentage points across the grade level between these two assessment periods.

The final Tier 1 placement of students by the EOY assessment period was as follows: female, 38%; male, 48%; African American, 38%; White, 49%; special education, 30%; English-language learner, 44%; Hispanic, 44%; and homeless, 33%. The net gain or loss of students' scores correlating to Tier 1 across all three assessment periods was follows: female increase of 4 percentage points, male increase of 7 percentage points, African American increase of 8 percentage points, White increase of 2 percentage points, special education decrease of 15 percentage points, English-language learner increase of 4 percentage points, Hispanic no change, and homeless increase of 8 percentage points.

Research Question 1 measured usage minutes per month and the amount of idle

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time students reported during usage measured within the three assessment periods. The results of the study showed the usage per month ranged from 169 minutes per month to 217 minutes per month. The platform for this program is animated with a game-like interface, ideal for operant conditioning, and is designed to be a highly interactive digital curriculum. Operant conditioning involves reinforcing a behavior and rewarding it and is the most important type of behaviourist learning (Pritchard, 2013). The system is adaptive and determines skills for students to practice based upon diagnostic testing and demonstrated mastered skills during usage. With drill-and-practice software, children are routinely presented with several answers to a question, and, with each correct response, they receive positive reinforcement through the game-like program.

Skinner is the most famous psychologist in the field of operant conditioning (Pritchard, 2013). By repeatedly presenting information in small amounts and by reinforcing correct responses, the program operates in a way that can be traced back directly to Skinner's ideas (Pritchard, 2013). The students of the school of study face a variety of challenges, and intensive interventions must be in place such as individualized instruction, whether it be from the teacher or a more knowledgeable other. In the case of this study, the I-Station adaptive reading program was examined as the more knowledgeable other that continually adjusted skills based upon the accuracy of student responses. The undertaking of this other role, in a planned way, is known as scaffolding (Pritchard, 2013), which is a branch of constructivism supported by Lev Vygotsky.

To fully understand the concept of scaffolding, the notion of a zone of proximal development should be further examined. The zone of proximal development is a theoretical space of understanding that is just above the level of understanding of a given individual. It is the area of understanding into which a learner will move next (Pritchard,

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2013). When computer software or programs are aligned and scaffolded with the instruction students receive in class, the supplemental programs better support the students' learning. Idle time during the usage of the program was demonstrated by 53% of overall students, which rose to 66% of the students by the end of the school year.

Results for Research Question 2 revealed there was growth in the number of students in third grade, moving to or remaining in Tier 1, ranging from 30% to 49%. If this is used as a predictor of students demonstrating proficiency on the Florida State Assessment for the 2016-2017 school year, there would be no significant growth in the 40% proficiency demonstrated on the 2015-2016 state assessment. Additionally, the results showed a gap of 11 percentage points of White students over African American students and a gap of 5 percentage points between White students and Hispanic students in Tier 1 placement. Hispanic students demonstrated a gap that was 6 percentage points higher over African American students as well. These findings support the research of Waldfogel (2012) that reading gaps for Hispanic children tend to close or stabilize after a few years, but Black-White gaps and gaps between children from socioeconomically disadvantaged and more advantaged families tend to widen during the school years.

Implications of the Findings

The goal of this study was to determine the impact of the use of the I-Station program to increase third-grade reading proficiency. The study initially indicated an improvement in reading fluency and reading comprehension between the BOY data and MOY data, but the data showed a sharp decline in reading proficiency by the end of the school year. In addition, there was no correlation between usage and measured idle time and student growth. Considering these findings, the school of study and district will need to further analyze (a) fidelity of usage, (b) teacher perception of usefulness, (c) student

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motivation, and (d) possible cognitive fatigue before making decisions to invest in this program on a long-term basis.

The average usage per minute per month during this study ranged from 7 minutes to 747 minutes. This wide range of usage indicates the program was not used with fidelity in all classes and possibly not monitored for each student. As a result, the researcher recommends allowing stakeholders to collaboratively create a plan to (a) set a site-based recommendation for time students should utilize the program, (b) define when to monitor the fidelity of usage, and (c) create a survey to determine teacher perception as to the usefulness and student appeal of program use. The survey should assess if additional teacher training is required and gather specific examples of how and where to imbed the use of the program in the instructional day. This may assist the school and possibly the district in determining which instructional setting yields the best results in student use and possible growth.

The results of this study indicated a positive correlation between tier movement, usage, and time spent idle for only one of the seven demographic groups. Analysis of tier placement during the school year revealed a significant difference between the likelihood of being in Tier 1 at the BOY assessment period ($M = 36$, $SD = 11$), MOY assessment period ($M = 70$, $SD = 5$), versus EOY assessment period ($M = 40$, $SD = 12$), $p < .05$. The testing window for the Florida State Assessment in reading was March 27 to March 31, 2017, and math was April 10 to May 5, 2017 (Florida Department of Education, 2017). These time frames overlap the EOY diagnostic window for third grade, which may indicate possible cognitive fatigue of the students.

Cognitive fatigue is described as an increasingly common human condition that results from sustained cognitive engagement that taxes mental resources. Persistent

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cognitive fatigue has been shown to lead to burnout, lower motivation, increased distractibility, and poor information processing (Sievertsen, Gino, & Piovesan, 2016). The school of study should consider this possibility because it may be connected to the significant increase in the number of students demonstrating idle time by the EOY assessment and decline in Tier 1 students. Sievertson et al. (2016) also stated that low-performing students are those who suffer more from fatigue and benefit more from breaks.

Stakeholders and researchers would benefit from the results of this study, as the findings can be applied to other programs being vetted or evaluated for student use. Low reading proficiency affects all stakeholders in the educational environment external and internal to the school system. The results of this study also support the benefit of conducting logic model studies annually to determine effectiveness and allow informed decision making. Logic models can be used to clarify for stakeholders what critical factors are required to achieve the desired outcomes, what sequence of events are potentially influencing the outcomes, what performance measures are most relevant for different target populations, how program outcomes vary across target populations, what factors beyond the program control influence intermediate and long-term outcomes across program participants or target populations, and what resources are required to achieve the desired outcomes (Lewis-Beck, Bryman, & Futing-Liao, 2004).

Limitations

Similar studies (I-Station, 2014a, 2014b; Mathes, 2009; Patarapichayatham, 2014) compared the ISIP results to other diagnostic programs, such as state assessments and Dynamic Indicators of Basic Early Literacy Skills, to determine program effectiveness. This was not a replicable condition due to the program being the only assessment and

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progress-monitoring tool provided to students in the school of study. Therefore, a limitation of the current study was the lack of a control group of students who did not use the I-Station curriculum to afford an experimental design in the district of study. In a quasi-experimental design study, a popular research approach, the study population consists of Group A, the experimental group, and Group B, the control group. Only Group A receives the treatment during the experiment (Creswell, 1994).

The researcher did not assess the level at which elements and activities of the I-Station program were implemented, as defined by the I-Station program, but only anticipated outcomes based upon internal measures for usage. It was also undetermined if some of the students in this study came from homes with limited access to technology, possibly creating an unavoidable selection bias of program effectiveness for students with a greater exposure to technology access. The data collected for the study were limited to the 2016-2017 school year and were not compared to previous or prior year I-Station performance results.

Additional limitations included the study being contained to a small sample because the focus was on one elementary school in a district of 25 public and charter elementary schools. In considering maturation, 28 of the 109 students studied were 1 to 2 years older than the average range of 8 to 9 years for this age group. These students were indicated as having been retained up to 1 to 2 years prior in third grade or earlier. The data from this group of these retained students were not extrapolated and were, therefore, analyzed with those students enrolled in the third grade for the first time.

Recommendations for Future Research

Based on the results of the study, the researcher proposes the following recommendations for future research:

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1. Replicate the study either with a larger sample size or at multiple schools to determine if the results change.

2. Consider a survey to measure student perception of the program and its usefulness.

3. Consider adding a survey to measure teacher and administrator perception of implementation and fidelity of usage.

4. Correlate the students identified in Tier 1 on the EOY assessment to those scoring in the proficient range on the Florida State Assessment for reading to determine if the program is a strong predictor for reading proficiency.

Summary

The results of this study show that third-grade students did not demonstrate a consistent improvement in reading across the three assessment periods despite average to slightly below average grade-level usage of the program throughout the year. The researcher recommends that the school reassess the use of the program and its impact on reading proficiency. The researcher further recommends that the school conduct additional research to examine best practices that reinforce more teacher-directed instruction of reading remediation and proficiency.

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Appendix A

Growth Pattern and Positive Trajectories of Students in Grades 1 to 8

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Growth Pattern and Positive Trajectories of Students in Grades 1 to 8

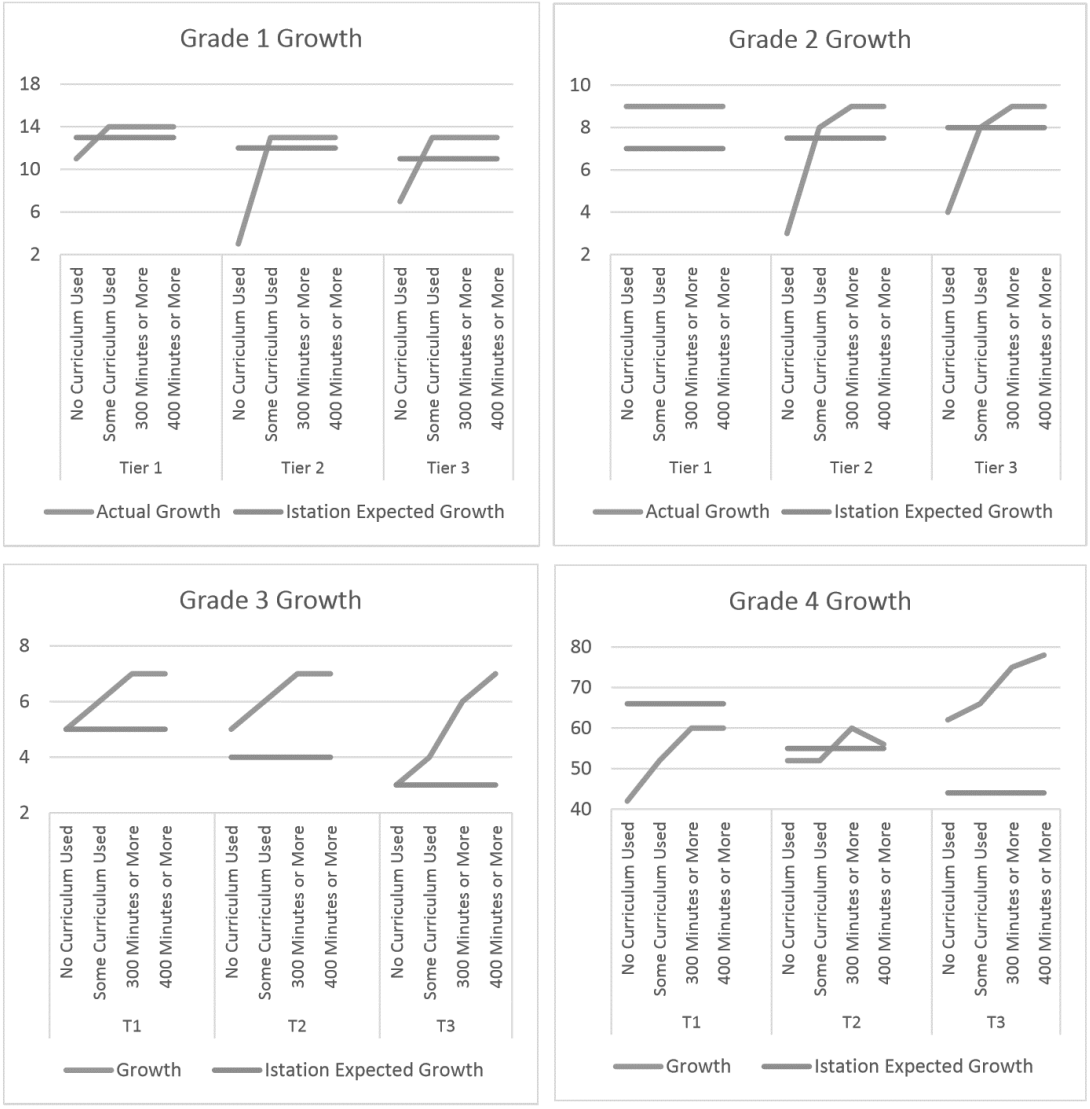

Figure 1: Grades 1 – 4 Growth of BOY and MOY, Combined Model

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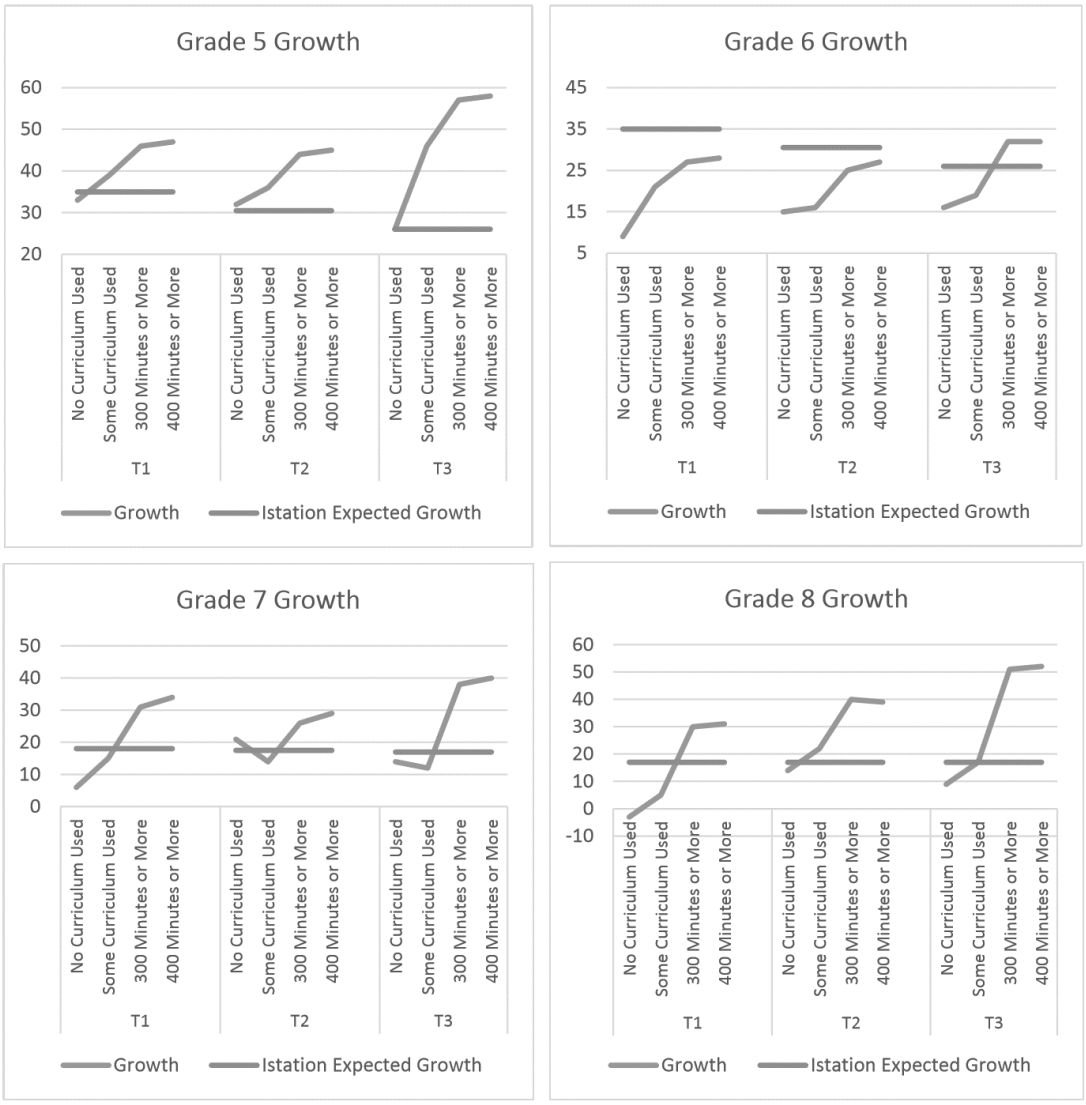

Figure 2: Grades 5 – 8 Growth of BOY and MOY, Combined Model

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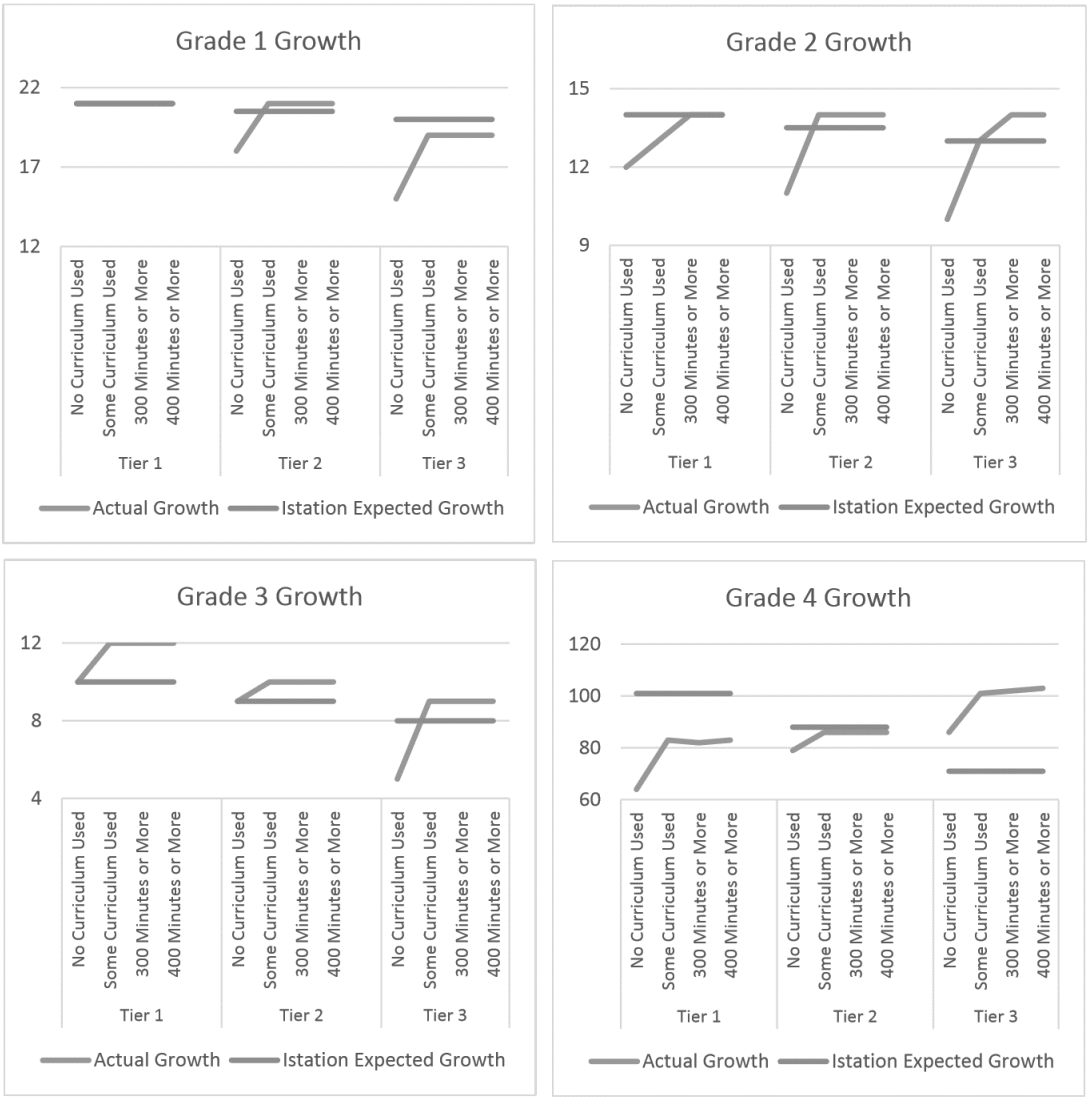

Figure 3: Grades 1 – 4 Growth of BOY and EOY, Combined Model

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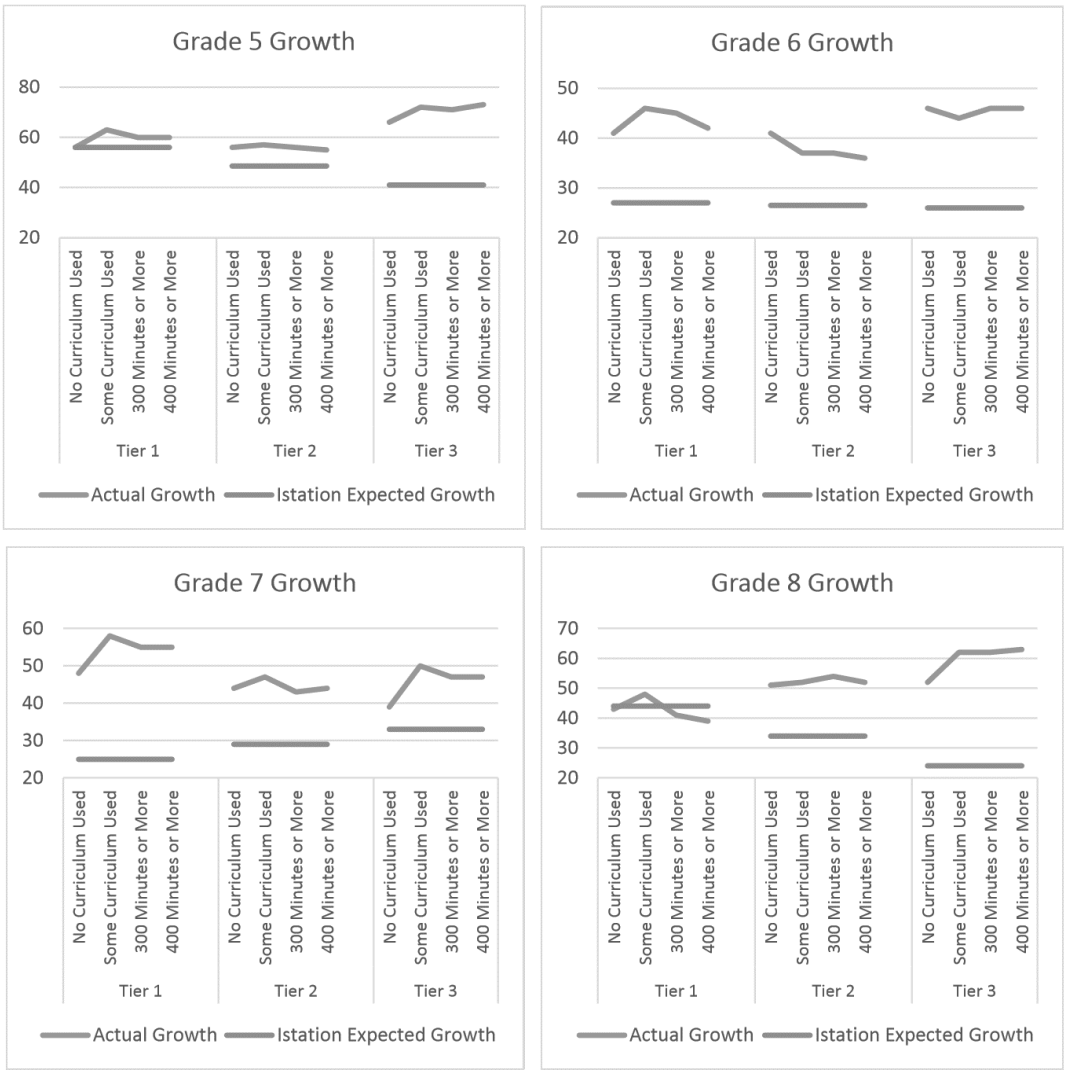

Figure 4: Grades 5 – 8 Growth of BOY and EOY, Combined Model

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Appendix B

Overall Reading Test-Retest Reliability

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Overall Reading Test-Retest Reliability

ISIP Early Reading Overall Reading Test-Retest Reliability[a] *between Testing Sessions*

	Oct 20	Nov 3	Nov 17	Dec 8	Jan 12	Jan 26	Feb 9
Oct 20	---						
Nov 3	0.970	---					
Nov 17	0.962	0.975	---				
Dec 8	0.947	0.962	0.969	---			
Jan 12	0.946	0.963	0.964	0.960	---		
Jan 26	0.936	0.956	0.962	0.960	0.963	---	
Feb 9	0.927	0.945	0.951	0.949	0.958	0.961	---

[a]Pearson product moment correlations (*r*).

Note. Sessions were two weeks in length and started on the date indicated.

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Appendix C

Correlations Between External Measures and Early Reading Subtest Scores

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Correlations Between External Measures and Early Reading Subtest Scores

Correlations[a] between External Measures and ISIP Early Reading Subtest Scores for Grades K-3

ISIP Early Reading Subtest	*External Measure*		Grade Level *K*	*1*	*2*	*3*	*K-3*
Phonemic Awareness (PA)							
	CTOPP Blending Words	*r*	**.688**	**.431**			**.702**
		N	120	100			220
	CTOPP Blending Non Words	*r*	**.676**	**.336**			**.650**
		N	120	100			220
	CTOPP Segmenting Words	*r*	**.644**	**.344**			**.620**
		N	122	101			223
	CTOPP Sound Matching	*r*	**.624**	**.474**			**.662**
		N	122	101			223
Letter Knowledge (LK)							
	Letter Names	*r*	**.593**				**.593**
		N	121				121
	Letter Sounds	*r*	**.693**				**.693**
		N	121				121
	WLPB-R Letter Word Identification	*r*	**.711**				**.711**
		N	120				120
Alphabetic Decoding (AD)							
	TOWRE Phonemic Decoding	*r*	**.582**	**.679**	**.539**		**.838**
		N	122	103	93		313
	TOWRE Sight Word Efficiency	*r*	**.583**	**.626**	**.586**		**.811**
		N	120	100	93		313
	WLPB-R Word Attack	*r*	**.535**	**.701**	**.702**		**.830**
		N	122	102	94		316
	WIAT-II Target Words	*r*		**.624**	**.507**		**.589**
		N		101	92		193
Spelling (SPL)							
	WJ-III ACH Spelling	*r*		**.800**	**.823**	**.798**	**.890**
		N		103	94	96	293
	WIAT-II Spelling	*r*		**.726**	**.774**	**.788**	**.875**
		N		101	91	96	288
Fluency with Text (TF)							
	DIBELS ORF[b]	*r*		**.741**	**.667**	**.627**	**.766**
		N		103	92	94	289
Comprehension (CMP)							
	GORT-4 Comprehension	*r*		**.456**	**.354**	**.473**	**.621**
		N		102	95	94	291
	WLPB-R Comprehension	*r*		**.707**	**.597**	**.569**	**.794**
		N		102	92	93	287
	WIAT-II Reading Comprehension	*r*		**.630**	**.554**	**.596**	**.682**
Vocabulary (VOC)							288
	PPVT-III	*r*	**.687**	**.696**	**.582**	**.785**	**.814**
		N	121	101	94	95	411
	WLPB-R Vocabulary	*r*	**.368**	**.656**	**.702**	**.716**	**.836**
		N	121	103	94	96	414

[a]Pearson product moment correlations (*r*). [b]Feb 9 session data used for correlations.
Note. Empty cells indicate no students were administered that instrument for that grade level.

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Appendix D

Overall Scores for Usage

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Overall Scores for Usage

Beginning of the Year Overall

		N	M	SD	Min	Max	Result
Gender	Female	53	236.46	14.67	182.87	277.27	t (103.9) = -0.78, p=0.434
	Male	56	238.56	13.07	207.37	271.12	
		N	M	SD	Min	Max	Result
Race	AA	50	236.79	11.04	210.84	271.12	t (92.2) = -0.75, p=0.453
	WH	53	238.83	16.14	182.87	277.27	
		N	M	SD	Min	Max	Result
Special Education	No	89	236.85	11.95	182.87	261.09	t (22) = -0.79, p=0.437
	Yes	20	240.60	20.41	207.37	277.27	
		N	M	SD	Min	Max	Result
English Proficient	Yes	93	238.92	12.74	207.37	277.27	t (17.8) = 2.07, p=0.053
	No	16	229.49	17.42	182.87	249.05	
		N	M	SD	Min	Max	Result
Hispanic	Yes	23	239.13	12.10	217.21	270.50	t (40) = 0.68, p=0.499
	No	86	237.11	14.31	182.87	277.27	
		N	M	SD	Min	Max	Result
Homeless	No	97	237.70	14.17	182.87	277.27	t (15.6) = 0.4, p=0.693
	Yes	12	236.27	11.27	217.21	261.09	

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Middle of the Year Overall

		N	M	SD	Min	Max	Result
Gender	Female	53	244.30	15.22	205.92	285.17	t (150.2) = -0.69, p=0.487
	Male	56	246.26	14.13	210.82	277.02	
		N	M	SD	Min	Max	Result
Race	AA	50	244.41	12.53	215.93	277.02	t (95.2) = -0.60, p=0.546
	WH	53	246.19	17.12	205.92	285.17	
		N	M	SD	Min	Max	Result
Special Education	No	89	245.19	11.66	207.58	270.09	t (21) = -0.11, p=0.910
	Yes	20	245.83	24.24	205.92	285.17	
		N	M	SD	Min	Max	Result
English Proficient	Yes	93	246.44	14.47	205.92	285.17	t (20.6) = 1.99, p=0.059
	No	16	238.74	14.27	207.58	258.54	
		N	M	SD	Min	Max	Result
Hispanic	Yes	23	247.15	11.42	229.28	281.23	t (14.4) = -0.21, p=0.832
	No	86	244.82	15.41	205.92	285.17	
		N	M	SD	Min	Max	Result
Homeless	No	97	245.21	14.82	205.92	285.17	t (14.4) = -0.21, p=0.832
	Yes	12	246.12	13.62	224.96	270.09	

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End of the Year Overall

		N	M	SD	Min	Max	Result
Gender	Female	53	246.21	22.24	126.00	310.00	t (93.4) = -1.55, p=0.122
	Male	56	252.00	15.83	223.00	304.00	
		N	M	SD	Min	Max	Result
Race	AA	50	247.72	11.16	228.00	275.00	t (72.3) = -0.81, p=0.418
	WH	53	250.83	25.36	126.00	310.00	
		N	M	SD	Min	Max	Result
Special Education	No	89	249.38	18.70	126.00	310.00	t (25.2) = 0.20, p=0.843
	Yes	20	248.30	22.50	223.00	304.00	
		N	M	SD	Min	Max	Result
English Proficient	Yes	93	249.65	20.15	126.00	310.00	t (27.1) = 0.77, p=0.445
	No	16	246.50	13.92	223.00	271.00	
		N	M	SD	Min	Max	Result
Hispanic	Yes	23	244.78	31.66	126.00	310.00	t (24.5) = -0.82, p=0.418
	No	86	250.36	14.47	225.00	304.00	
		N	M	SD	Min	Max	Result
Homeless	No	97	248.95	19.20	126.00	304.00	t (13.3) = -0.33, p=0.745
	Yes	12	251.08	21.25	230.00	310.00	

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Appendix E

Reports of Idle Time

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Reports of Idle Time

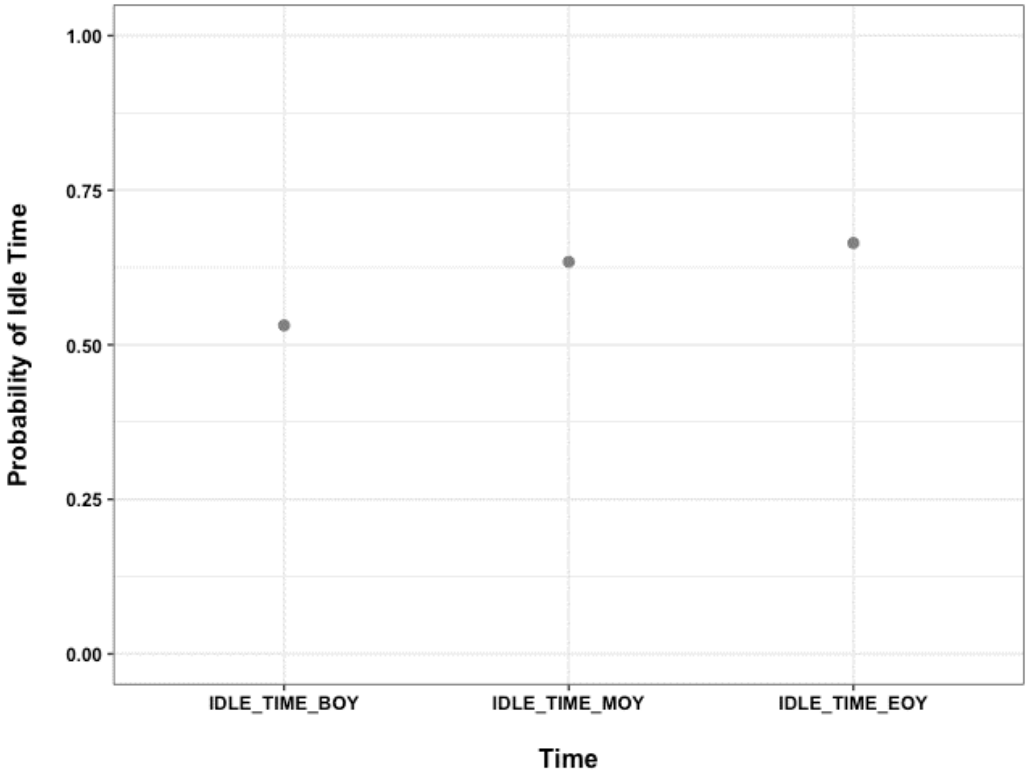

Figure 2. Probability of idle time

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Beginning of the Year

		No	Yes	Result
Gender	Female	24 (45.3%)	29 (54.7%)	C^2(1, N =109) =0.09, p=0.759
	Male	27 (48.2%)	29 (51.8%)	
		No	Yes	Result
Race	AA	25 (50.0%)	25 (50.0%)	C^2 (1, N =103) =0.22, p=0.613
	WH	24 (45.3%)	29 (54.7%)	
		No	Yes	Result
Special	No	40 (44.9%)	49 (55.1%)	C^2 (1, N =109) =0.66, p=0.415
Education	Yes	11 (55.0%)	9 (45.0%)	
		No	Yes	Result
English	Yes	44 (47.3%)	49 (52.7%)	C^2 (1, N =109) =0.06, p=0.792
Proficient	No	7 (43.8%)	9 (56.3%)	
		No	Yes	Result
Hispanic	Yes	11 (47.8%)	12 (52.2%)	C^2 (1, N =109) =0.01, p=0.910
	No	40 (46.5%)	46 (53.5%)	
		No	Yes	Result
Homeless	No	43 (44.3%)	54 (55.7%)	C^2 (1, N =109) =2.14, p=0.143
	Yes	8 (66.7%)	4 (33.3%)	

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Middle of the Year

		No	Yes	Result
Gender	Female	20 (37.7%)	33 (62.3%)	C^2 (1, N =109) =0.01, p=0.979
	Male	21 (37.5%)	35 (62.5%)	
		No	Yes	Result
Race	AA	19 (38.0%)	31 (62.0%)	C^2 (1, N =103) =0.02, p=0.865
	WH	21 (39.6%)	32 (60.4%)	
		No	Yes	Result
Special	No	30 (33.7%)	59 (66.3%)	C^2 (1, N =109) =3.15, p=0.045
Education	Yes	11 (55.0%)	9 (45.0%)	
		No	Yes	Result
English	Yes	34 (36.6%)	59 (63.4%)	C^2 (1, N =109) =0.30, p=0.583
Proficient	No	7 (43.8%)	9 (56.3%)	
		No	Yes	Result
Hispanic	Yes	9 (39.1%)	14 (60.9%)	C^2 (1, N =109) =0.02, p=0.865
	No	32 (37.2%)	54 (62.8%)	
		No	Yes	Result
Homeless	No	36 (37.1%)	61 (62.9%)	C^2 (1, N =109) =0.09, p=0.758
	Yes	5 (41.7%)	7 (58.3%)	

During the middle-of-the-year a greater percentage of non-special education students (66%) reported Idle time than non-special education students (45%), $p < 0.05$.

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End of the Year

		No	Yes	Result
Gender	Female	25 (47.2%)	28 (52.8%)	C^2 (1, N =109) =6.88, p=0.008
	Male	13 (23.2%)	43 (76.8%)	
		No	Yes	Result
Race	AA	22 (44.0%)	28 (56.0%)	C^2 (1, N =103) =2.75, p=0.096
	WH	15 (28.3%)	38 (71.7%)	
		No	Yes	Result
Special	No	31 (34.8%)	58 (65.2%)	C^2 (1, N =109) =0.01, p=0.988
Education	Yes	7 (35.0%)	13 (65.0%)	
		No	Yes	Result
English	Yes	32 (34.4%)	61 (65.6%)	C^2 (1, N =118) =0.05, p=0.810
Proficient	No	6 (24.0%)	19 (76.0%)	
		No	Yes	Result
Hispanic	Yes	8 (34.8%)	15 (65.2%)	C^2 (1, N =109) =0.01, p=0.992
	No	30 (34.9%)	56 (65.1%)	
		No	Yes	Result
Homeless	No	34 (35.1%)	63 (64.9%)	C^2 (1, N =109) =0.01, p=0.906
	Yes	4 (33.3%)	8 (66.7%)	

At the end-of-the-year a greater percentage of male students (77%) reported Idle time than female students (53%), $p < 0.05$.

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Appendix F

Scores Over Time and Tier Placement

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Scores Over Time and Tier Placement

Item 1

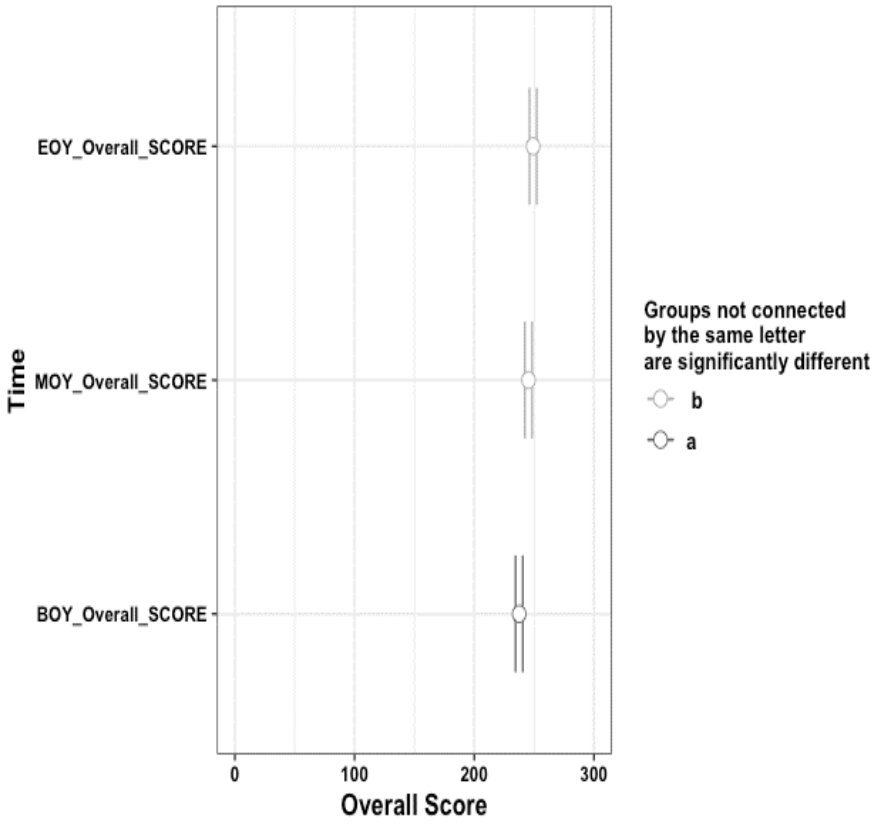

Figure 1. Least squares mean plot with 95% CI

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Item 2

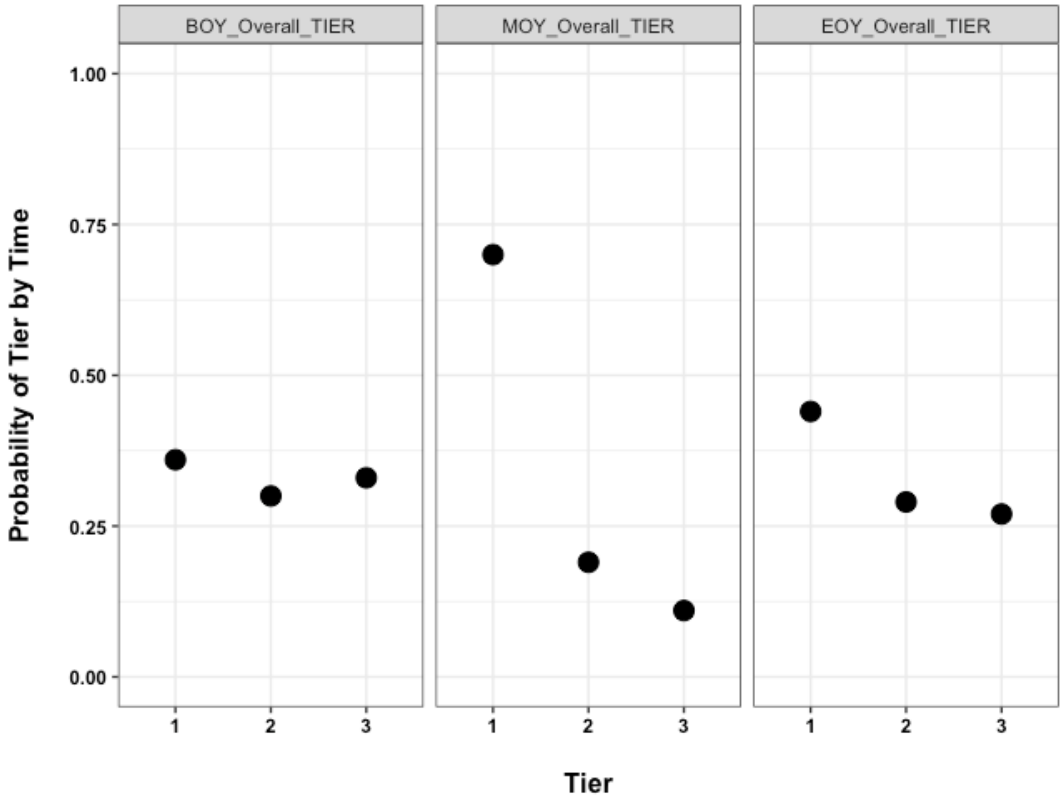

Figure 3. Probability of tier by time

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Appendix G

Reports of Tier Placement by Group

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Reports of Tier Placement by Group

Beginning of the Year

		1	2	3	Result
Gender	Female	18 (34.0%)	13 (24.5%)	22 (41.5%)	C^2 (2, N =109) =2.00, p=0.366
	Male	23 (41.1%)	17 (30.4%)	16 (28.6%)	
		1	2	3	Result
Race	AA	15 (30.0%)	17 (34.0%)	18 (36.0%)	C^2 (2, N =103) =3.39, p=0.183
	WH	25 (47.2%)	12 (22.6%)	16 (30.2%)	
		1	2	3	Result
Special	No	32 (36.0%)	27 (30.3%)	30 (33.7%)	C^2 (2, N =109) =1.93, p=0.379
Education	Yes	9 (45.0%)	3 (15.0%)	8 (40.0%)	
		1	2	3	Result
English	Yes	37 (39.8%)	25 (26.9%)	31 (33.3%)	C^2 (2, N =109) =1.31, p=0.518
Proficient	No	4 (25.0%)	5 (31.3%)	7 (43.8%)	
		1	2	3	Result
Hispanic	Yes	10 (43.5%)	6 (26.1%)	7 (30.4%)	C^2 (2, N =109) =0.45, p=0.797
	No	31 (36.0%)	24 (27.9%)	31 (36.0%)	
		1	2	3	Result
Homeless	No	38 (39.2%)	27 (27.8%)	32 (33.0%)	C^2 (2, N =109) =1.48, p=0.475
	Yes	3 (25.0%)	3 (25.0%)	6 (50.0%)	

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Middle of the Year

		1	2	3	Result
Gender	Female	33 (62.3%)	14 (26.4%)	6 (11.3%)	C^2 (2, N =109) =2.96, p=0.227
	Male	43 (76.8%)	8 (14.3%)	5 (8.9%)	
		1	2	3	Result
Race	AA	34 (68.0%)	11 (22.0%)	5 (10.0%)	C^2 (2, N =103) =0.18, p=0.914
	WH	37 (69.8%)	10 (18.9%)	6 (11.3%)	
		1	2	3	Result
Special Education	No	63 (70.8%)	20 (22.5%)	6 (6.7%)	C^2 (2, N =109) =6.73, p=0.034
	Yes	13 (65.0%)	2 (10.0%)	5 (25.0%)	
		1	2	3	Result
English Proficient	Yes	67 (72.0%)	17 (18.3%)	9 (9.7%)	C^2 (2, N =109) =1.73, p=0.420
	No	9 (56.3%)	5 (31.3%)	2 (12.5%)	
		1	2	3	Result
Hispanic	Yes	18 (78.3%)	5 (21.7%)	0 (0.0%)	C^2 (2, N =109) =3.28, p=0.193
	No	58 (67.4%)	17 (19.8%)	11 (12.8%)	
		1	2	3	Result
Homeless	No	69 (71.1%)	18 (18.6%)	10 (10.3%)	C^2 (2, N =109) =1.44, p=0.484
	Yes	7 (58.3%)	4 (33.3%)	1 (8.3%)	

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End of the Year

Gender		1	2	3	Result
	Female	20 (37.7%)	20 (37.7%)	13 (24.5%)	C^2 (2, N =109) =2.16, p=0.339
	Male	27 (48.2%)	14 (25.0%)	15 (26.8%)	
Race		1	2	3	Result
	AA	19 (38.0%)	20 (40.0%)	11 (22.0%)	C^2 (2, N =103) =3.62, p=0.167
	WH	26 (49.1%)	12 (22.6%)	15 (28.3%)	
Special Education		1	2	3	Result
	No	41 (46.1%)	29 (32.6%)	19 (21.3%)	C^2 (2, N =109) =4.83, p=0.049
	Yes	6 (30.0%)	5 (25.0%)	9 (45.0%)	
English Proficient		1	2	3	Result
	Yes	41 (44.1%)	30 (32.3%)	22 (23.7%)	C^2 (2, N =109) =1.38, p=0.500
	No	6 (37.5%)	4 (25.0%)	6 (37.5%)	
Hispanic		1	2	3	Result
	Yes	10 (43.5%)	5 (21.7%)	8 (34.8%)	C^2 (2, N =109) =1.77, p=0.411
	No	37 (43.0%)	29 (33.7%)	20 (23.3%)	
Homeless		1	2	3	Result
	No	43 (44.3%)	29 (29.9%)	25 (25.8%)	C^2 (2, N =109) =0.78, p=0.678
	Yes	4 (33.3%)	5 (41.7%)	3 (25.0%)	

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