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The Effects of a Computer Based Program on Student Mathematics Achievement Within an Urban Middle School in Georgia

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The Effects of a Computer Based Program on Student Mathematics Achievement Within an Urban Middle School in Georgia

by
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Approval Page

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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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*Sheree Barnes*____________________
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June 25, 2020______________________
Date

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Abstract

The Effects of a Computer Based Program on Student Mathematics Achievement Within an Urban Middle School in Georgia, Sheree Barnes, 2020 Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education and School of Criminal Justice. Keywords: achievement, benchmark assessments, computer-assisted instruction (CAI), Georgia Milestones, parental involvement, School City, SuccessMaker, and Survey Monkey

The purpose of this quantitative study was to investigate the effects of adaptive computer-assisted instruction (CAI) on student mathematics achievement. The researcher sought to describe factors that may influence academic achievement for eight-grade students.

The instruments used to gather data were post curriculum-based mathematics benchmark assessment data administered during fall, winter, and spring semesters, the spring mathematic assessment for the Georgia Milestones, and open and close-ended questionnaires. A purposeful sampling of 63 students were chosen to complete questionnaires. Data analyzed from the 2018 Mathematics scores from SchoolCity and the Georgia Milestones revealed that the SuccessMaker online adaptive software tool positively impacted student mathematics achievement. The questionnaire responses showed that 100% of the teachers believed the online tutoring software to effective in improving student mathematics skills. Only 50% of the student participants rated the program as effective. Additionally, the students who received teacher and parental support with using SuccessMaker obtained higher scores on the standardized assessment, Georgia Milestones.

Table of Contents

Page

Chapter 1: Introduction 1
Statement of the Problem 1
Background and Justification..3
Deficiencies in the Evidence..5
Audience 6
Purpose Statement..7
Definition of Terms..7

Chapter 2: Literature Review..9
Introduction..9
Computer Assisted Instruction and Mathematics Achievement 10
Student Perceptions of Computer Assisted Instruction 13
Teacher Perceptions of Computer Assisted Instruction..18
Effective Mathematics Interventions 23
Parental Involvement and Student Learning...27
Adaptive Mathematics Programs...36
Summary 38
Research Questions 38

Chapter 3: Methodology 39
Participants..39
Questionnaire Student Sample..40
Instruments..40
Procedures..41
Research Design..43
Assessment Data Collection 43
Questionnaire Data Collection..44
Questionnaire Analysis 47
Assessment Data Analysis 48

Chapter 4: Results..49
Research Question#1: "What Are Student Perceptions of the CAI Program, SuccessMaker?..49
Research Question 2: "What Are Teacher Perceptions of the CAI Program, SuccessMaker?"..51
Research Question #3: "In What Ways Do Students Believe Their Parents Engage in Their CAI Progress at School and at Home?" 52
Research Question #4: "Is There a Significant Change in Students' Scores on Curriculum-based Benchmark Tests and Standardized Assessment Results After Using the CAI Intervention?" 53

Statistical Analysis 53
Frequencies and Percentages 56
Summary 58

Chapter 5: Discussion 60
Summary of Findings 60
Implications 61
Limitations 63
Recommendations 64

References 66

Appendices
A Student Questionnaire 82
B Teacher Questionnaire 85
C Site Approval Letter 89
D Student Consent Form 91
E Student Questionnaire Responses 96
F Teacher Questionnaire Responses 100

Tables
1 Teacher Responses to Question #10 52
2 Pearson Correlation Results Between SchoolCity(SC) Raw Scores, Term (T3), SC Correct ResponsesT3, and Milestones Scores 54
3 Frequency Table for Nominal Variables 54
4 Repeated Measures ANOVA Results 55
5 Means Table for Within-Subject Variables 55
6 The Marginal Means Contrasts for Each Combination of Within-Subject Variables for the Repeated Measures ANOVA 56
7 Frequency Table for Nominal Values 57
8 2018 SchoolCity Posttests and Georgia Milestone Math Scores 58

Figures
1 Georgia Milestones End of Grade Scores From 2016-2017 4
2 Georgia Milestones End of Grade Scores From 2017-2018 5
3 Question #10 From Appendix E 50
4 Within-Subject Variable Means 55

Chapter 1: Introduction

The purpose of this expo-facto, non-experimental study was to explore what effect, if any, does SuccessMaker, an online instructional tool, have on student mathematics achievement of a group of eighth-grade students who received the instructional intervention during the 2017-2018 school term. SuccessMaker is an adaptive online instructional reading and math intervention program for grades kindergarten to grade 8. As students achieve mastery of a particular strand of scaffolded lessons taught at their current ability level, they advance to a higher level. The program is designed to improve a student's ability to retain skills in his or her long-term memory, thus increasing achievement scores in reading or mathematics (Pearson Education, 2019). The research included two questionnaires completed by the students and 8th-grade teachers on their perceptions of the use of the program and how parents were involved in the process. In addition, the researcher provided results of student progress on curriculum-based and standardized assessments for the year.

Statement of the Problem

Eighth-grade students at the target school had been performing below grade level on the Georgia Milestones end-of-grade assessments since 2016**.** In order to advance to the next grade, students were expected to obtain scores within the Proficient range (Georgia Department of Education, 2018, "Promotion and Retention"). The urban middle schools' population in middle Georgia consisted of 45% African-Americans, 43% Caucasians, 9% Hispanic, and 2% other ethnic (Great Schools, 2018). The federal mandate of *No Child Left Behind* required that P-12 students in all states meet 100% proficiency by 2014. The law further stated that 95% of subgroups (students receiving free/reduced lunch and special education services and minorities) be included in state testing (Lee, 2014). However, *No Child Left Behind* was revised in 2010 under the Obama administration as Every *Student Succeeds Act* (ESSA). The new law provided a safety net for economically disadvantaged students (U.S. Department of Education, 2015). Stakeholders included teachers, family members, community leaders, and students. Interchangeably, each group works together to enable students to develop high levels of learning. School districts with low-performing schools must positively address deficits in the academic progress of the students. The target school implemented SuccessMaker as a tool to remediate and accelerate mathematics skills for 8th-grade students.

Mathematics empowers children to advance their critical-thinking skills through real-life applications (Crews, 2012). Without substantial preparation for problem solving, students have difficulty understanding the significance of the mathematical concepts in real-life situations (Sierpinska, Bobs, & Knipping, 2007). Post-secondary institutions experienced low-retention rates for students enrolled in mathematics degree programs (Koenig, Schen, Edwards, & Bao, 2012). Koenig, Schen, Edwards, and Bao (2012) found that only 30% of students enrolled in one Midwest university received a science or mathematics degree. University officials attributed the lack of student success to inadequate prerequisite skills that should have been acquired in high school.

The researcher of the current study investigated the impact of computer assisted instruction (CAI) on mathematics achievement. The research included questionnaires of student and teacher perceptions of the CAI program, SuccessMaker. The participants provided their viewpoints on the usability and some strengths and weaknesses of the program.

Background and Justification

The study site was a Title 1 middle school that had a student population of 912 students with 99.1% being economically disadvantaged. In 2012, the school did not meet the expected proficiency level (Georgia Department of Education, “CRCT Statewide Scores,” 2018) due to low CRCT mathematics results for (a) Did Not Meet, (b) Met-with score of at least 800, and (c) Exceeding. In 2012, these groups met math proficiency levels at 52.6%, 41.7%, and 5.6%, respectively. However, since 2012, the CRCT Met/Succeed scores for eighth-grade students increased to 74.4% in 2013 and 76.4% in 2014.

From 2014 to 2018, eighth-grade students were administered the Georgia Milestones assessment. At the end of the 2015-2016 school year, students in the target middle school obtained scores of 71.2% within the Beginning and Developing learner range, with only 28.8% with scores of Proficient and Distinguished (Georgia Department of Education, “Georgia Milestones,” 2018). In comparison, the statewide results yielded End-of-Grade scores of 24.4% of students as Beginning learners, 42.1% as Developing learners, 26.1% as Proficient learners, and 7.3% as Distinguished learners. Students in the Beginning category needed more intense support prior to progressing to the next grade. A score in the Developing range indicated partial proficiency with some additional support needed. Students in the Proficient and Distinguished range demonstrated the appropriate skills for advancement to the next grade level (Georgia Department of Education, “Understanding the Georgia Milestones,” 2018). However, *Figure 1* reveals that only

28.7% of the 8th- graders at the research site achieved proficient and above at the end of 2017 and 71.3% were below.

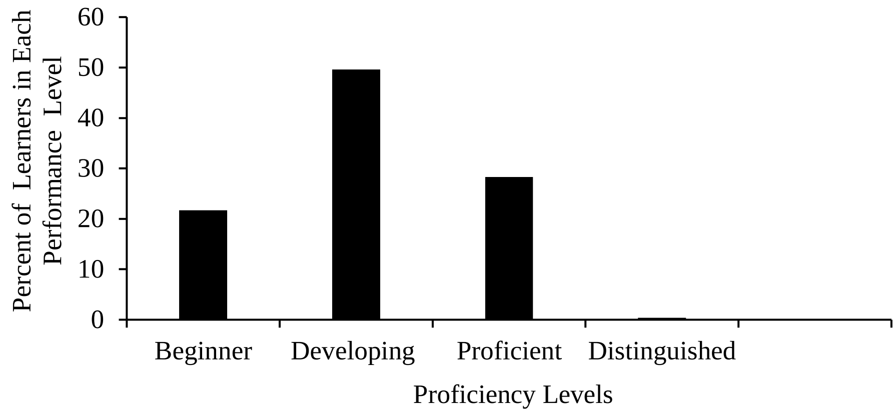

Figure 1. Georgia milestones end of grade scores from 2016-2017.

From 2015 to 2017, eighth graders at the research site had not met the criteria of 100% as mandated by *No Child Left Behind*. From 2010 to 2012**,** eighth grade students maintained a competency level below 75% in mathematics. In 2012, the scores declined to a level of 47.4% (Georgia Department of Education, "CRCT Statewide," 2014). By the end of the 2017-2018 school year, only 13.7% of the students at the site performed at proficiency and above, and 86.4% were below as indicated by *Figure 2*.

In 2017, states were allowed to use what is called *the College and Career Ready Performance Index (*CCRPI) (Georgia Department of Education, "ESSA," 2019) to address the requirements of the ESSA plan. The plan was approved in 2018. Schools were expected to improve a 1.05% each year until a content mastery of 90% was obtained. For the 2018-2019 school year, the target middle school met CCRPI content mastery at 50% for mathematics, only a 1% increase from the 2017-2018 school year.

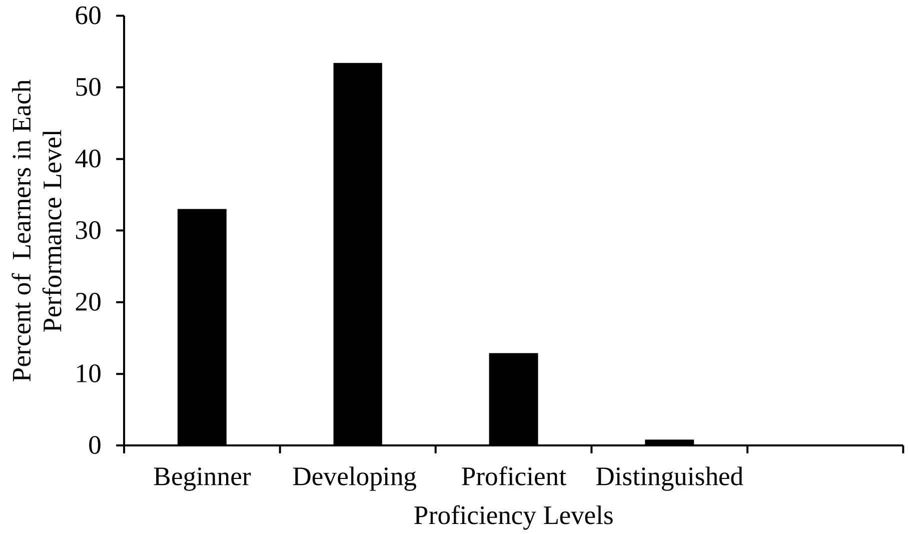

Figure 2. Georgia milestones end of grade scores from 2017-2018.

Deficiencies in the Evidence

Past and current literature has limited findings on how children acquire mastery of mathematics concepts (O'Sullivan, Chen, & Fish, 2014). A lack of adequate studies of the effects of Virtual Learning Environment (VLE) on student learning exists for elementary and high school students (Heemskerk, Kuiper, & Meijer, 2014). Subsequently, research cannot reveal all interventions teachers use to increase student achievement (Witzel, Ferguson, & Mink, 2012). Pavia et al. (2017) stated that future research should use questionnaires to collect data on the relationship between teachers and parents when evaluating computer activities for students. Additionally, more in-depth research needs to be done on how parental involvement can lead children to become independent learners (Bieschke, 2007). Numerous studies reflect that children experience higher levels of academic success when parents actively participate in the school process (Yoder & Lopez, 2013; Kitsantas, Cheema, & Ware, 2011; Strayhorn, 2010; Ashbaugh, 2009; Bali, Wedman, & Demo, 1998). Daniely (2007) further recommended that future research is needed to explore mathematics interventions for students who continued to fail pre-and posttests. Kiriakidis and Geer (2014) reported that the school site in their study had not previously conducted research on the effect of SuccessMaker on student standardized test scores. The proposed study included quantitative and questionnaire reports to explore the impact of an instructional online computer program, SuccessMaker, on the related variables of mathematic achievement and computer interactions of students, teachers, and parents.

Audience

The findings of the study may possibly generate more collaboration between teachers, parents, and students that might lead to an increase in parent-teacher conferences throughout the school year. Teachers and members of the community may alter their perceptions on homework and use the results from the study to determine which technology tools actually benefit students. School system administrators can use this study to assist with conducting feasibility studies of mathematics intervention programs that lead to increased student achievement. Moreover, student perception of the programs and parental involvement could lead to higher incidences of student buy-in. Consequently, the findings may facilitate the use of more research-based mathematics programs that target specific higher order thinking skills for middle school students. As evidenced in other research studies proficient mastery of these skills often enables students to be more successful in high school mathematics courses.

Purpose Statement

The purpose of this study, incorporating a non-experimental, descriptive design, was to determine if a correlation existed between a mathematics intervention program, SuccessMaker, and the improvement of 8th-grade Georgia Milestones and curriculum-based benchmark scores by using quantitative data derived from the two assessments from the 2017-2018 school year. Additionally, the researcher used questionnaires to determine the influences, if any, that parental involvement had on the students' achievement scores using student feedback from anonymous questionnaires. The 2017-2018 8th-grade mathematics teachers and the 2017-2018 8th-grade student intervention group completed anonymous questionnaires for the study. The answers to the questionnaire questions reflected student and teacher perceptions of the SuccessMaker program and reflections on how parents participated in the process.

Definition of Terms

The following definitions are important to understanding the different variables used in the present study:

Achievement. Achievement is defined as "grades and test scores" (Ross & Broh, 2000, p. 274**).**

Benchmark assessments. Instruments used to periodically assess student growth within a school curriculum (Brasiel, Martin, Soojeong, & Min, 2016).

Computer-assisted instruction (CAI). This term refers to online software programs designed to improve mathematics skills for struggling students (Garrett, 2012).

Georgia milestones. Assessments which measure a student's knowledge and skills of stated curriculum standards in the academic content areas (Georgia Department of Education, "Georgia Milestones," 2018).

Parental involvement. Active participation of a parent in the academic aspect of a child's life (Bowen, Hopson, Rose, and Glennie, 2012).

School city. This term refers to an online assessment and data collection tool for tracking student achievement in various subject areas using a pretest and three posttests during the year (School City, 2018).

SuccessMaker. A research-based online adaptive mathematics intervention program (Pearson Education, 2019; Tucker, 2009).

Survey Monkey. Survey Monkey is an online survey tool that is HIPPA compliant (Survey Monkey, 2018).

Chapter 2: Literature Review

Introduction

The Internet is a beneficial medium for enhancing classroom instruction (Kumar, 2007). Students can advance according to their individual pace. Qualitative and quantitative methods of research provide in depth analyses of *computer-assisted instruction* (CAI). The first section of the literature provided a review of student CAI self-efficacy. The second section included teacher perception of CAI and how it relates to traditional teaching methods. The third section of the literature review presented limited research on the SuccessMaker program, in addition to other effective mathematic interventions used in classrooms. The fourth section of research articles focused on how CAI tools may affect student achievement in mathematics. The fifth section of the literature offered ways that parents engage in the learning progress of their child. Included were the effects of parental involvement with CAI at home and school. Lastly, the sixth section of literature discussed various adaptive online learning tools for improving student mathematics achievement.

The researcher presented comprehensive literature to explain the research problem that was investigated in the proposed study. Many external factors influence student achievement, e.g., peer influence, school interactions, and self-perception (Kim, Gendron, Toro, & Fairborn, 2011). The following literature review explored (a) student and teacher perception of CAI tools, (b) mathematics interventions, and (c) CAI and achievement, (d) parental involvement and student learning, and (e) types of adaptive online mathematics programs. The noted research findings provided further supportive evidence for the proposed study. Research designs that combine qualitative and quantitative approaches can have high impact on advancing research knowledge (Niedzwiecki & Nunnally, 2017). Parents can use technology to connect with the academic development of their children (Paiva, Morais, & Moreira, 2017). Thus, the student and teacher questionnaires included close-ended questions on parental involvement with the SuccessMaker program. The researcher in the current study used quantitative data and questionnaires to describe the effectiveness of the SuccessMaker program on student performance.

Computer Assisted Instruction and Mathematics Achievement

Garrett (2012) examined the use of teacher-guided, computer-based mathematics programs to supplement traditional teaching practices. The teacher taught 3rd-grade students to use various Microsoft software, how create web pages, and to navigate the Internet. The outcomes yielded significantly different Measures of Academic Progress (MAP) scores between the students who received mathematics instruction through traditional methods and the students who had access to computer-assisted instruction (CAI). The mean score for the CAI group increased seven points above the traditional group.

Tucker (2009) designed a three-year quasi-experiment to determine if the SuccessMaker software program would result in mathematics improvement on the Texas Assessment of Knowledge and Skills (TAKS) for 5th-grade students. Texas required that 5th-grade students achieve proficiency on the TAKS for promotion. A *t-test* compared the demographics of the 479 students who participated in the study. The results indicated that no significant differences existed between TAKS scores for the control group (students who did not receive SuccessMaker as an intervention) and the intervention group that received SuccessMaker as an intervention. The correlation between CAI and TAKS scores was <.01. In addition, the schools involved in the study used other CAI programs, such as, *Accelerated Math*, *Incredible Tutor*, *PLATO*, and *Symphony Math*. None of the interventions led to mathematics proficiency for 12% of the 5th-grade students. Tucker suggests that other options must be considered for these students. They may have needed additional instruction, after-school tutoring, and more parent engagement.

Curiosity motivates learning (Ciampa, 2014). Interactive mobile devices help the earner to self-regulate and make personal choices. Ciampa's single case study investigated students' and teachers' perceptions of using iPads as learning tools. The 24 students from one classroom received feedback on their skill level throughout each game played on the iPad. According to the students who responded to interview questions, the feedback motivated them to continue to work on difficult problems until mastery was achieved. The students also reported experiencing a desire to learn because the technology provided a sense of authority and allowed them to use individual learning styles. The students transferred what they learned via traditional classroom instruction to completing activities within the games that they played. Furthermore, students worked cooperatively with each other by collaborating on their experiences with the various games.

Adversely, students from grades 8 through 11 in the Kolikant (2009) study responded to survey questions on their viewpoints of learning gained from using technology to complete in-school assignments and homework. The majority of the students used computers to enhance school projects, to study for exams, and to complete homework. Although computer usage increased their skill as an independent, the students did not believe computer usage increased their achievement levels. The results of the studies indicted a correlation existed between student Internet usage and studying. Students also perceived themselves to more knowledgeable about the Internet than their teachers. Kolikant suggested that more studies be done on “student attitudes towards computers and the Internet” (p. 142).

Mathis (2010) investigated whether significant correlations existed between student standardized assessments, demographics, and instructional interventions. Mathis conducted a quasi-experimental study to compare Criterion-Referenced Test (CRCT) scores for 8th grade subjects who received SuccessMaker intervention in two middle schools and the students who did not receive the intervention in two different schools. Mathis did not find a significant difference in the math scores of the two groups. The average scores for the SuccessMaker group and non-SuccessMaker group was 798 and 800, respectively. Additionally, ANOVA results did not produce any interactions between demographics and instructional strategies. However, the ANOVA results did reveal that Caucasian students (M=817) outscored African American students (M=794). A passing score of 800 was need for proficiency (Georgia Department of Education, “CRCT Statewide,” 2018). Mathis noted that the principals of the four schools involved in the study used a “modified” (p. 92) version of the SuccessMaker program. Mathis proposed that administrators monitor teacher implementation of the program in the classroom and that future studies involve qualitative surveys on student opinion of the program and how it impacted their standardized test scores.

Student Perceptions of Computer Assisted Instruction

Carwell (2012) found that school climate and culture did not directly impact student achievement perceptions for the female students who received mathematics instruction using Stanford Math Intervention Program (SMIP). Student scores increased on the district's Discovery Formative Assessment, indicating that the SMIP had been effective in elevating student motivation and confidence levels. Carwell did not find any significant factors between interpersonal relationships within the school environment and academic achievement. An effective mathematics intervention program should allow students to self-advocate by providing feedback to teachers on how the program benefits them. Consequently, teachers and administrators can readjust strategies to meet the needs of the students.

A plethora of factors influence the use of computers as educational teaching tools (Penna & Stara, 2010). A student sampling of 305 students (males=55% and females=45%) rated their CAI experience. The male participants significantly reported having a greater knowledge of technology than the female students. A factorial analysis of the student responses indicated that all students preferred to use computers at school and not at home. Despite the positive interview feedback on CAI, the researcher's ANOVA analyzed results revealed that student achievement was not impacted. Penna attributed this to an inner resistance of the students to accept alternative learning methods. The study did not include other variables, such as, cultural background, the traditional teaching methods used by teachers, and adequate statistical data analyses.

Stone (2017) conducted a study of one-to-one student usage of individual laptops that were provided by the school district. Stone interviewed 622 students about their perceptions on using the laptops in the classroom for different subjects. A multivariate analysis found that the student participants used the laptops to email weekly assignments to their teachers for 3 to 4 classes. Students with higher usage tended to have positive responses on how technology impacted their studies. However, the positive feedback from students declined from 54.8 at the beginning of the school ear to 49.6 in the Spring. Stone attributed the decline in feedback to the sometimes unreliability of the laptops and the lack of technical support. An extended study would have allowed the school district to address the technical issues and to collect data on student learning outcomes.

Students, participating in an *intercultural computer-supported collaborative learning* (iCSCL) groups, completed surveys, interviews, and self-reflection logs about their experiences. The Chinese student participants were intrinsically motivated to use computers by a desire to learn English and to learn of other cultural differences. The American students held misconceptions about the Chinese culture until after the collaboration began. After iCSCL, American students became intrinsically motivated to use technology to interact with other cultures. Scheduling of collaborations due to different residential time zones presented a conflict for some iCSCL members. Another negative impact was waiting until the end of the study to collect self-reflection feedback from the participants. Instead, McLeod et. al recommends gathering self-reflections throughout the study in order to address any needed changes within the iCSCL groups.

Early studies stated that students believed that they knew more about navigating and using the Internet than their teachers (Kolikant, 2009). High school students enrolled in history classes believed that they knew more about the Internet than their teachers as conveyed in the survey used in the Kolikant study. Teachers and students did not view the Internet or computers to be beneficial for learning. The positive aspect for the students was that they could easily research a topic using a computer because gathering the information from a textbook would be time consuming and mentally strenuous. Results of an ANOVA test on Likert scale responses (M=3.07) found that students agreed that computers were important tools that should be used in a history class. In addition, students posted a mean score of 3.07 for cognitive improvement as a result of using computers versus books. Kolikant wrote that more studies need to be done on students' perspectives on learning in the school environment, teacher attitudes towards students using technology away from school, and how students are influenced by their views of the role of technology in the school environment.

Student commentaries of interactive online tutoring revealed that at least 40% of the middle school participants from two middle schools experienced improved mathematics skills and highly approved of the support provided by their assigned tutors (Chappell, Arnold, Nunnery, & Grant, 2015). As a result, Middle School 1 improved mathematics scores from pretest to posttest by 23 points. Middle School 2 improved their scores by 26 points. Chappell et al. gathered several implications from the mixed-method study. First, online tutorials need to include imbedded prompts for students monitor their own thought processes when solving challenging. Secondly, despite favorable feedback from participants of both schools, a large majority reported needing more time to complete lessons.

Authors Kuiper and de Pater-Sneep (2014) instructed 329 fifth- and sixth-grade students to give their opinions of two ICT software programs, Rekenrijk and Pluspunt. Chi-square tests were used to analyze student questionnaire responses about the drill-and-practice software packages. About one-third (n=65.8%) of the students preferred to complete mathematics practices using the curriculum workbooks. They felt that their concentration and stamina were greater. Incidentally, the Pluspunt group gave higher positive reviews on the software than the Rekenrijk group (Kuiper & de Pater-Sneep, 2014). Both groups found the computer exercises to be more difficult, and they expressed a desire to have the autonomy to choose their own tasks instead of the software selecting them. The students wanted the ability to complete problems out of sequence. Students also reported that teacher feedback and assistance with difficult problems increased their motivation. Based on the outcomes from the study, Kuiper and de Pater-Sneep (2014) proposed that more research be added to the limited existing studies on student perceptions of ICT.

In a study by Huang (2013), students expressed concern for improvements to be made to the visual aids within the software, *English Reading Online*. The online software provided activities in English and Chinese. Students desired more videos, attractive screen layouts, and illustrations that assisted with understanding the text. In that study, thirty-two Taiwanese freshmen college students reflected on the proficiency of the program by completing an open and closed ended survey and writing a reflection log. Students responded to a 5-point Likert scale survey from *Strongly Disagree* to *Strongly Agree* and indicated an average of 3.5 points for the support strategies of the dictionary, language translation, and high-lighting. They least favored the music choice for listening while reading, graphic organizers, and having timed reading comprehension question and answer modules. Students and teachers suggested that (a) the automated voice function be made to sound more human, (b) the software should incorporate short quizzes throughout the session, not just at the end of the reading passage, and (c) the site developers should enable students and teachers to participate in a question and answer platform. Huang recommended that the program designers should make the suggested changes gleaned from the surveys in order to make the program more user-friendly for diverse learners.

A two-year study by Howard (2018) examined how two groups of students, high school and college, ages 16 and above, perceived using social media to collaborate on class assignments. Using the free network platforms, Edmodo and Facebook, “high-engaged” (HE) students and “low engaged” (LE) students formed learning communities (Howard, 2018). They posted work to discussion boards within the online sites. Initially, both groups experienced some level of shyness or resistance for sharing their writing styles and abilities with others. Continued support from HE students enabled the LE students to continue on during the second year of the study. By the end of the study, both groups accepted social media as a resourceful tool for gaining a sense of belonginess and self-reliance. The need for one-on-one support from the instructor also diminished for the participants. The students preferred to gain encouragement from peers within their learning groups. The results of the study revealed that student performance depended upon the student’s interactions within the social media community. When students formed alliances, they assumed responsibility for the members of their social media group. Social media also allowed students who had become disengaged in face-to-face classroom settings to gain a sense of respect and belonginess when participating in asynchronous learning communities (Howard, 2018).

Lee, Yeung, and Ip (2016) polled university students enrolled in blended English courses. The researchers used an anonymous survey that required the students to provide information on self-perceived learning styles and computer usage. Little differences on computer usage and competency were found to exist between the younger and older (pre-90s) age groups. However, students' perceptions of individual learning styles and the actual usage of that style differed significantly. In other words, some students tended to use more than one learning style versus the dominant one that was reported. The researchers attributed the phenomena to the student lack of using computers in more than one setting. They advised that non-participating students and teachers conduct follow-up interviews to provoke study participants to review their learning styles and make any needed adjustments for optimizing their learning.

Lee, Tsai, Chai, and Koh (2014) sought to investigate how secondary students' perceptions of collaborative learning (CL) and self-directed learning (SDL) with and without the use of information and computer technology (ICT). Students' communication skills greatly impacted the success of CL with or without ICT. Reciprocal actions of proper manners, intelligent and engaging conversations, and work ethics. Lee et al. discovered that the absence of ICT support and user resources for CL group and SDL only group did not negate the need for these students to receive ICT training. Pre-ICT training would have empowered the students to engage effectively with each other and to maximize their ICT skills.

Teacher Perceptions of Computer Assisted Instruction

Of the teachers in the Penna and Stara (2010) study, 84% gave positive responses for student usage of computers at school, 60% believed that technology helped to improve instruction, and 65% thought that CAI was better than traditional instructional methods. Penna suggested that similar pilot studies should use a factorial ANOVA analysis. Self-made surveys or interviews questions should undergo several adjustments before a researcher can deem them to be reliable and valid. Likewise, teachers need pre-training prior to having to adopt a new technology to use as an instructional tool in the classroom. In doing so, teachers would be less disoriented and more receptive to redefining individually learned mindsets towards technology. The fifth-grade students were observed to show less reluctance to use new technology than the 6th-grade students.

Teachers responded to survey questions from the Game-based Teaching Belief Scale (GBTS) and the Technological Pedagogical Content Knowledge-Games (TPACK-G) (Chung-Yuan, Meng-Jung, Yu-Hsuan, & Jyh-Chong, 2017). According to the results of the study, elementary school teachers yielded a higher belief than middle school teachers that students learned more from games-based computer activities and that teacher instruction was enhanced. Middle school teachers thought that time constraints interfered with teachers becoming proficient with how game-based learning could be incorporated with traditional teaching methods. ANOVA analyses of the TPACK-G inventory identified a statistical significance for males and teachers under the age of 40 having a higher confidence level of expertise with using technology.

Nikolopoulou and Gialamas (2015) investigated teacher opinions of using computers to supplement classroom instruction. In a qualitative study with a descriptive design, a group of 134 elementary teachers completed a questionnaire on barriers that prevent adequate implementation of computer technology in the classroom. Using a Principal Component Analysis (PCA), the researchers collected feedback from the surveys that revealed four barriers: (a) lack of technical support, (b) low self-efficacy and training opportunities, (c) inefficient number of computers, and (d) scheduling issues. The less experienced teachers reported having more confidence and ability to work with technology. Nikolopoulou and Gialamas recommended that the qualitative study be extended to a mixed method approach to include a larger sampling size and qualitative data only.

Similarly, English as a Foreign Language (EFL) teachers reported that limited knowledge of technology influenced how effectively *Computer Assisted Language Learning* (CALL) was implemented in the classroom (Park & Son, 2009). Only five of the 12 participating teachers had received professional learning that included training on how to incorporate computer into classroom instruction. All but one teacher agreed that EFL students were successfully engaged in learning with CALL. The EFL teachers further stated that time constraint, unavailability of computers, and lack of technology training/support impacted CALL usage (Nikolopoulou & Gialamas, 2015; Park & Son, 2009). Park and Son (2009) emphasized that professional learning opportunities for teachers and unilateral collaboration would be paramount in facilitating the effective use of CALL. EFL teachers in the Huang (2013) study agreed that the online reading program, *English Reading Online*, presented students with strategies to enhance their reading abilities. Teachers experienced a disconnect with their own expectations of what students should do when using strategies provided by the site. Teachers believed that students should focus on how to derive meaning from context clues and prior knowledge. Nevertheless, students preferred to take advantage of the more supportive tools for highlighting, translating, and dictionary skills. Lee, Yeung, and Ip (2016) stated that teachers should be aware of student learning styles in order maximize learning. According to Lee et al, pre-service computer instructors believed that four teaching strategies should be followed with learners:

1. An instructor should demonstrate and explain how to complete tasks using the technology.
2. Provide the learner with repeated practice on the computer.
3. Use a visual presentation to introduce new skills to be learned via the online computer program.
4. Have students collaborate with each other to complete group activities (Lee, Yung, & Ip, 2016).

Teachers in other countries struggle with inducting technology into the instructional environment on a daily basis. A case study of the *United States Agency for International Development* (USAID) of how teachers perceived their use of computers in the school community (Hosman & Cvetanoska, 2013). Of the 82% reporting, only 42% actually used computers with their classes. Sixty-percent of the 212 students from the study actually incorporated *Information and Communication Technolo*gy (ICT) into the classroom setting. ICT was used to prepare teaching and instructional materials. In their interview and survey responses, teachers revealed that self-confidence, limited training, and lack of technical support hindered the consistency of implementation of ICT. Low funding prevented the researchers from extended the study from three to five years as needed for follow-up interviews. Hosman and Cvetanoska summarized that teachers need at least one year of professional learning for effective use of ICT in the classroom.

Even with limited research on why students engage in massive open online courses (MOOCs), the medium has garnered increased attention in the educational community (Hew, Chen, & Tang, 2018). The participants commented on the six preset themes: (a) structure and pace, (b) qualities of the course instructors, (c) course content and related resources, (d) interactions between course members and support, (e) video components, and (f) coursework and assessments. The student feedback indicated that they remained engaged when professors interjected humor and interest throughout the video lectures. The course real-life content, tutorial support, and associated resources also enabled the students to remain focused. The researchers stated that MOOC instructors should refrain from requiring assignments that lack opportunities for students to interact with each other and their professors. Students are less likely to continue in courses that require the learner to recall information without any opportunities to apply the knowledge.

For a non-probability sampling, Zehra and Bilwani (2016) selected four teachers from an exclusive elementary school and 4 teachers from an average one. The researchers required the teachers, ages 20 to 35 years of age, to complete open-ended surveys of their insights on the usefulness of technology in the classroom. Both groups of teachers agreed that technology was an integral part of their everyday lives, and it evokes excitement to learn amongst students in the classroom. The teachers also believed that technology addresses all learning styles. Nonetheless, several teachers from the two schools held the opinions that technology can be time consuming and aggravating when a student fails to learn from using ICT. The findings of the study further revealed that school administrators can create a negative mindset with teachers when technology is not readily available or missing. All stakeholders, including parents and community leaders, must work together to procure adequate and efficient technology for all learners in the school setting.

Effective Mathematics Interventions

A standards-based curriculum (SBC) and schema-based instruction (SBI) proved to be beneficial in increasing mathematical posttest scores for 136 third-grade elementary students. Jitendra, Rodriguez, Kanive, et al. (2013) assigned the students to one of the instructional groups. Mastery of basic computational skills precedes the ability of a student to benefit from mathematics instruction that involves problem-solving strategies. The *SBC* group received tutoring in number operations and how to solve word problems. The tutors for the *SBI* group taught schematic strategies with graphic organizers for solving word problems.

Older studies provided evidence that traditional teacher-led, teacher-oriented mathematics instruction had been ineffective (An, Capraro, & Tillman, 2013). Using a five step Model-Strategy-Application assessment, students completed mathematics problems by matching a musical note with each step in a task. As a result of the instructional strategy, students demonstrated increases in problem-solving skills involving graphing, creating tables and charts, and computation fluency when solving word problems.

Koichu, Berman, and Moore (2007) hypothesized that *heuristic literacy*, the innate ability an individual has to problem solve, had a direct link to mathematical achievement in middle school students. The study required the students to respond to pre- and posttest items from the Raven Progressive Matrix Test (RPMT) and a high school scholastic Aptitude Test (SAT). In problem-solving interviews, students verbally shared how they solved the mathematic problems presented by Koichu et al. As a result, students who initially scored lower on the pretest outscored those who scored higher on the same pretests. The interviews forced students to use higher-order thinking skills and to use mathematic vocabulary and skills previously learned during whole group discussion in the classroom. Schools should use think aloud activities to promote and enhance heuristic literacy in mathematics curricula (Koichu, Berman, & Moore 2007).

Swanson, Orosco, and Lussier (2014) assigned elementary students with and without problem solving difficulties to differentiated mathematics instructional groups. Instructors taught students to use visual, verbal, and tactile strategies to complete word problems. Unlike previous studies, the students focused on finding relevant information in the word problems without paying attention to extraneous statements (Swanson, Orosco, & Lussier, 2014). The control group of students received no interventions and had the lowest posttest scores on standardized and norm-referenced assessments. On the other hand, the intervention students received significantly higher scores. The results of the study revealed that the working memory of students with problem-solving difficulties could be improved with guided instruction that included visual and verbal cues.

In their study, Hinton and Kern (1999) utilized homework as an intervention tool for 22 inner-city fifth graders. The children completed assignments three times per week. The researchers collected baseline data by administering unfamiliar standardized math problems to the students. In order to invoke student interest, the researchers subsequently included the students' names into some of the weekly homework problems. As a result, homework completion increased from 59% to 96%. For validation purposes, they removed the intervention. The completed homework rate decreased to 61%. The researchers reported that their study was limited in its ability to address variables of parent support, accuracy of submitted homework, and other content subjects.

Tiered behavior and academic interventions known as *Response to Intervention* (RTI) has improved academic performance in several core subjects for low performing students in middle schools (Johnson & Smith, 2011). Instructional strategies took place at three levels: Tier 1, Tier 2, and Tier 3. At Tier 1, the general education curriculum was taught to all students. Tiers 2 and 3 required teachers, support staff, and administrators to implement specific, differentiated, and intentional instructional and behavioral modification and to collect data to monitor the progress of each student who received additional support beyond the regular education Tier 1 interventions. A student could return to Tier 1 once optimum progress had been maintained at Tiers 2 or 3 over an extended period of time as evidenced by the progress monitoring data. The RTI process can differ from school to school (Johnson & Smith, 2011). Garner, Thorn, and Horn (2017) stated that data driven instruction limits the ability of educators to develop equity in their instructional practices. In other words, some students do not receive needed remediation and have little or no input in their own thought processes. Teachers are forced to accept district and state assessments as the deciding factors in student retention and promotion. In order to achieve higher levels of validity, school stakeholders should concentrate on improving instructional strategies versus raising test scores.

Daniely (2007) used quantitative data from CRCT test scores and the Iowa Algebra Aptitude Test to measure the effectiveness of manipulatives during 9th-grade Algebra instruction. Of the 309 participants, 47% had failed End-of-Course assessments in 2005. From January 2006 to April 2006, students who did not achieve a mastery score of 809 on weekly mini-assessments, received after-school tutoring. Daniely elaborated that only 18% of the students involved in the study met criteria for algebra readiness on pretests. After intervention, 50% of 154 students met readiness for pre-algebra. The CRCT scores for 8th grade students improved from 52% in 2005 to 72% in 2006. Daniely attributed the intervention scores to the use of cooperative groups and hands-on activities during classroom instruction, curricular aligned to standard objectives, and the researched-based intervention, Versatile Math Lab.

Math to Mastery (MTM) and Cover-Copy-Compare (CCC) interventions proved to be effective in increasing mastery of mathematics for students who demonstrated low computational skills in addition and subtraction (Mong & Mong, 2010). With both interventions, students received rote practice, self-monitoring opportunities, and feedback through progress monitoring. Mong and Mong (2010) chose two different methods for providing feedback. The students using the CCC strategy gained feedback on mastery by self-monitoring mistakes made when completing the worksheets. The MTM group received feedback from an intervention. The researchers stated that the MTM intervention strategy has research enough to be considered an infallible cure-all for delivering math instruction despite decreases in computation errors for two of the participants in the study. One individual student demonstrated high levels of mastery during baseline. Because MTM allowed for more practice for automaticity, the results yielded more correct digits per minute on computation probes than the CCC intervention. Implications from the study suggested that both interventions need to be extended to include multiplication and division in order to be generalized for all mathematics operations. However, the MTM and CCC strategies would be highly effective in increasing computation fluency for students who lack the cognitive skills needed to perform basic mathematics operations.

The heterogeneous peer-tutoring (HPT) program boosted student confidence and improved attitudes about completing mathematics tasks in algebra (Worley & Naresh, 2014). The gifted students served as tutors for peers who continued to struggle with solving algebra problems. Student-to-student collaborations created trusting relationships as they solved hands-on performance tasks related to topics covered in the pre-algebra curriculum, such as, volume and area. One unexpected event occurred when the tutees became the tutors. Despite receiving accelerated classroom instruction, the original tutors did not receive the same remedial practice that the tutees received in their regular mathematics class. Worley and Naresh (2014) suggested that teachers (1) create intentional heterogeneous collaborative groups for reciprocal learning opportunities, (2) incorporate project-based, task-oriented lessons with any paper/pencil activities in order to facilitate stronger higher order problem-solving and thinking skills, and (3) progress monitor the outcomes at specific intervals. They advocate that peer-tutoring is an intervention that is cost-effective for schools with limited budgets and one that will yield the same benefits as any expensive mathematics program which requires purchasing additional materials and computer software.

Parental Involvement and Student Learning

Executive leaders in American government have included parent involvement as a key of educational reform since 1996, under the Clinton administration (McNeal, 2014). Additionally, few studies existed on parent involvement beyond the elementary level (Choi, Chang, Kim, & Reio, 2015). Newer research studies have conveyed that parent involvement encompasses a plethora of variables, such as, the attitudes of all stakeholders, administrative relationships with parents, individual roles, and group dynamics. Thus, McNeal (2014) implemented a longitudinal study of how parent involvement affects the aforementioned behaviors. A cohort of 12,101 eighth and 10th-graders and parents participated in a series of interpersonal activities. Despite socio-economic status, at-home discussions between parents and students about school activities, and parent monitoring of homework completion, improved truancy rates, the rate of homework completion, and student educational expectations. The study provided results that suggested that parent involvement increased academic achievement for both grades (eighth-grade standard deviations from .18 to .21 and .03 to .04 for 10th-grade students). On the other hand, parent involvement in school activities did not influence student performance and achievement. McNeal stated that additional studies are needed to address how parent involvement impacts student behaviors and attitudes towards academic achievement.

Williams (2009) supported other studies that suggest parental involvement is paramount in improving student achievement. Parent participants in the study attended workshops to learn strategies for assisting their fifth-grade children with reading and mathematics homework. Using results from the *Florida Comprehensive Assessment Test*, Williams concluded that mathematics and reading scores increased significantly from the previous year. The researcher listed limitations from the study as interferences of parent work schedule, having only twenty-nine of the 50 parents participate from the beginning to the end, family relocation, and the absence of longitudinal data. Nevertheless, the elementary school decided to retain the strategies used in the study: (a) providing food at parent workshops, (b) parental supervision of homework packets, (c) ensuring accountability by having the parent complete surveys and sign-in sheets when attending school activities, and (d) weekly parent-teacher conferences.

Middle school students from a longitudinal study completed a School Success Profile (SSP) to determine if parental support influenced student academic achievement (Bowen, Hopson, Rose, and Glennie, 2012). The 22-item survey required students to rate self-perceptions of parent, teacher, neighbor, and friend support. Students, who had greater friend support in the sixth grade, experienced greater success in math. The same group demonstrated higher performance in reading during eighth grade. However, the students indicated that neighbors, teachers and other family members least affected academic performance. Students with high math and reading scores also had lower incidences of exhibiting unacceptable behaviors. Implications from the study supported earlier studies which stated that early parent involvement increases student motivation in latter school years. Students who perceived that parents projected high expectation for school success during 6th grade continued to perform at higher levels on standardized assessments throughout middle school. The researchers suggested that schools capitalize on parental influence by creating ongoing partnerships with parents through networking with community agencies that provide additional support for parents, such as, counseling, teaching effective parenting and communication skills, and management strategies.

Balli, Demo, and Wedman (1998) explored the effects of parental involvement on math achievement. Seventy-four sixth-grade students chose to participate (Balli, Wedman, & Demo, 1998). Students completed math pre- and post-tests using the

“Missouri Mastery and Achievement Test (MMAT)” (Balli et al., p. 132). The students were divided into three homework groups: (a) students and family, whose homework had instructions for obtaining assistance from a family member; (b) student prompt, whose homework required the student to seek help from a family member; and (c) no prompt, which did not contain directions for including a family member. Each group received 20 assignments. Once all students completed and returned all of the required assignments, the researcher administered the posttest. The findings yielded that the *no prompt* group scored lowest on the MMAT. Students, whose parents had college degrees, scored an average of 77%. Children of parents without degrees scored an average of 60%. The student and family group had the highest average. Balli et al. (1998) attributed the low correlation to the small sampling used in the study.

African-American parents of middle school students in the Archer-Banks and Behar-Horenstien (2007) study mentioned typical reasons for not being more involved in their child’s school experiences as evidenced in earlier research, such as, lack of time, negative experiences with school staff, and transportation issues. Without parental support, African-American students received harsher punishment for misbehavior than their white peers. African-American parents felt that several changes could increase their involvement with school and homework activities: (a) motivate the students by expecting them to excel, (b) create meeting places closer to the child’s residence, (c) provide homework workshops to train parents, and (d) have school personnel create an inviting and supportive atmosphere for parents. However, the parents praised school administrators who recognized student academic achievements with special awards ceremonies. Receiving awards influenced the students’ willingness to become more involved in school and homework activities. Due to the limited pool of participants in the study, Banks and Behar-Horenstein suggested that more research is needed to address the perceptions of African-American parents on their involvement with middle and high school personnel.

When American-born Caucasian and African-American parents actively participate in the education of their children at school, academic achievement increased (Sibley & Dearing, 2014). In comparison, the children of Latino immigrants demonstrated higher achievement in reading than mathematics. Similar to the Yoder and Lopez (2013) study, Sibley and Dearing (2014) concluded that low incidences of parental involvement could be attributed to cultural differences between the parents and school staff. Positive gains in mathematics achievement were noted for American-born Asian students and children of Latino immigrants.

In a grounded theory study of parental involvement of families living in public housing complexes, parents reported that numerous barriers prevented them from actively supporting school activities with their child (Yoder & Lopez, 2013). Parents lacked transportation, technology to aid in homework assignments, and adequate knowledge for speaking and understanding educational jargon. Some of the parents depended upon external resources, such as, community-based agency, other family members, and school employees to assist with advancing student achievement. Other parents demonstrated despondency out of frustration when school officials failed to address existing disparities between schools within the school district. Yoder and Lopez (2013) asserted that low-income parents often experience feelings of alienation and rejection attempting to communicate with school staff and administrators. “Mageilition” (p. 415) ostracizes parents and increases academic inequity for students of low socio-economic status.

School officials should reevaluate the relevancy of parent-teacher organizations (PTO) (Paylor, 2011). Despite the fact that parents believe that a PTO provides needed support to the education of their child, many parents have job obligations which preclude attending school meetings and events during the evenings. Contrary to previous studies, Paylor found that income level did not affect parent involvement. According to Yoder and Lopez, school systems can change parent perception by providing school choice and allowing parental input in administrative and academic processes.

Bieschke (2011) used 12 independent variables related to parental involvement as predictors of student achievement. Bieschke divided the variables into three types of systems, macro-, micro-, and exo-. Student, parent, and community demographics made up the *macrosystem*. The *microsystem* was comprised of various types of parent involvement. Lastly, Bieschke grouped interpersonal communication between schools and parents into the *exosystem*. The results indicated a high correlation between the exosystem and student grades. Students tended to receive higher grades when school to parent communications did not involve personal information. The macrosystem yielded information that suggested parents engaged more in the education of their female children. Most parents were actively involved in requiring schools to provide homework to students. In a study by Xu (2005), student and parent participants viewed homework as a mean of increasing academic knowledge and skills, improving grades, and provide students with a better understanding of information that was taught in the classroom. Homework has been an area of educational debate for decades. Recent studies provide little evidence that homework unequivocally leads to academic success (Eren & Henderson, 2011; Gutarts & Bains, 2010). Many students believe that teachers require too much homework (Wilson & Rhode, 2011).

In a synthesized report, Cooper, Robinson, and Patall (2007) noted that earlier studies on the practice revealed only a 50% correlation between students who completed homework versus those who do not. Cooper (2001) suggested that the positive effects reported by earlier researchers occurred due to the use of participants who already possessed high academic aptitudes. The 709 students were selected from urban, rural, and suburban school districts. A factor analysis of the respondents' answers to a homework survey revealed that over 60% of the students felt homework helped them to become self-motivated to take ownership of their learning, develop better study habits, and increased understanding of the subject matter. Female middle school students reported internal reasons for completing homework; however, the male students were more motivated by the outside factors of parent involvement.

Kitsantas, Cheema, and Ware (2011) completed a study on how student confidence and homework impacts mathematic achievement. They selected 3,776 students from a 2003 Program for International Student Assessment (PISA). The instruments measured reading and mathematics competency skills for 15-year-old American students. The students responded to rating scales on "self-efficacy" (Kitsantas et al., 2011, p. 317) and the amount of time spent completing homework.

The researchers correlated math achievement to: (a) student's race and gender, (b) amount of time spent on homework, (c) self-confidence, and (d) homework support. The results suggested that students who receive homework support at home obtained higher math scores. When students received the necessary support, their confidence levels increased. Spending large amounts of time on homework did not increase math achievement.

Eighteen students, their families, and nine teachers participated in a study by Xu & Yuan (2003). They collected qualitative data using *open-ended* interview questions. The purpose of the study was to explore the attitudes of students, family members, and teachers towards homework. The results of the data collections showed that all participants agreed that homework provides students with additional practice to enhance academic skills. Parents and teachers provided comments which supported their beliefs that homework enables a student to develop good organizational skills and study habits. Only a few students shared this belief. More students reported that they completed homework for grades and to satisfy their parents. The data did not provide concerns among the group on how homework should be completed at home. Furthermore, middle and high school girls received more homework assistance than boys. Inherent motivation affected homework completion levels and academic success. Xu suggested that future research is needed using the survey instrument from the present study and include students with include students with learning disabilities and gifted students.

O'Sullivan, Chen, and Fish (2014) hypothesized that (a) student achievement would be influenced by parent efficacy and involvement and (b) parent involvement would be dependent upon the level of personal efficacy. Fifty percent of the 87 parents in the study admitted to helping with homework and 75% created a study environment for their children, but not homework assistance. O'Sullivan et al. (2014) found that students' grades improved as a result of having a structured environment.

Parental supervision and input had a direct impact on the amount of time a student spent completing the actual homework assignments (Nunez, et al., 2015). The researchers suggested that teachers devise strategies for helping students to take ownership of improving homework habits and educating parents on ways to assist their middle and high school children to develop study habits that will lead to academic success. Nunez et al. did find that younger students completed higher levels of homework than junior high and high school students. However, academic achievement as evidenced by report card grades did not improve with parental control of homework completion. Future studies should examine why older students tend to lose self-motivation for completing homework activities and include the parental perception of control and support.

Parents have increasingly become more directly involved in education due to No Child Left Behind legislations (Bennett-Conroy, 2012). District and school level administrators have used various strategies to coerce parents to assist their children with completing homework assignments. In addition to homework, parents can extend learning at home by placing children on specific after-school schedules or by accompanying them to extra-curricular events. Bennett-Conroy utilized the Teacher Involve Parents (TIPS) to test the hypothesis that parental involvement with homework could lead to higher homework grades. The hypothesis proved true when the results revealed that parental participation led to higher grades for male and female student participants in the intervention group. The implications of the study suggested that bi-directional communications would be more effective and yield higher outcomes if the intervention had been implemented at the beginning of the school year. Parents needed more time to develop a trusting relationship with administrators and teachers. Several limitations existed with the research. Parents, who worked more than two low-wage jobs with more than eight hours, were absent from the sampling pool. A second limitation of parents who did not have access to phones prevented teachers from including a small percent of students assigned to the intervention group.

The socio-economic status (SES) of parents precedes the amount of parent involvement (Choi, Chang, Kim, & Reio, 2015). As stated in earlier studies, parents from high SESs participated more in school and homework activities with their children. In addition, parental ambition directly impacted student ambition. Students tended to strive to meet the expectation of the parent. If the parent lacked high expectation, the student tended to mirror those same expectations. Self-belief and gender adversely affected mathematic scores for 10^{th}-grade girls in the study. Female students scored significantly lower on mathematics assessments than males. The findings indicated that parental assistance with mathematics assignments had a miniscule impact on student ability and achievement.

Adaptive Mathematics Programs

SuccessMaker should be paired with an assessment provides pre- and posttest data (Mckissick, 2016). Additionally, student motivation should be addressed. Due to the high cost of purchasing adaptive software, most districts do not collect data needed to determine the effectiveness of the adaptive instructional program. McKissick found that students, who spend optimum minutes using the program, achieve high gains in mathematics achievement. Successful implementation of SuccessMaker is dependent upon adequate personnel to monitor individual student progress, time management, and accountability.

The Gotti Evaluation Group evaluated the effectiveness of a trial usage of SuccessMaker during the 2001-2010 school term (Pearson Education, Inc.,2019). Ten U.S. schools from seven states participated in in the study. Students from grades 3, 5, and 7 completed two to three weekly sessions at 24 minutes each. Using end of year student scores from the Group Mathematics Assessment and Diagnostic Evaluation (GMADE), the researchers compared the experimental group (students who used SuccessMaker) scores to those of the control group. In comparison, the experimental group outscored the control group by at least 9 points. The largest gain occurred with the 3^{rd}-grade students-17.5%. However, as the grade level increased, the GMADE scores decreased for the 5^{th} and 7^{th} graders. In response to an attitude survey, 87% of the SuccessMaker students reported that they enjoyed using the program. Teacher surveys revealed that teachers thought that SuccessMaker was user-friendly, supported classroom instruction, and differentiated modules to challenge all learners. Teachers and students did not report any disadvantages or negative perceptions after using the software.

Hill (2018) investigated the effects of the online instructional program, *i-Ready*, on student mathematics and reading test scores as evidenced by the Mississippi Academic Assessment Program (MAAP) assessments. Irrespective of race, socio-economic status, grade level, and gender, all student participants had growth of at least 23 points on i-Ready posttests for reading and math. Although i-Ready had a significantly positive effect on student mathematics and reading growth scores, MAAP assessments did not show any significant mean growth scores for each of the five performance levels for grades 4 and 5. Hill attributed the findings to the lack of control groups and inconsistent instruction by teachers.

Summary

The research literature supported the research questions (RQ) answered by the current dissertation. The study measured student progress based on curriculum-based and standardized assessment scores. Additionally, the literature supported the use of surveys to gather information on teacher and student perceptions of CAI and how parents engage in the academic progress of their child. By collecting data from curriculum-based benchmark posttests and standardized assessments, the findings added validity to previous research on the positive effects of CAI instruction.

Research Questions

1. What are student perceptions of a CAI intervention?

2. What are teacher perceptions of a CAI intervention?

3. In what ways do students believe their parents engage in their CAI progress at school and at home?

4. Is there a significant change in students' scores on curriculum-based benchmark tests and standardized assessment results after using the CAI intervention?

Chapter 3: Methodology

Participants

During the 2017-2018 school year, the target middle school had a student population of 912 students with more than 95% receiving free/reduced lunch (Georgia Department of Education, “Student Enrollment,” 2018). The population of interest for this study consisted of 60 students who received the SuccessMaker intervention in the 8th grade during the 2017-2018 school year and 3 math teachers at an urban middle school in Georgia. A purposeful sampling method was used for this study. A purposeful sampling method is appropriate to use when participants with specific characteristics are required to fulfill the purpose of a study (Patton, 1990). As the purpose of this study was to evaluate the impact of the SuccessMaker program on 8th-grade students’ math achievement, it was appropriate to purposively sample students and teachers from this school.

Sample for the assessment data collection. Initially, the researcher used pre- and posttest data from the mathematics intervention program, SuccessMaker, the School City system posttests, and state standardized data for the 8th grade cohort of students who received mathematics instruction via the online program from 2017 to 2018. However, data from the actual program was no longer available. The school district discontinued using the program at the middle school in March of 2018. All licenses to any student data were suspended.

The research sample was selected from the 2017-2018 8th-grade population of 291 students due to the availability of data needed from SchoolCity and the 2018 administration of the Georgia Milestones. A power analysis was conducted using

G*Power software to determine the appropriate sample size for the quantitative analysis. The results of the power analysis showed that the appropriate sample size is 34 for a dependent samples *t*-test with a desired power of .80, a significance level of .05, and a medium effect size assumed. Of the 63 students selected for the quantitative data, 45 to 50 completed SchoolCity benchmark posttests for all three assessments.

Questionnaire Student Sample

A purposeful sampling was used for selecting the participants. The same students were selected from the 2017-2018 8th-grade population of 291 students due to the availability of data needed from SchoolCity and the 2018 administration of the Georgia Milestones. The sixty-three 8th-grade students selected actually used SchoolCity and provided individual perceptions of the SuccessMaker program. However, only four students provided parental permission to complete and submit the questionnaires.

Instruments

Four of the SuccessMaker mathematics student participants and four 8th-grade mathematics teachers completed anonymous open- and close-ended questionnaires created by the researcher using Survey Monkey. The student survey consisted of 13 questions designed to collect data on students' perceptions of the SuccessMaker program and their parents' engagement in their academic progress. The questionnaire included open-ended questions for which students were asked to explain their answer (e.g., "Do you think SuccessMaker helped you to increase your math grades or test scores? Explain your answer."), close-ended questions (e.g., "Did your teacher explain what to do when you did not understand a SuccessMaker problem?"), and a multiple-choice question

(“Please rate the SuccessMaker program.”). Appendix A contains the complete list of student survey questions.

The teacher questionnaire consisted of 11 questions designed to collect data on teachers’ perceptions of the SuccessMaker program. The questionnaire included open-ended questions (e.g., “How did your students access the program at school?”), close-ended questions (e.g., “Did you observe an increase in your students’ mathematics benchmark scores for the students who received the SuccessMaker Intervention?”), and a multiple-choice question (“Please rate the SuccessMaker program”). Appendix B contains the complete list of teacher questionnaire questions.

Procedures

The research was conducted according to the guidelines set forth by the Joint Committee on Standards for Educational Evaluation (2018). The Committee on Standards for Educational Evaluation is a non-profit organization that sets standards for evaluating students and educational programs. The non-profit organization oversees the evaluation process that organizations and individuals must adhere to when judging a particular educational evaluation. The evaluation must address: (a) *utility*, add credible and valuable information to existing evaluations; (b) *feasibility*, be relevant and easily completed; (c) *propriety*, be conducted ethically; and (d) *accuracy*, have reliability and validity (ERIC Clearinghouse on Assessment and Evaluation, 1995; Hopkins, 2016).

The data collected for this study included questionnaires completed by students and teachers, as well as mathematic achievement data collected from students’ records. In Phase I, after receiving permission from the district’s research committee, the researcher arranged to meet with the students to explain the procedures and how to submit the questionnaires. The permission to conduct research can be viewed in Appendix C.

The students were told that the questionnaire was voluntary and that their responses would be kept confidential. Permission letters were sent home with the students at least 48 hours prior to dispersing the consent forms and questionnaires. After the 48-hour time period, Informed Consent forms for parents and Assent forms for students were sent home with the students, attached to the questionnaire. The participants were to mail the permission letters to the researcher in the stamped, self-addressed envelope that was included with the other forms. The questionnaire included an option for the students to complete the questionnaire online. The parent consent forms and questionnaire were coded with an identification number that matched the students' records for the quantitative data. For example, *Student 1* had a *Student 1* label placed on the permission and questionnaire forms prior to being dispersed to the students. Student participants who did not have Internet access were asked to mail the completed questionnaires to the researcher within two weeks. Phase II encompassed teachers anonymously responded by using their secure email provided by the school district. Paper submissions, along with printed data, were kept in a locked cabinet within the researcher's residence. When the completed questionnaires were received, the researcher input the questionnaire responses into electronic text and spreadsheet files.

Phase III involved tabulating formulas and creating tables to evaluate the findings from the study. This stage took two weeks. In Phase IV, the researcher prepared to review the final dissertation and send it to the dissertation chair and member for approvals.

Research Design

The researcher chose a nonexperimental, descriptive approach for this study because both quantitative mathematic achievement data and questionnaire responses from teachers and students were needed to address factors related to student mathematics achievement. A descriptive design was selected for this study because this study does not involve the manipulation of any variables, and the purpose of the study was to determine the effects of the SuccessMaker intervention on student mathematics achievement scores.

The researcher also sought to investigate if a correlation existed between students' mathematics achievement on state and school-based assessments and the SuccessMaker program. The research site used the program for 8^{th}-grade students from 2016 to 2018. SuccessMaker software is a computer assisted instructional tool used to improve reading or mathematics skills for underperforming students in grades K-8. The program assigns individualized practice lessons and quizzes based on the initial performance of each student. As students reach mastery, the assignment levels increased.

The questionnaires added value to the study by providing positive or negative feedback to assist the researcher with explaining the quantitative data. Consequently, descriptive data can strengthen outcomes for quantitative techniques when used with the same framework (Johnson & Onwuegbuzie, 2006). The researcher interpreted the open-ended qualitative responses of the student and teachers.

Assessment Data Collection

The researcher requested quantitative data for the target group of student participants from the psychometric statistician of the Department of Research, Evaluation, Assessment and Accountability. The SchoolCity (SC) post-test scores for each benchmark, term 1 (T1), term 2 (T2), and term 3 (T3) and the Spring 2018 Georgia Milestones were sent to the researcher via email with password protection. The data was placed in an excel spreadsheet using pseudonyms. Students completed fall, winter, and spring benchmark assessments after having classroom instruction related to the content. Questions on the SC assessments were based on the Georgia Standards of Excellence (Georgia Department of Education, "Mathematics Standards," 2019). All 8th-grade students attended the SuccessMaker lab for mathematics skills practice each week. SuccessMaker data was no longer available at the time the study was conducted. Dependent upon the term, data was available for 50 to 51 students. Missing scores were due to absenteeism, transfers, or withdrawals. The researcher used the software, IntellectusStatics. The correlations were examined using Holm corrections to adjust for multiple comparisons based on an alpha value of 0.05. The researcher created tables to display the differences in the nominal variables that indicated the mathematics proficiency level of the group from T1 to T3. Each student had been assigned a pseudonym to preserve anonymity.

Questionnaire Data Collection

The researcher mailed Appendix D student consent form and the student questionnaire to student respondents. The packet included a stamped, self-addressed envelope for returning the documents along with the option to complete the questionnaire using Survey Monkey. After two weeks, the researcher received one undeliverable envelope and one completed questionnaire. The researcher sought the assistance of the principal of the school where the target cohort of students attended. The principal's secretary agreed to make a request for the questionnaires and consent forms to be returned to the school. After one week, the researcher contacted the school and found that forms had not been returned. Three teachers, two regular education and 1 special educator, participated in the current study. Sixty-three students were selected to be included for both, quantitative and questionnaire methods, at the start of the study. Only 51 students met the conditions to be included in the SchoolCity data collection. Eleven to 12 of the original sample of students did not post scores for each of benchmark assessments due to absences or transfers to other schools. The researcher obtained permission from the principal of the high school to meet with the 8th-gade cohort of students, currently 9th graders, from which the study sampling was obtained. The researcher provided questionnaires and parent consent forms to 50 students and offered a $1 incentive voucher to students who returned the forms as requested. The researcher only received one student questionnaire via mail. After an additional two weeks, three more students turned in both forms. The teachers completed their questionnaires using Survey Monkey.

For Phase I, the researcher obtained student and parent permission prior to dispersing the questionnaire forms. During Phase II, student and teacher responses were disseminated according to similarities and differences and placed into electronic text and spreadsheet files. Phase III involved tabulating formulas and creating tables to evaluate the findings from the study. This stage took two weeks. In Phase IV, the researcher prepared to review the final dissertation and send it to the dissertation chair and member for approvals.

RQ1, “What are student perceptions of a CAI intervention?” was answered by the following questionnaire questions:

1. Was it easy for you to use SuccessMaker on you own? Explain your answer.

2. How often did you complete SuccessMaker assignments at home?

4. Did your teacher explain what to do when you did not understand a SuccessMaker problem?

5. Do you think SuccessMaker helped you to increase your math grades or test scores? Explain your answer.

6. How many hours did you spend on SuccessMaker at school each week?

7. How many hours did you spend on SuccessMaker at home each week?

8. Did you enjoy completing activities on SuccessMaker? Explain your answer.

9. Did you understand what you did wrong when SuccessMaker explained your mistake? Explain your answer.

10. Please rate the SuccessMaker program: (a) effective-It helped me get better at solving math problems or (b) ineffective-I did not get better at solving math problems. Please circle your answer.

RQ2, “What are teacher perceptions of a CAI intervention?” was answered by the following questionnaire items:

1. How did your students access the program at school?

2. How often did your students attend the SuccessMaker lab?

3. Did you experience any difficulties with using the online program? If, no, please explain your answer.

4. Were you able to obtain copies of your students’ weekly progress? If, no, please explain your answer.

5. Did you assist your students when they did not understand how to complete SuccessMaker mathematics activities?

6. Do you believe your students spent more time on SuccessMaker at school or at home? Explain.

7. Did you observe an increase in your students’ mathematics benchmark scores for the students who received the SuccessMaker Intervention?

8. What did you do when students from the SuccessMaker group did not improve on their mathematics benchmark assessments? Explain.

9. If given a choice, what other online mathematics intervention program would you recommend and why?

10. Please rate the SuccessMaker program: (a) highly effective, (b) somewhat effective, or (c) ineffective. Please circle your response.

Question 11 from the teacher survey, “How did you share student progress in the SuccessMaker program with parents?” was used to answer RQ3- In what ways do students believe their parents engage in their CAI progress at school and at home? From the student questionnaire, the following questions 3, 11, and 12 also answered RQ3:

3. How often did your parent or guardian assist you with completing SuccessMaker lessons at home?

11. How did your parent/guardian help you with completing assignments on SuccessMaker? (please explain).

12. How did your parent/guardian communicate with your teacher about the SuccessMaker program? Explain how.

Questionnaire Analysis

The questionnaire data used to support Research Questions 1-3 came from the responses to the open-ended student and teacher survey questions, respectively. The data was imported as electronic text files into Survey Monkey to facilitate the data analysis. Thematic analysis, as described by Braun and Clarke (2006), was conducted to address the research questions. This approach to descriptive data analysis involved six steps. First, the open-ended responses were reviewed multiple times in order for the researcher to become familiar with the data and to gain a general understanding of participants’ responses. Second, initial codes were assigned to words, phrases, and sentences. Third, the initial codes were organized into categories, i.e., themes. Fourth, the themes created in Step 3 were reviewed and refined for coherence. Fifth, the researcher defined and further refined the core of each theme. Finally, a report of the results was written. The report described each theme in relation to the research questions and included relevant extracts from the data that underscored each theme.

Assessment Data Analysis

RQ 4 was answered by using quantitative data collected from SC pre- and posttests quarterly benchmark assessments and the 2018 Spring Georgia Milestones 8^{th}-grade mathematic scores. The researcher used IntellectusStatics software (Intellectus Statistics, 2019) to disaggregate the quantitative data. Statistical software enables researchers to make predictive, descriptive, correlation, and numerical analyses of collected information (Technopedia, 2016). Statistical analyses provide validity and reliability for readers of research studies (Gutzwiller & Riffell, 2014). Vigorous disaggregation of collected data can prove or disprove assumptions indicated in a researcher’s hypotheses. Descriptive statistics were computed and reported for available student demographic data. In order to determine if the program significantly improved mathematic achievement, dependent sample *t*-tests were conducted to compare the pretest versus posttest scores. An alpha level of .05 was used to determine statistical significance. The researcher used ANOVA variance to establish possible differences between students’ posttests for each of the three benchmark terms of the school year.

Chapter 4: Results

This study used a nonexperimental, descriptive design to collect and explain data used to investigate the effects of a computer-based program on student and teacher perceptions and student mathematics achievement. The researcher used purposeful sampling to select the student participants. A questionnaire was used to collect responses from students and teachers about their perceptions of the SuccessMaker software. Appendix E provides individual student responses to each questionnaire inquiry. Responses from each teacher can be found on Appendix F.

Research Question#1: "What Are Student Perceptions of the CAI Program, SuccessMaker?

Using a questionnaire prepared by the researcher, the students responded to twelve questions. Questions 1 through 10 on their perception of the SuccessMaker program. For Questions 11 and 12, students provided open-ended questions about parental involvement.

Student perception. Student perception of the effectiveness of SuccessMaker, revealed in Figure 3, was evenly divided. Two students felt that the lessons enabled them to improve their mathematics skills. They also stated that they understood the mistakes made when completing SuccessMaker tasks. Two students did not believe that their skills improved as a result of completing tasks using the software because they could not self-correct when making errors.

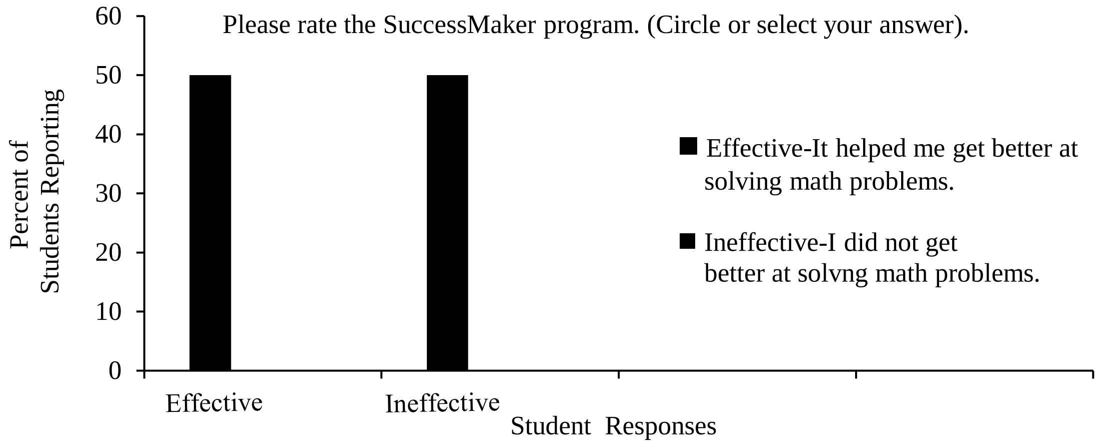

Figure 3. Question #10 from Appendix E.

When asked Question 4: Did your teacher explain what to do when you did not understand SuccessMaker problem? Three students reported that the teacher provided assistance when asked. One student replied, “No, not really.” All four students perceived the program to be easily navigated and user friendly. When asked Question 5, whether SuccessMaker helped them improve math grades and test scores, only one student found success when the program modules related to the lessons learned in the classroom setting.

Responses to time commitment revealed that three students spent more time completing SuccessMaker assignments during school hours. The one student, who only spent one hour at school per week, completed three hours per week at home. Only one student found the mini-games to be entertaining. The others felt that the activities were boring and uninteresting.

Research Question 2: "What Are Teacher Perceptions of the CAI Program, SuccessMaker?"

Teachers gave responses to Questions 1 through 10 on the questionnaire, developed by the researcher, about their perception of SuccessMaker. Teachers gave open-ended responses to questions 10 and 12 on parental involvement.

Teacher perception. Teachers 1 and 2 stated that their students used the computer lab at school. Teacher 3 stated that student used the classroom laptops. Students completed lessons daily in the computer lab, but only three times per week in the classroom. Teachers 1 and 2 reported they did not have any issues with accessing SuccessMaker online. However, Teacher 3 often experienced problems with connectivity on the student laptops. All teachers could view student progress, assisted students with completing difficult lessons as needed, and retaught any skills needed for completing the online tasks. Each teacher believed that students completed more lessons at home and that SuccessMaker enabled the students to increase their benchmark scores. Although the teachers did not recommend any alternative computer software for increasing student test scores, they all agreed that SuccessMaker was "somewhat effective" to "highly effective." Table 1 presents the teachers' responses to Question #10 from the Survey Monkey questionnaires.

Table 1

Teacher Responses to Question #10

Answer Choices	Responses	#Teachers
Highly effective.	33.33%	1
Somewhat effective.	66.67%	2
Ineffective.	0.00%	0
TOTAL		3

Although each teacher admitted to sharing student SuccessMaker progress with parents in meetings, Teacher 3 was the only one who explained ways for parents to assist students with the program at home.

Research Question #3: "In What Ways Do Students Believe Their Parents Engage in Their CAI Progress at School and at Home?"

Students and teachers responded to open-ended questions 11 and 12. They reported how parents were involved in supporting SuccessMaker at home and at school.

Parental involvement. As evidenced in the earlier Bennet-Conroy study (2012), student SchoolCity benchmark and Georgia Milestone scores improved with parental participation in homework activities. Questions 11 and 12 asked students about parental involvement. Two students reported that their parents explained the questions and provided ways to find the answer. However, the students stated that the parents did not communicate with the teacher about the program. Teachers and administrators should have more faith in a parent's willingness to actively participate in partnering with school officials to educate their child (Bennet-Conroy). Therefore, school officials should make every effort to include parents.

Research Question #4: "Is There a Significant Change in Students' Scores on Curriculum-based Benchmark Tests and Standardized Assessment Results After Using the CAI Intervention?"

The researcher used the software, IntellectusStatics. The correlations were examined using Holm corrections to adjust for multiple comparisons based on an alpha value of 0.05. The researcher created tables to display the differences in the nominal variables that indicated the mathematics proficiency level of the group from T1 to T3. Each student had been assigned a pseudonym of *S1*, *S2*, *S3*, etc. to preserve anonymity.

Statistical Analysis

A significant positive correlation was observed between SC raw score for term 3 (T3) and the number of problems correct, SC_Correct_T3 ($r_p = 1.00$, $p < .001$). The correlation coefficient between SC raw scores for T3 and SC Correct responses for T3 was 1.00, indicating a large effect size and a strong correlation. This correlation indicates that as the SC raw score for T3 increases, the SC number of correct responses for T3 tends to increase. A significant positive correlation was observed between the SC posttest Score for T3 and Milestones Score ($r_p = 0.58$, $p < .001$). The correlation coefficient between SC number of correct responses for T3 and the Milestones Score was 0.58, indicating a large effect size. This correlation indicates that as SC Correct Score for T3 increased, Milestones Score tended to increase. A significant positive correlation was observed between SC Correct for T3 and Milestones Score ($r_p = 0.58$, $p < .001$). A p-value <.05 denotes statistical significance. Table 2 presents the results of the correlations.

Table 2

Pearson Correlation Results Between SchoolCity(SC) Raw Scores, Term 3(T3), SC Correct ResponsesT3, and Milestones Scores

Combination	r_p	Lower	Upper	*p*
SC_Score_T3-SC_Correct_T3	1.00	1.00	1.00	< .001
SC_Score_T3-Milestones_Score	0.58	0.36	0.74	< .001
SC_Correct_T3-Milestones_Score	0.58	0.36	0.74	< .001

Note. The confidence intervals were computed using $\alpha = 0.05$; $n = 50$; Holm corrections used to adjust *p*-values.

Frequencies and percentages were calculated for SC Performance level for T1, T2, and T3. Student performance levels were tabulated for Below Target, Approaching Target, On Target, and Above Target for Posttests at the end of each term. The correlations were examined using Holm corrections to adjust for multiple comparisons based on an alpha value of 0.05.

The most frequently observed category of Milestones Achievement was Developing Learner ($n = 34$, 54%). Frequencies and percentages for the 63 subjects are presented in Table 3. Students in this category obtained scores from 475 to 524. Students at Proficient level received scores from 525-578. Beginning Learners received scores from 275-474. A level of Distinguished indicates that the student received scores from 579-755.

Table 3

Frequency Table for Nominal Variables

Variable	*n*	%	Cumulative %
Milestones Achievement			
Proficient Learner	4	6.35	60.32
Developing Learner	34	53.97	53.97
Beginning Learner	13	20.63	80.95
Missing	12	19.05	100

Note. Due to rounding errors, percentages may not equal 100%.

The results were examined based on an alpha of 0.05. The main effect for the within-subjects factor was significant $F(2, 88) = 7.05$, $p = .001$, indicating there were significant differences between the values of SC Correct responses for T1, SC Correct responses for T2, and SC Correct responses for T3. Table 4 presents the ANOVA results. The means of the within-subjects factor are presented in Table 5 and Figure 4 below.

Table 4

Repeated Measures ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Within-Subjects						
Within Factor	2	1727.39	863.70	7.05	.001	0.14
Residuals	88	10779.95	122.50			

Table 5

Means Table for Within-Subject Variables

Variable	*M*	*SD*
SC_Correct_T1	32.75	11.57
SC_Correct_T2	35.06	14.50
SC_Correct_T3	41.22	16.28

Note. *n* = 45.

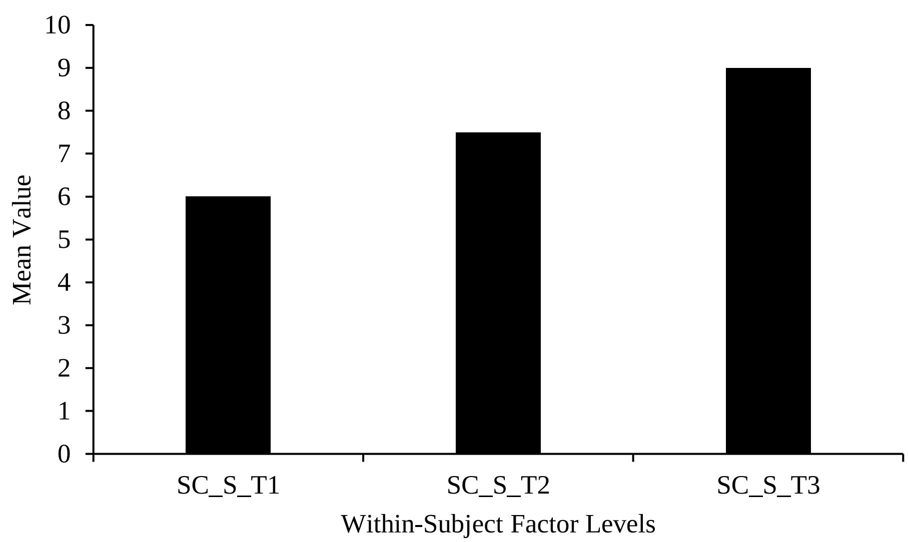

Figure 4. Within-subject variable means.

Within effects. SC_Correct_T1 was significantly less than SC_Correct_T3, *t*(44) = -3.78, *p* = .001. Table 6 presents the marginal means contrasts for the Repeated Measures ANOVA.

Table 6

The Marginal Means Contrasts for Each Combination of Within-Subject Variables for the Repeated Measures ANOVA

Contrast	Difference	*SE*	*df*	*t*	*p*
SC_Correct_T1 - SC_Correct_T2	-2.31	2.08	44	-1.11	.511
SC_Correct_T1 - SC_Correct_T3	-8.48	2.24	44	-3.78	.001
SC_Correct_T2 - SC_Correct_T3	-6.16	2.65	44	-2.33	.062

Note. Tukey Comparisons were used to test the differences in estimated marginal means.

Frequencies and Percentages

The most frequently observed category of Milestones Achievement was Developing Learner (*n* = 34, 54%). Frequencies and percentages are presented in Table 7. The average of the SchoolCity scores per term increased, indicating an increase in proficiency.

In Table 7, the most frequently observed category of SchoolCity Performance1, Term 1 was Below Target (*n* = 39, 62%). The most frequently observed category of SchoolCity Performance2, Term 2 was Below Target (*n* = 36, 57%). The most frequently observed category of SchoolCity Performance3, Term 3 was Below Target (*n* = 24, 38%). Each Term the number of students Below Target, decreased.

Table 7

Frequency Table for Nominal Variables

Variable	*n*	%	Cumulative %
SC_Performance1_T1			
Below Target	39	61.90	61.90
Approaching Target	11	17.46	79.37
Missing	13	20.63	100
SC_Performance2_T2			
On Target	2	3.17	3.17
Below Target	36	57.14	60.32
Approaching Target	13	20.63	80.95
Missing	12	19.05	100
SC_Performance3_T3			
Below Target	24	38.10	38.10
On Target	6	9.52	47.62
Approaching Target	21	33.33	80.95
Missing	11	17.46	100

Table 8 revealed that the students who had parental and teacher support when completing SuccessMaker modules scored highest on the standardized assessment, Georgia Milestones, and on SchoolCity benchmarks for each semester. Student 1 did not complete any SchoolCity or Georgia Milestone assessments. These were the four students who completed the questionnaires.

Table 8

2018 SchoolCity Posttests and Georgia Milestone Math Scores

Student #	T1	T2	T3	Georgia Milestones Score	Teacher Support	Parental Support
1					No	No
2	39.1	72.2	65	546 (Proficient)	Yes	Yes
3	21.7	27.8	10	471 (beginning learner)	None	None
4	47.8	55.6	30	501 (Developing)	Yes	Yes

(Table 8-Developed from SchoolCity data)

Summary

Student responses to Research Question 1 were divided. Two students believed that SuccessMaker helped them to improve their mathematics skills. None of the students thought that teachers collaborated with parents on how to assist them with using SuccessMaker at home. For Research Question 2, the three teacher participants perceived SuccessMaker to be effective in improving student mathematics skills and improving test scores. However, a consistent, clear strategy for obtaining parental buy-in was not established. Instead, one teacher only shared the weekly SuccessMaker reports during parent conferences. Student responses to Research Question 3 indicated that 50% of the students did not receive assistance from an adult at home. Moreover, parental involvement did not influence a student's perception of the effectiveness of the SuccessMaker intervention. Finally, the student group was larger for the quantitative data needed to address Research Question 4. The results revealed a positive learning curve on semester assessments. Over 60% of the 63 students included in the quantitative data achieved Level II or higher on the 2018 Georgia Milestones. A Level II rating indicated that the student is a Developing Learner whose skills can improve with continued progress monitoring.

Student SchoolCity posttests improved overtime. The results from the current study supports the findings of Mathis (2017). Mathis used a *t*-test to prove that SuccessMaker positively affected standardized scores for low, middle, and high performing students. Mathis also suggested that administrators should solicit student opinion on how using the SuccessMaker program helped to improve their math scores. According Kuiper and de Pater-Sneep (2014), more studies should focus on how students perceive computer assisted instruction.

Earlier studies from the literature agreed that more research is needed on the effectiveness of SuccessMaker (Washington, 2012). Penna and Stara (2010) found that lack of student interest prevented an increase in mathematics achievement for the students who received remediation with the SuccessMaker online tool. Kolikant (2009) reported that student perception of technology can influence how students interact in online environments. Furthermore, parental involvement and teacher support encouraged students in the current study to spend more time completing SuccessMaker modules. Students who had parental input when completing computer assignments at home scored higher on assessments than those who did not (Nunez, et al., 2015). Results from the study revealed that students who followed this pattern had higher SchoolCity and Georgia Milestones scores than students who did not have the needed support.

Chapter 5: Discussion

The purpose of this applied dissertation was to investigate the impact of the online SuccessMaker intervention program on student mathematics achievement for a cohort of eighth-grade students. The researcher addressed the findings, implication, and limitations of this expo-facto study. Recommendations were offered for future research on the topic. Three teachers and four students participated in the questionnaire phase of this study. Assessment data was available for 51 of the 63 eighth-grade students selected by using 2017-2018 School City and the Georgia Milestones results from the target school. All student participants received SuccessMaker intervention during their 8th-grade year.

Questionnaires, student School City posttest scores, and Georgia Milestones assessment data were used to address the following research questions:

1. What are student perceptions of the CAI program, SuccessMaker?
2. What are teacher perceptions of the CAI program, SuccessMaker?
3. In what ways do student believe their parents engage in their CAI progress at school and at home?
4. Is there a significant change in students' scores on curriculum-based benchmark tests and standardized assessment results after using the CAI intervention?

Summary of Findings

On the questionnaire responses, students agreed on the themes of usability, teacher support, and parental involvement. They found the navigation tools within the SuccessMaker program to be user-friendly. The students reported that teachers provided assistance when asked. However, none of the students believed that teachers communicated with parents about student progress on SuccessMaker. Only two students received assistance with SuccessMaker from parents at home. Despite having teacher assistance at school, the students expressed a need for the SuccessMaker program to provide feedback to explain mistakes in addition to showing which problems were answered incorrectly. Appendix E lists each student questionnaire response.

On the theme of usability, one teacher reported having difficulty using the online program, but did not offer an explanation. The teachers employed various reteaching techniques to provide students with more practice exercises related to the problems missed on SuccessMaker and failed SchoolCity benchmark assessments. The teachers did not reveal whether or not they shared the weekly progress reports with the students. Teachers expressed a high confidence level for student mathematics improvement as a result of using the SuccessMaker software. Complete teacher questionnaire responses can be found in Appendix F.

In 2018, the Title I middle school's SuccessMaker data revealed that the students completed mathematics skills at 93% mastery (Bibb County Schools, 2019). Initial placement showed that all students were at a 5.1 grade level for basic mathematics skills. From August 2017 to December 2017, students averaged 94.36 mastery, indicating a grade level increase of 2.3 months. A school license for the program cost $110,00. Feasibility may have been the underlying deterrent for phasing out the program in 2018.

Implications

The current study would add to the growing need for more research on the effectiveness of online resources that can be monitored in and out of the classroom. SuccessMaker allowed teachers access to student activity away from the school setting. Although SuccessMaker has been discontinued the target school site, the findings of this study could influence school officials to select SuccessMaker as an intervention tool for younger students. Student opinion can also influence school administrators and teachers on the types of instructional materials and tools selected for use in classroom settings. An analysis of the quantitative data suggested that SuccessMaker had a positive effect on student mathematic achievement. Repeated practice on modules related to classroom instruction may have led to retention of mathematics skills needed to be successful on curriculum benchmarks and standardized assessment.

The findings from this study could demonstrate the need for system and school administrators to form a cohort of teachers, students, and parents to explore computer software in a separate training prior to investing monies to purchase them. The system administrators require that teachers maintain a standards-based classroom (Georgia Department of Education, “Mathematics Standards of Excellence,” 2019). Students are expected to collaborate. The cohort of trained students could serve as experts on how to navigate and understand the CAI tools in the classroom and the computer lab. Computers in the classroom are limited and teachers cannot provide assistance to each student during a 30-minute lab session.

Furthermore, students from the study site did not receive training prior to being required to use the program. The lab teacher provided step-by-step procedural instruction, but little or no assistance with correcting mistakes. As stated by Carswell (2012) et al. in the research literature, students need to be able to discuss their opinions and perceptions of the CAI program. Additionally, teachers need to proficient in computer skills when knowing how to access pertinent data to share with the students and school administrators. All teachers who use CAI instruction should have adequate training before implementing an extensive intervention program.

Limitations

The cohort of 8th-grade students the researcher sought to include as part of the study had become 9th grade students when the study was initiated; therefore, the accuracy and details of their perceptions of the SuccessMaker program they completed in 8th grade may be limited. External factors of parental permission and the willingness of students to complete the questionnaires precluded obtaining a significant amount of reliable and valid descriptive data. Additionally, the study was limited to a specific cohort of students and criteria. The study did not address mathematics instructional strategies used in the classroom. Finally, as there were no random assignments and no control group in this study, causal conclusions about the impact of the program were limited. As suggested by Paiva et al. (2017), the current study did not track parent and student interactions within the SuccessMaker platform.

The effect size of the student questionnaire data was too small to generalize to the cohort of sixty-three 8th-grade students. The low response rate was attributed to timing issues, teacher/student availability, and lack of parental support. The researcher mailed the questionnaires and parent consent forms at the beginning of the school term. Parents may not have perceived participation in a research project as a top priority. The researcher was not able to establish a rapport with the target group of students with frequent face-to-face interactions. Few studies have students actively engaged in the research process (Alley, 2018). Requiring the students in the current study to respond to questionnaires may have led to apprehension about completing and returning the forms.

A valid correlation between SuccessMaker achievement scores and Georgia Milestones scores could not be established. However, four students did return the questionnaire. School City benchmark scores were not available for S1. This student received the questionnaire in person and was not included with the remaining 62 students from the mail-in group. Therefore, the student's questionnaire responses could not be used for addressing Research Questions 3 and 4 by establishing a possible correlation between parental support and mathematics achievement.

Recommendations

Future research should include longitudinal comparisons of Georgia Milestones data for the same group of students for at least two years. The results of the studies could help school leaders to make more informed decisions on the effectiveness of adaptive computer assisted instruction for mathematics in grades K through 8. Through a longitudinal study, stakeholders can monitor how students are maintaining skills over time.

Subsequent studies should include a questionnaire for parents. Parental feedback would enable school officials to develop strategies for including parents when making technology decisions that impact student achievement. Findings and literature from this study provided important data to support that parents have positive influences on student achievement.

Teachers should make sure students understand when and how to ask for assistance when they are required to repeat sessions. For those students who have difficulty seeking help, using an instructional computer program which allows the teacher to virtually monitor student activities at school and at home would provide the teacher with immediate feedback to share with the students. The computer software will have added value if teachers can print student reports to share with all stakeholders. Transparency is key in forming trusting relationships between school personnel, students, and parents.

Teachers may need to develop an accountability strategy to evoke students to use the technology at home. Research in the literature suggests that students prefer to use instructional technology at school. Timely feedback on individual progress enables student learners to develop their own self-accountability. Student buy-in should occur at the beginning of intervention.

Lastly, district leaders may consider developing a research task force to visit schools that actually used and had high levels of success with increasing student test scores before considering the purchase of a CAI mathematics intervention tool. A component which includes parents and students should be included. Early buy-in may save on hours of additional training and prevent unnecessary expenditures when adopting new technology to use with students.

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Appendix A

Student Questionnaire

Student Questionnaire

1. Was it easy for you to use SuccessMaker on you own? Explain your answer.

____

____

____

2. How often did you complete SuccessMaker assignments at home?

____

3. How often did your parent or guardian assist you with completing SuccessMaker lessons at home? ____

____

4. Did your teacher explain what to do when you did not understand a SuccessMaker problem?

____

____

____

5. Do you think SuccessMaker helped you to increase your math grades or test scores? Explain your answer. ____

____

____

____

6. How many hours did you spend on SuccessMaker at school each week? _____________

____

7. How many hours did you spend on SuccessMaker at home each week?

____

8. Did you enjoy completing activities on SuccessMaker? Explain your answer.

____

____

____

9. Did you understand what you did wrong when SuccessMaker explained your mistake?

Explain your answer. ____

____

____

____

10. Please rate the SuccessMaker program. (Circle your answer).

a. effective-It helped me get better at solving math problems.

b. ineffective-I did not get better at solving math problems.

11. How did your parent/guardian help you with completing assignments on SuccessMaker? (please explain).

____

____

____

12. How did your parent/guardian communicate with your teacher about the SuccessMaker program? Explain how. ____

____

____

Appendix B

Teacher Questionnaire

Teacher Questionnaire

1. How did your students access the program at school?

____

____

____

2. How often did your students attend the SuccessMaker lab?

____

3. Did you experience any difficulties with using the online program? If, no, please explain your answer.

____

____

____

4. Were you able to obtain copies of your students' weekly progress? If, no, please explain your answer.

____

____

____

5. Did you assist your students when they did not understand how to complete SuccessMaker mathematics activities?

____

____

____

6. Do you believe your students spent more time on SuccessMaker at school or at home.

Explain. ____

____

____

____

7. Did you observe an increase in your students' mathematics benchmark scores for the students who received the SuccessMaker Intervention?

____

____

____

8. What did you do when students from the SuccessMaker group did not improve on their mathematics benchmark assessments? Explain.

____

____

____

9. If given a choice, what other online mathematics intervention program would you recommend and why? ____

____

____

____

10. Please rate the SuccessMaker program. Circle your response.

a. highly effective b. somewhat effective c. ineffective

11. How did you share student progress in the SuccessMaker program with parents?____

____

____

12. Did you explain to parents how to assist their child with completing assignments in SuccessMaker? If yes, how? If, no, why not? ________________________________

____

____

Appendix C

Site Approval Letter

Site Approval Letter

BIBB COUNTY SCHOOL DISTRICT

STRENGTH OF CHARACTER AND COLLEGE OR CAREER READY

March 6, 2018

The Research Committee met to review your request to conduct research in the Bibb County School District. On behalf of Dr. Curtis L. Jones, Superintendent of Schools, the committee "***has approved***" your request to conduct research. Please use this letter as verification for Nova Southeastern University as proof that you have permission to conduct the research outlined in your proposal.

Please provide the Research, Evaluation, Assessment, and Accountability Office a copy of your research findings once completed so we may have a record of all research carried in our district.

Congratulations as you approach the successful completion of all of your doctorate!

Sincerely,

Anthony Jones
Director, Research, Evaluation, Assessment and Accountability
Bibb County School District

484 Mulberry Street ● Macon, Georgia 31201 ● Office (478) 765-8711 ● Fax (478) 765-8549

Appendix D

Student Consent Form

General Informed Consent Form
NSU Consent to be in a Research Study Entitled
The Effects of a Computer Based Program on Student Mathematics
Achievement Within an Urban Middle School in Georgia

Who is doing this research study? **Sheree Barnes**

College: Abraham S. Fischler College of Education 3301 College Avenue, Fort Lauderdale, Florida 33314

Principal Investigator: Sheree Barnes

Faculty Advisor/Dissertation Chair: Roberta Schomburg, PhD

Co-Investigator(s): None

Site Information:

Funding: Unfunded

What is this study about?

This research study is to determine if student achievement on standardized mathematics assessments changed over time after students had received mathematics intervention using SuccessMaker online. Additionally, the students and teachers from the 2018 school year will complete questionnaires related to their experiences with the SuccessMaker lessons. School-based and state mandated assessments will be analyzed. Names of students will not be included in the actual study.

Why are you asking me to be in this research study?

You are being asked to be in this research study because you were a student at Middle School during the 2017-2018 school year and received mathematics tutoring and practice via the SuccessMaker online learning modules. This study will include about 60 participants. It is expected that all 60 participants, including three teachers, will participate from this location.

What will I be doing if I agree to be in this research study?

1. Read and sign consent form with parent. (20 minutes)
2. Complete questionnaire. (20 minutes)-you may complete it online. A code will be provided on the questionnaire. **DO NOT INCLUDE YOUR NAME OR YOUR PARENT'S NAME ON THE QUESTIONNAIRE.**
3. Mail the permission form and questionnaire (if completed by paper) in the envelope addressed to:

Could I be removed from the study early by the research team?

Yes, upon request or If the student no longer meets the requirement to be included.

Are there possible risks and discomforts to me?

This research study involves minimal risk to you. To the best of our knowledge, the things you will be doing have no more risk of harm than you would have in everyday life. No student's or teacher's name will be included in the study.

What happens if I do not want to be in this research study?
You have the right to leave this research study at any time, or not be in it. If you do decide to leave or you decide not to be in the study anymore, you will not get any penalty or lose any services you have a right to get. If you choose to stop being in the study, any information collected about you **before** the date you leave the study will be kept in the research records for 6 months from the end of the study, but you may request that it not be used.

What if there is new information learned during the study that may affect my decision to remain in the study?
If significant new information relating to the study becomes available, which may relate to whether you want to remain in this study, this information will be given to you by the investigators. You may be asked to sign a new Informed Consent Form, if the information is given to you **after** you have joined the study.

Are there any benefits for taking part in this research study:
Your candid responses shared will be used to bring greater awareness to the thoughts and feelings of current students who receive mathematics intervention using SuccessMaker. Student voices will aid in the types of computer programs Bibb County may purchase in the future or continue to use in the present. Your responses will be of great value in enabling district officials to select student-friendly software.

Will I be paid or be given compensation for being in the study?

You will not be given any payments or compensation for being in this research study.

Will it cost me anything?

There are no costs to you for being in this research study.

How will you keep my information private?

Information we learn about you in this research study will be handled in a confidential manner, within the limits of the law and will be limited to people who have a need to review this information. This data will be available to the researcher, the Institutional Review Board and other representatives of this institution, and any regulatory and granting agencies (if applicable). If we publish the results of the study in a scientific journal or book, we will not identify you. All confidential data will be kept securely in a locked and secured safe with access only to the Principal Investigator. All data will be kept for 6 months from the end of the study and destroyed after that time by cross-shredding.

Will there be any Audio or Video Recording? None

What Student/Academic Information will be collected and how will it be used?

The following information will be collected from student's educational records:

- Quarterly mathematics benchmark assessments from 2018.
- 8th-grade Georgia Milestone Spring mathematics test scores.

These records will be given to the Principal Investigator by the Research Committee from Bibb County School district. The data will be used to compare student final mathematics benchmark scores to the Spring Georgia Milestones achievement level. Again, names of the students will not be included in the actual study.

Whom can I contact if I have questions, concerns, comments, or complaints?

If you have questions now, feel free to ask us. If you have more questions about the research, your research rights, or have a research-related injury, please contact:

Primary contact: Sheree Barnes, M.S. Interrelated, Ed. Specialist in Educational Leadership can be reached at

If primary is not available, contact: Roberta Schomburg, PhD
can be reached at (412) 310-3089

Research Participants Rights
For questions/concerns regarding your research rights, please contact:
Institutional Review Board
Nova Southeastern University
(954) 262-5369 / Toll Free: 1-866-499-0790
IRB@nova.edu

You may also visit the NSU IRB website at www.nova.edu/irb/information-for-research-participants for further information regarding your rights as a research participant.

All space below was intentionally left blank.

<u>Research Consent & Authorization Signature Section</u>

<u>Voluntary Participation</u> - You are not required to participate in this study. In the event you do participate, you may leave this research study at any time. If you leave this research study before it is completed, there will be no penalty to you, and you will not lose any benefits to which you are entitled.

If you agree to participate in this research study, sign this section. You will be given a signed copy of this form to keep. You do not waive any of your legal rights by signing this form.

SIGN THIS FORM ONLY IF THE STATEMENTS LISTED BELOW ARE TRUE:

- You have read the above information.
- Your questions have been answered to your satisfaction about the research.

<u>Parental/Guardian or Legally Authorized Representative (LAR) Signature Section</u>

I am voluntarily giving my consent for another person to participate in this study because I believe this person would want to take part if able to make the decision and I believe it is in this person's best interest.

*Person giving Consent must select whether they are a Parent/Guardian or a LAR

Printed Name of Participant (student)	Signature of Participant, indicating Assent for Adults and Children over the age of 13 (*Children under the age of 13 must sign the Child Assent Form*)	Date
Printed Name of Person Giving Consent & Authorization for Participant	Signature of Person Giving Consent & Authorization* ☐Parent/Guardian ☐LAR	Date
Printed Name of Person Obtaining Consent and Authorization	Signature of Person Obtaining Consent & Authorization	Date

(Return this page only with the Student Questionnaire in the stamped envelope provided. A copy has been provided to you.)

Appendix E

Student Questionnaire Responses

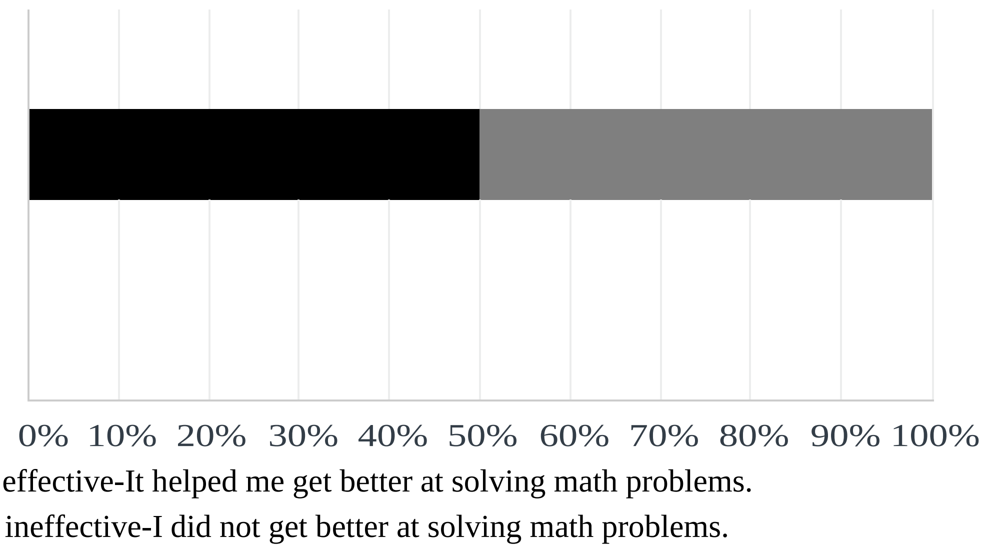
Table 1. Student responses to questionnaire inquiries

Question #1	It was easy at the beginning, but towards the end, it was hard. Yes. They were very well explained and easy to learn on. Yes. It was very easy. I only had two buttons to press for either math or reading. Yes. It was very easy. The program was very simple and easy to use.
Question #2	I would usually finish at school, but sometimes at home. very rarely None I completed every assignment that was due at home.
Question #3	Not that often. they really didn't Never I don't do it at home. I do it at school. I rarely needed assistance with completing SuccessMaker lessons at home.
Question #4	Yes, they had helped me when I needed help on SuccessMaker. No. Not really. Yes. He was very helpful when it came to difficult questions. Yes. Whenever I asked my teacher a question, she would always work it out and explain it to me.
Question #5	Yes. Whenever I asked my teacher a question, she would always work it out and explain it to me. Sometimes. When that was what we were learning. I feel they just assigned it every day for busy work. No. It was too easy and it threw me the same question over and over again No. Because it just showed you your answer and he right answer. It didn't explain it.
Question #6	I spent 1 hour on SuccessMaker. 5 5 4-5 hours a week
Question #7	3 0 0 5-6 hours a week

Question #8 Some of them because some are not that enjoyable.
They weren't terrible, but they weren't that fun and easy to enjoy.
No. I did not enjoy the activities because they were not fun at all or challenging.
No. The activities on SuccessMaker were boring, but I did enjoy the little mini-games that would come every now and then.

Question #9 Yes, but it was difficult to understand and would have to ask the teacher for help.
Yes. It had descriptive details on what you did wrong.
No. Because it does not tell me what I did wrong. It just gave me the answers I got wrong.
No. I didn't understand how SuccessMaker explained the answers. Also, when I had a question about something at home, I had nothing or no one to ask.

Question #10



Question #11 My parents helped me by explaining the question and how you get the answer.
There was not help.
They did not help me. I did it at school.
They helped me by trying to explain the answer to me in a different way.

Question #12 They kind of liked it but it was hard to understand.
No communications.
The program did not have a way for my parent to communicate with my teacher.
They didn't really communicate with my teacher about the program.

Note: Each question response corresponds to a single student, e.g., Reponse1 for each question is from Student 1, Response 2 provided by Student 2, etc.

Appendix F

Teacher Questionnaire Responses

Question 1	Teacher	Response
	1	"The students accessed the program through their using the laptops I had set up in my classroom."
	2	"Computer lab."
	3	"Computer lab."
Question 2	1	"At least three times per week."
	2	"Daily.
	3	"20 minutes per day."
Question 3	1	"Yes."
	2	"No. Never had any issues."
	3	"No."
Question 4	1	"Yes."
	2	"Yes."
	3	"Yes."
Question 5	1	"Yes."
	2	Yes. I intervened with a quick lesson intervention given by the program."
	3	"Yes."
Question 6	1	"I believe they spent more time on SuccessMaker at school. All students didn't have computer access at home."
	2	"Yes. They had a set schedule at school with me that allotted a straight 60 minutes on the program."
	3	"School."
Question 7	1	"Yes."
	2	"Yes."
	3	"Yes."
Question 8	1	"I had them go to the reteach section of SuccessMaker."
	2	"I would reassign them certain lessons in the areas of which they failed on the benchmarks.
	3	"Reteach."
Question 9	1	"I don't have any online program to recommend."
	2	"None."
	3	"N/A."
Question 10	1	"Somewhat effective."
	2	"Highly effective."
	3	"Somewhat effective."
Question 11	1	"I shared the information when IEP meetings were held with parents."
	2	"Student growth printouts."
	3	"In meetings." (not specified)

Question 12	**1**	"I explained to parents about SuccessMaker only if the household had computer and Internet access. I taught a diverse class of students."
	2	"If they inquired, yes, but if they did not, I simply sent home their progress."
	3	"No."

Figure 5. Teacher Survey Monkey questionnaire responses.