

A COMPUTER-ASSISTED READING INTERVENTION FOR HIGH SCHOOL STUDENTS
WITH READING DIFFICULTIES

by

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We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

DEDICATION

I would like to dedicate my dissertation to my family. My husband, Ross, and my two children, Hutch and Noelle who have stayed by my side to encourage me throughout my graduate training. Hutch witnessed all stages of the dissertation process unfold, while Noelle has been thoughtfully working on “her special project” while I have worked on mine.

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ABSTRACT

Various approaches have been introduced and tested to try to help struggling high school students catch up on their reading achievement. The current research study investigated how to support high school students with reading difficulties in increasing their reading abilities, engagement, and perception of their school as a supportive and structured environment to help them progress toward high school graduation. Struggling readers within a Southern Arizona charter high school participated in the computer-assisted reading intervention, MindPlay Virtual Reading Coach (MVRC) as part of a remedial reading class. Reading, student engagement, and authoritative school climate measures were collected with the high school students (in the intervention and comparison groups) at the beginning and end of the academic year to gauge intervention effectiveness. The intervention group showed improvements in basic reading skills but did not increase in cognitive and affective engagement. Authoritative school climate and student engagement were positively correlated. These findings show that positive school climate characterized by student support and school disciplinary structure are critical for student engagement among high school students who are reading below grade level. The study also demonstrated that basic reading skills curriculum can be successfully taught through the computer and supported by an in-person teacher. An important consideration of the study is how to increase reading intervention fidelity for high school students. School psychologists fulfill an important role as advocates for at-risk high school student populations who encounter reading difficulty and specific learning disabilities.

Keywords: Computer-Assisted Reading Intervention, MindPlay Virtual Reading Coach, Student Engagement

CHAPTER 1: INTRODUCTION

There has been and continues to be a focus within the research literature on identifying the risk factors that lead to academic and social difficulties in high school that can lead to dropout. (Rumberger & Rotermund, 2012). The National High School Center at the American Institutes for Research has focused on identifying early warning signs to help with high school dropout prevention. In their October 2007 report, they urged schools to identify and focus on students who meet any of the following criteria: receive poor grades in core subjects (such as reading), possess low attendance rates, fail to be promoted to the next grade level, and are disengaged in the classroom (Kennelly & Monrad, 2007).

Reading is a foundational academic ability that impacts all learning and academic achievement areas, and has been a targeted focus of educational reform initiatives. Research literature has shown the negative impacts of students struggling with their reading, such as lower levels of engagement at school, which can interfere with their ability to graduate high school (Reschly, 2010). According to the National Assessment of Educational Progress Report (NAEP), only 37% of 12th-grade students (31% at proficient), 31% of 8th-grade students (27% at proficient), and 33% of 4th-grade students (24% at proficient) were performing at or above the proficient level in reading (U.S. Department of Education, 2019; 2022). Looking more closely at reading proficiency by race or ethnic group for 12th graders in 2019, 17% Black, 19% American Indian/Alaska Native, 25% Hispanic, 27% Native Hawaiian/Other Pacific Islander, 47% White, 46% two or more races, 49% Asian/Pacific Islander, and 50% Asian were performing at or above proficient levels (U.S. Department of Education, 2019).

There has been a shift in high school dropout prevention research to not only identify the risk factors for dropping out but also identify what protective factors can be put into place to help high school students reach graduation and beyond (Reschly & Christenson, 2022; Rumberger & Rotermund, 2012). Research literature has identified that evidence-based reading instruction, student engagement, and an authoritative school climate (Jia et al., 2015), with a structured and supportive learning environment, can serve as protective factors for high school students as they navigate the academic and social challenges of high school.

The national adjusted cohort graduation rate for public high schools (National Center for Education Statistics, 2023) was 87 percent for the 2019-2020 academic year (Asian/Pacific Islander: 93%, White: 90%, Hispanic: 83%, Black: 81%, & American Indian/Alaska Native: 75%). Of the exiting public high school students receiving special education services during the 2020-2021 academic year, 74.9 percent graduated with a regular high school diploma, 9.7 percent received an alternative certificate, and 14.2 percent dropped out (National Center for Education Statistics, 2023). Looking at the overall 2021 status dropout rate (not enrolled in school and have not earned a high school credential) of 5.2 percent for the student population of ages 16-24, the status dropout rates of American Indian/Alaska Native (10.2 percent), Hispanic (7.8 percent), Pacific Islander (7.6 percent), and Black (5.9 percent) students were higher than the status dropout rates of White (4.1 percent) and Asian (2.1 percent) students (National Center for Education Statistics, 2023).

Given the current percentage of students dropping out of school before reaching high school graduation and students reading below the proficient level, there should be an urgency to figure out the contributing factors and ameliorate the situation. All high school students, but especially those struggling in their basic reading skills need to feel connected to the school and

motivated to continue their path to high school graduation. With the full academic impact of the COVID-19 pandemic unfolding, it is an important time for researchers to find evidence for interventions that 1) individualize instruction for each student to target their areas of weakness, 2) adapt the instruction as progress is made, 3) cognitively and psychologically engage the students to continue their progress, and 4) support teachers in reading instruction, especially when the number of students needing reading interventions outnumbers the available skilled teachers. An online, individualized reading intervention, Mindplay Virtual Reading Coach (MVRC) may be a viable option for high school students who require additional evidence-based instruction in the five essential elements of reading recommended by the National Reading Panel (NRP; 2000) (1) phonemic awareness, (2) phonics, (3) fluency, (4) vocabulary, and (5) comprehension, as well as grammar. To address this, the current study examines whether an online reading intervention can positively impact the reading scores of struggling high school readers and their cognitive and affective engagement, sense of support, and academic expectations.

Theoretical Framework

The Conceptual Model of High School Performance (Rumberger & Rotermund, 2012) highlights the individual domains (educational performance, behavior, attitudes, and background) and contextual or institutional domains (families, schools, and communities) that impact the educational experience of high school students. These various student domains can ultimately lead to high school graduation or dropout. Rumberger and Rotermund's research focuses on high school dropout as a process, rather than an event, which is influenced by factors at school and outside of school. As noted in research by Bridgeland et al. (2006), high school dropout rates in the United States have been identified as a national crisis and a "silent

epidemic.” Rather than only focusing on what immediately precedes dropping out, research has focused on underlying factors that lead to it through a process that occurs over time. Bachman et al. (1971) stated, “Dropping out of high school is overrated as a problem in its own right – it is far more appropriately viewed as the end result or symptoms of other problems which have their origin much earlier in life” (p.169).

The Conceptual Model of High School Performance (Rumberger & Rotermund, 2012) outlines the factors that make up each individual and institutional domain to provide an organized model for the research literature to follow. The educational performance domain includes academic achievement (grades and test scores), educational persistence (continued enrollment in school), and educational attainment (progressing in school). The behaviors domain includes student engagement, coursework, deviances, peer associations, and employment. The attitudes domain is made up of psychological factors, including expectations, goals, values, and self-perceptions (perceived competence, autonomy, and sense of belonging). The background domain is made up of demographic characteristics, health, prior school performance, and past educational experiences. The family context is made up of structure, resources, and practices, while the school context is made up of composition, structure, resources, and practices, and the community context is made up of composition and resources. This conceptual framework identifies the influence of the individual factors of academic achievement (educational performance domain), student engagement (behavioral domain), and the institutional contexts of school climate and quality academic instruction on students progressing to high school graduation.

Struggling High School Readers

What characteristics identify a student as a “struggling reader?” Research literature has focused on the attributes of “struggling readers” to identify other areas of intervention to help them succeed academically. Much concentration has been on the lack of academic progress, such as achieving grade-level performance in basic reading skills (e.g., phonological awareness, word recognition) and more advanced reading skills (e.g., reading fluency, reading comprehension) (Vacca & Vacca, 1999). Many researchers believe that student engagement in reading needs to be a focus area of intervention (e.g., Guthrie & Wigfield, 1999)

Researchers have studied the shift in the role that reading plays within academic subjects as a student progresses through school. For example, Shellard (2001) pointed out that high school students typically (if reading within the expected range) shift from “learning to read” to “reading to learn.” Through this shift, more responsibility is put on each student to become a self-directed learner and develop academic self-regulation skills to monitor their progress and sustained effort (Zimmerman, 1995). Unfortunately, the research literature has shown evidence of struggling readers lagging in their advancement from extrinsic motivation to intrinsic motivation in their reading development. Typically developing readers transition from depending on grades as motivating factors to improve reading to reading for enjoyment and satisfaction (Guthrie & Wigfield, 1999). When this milestone is not met, the student is stuck at a stage requiring extrinsic motivation, which is difficult to obtain when struggling with reading.

If a student does not follow an expected pattern of reading development, it can lead to low confidence in their reading abilities and low confidence in potential for improvement (Guthrie & Wigfield, 1999). In that case, a lack of reading progress negatively impacts progress and motivation in other subject areas, which require high amounts of reading to acquire

knowledge. If high school students with low reading ability are failing multiple core academic subjects (English, History, Science, etc.) because the curriculum relies heavily on reading comprehension skills beyond basic reading skills, it would be difficult for these students to stay interested and motivated in going to and participating in school. Research has identified some strategies that struggling readers have used to protect their self-image but also limit their reading growth. For example, students may procrastinate completing assignments or not study for exams to have excuses for their poor performance to cover up their poor reading abilities (Roeser et al., 1996).

Research has shown that struggling readers feel socially marginalized, disrespected, and uncomfortable and do not experience belongingness at school. These experiences lead to lower levels of social support and lower quality of peer relationships, which contribute to academic difficulties (Anderman, 1999). It is critical to intervene and equip high school students with the academic skills, structure, and support to engage in their schoolwork fully.

Reading Intervention

Student reading achievement has become a national priority through the No Child Left Behind (NCLB) and the Individuals with Disabilities Education Act (IDEA 2004), pushing the education system to support struggling students through scientifically based reading instruction (Smartt & Reschly, 2007). Explicit literacy instruction was recommended by the National Reading Panel Report (2000), which outlined the need for educators to focus on the areas of phonemic awareness, phonics, fluency, vocabulary, and reading comprehension (National Institute of Child Health and Human Development [NICHD]). Research has demonstrated a connection between not obtaining basic reading skills by 4th grade with the inability to reach basic or proficient reading levels by the end of 12th grade, resulting in failed courses, poor

grades, and higher dropout rates (Reschly, 2010). Research has also demonstrated the connection between student disengagement (lack of motivation, boredom, etc.) and academic failure, leading to school drop-out (Bridgeland et al., 2006; Finn, 1993). With the knowledge of the risk factors contributing to high school dropout, the focus has shifted to identifying the critical areas of intervention to promote high school academic success and completion. Reschly (2010) emphasized the relationship between student reading competence, motivation, and engagement at school, demonstrating the importance of offering student interventions that focus on increased engagement and reading skills.

Research has shown the importance of school climate, teacher-student relationships, and individualized instruction in supporting students' learning, academic development, and overall engagement in the learning process. Lee (2012) found that an authoritative school climate was associated with higher student engagement and reading achievement. It has also been found that student engagement in high school predicts postsecondary enrollment, which can motivate teachers to intervene at the high school level to know that their impact can continue to have a positive effect on the student's academic trajectory (Fraysier & Reschly, 2022). Struggling high school readers have shown resilience to make it to high school. With proper intervention, they can receive the academic support they need to remain engaged to graduate high school. Masten et al. (2022) identified student engagement, school climate, quality teacher-student relationships, and effective instruction as important factors to help students build resilience.

There has been substantial effort put into identifying evidence-based reading instructional strategies and interventions that directly improve student reading achievement, which has evolved into hybrid classroom environments with twenty-first-century teaching technology, such as computer-assisted instruction (CAI) and computer-based reading programs (CBRPs) (Speed,

2020). Researchers must work to provide the best approaches to sparking reading engagement in high school readers while supporting high school teachers in learning evidence-based teaching strategies for high school students who lack foundational reading skills. Muñoz and Chang (2007) pointed out that literacy programs can simultaneously serve the dual purpose of educating high school students and their teachers in reading instruction. With the increasing number of students requiring supplementary instruction in reading and the shortage of qualified teachers available to provide this additional support, technology has opened additional opportunities for skill-building outside of traditional in-person instruction. Computer-assisted instruction (CAI), computer-managed instruction (CMI), computer-based teaching (CBT), computer-assisted learning (CAL), and computer-based reading programs (CBRPs) have gained evidence as viable options to help students build their reading skills. For example, Schneider et al. (2016) demonstrated the positive impact of the tailored instruction and formative feedback of the MindPlay Virtual Reading Coach (MVRC) on elementary students' reading fluency and spelling, filling the instructional gaps, and providing the extra academic support many students need.

Student Engagement

The Committee on Increasing High School Students' Engagement and Motivation to Learn within the National Research Council (NRC) identified increasing student engagement as a national school improvement goal. They issued a report, *Engaging Schools: Fostering High School Students' Motivation to Learn*, which discussed the difference between motivation and engagement in academic work (National Research Council & Institute of Medicine, 2004). The National Academies panel, made up of educators and scholars, met to collaborate and discuss how to ameliorate the pattern of student decline in academic motivation and engagement as they

progress from elementary school through high school (National Research Council & Institute of Medicine, 2004).

To expand the work previously done by the NRC Committee, “Preventing Reading Difficulties in Young Children” (Snow et al., 1998), the National Reading Panel was formed to put together resources and reports of evidence-based reading strategies. The National Reading Panel’s (2000) recommendations that tie into student engagement are summarized in the following excerpt:

A common theme among effective practices is that they address underlying psychological variables related to motivation, such as competence and control, beliefs about the value of education, and a sense of belonging. In brief, engaging schools and teachers promote students’ confidence in their ability to learn and succeed in school by providing challenging instruction and support for meeting high standards, and they clearly convey their own high expectations for their students’ success. They provide choices for students and they make curriculum and instruction relevant to adolescents’ experiences, cultures, and long-term goals, so that students see some value in the high school curriculum. (p. 2–3)

Student engagement has been found to positively influence academic achievement and student learning (Wang & Eccles, 2013), but current research has aimed to identify what leads to higher student engagement at the student level, class level, and school level. For example, based on previous research on a significant association between school climate and student engagement (Wang & Eccles, 2013), Konold et al. (2018) investigated whether student engagement mediated the relationship between school climate and academic outcomes. They found that higher teacher

expectations and stronger student-teacher relationships increased student engagement and academic performance.

The way these variables relate to one another and interact will continue to interest researchers and educational initiatives because there is a national urgency to improve educational outcomes, such as high school graduation rates. Konold et al. (2018) pointed out that there are reciprocal effects or feedback loops amongst these variable relationships, and research literature should continue to investigate these interactions. The U.S. Department of Education has issued national guidelines to improve school climate and created educational programs to strive toward school climate goals (National School Climate Center, 2017). Through the 2015 Every Student Succeeds Act, the U.S. Department of Education and The Office of Safe and Healthy Students provided a national resource of school climate surveys and requested that schools measure school climate and safety as a nonacademic indicator of school quality or student success (Konold et al., 2018).

Problem Statement

While research literature has identified that evidence-based reading instruction, student engagement, and a structured and supportive learning environment (authoritative school climate) can serve as protective factors to support high school graduation, it is not known whether a computer-based reading program, such as MVRC, can positively influence high school students' growth in these areas. While being encouraged to improve their reading skills through an evidence-based intervention, students deserve to feel connected to their teachers and school. Feelings of connectedness, support, and knowing that teachers believe in their abilities can help motivate students to persevere through challenging academic subjects.

Additional research is needed to help identify the relationship between authoritative school climate and student engagement. Quality student-teacher relationships may serve as protective factors for students struggling in core academic subjects, such as reading (Wang & Eccles, 2013). In addition to instructing teachers on evidence-based reading instruction, teachers must be equipped to provide a structured and supportive classroom environment to allow the students' learning and growth to occur to progress toward graduation.

In summary, current research literature demonstrates the need for a reading intervention that targets high school students with significant difficulties in basic reading skills, and the current study focused on showing that a computer-assisted reading intervention could be a reliable approach. The current study examined the effectiveness of the MVRC on high school students' basic reading skills. Currently, no study has examined the impact of the MVRC on student engagement (cognitive and affective) in high school students. Its individualized nature provides ample support and structure for students and teachers. With additional empirical support for the MVRC's effectiveness, it can become a powerful intervention tool for high school students. Finally, there needs to be more research examining the relationship between reading difficulties and student engagement among high school students. Students with significant difficulties are often disengaged in the learning process. Of particular interest is how we create a learning environment and climate that promotes student engagement.

The Current Study

Previous studies have demonstrated significant associations among reading achievement, student engagement, and school climate. The present study tested a more comprehensive model that explains the relations among a computer-based reading program, school climate, student engagement, and reading achievement. Specifically, the current study hypothesized that the

MVRC would increase students' basic reading skills, which would also improve their engagement (cognitive and affective) and increase their perception of a supportive and structured academic environment that encourages academic achievement.

This study focused on three main areas of inquiry. First, it examined the impact of the MindPlay Virtual Reading Coach (MVRC) on high school students' reading and spelling achievement. Many research studies have investigated the impact of evidence-based reading interventions on students, with the majority of research studies including elementary school students. There are fewer research studies that include high school students, which makes it difficult for the education system to find evidence-based reading interventions that target high school student populations. Investigating the impact of a computer-based reading program with high school students adds another layer of novelty to the current study (Cantrell et al., 2011; Faddis et al., 2011; Lauritzen, 2018; Loadman et al., 2011; Keane, 2018; Speed, 2020; Swanlund et al., 2012; The Educational Alliance at Brown University, 2012; Vaden-Kiernan et al., 2012). Only three other research studies have investigated the impact of the MVRC on high school students' reading achievement, and the results have been positive (Bliss, 2000; Kloos et al., 2019; Serido & Wilhem, 2008). They have showed that MVRC is a promising intervention for struggling readers, because it emphasizes the mastery of basic reading skills and adapts to the needs of each individual student.

The second purpose of the study was to examine the impact of participating in MVRC on the student's perception of their engagement, climate, and academic expectations. Four research studies (one with high school students) have investigated computer-assisted instruction and student engagement (Bright, 2020; Francescucci et al., 2021; Lauritzen, 2018; Speed, 2020). No research studies have examined the MVRC and its impact on students' perception of academic

expectations and support. Based on previous studies showing that computer-based interventions can motivate students to engage with reading intervention material, and subsequently increasing their participation and reading skills, the current study planned to examine the impact of MVRC from various angles. It was anticipated that a structured and supportive educational intervention such as MVRC would influence how high school students perceive school climate and their relationships with teachers, further influencing their cognitive and affective engagement levels. Students may feel more support and perceive higher academic expectations from their teachers after completing an intervention in an academic area of weakness.

Finally, the third purpose of the study was to contribute to the research literature on authoritative school climate and student engagement among high school students struggling with reading. Konold and Cornell (2015) demonstrated the efficacy of using the authoritative school climate model with the high school population and provided evidence for the positive influence that authoritative school climate can have on cognitive and affective student engagement. The current study focused specifically on high school students reading below grade level. It was anticipated that as the students perceive the school climate as more authoritative, due to the increased levels of support and structure provided through MVRC, their levels of engagement would increase.

Research Questions and Hypotheses

High school readers not reading at grade level present unique difficulties that need to be addressed through targeted intervention. In addition to improving the students' reading performance, the current study aims to increase their engagement and perception of the school climate through the implementation of the computer-assisted reading intervention. The following

research questions were identified to understand better how to impact the academic trajectory of struggling high school readers positively.

Research Question 1. What effects does a computer-assisted reading intervention/computer-based reading program, MindPlay Virtual Reading Coach (MVRC), have on students' reading and spelling skills? It was hypothesized that MVRC would improve the students' reading and spelling skills, as demonstrated by higher post-test scores on the reading measures (than the pre-test scores). Those participants in the intervention group would have higher reading and spelling skills gains than the comparison group.

Research Question 2. Do high school students' engagement (affective and cognitive) levels improve after participating in the MVRC intervention? It was hypothesized that students' engagement (affective and cognitive) would improve after the reading intervention (intervention group with higher post-test scores than pre-test scores). It was also hypothesized that those participants in the intervention group would have higher student engagement (affective and cognitive) scores than the comparison group.

Research Question 3. Does the MVRC intervention promote students' sense of support and academic expectations? It was hypothesized that students' sense of teacher support and academic expectations would improve from the pre-test to the post-test. It was also hypothesized that those participants in the intervention group would have a higher sense of student support and academic expectations than the comparison group.

Research Question 4. What is the relationship between authoritative school climate and student engagement in high school students? Are the students' perceptions of the authoritative school climate (structure and support) related to their engagement in the classroom?

It was hypothesized that the more authoritative their perceived school climate is, the higher the student engagement would be.

Rationale and Significance of the Study

The current research study examined how high school students with lower reading achievement can be adequately supported to increase their reading abilities, engagement, and perception of their school as a supportive and structured environment to help them to maintain their participation and reach the academic milestone of high school graduation. The extent to which a computerized reading intervention can help improve individual and contextual factors in the student's experience has not been studied previously.

Research has not addressed these inquiries using the MVRC intervention, reading achievement measures, the authoritative school climate survey, and the student engagement instrument. The study population of high school students was a unique factor of this study because intervening at this vulnerable age can be a challenge for both the students and the teachers. High school students with reading difficulties may have had years of disengagement and require high motivation and determination to improve their reading progress. The online and individualized format of MVRC is well-suited for a technology-savvy age group hoping to increase their engagement in school through their improvements in reading. High school students are also interested in computers and electronics and are accustomed to navigating online, which is a benefit of providing an online intervention. The discreteness of the online design combats the high sensitivity to the social stigma apparent in the high school setting when students lack basic academic skills that, on average, that were previously obtained by many students in earlier grade levels.

Each student had an account where they tracked their progress throughout the reading intervention, and based on their performance, the program adapted to their specific needs. Because the program was tailored to the individual students' needs (and not the overall needs of the class), comparing their performance to others did not impede their reading progress. Each student received immediate formative feedback (not delivered to them in front of the class, but instead to their computer screen) while interacting with the program (MINDPLAY®, 2006-2015). The MVRC intervention provided the students with ample opportunities to experience success while mastering reading lessons, intended to ignite their reading engagement in the classroom and at home. It also provides structure and support for the teacher in administering an evidence-based intervention to their students. As research literature has pointed out, a high school teacher may not have the educational training to teach basic reading skills to high school students so that the MVRC can provide the instruction. In contrast, the teacher monitors their students, supplements them with additional reading instruction and activities, and receives support from the program.

As highlighted above, school engagement/disengagement plays a critical role in students' academic performance, and thus it is essential to understand better how we promote student engagement. The findings of this study can inform teachers of the extent to which the student's perception of the authoritative school climate (demandingness and responsiveness) influences their cognitive and affective engagement in the classroom. Whether support and discipline influence student engagement can help inform classroom interventions to promote positive classroom climates. Furthermore, MVRC may impact the students' cognitive and affective engagement.

CHAPTER 2: LITERATURE REVIEW

Developmental tasks are “physical or psychosocial milestones or accomplishments by which progress in development is typically evaluated by society, parents, and eventually by young people themselves” (Masten et al., 2022, p. 242). As students get older, specific developmental tasks are expected of them within the academic environment, such as attending school regularly, progressing to higher grade levels, forming positive relationships with teachers and peers, and mastering the educational content of each grade level. Academic milestones, if achieved by the expected grade (criteria based on research), indicate whether a student is progressing academically at the appropriate pace and competence level that puts the student on the trajectory for future competence (Masten et al., 2006, 2022). For example, students are expected to master basic reading skills by third grade to concentrate on building more complex reading abilities, such as reading comprehension. If students do not advance in their reading abilities as they continue to advance in their grade level. In that case, their reading achievement will not align with the expectations set for their grade level, and they will fall behind. Struggling readers have been identified as being at higher risk for high school dropouts.

The research literature highlights various promotive, protective, and risk factors that struggling high school students may encounter throughout their academic journey. There has been a shift in the research literature to identify which factors can be bolstered through intervention to support high school students with their difficulties in the classroom. High school students at risk for school withdrawal have been the target of research studies and interventions to find adequate solutions to help them to build protective and promotive factors and resilience. Masten et al. (2022) defined resilience as “the capacity of a dynamic system to adapt successfully through multiple processes to challenges that threaten that system’s function,

survival, or development” (p. 241). In their research, they explain that students are “living systems” whose resilience and development are influenced by “many interacting systems within their bodies and minds as well as between the whole person and their environments” (p. 241). Research has shown that high-quality student engagement improves the school's overall effectiveness and the students' positive experiences (Masten et al., 2022). In particular, the research literature has identified that student engagement can be a protective factor for students at a higher risk of poor educational outcomes, such as low reading abilities (Masten et al., 2022).

Theoretical Framework and Conceptualization

The theoretical framework that influenced the current study combines existing theories and models of various researchers in psychology and education. Various student development areas were studied to understand better factors that influence a student’s progression toward high school graduation or digression towards high school dropout. The current study was interested in learning what areas of the high school student experience influences their day-to-day academic success to determine where schools can focus their interventions. To help struggling high school readers get the support they need to reach graduation, research needs to continue to examine how important variables interact. Research literature has shown that support to learn the academic material and feel connected to peers and teachers within their learning environments help high school students stay committed to completing their education. The research literature on high school dropout prevention has pointed to multiple protective factors to help students reach the milestone of high school graduation, including *reading achievement*, *student engagement*, and *school climate*.

Multiple Systems Model of Reading (MSMR)

Understanding the underlying causes of reading difficulty and how the educational system can intervene to improve students' reading ability is imperative. The Multiple Systems Model of Reading (MSMR; Parrila, 2008) describes bidirectional influences of genetic, neural, psychological, behavioral, and environmental systems to reading development and disabilities.

The Multiple Systems Model of Reading considers reading development in all students across the achievement spectrum, from reading disabilities to expected reading development. Parrila and McQuarrie (2015) emphasize that the various causal theories of reading disabilities that focus on neural, genetic, and cognitive processes remain essential. Still, the contribution of behavior (actions and interactions), psychological (cognitive, motivational, and emotional), and environmental (physical, social, and cultural) systems should also be considered. They argue that the interaction of these contributing factors (as protective or risk factors) should focus on reading research, assessment, and interventions rather than identifying the single factor that causes reading problems. Other researchers have also explored the interplay of the multiple factors that influence reading development to identify the best avenues for intervention.

Integrated (Matthew Effects) Model

Finn's participation-identification model (1989) has provided a framework to understand better how a student's participation in school can lead to increased engagement and better academic outcomes (Fraysier & Reschly, 2022). Reschly (2010) expanded on this conceptualization to focus on reading development and the interplay of student engagement, reading competence, context, and motivation. This model is particularly relevant to the current study because the study population includes struggling high school readers that are not solely experiencing the positive momentum of the model, but also the negative repercussions of the

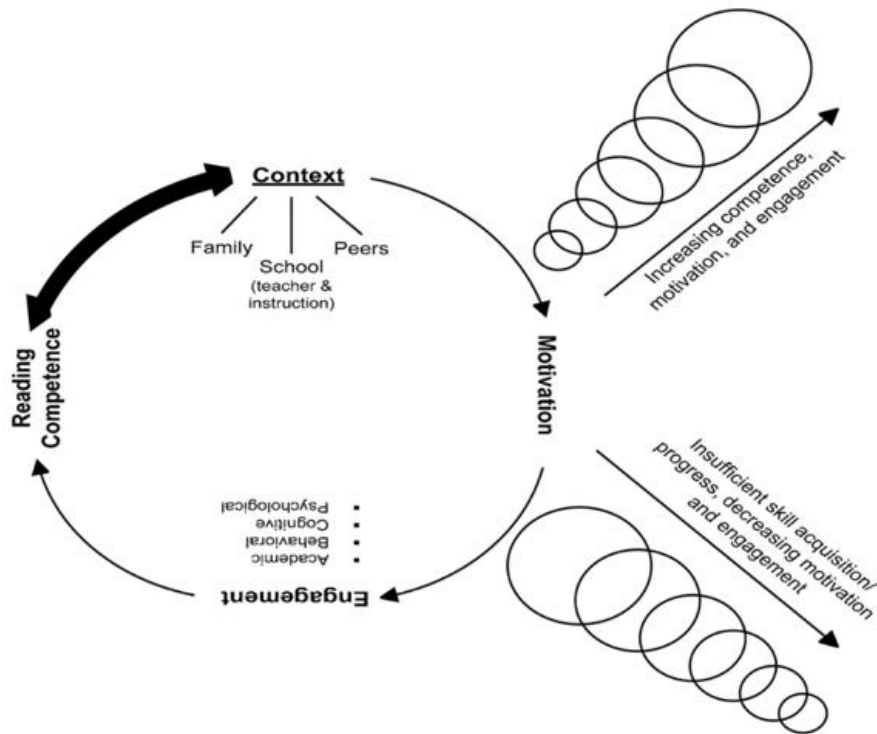
model. As Finn (1989) described through his model, gradual disengagement occurs when a student is not academically successful, and their participation in school decreases, causing their sense of belonging at school to decrease. If no intervention occurs and the student continues to perform poorly while distancing themselves from school, feelings of alienation can lead to school drop-out.

Reschly (2010) focused the Integrated Model (See Figure 1) around the role of student engagement (Academic, Behavioral, Cognitive, and Psychological) as the mediator between context (family, teacher, and peers) and outcomes and between reading competence and school completion, where engagement influences higher engagement (“Matthew Effects”). Reading achievement was identified as “the key academic skill in these cycles of engagement and withdrawal,” and Reschly (2010) deemed reading competence a critical factor in maintaining ongoing student engagement to progress academically to achieve high school graduation. The Integrated Model also contains a direct association between instructional context and reading competence, influencing the current study's thought process. Research literature has also identified the reciprocal relationship between students (and their academic performance) and their family, school, and peer contexts (Reschly, 2010).

Theorists have not reached a consensus on the role that motivation plays. However, within the Integrative Model, Reschly (2010) explained that “motivation may wholly or partially link family, school, and peer contexts and student engagement, or motivation may be subsumed by the engagement construct, most likely as a form of cognitive engagement” (p. 80). Some theorists have identified motivation as the “why” for a given behavior with engagement as the “action,” while others have concluded that engagement does not occur unless there is also motivation (Appleton et al., 2006; Guthrie & Wigfield, 2000).

Figure 1

Matthew Effects Model of Reading, Motivation, and Student Engagement



Note. Matthew Effects Model of Reading, Motivation, and Student Engagement. From “Reading and School Completion: Critical Connections and Matthew Effects,” by A. L. Reschly, 2010, *Reading and Writing Quarterly*, 26 (1), p. 84. Copyright 2010 by Taylor & Francis Group. Reprinted with permission from Taylor & Francis Group.

Student Engagement Theory

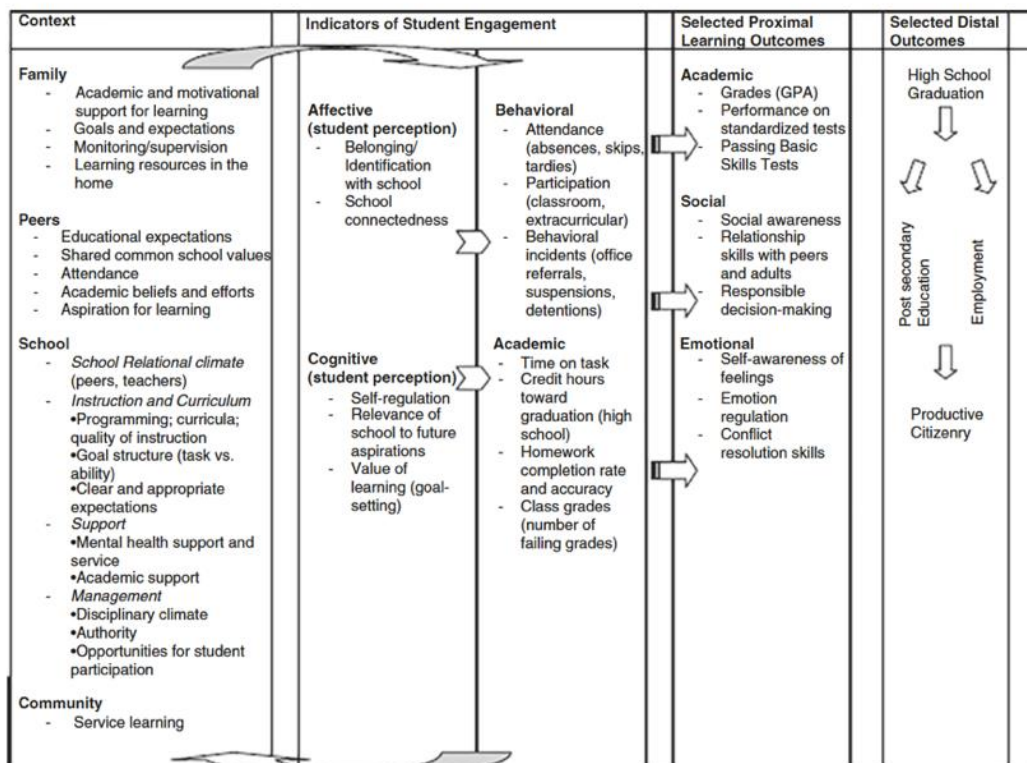
Student engagement has become a significant focus in the research literature to increase students’ perception of belonging and help them stay or get involved in school at a level that keeps them interested, committed, and supported. Reschly and Christenson (2012) developed the

Student Engagement Theory that describes the relationships between context, student engagement, and short and long-term learning outcomes. The Student Engagement Theory involves the four subtypes of student engagement (academic, behavioral, cognitive, and affective). They focus on improving all areas of student engagement, while also acknowledging that changes in affective and cognitive engagement can lead to changes in behavioral and academic engagement (Reschly & Christenson, 2006).

Reschly and Christenson (2022) describe engagement as a mediator between contextual factors and student learning outcomes. The model emphasizes that consistent support from family, peers, school, and the community surrounding a student can lead to positive cognitive, affective, behavioral, and academic engagement. The model also argues that by providing support and structure through the relationships at school, the overall school climate can also improve, showing the school environment’s influence on the student and the student on the school environment.

Figure 2

Context, Engagement, and Student Outcomes



Note. Model of Associations Between Context, Engagement, and Student Outcomes. Reprinted from “Jingle, Jangle, and Conceptual Haziness: Evolution and Future Directions of the Engagement Construct,” by A. L. Reschly & S. L. Christenson. 2012, In S.L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of Research on Student Engagement*, p. 10. Copyright 2012 by Springer Science + Business Media, LLC. Reproduced with permission from Springer Nature.

Teacher-Student Relationships and Student Engagement

Hofkens and Pianta (2022) state, “Engagement is not a characteristic of a student, rather, engagement emerges in the context of interactions with their teacher, which are fundamental to the classroom setting as a developmental context for children and adolescence” (p. 431). This perspective is important because it emphasizes that teacher-student relationships are crucial in the classroom climate and are a driving force for student engagement. Classrooms are a learning space where teachers can promote student development through challenging, consistent, responsive, and effective instructional and relationship support, and the way teachers interact with their students can produce or inhibit student engagement (Hofkens & Pianta, 2022). In their words, Hofkens and Pianta (2022) describe that “Interactions are the behavioral component of a broader classroom relational system, within which the quality of teacher-student relationships is the engine” (p. 433).

Research literature supports the relationship between parenting styles and children’s psychosocial development (Aunola & Nurmi, 2005; Baumrind, 1991). Researchers and practitioners have recognized that similar patterns exist in teacher-student relationships, with teaching styles influencing student behavior, achievement, and autonomy in the classroom and within the school (Walker, 2008). As parents, teachers serve as attachment figures and have the

capacity to create emotionally consistent and safe environments that foster healthy student learning and exploration within the classroom and school (Pianta et al., 2012). Teacher-student relationships have been conceptualized by Pianta (1999) as coordinated systems consisting of:

- (1) teacher and student beliefs and expectations about self, other, and the relationship
- (2) behavioral exchanges that shape and reflect experience and beliefs; and
- (3) individual characteristics (e.g., temperament) and experiences (prior attachments) that shape other components

The literature has focused on adapting teaching methods to help students feel competent and a successful approach has been to match the level of instruction to the students, influenced by the “zone of proximal development” (Davis et al., 2022; Vygotsky, 1978). This can be achieved through providing specialized instruction within special education services or one-on-one or small group instruction. The following sections of the literature review will focus on how focusing on reading achievement, reading interventions, and computer-based instruction can provide a possible solution on how to provide the large number of high school students needing their level of instruction to be matched to their “zone of proximal development.” The hope is that as high school students feel more supported and competent in their reading, their perceived levels of student engagement and authoritative school climate will improve.

Study Variable: Reading Achievement

“No other skill taught in school and learned by school children is more important than reading. It is the gateway to all other knowledge. Teaching students to read by the end of third grade is the single most important task assigned to elementary school” (National Center to Improve the Tools of Educators, 1996, p. 1). Reading is a key that unlocks learning opportunities for students that allow them to understand their educational material and gain a solid knowledge

base to progress in school, life, and their careers. “Every child would read if it were in his power to do so” is a powerful statement because it emphasizes how struggling readers have the will and the desire to read but need the help of experienced educators to guide them and give them the tools to have the power to accomplish their reading potential (Betts, 1946, p. 5).

Theories of Reading Development

Parrila and McQuarrie (2015) presented the Multiple Systems Model of Reading to demonstrate that there are many systems contributing to a student’s reading development and difficulties. For example, research has looked at brain functioning and reading and discovered that the Broca’s area of the brain (inferior frontal gyrus) impacts articulation and word analysis, the Parietotemporal region impacts word analysis, and the Occipitotemporal region impacts word form (Shaywitz et al., 2003; Shaywitz & Shaywitz, 2020). FMRI data has shown that a dyslexic brain exhibits less efficient patterns of processing when reading, such as over-activating the anterior system and under-activating the posterior reading systems, occipitoparietal region, and temporoparietal region, compared to a neurotypical brain (Shaywitz et al., 2003; Shaywitz & Shaywitz, 2020). While it is helpful to understand the neurological and genetic underpinnings of a reading disability to identify students at risk for difficulties, the neural, genetic, and cognitive contributions remain unchanged. Teachers can intervene to help at-risk students receive the specialized instruction that they need for their unique learning differences. Still, there are other systems (e.g., Behavior, Environment, Psychological) that students are involved in that can directly impact their reading and academic outcomes. If a student’s reading development is looked at through the various systems, there are more avenues for intervention and the contributing factors of each unique student can be acknowledged. By focusing on one theory or possible cause of a reading disability, a lot of helpful information could be missing, and the big

picture of reading development is not honored. Monroe (1932) stated that “No one factor was present in all [student] cases. It is probable that the reading defect is caused by a constellation of factors rather than by one isolated factor” (p. 110).

Research literature has shown many contributing factors to difficulties with reading, which supports the argument that each student should be looked at on an individual basis to see what their cognitive strengths and weaknesses are and how they are influencing reading development to best intervene. There has also been a shift to identify which area of reading is most impacted by the reading disability, including decoding (visual memory and working memory) (Kulp et al., 2002; Nevo & Breznitz, 2011), fluency (processing speed (Breznitz & Misra, 2003) and rapid automatized naming speed (Norton & Wolf, 2012), or comprehension (executive functioning (Sesma et al., 2009), working memory (Daneman & Merikle, 1996) to identify a specific type of reading disorder (Fletcher, 2009). Researchers have connected poor reading abilities with deficits in phonological processing, rapid naming tasks, orthographic processing tasks, and problems with processing visual information (Parrila & McQuarrie, 2015). Fletcher (2009) pointed out that not all cases of dyslexia can be explained by difficulties in phonological awareness and word recognition, and other researchers have found evidence for other contributing cognitive factors. Weaknesses in the following areas have been found to impact reading development: attention, visual perception, auditory perception, verbal auditory working memory, visual working memory, processing speed, and rapid naming speed (Amitay et al., 2002; Beidas et al., 2013).

Foundational Reading Skills

The National Reading Panel outlines the essential components of reading assessment and instruction that teachers and schools should focus on, including phonemic awareness, phonics,

fluency, vocabulary, grammar, and comprehension strategies (National Reading Panel, 2000).

The alphabetic principle is the systematic use of the alphabetic letters to represent speech sounds (Ehri, 1998). There are phases of sight word development that include the pre-alphabetic phase (2-5 years), partial alphabetic phase (6 years), full alphabetic phase (7-8 years), and consolidated alphabetic phase (7-9 years) (Metsala & Walley, 1998). Phonological awareness starts developing around age three through vocal play, and if the student progresses on the normal curve, they can perform all phonemic awareness and manipulation tasks: rhyming, blending, segmenting, deleting, substituting, and reversing phonemes by the end of the second grade (Ehri & Metsala, 1998). The major components of reading fluency include accuracy (good decoding skills and recognizing sight words), rate of reading (appropriate speed of reading and automatic recognition of words), and expression or prosody (adjusting voice and attending to punctuation) (Ehri & Metsala, 1998). Ehri (1998) stated that “automaticity of word reading is the secret of efficient text reading” (p. 13).

Measurement of Reading

Reading research has identified specific reading and spelling measures that capture a student’s basic reading skills. The Woodcock-Johnson IV Tests of Achievement include the Word Attack, Letter-Word Identification, Spelling, Word Reading Fluency, and Sentence Reading Fluency subtests. The Test of Word Reading Efficiency, Second Edition (TOWRE-2) includes the two subtests of Sight Word Efficiency and Phonemic Decoding Efficiency.

The Word Attack and Phonemic Decoding Efficiency subtests (nonwords), the Letter-Word Identification and the Sight Word Efficiency subtests (sight words) require readers to use their decoding and blending skills, which tap into their phoneme-grapheme knowledge to be able to convert letters (graphemes) into sounds (phonemes). Word Reading Fluency and Sentence

Reading Fluency require readers to read words smoothly and proficiently with automaticity and accuracy. The Spelling subtest also analyzes letter-sound knowledge by challenging the student to write out the correct graphemes for the phonemes of the words read by the test examiner (encoding). The Test of Silent Word Reading Fluency (TOSWRF-2) has been shown to measure whether a reader can quickly and accurately identify sight words.

Outside of these evidence-based measures, teachers can also review a student's academic work to learn more about their unique profile of reading strengths and weaknesses.

As more is known about a student's reading abilities, teaching methods should be modified to meet the needs of the student (Monroe, 1932).

Specific Learning Disability in Reading

According to the National Center for Education Statistics (2023), 14.7 percent of public school students ages 3-21 received special education services under the Individuals with Disabilities Education Act (IDEA) during the 2021-2022 academic year. Of the 7.3 million students who qualified for services due to their disability negatively impacting their learning and academic development, 32.4 percent were identified as having a Specific Learning Disability (SLD). The areas of Specific Learning Disability in Reading include Basic Reading Skills, Reading Fluency Skills, and Reading Comprehension. In the current study, various students in the intervention group fell under the Special Education Classification of Specific Learning Disability and Other Health Impairment.

Being flagged as a "struggling reader" can also identify students who need to be assessed for an educational or clinical diagnosis of a Specific Learning Disability in Reading. The level of intervention for this impairment would be higher due to the neurological etiology of the disorder. A Specific Learning Disability in Reading can be identified under IDEA (2004) through the

following methods: ability-achievement discrepancy (Bateman, 1965), response to intervention (RTI), or patterns of strengths and weaknesses. The ability-achievement discrepancy model identifies a discrepancy between a student's academic performance in reading and their estimated potential in reading (based on their cognitive functioning), the RTI model identifies if a student fails to respond to levels of reading intervention, and the patterns of strengths and weaknesses model identifies whether a student has an academic and cognitive profile that aligns with SLD in reading. A Specific Learning Disability is considered a neurodevelopmental disorder that is impacted by genetic and environmental factors that influence the brain's ability to perceive or process verbal and nonverbal information efficiently. The International Dyslexia Association (IDA, 2015) states:

Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (para 1).

Being identified with SLD in reading within the school system can help students receive the appropriate special education services for their academic growth and receive accommodations and/or modifications in the curriculum when needed under IDEA (2004). Students can also be identified as having SLD in Reading through a psychoeducational evaluation using The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., text rev.) (American Psychiatric Association, 2022) criteria (they must meet four criteria), which include:

1. Have difficulties in at least one of the following areas for at least six months despite targeted help:
 - Difficulty reading (e.g., inaccurate, slow and only with much effort).
 - Difficulty understanding the meaning of what is read.
 - Difficulty with spelling.
2. Have academic skills that are substantially below what is expected for the child's age and cause problems in school, work or everyday activities.
3. The difficulties start during school-age even if some people don't experience significant problems until adulthood (when academic, work and day-to-day demands are greater).
4. Learning difficulties are not due to other conditions, such as intellectual disability, vision or hearing problems, a neurological condition (e.g., pediatric stroke), adverse conditions such as economic or environmental disadvantage, lack of instruction, or difficulties speaking/understanding the language.

Whether a struggling reader is identified early or late in their academic career, and whether they are experiencing reading difficulty to the point of meeting the criteria for SLD in Reading (through IDEA or the DSM-5), there are evidence-based instructional methods and interventions available that can help them in their reading development. The rate of progress that students make when receiving remedial reading instruction has been linked to their cognitive abilities, age, amount of instruction, the severity of their disability, their behavior and personality difficulties, and the supervision they received when engaging in the remedial techniques (Monroe, 1932, p. 157).

Evidence-Based Reading Instruction and Interventions

Research literature has focused much attention on improving reading abilities in the elementary school years, due to reading skills building on each other and impacting student academic achievement while progressing through school. Research has shown that 50% of at-risk students (reading failure) who receive early reading instruction and intervention can be brought to normal levels of reading ability, providing hope for these students and motivation for schools to provide the needed interventions (Torgesen, 2000; Torgesen et al., 2010). The October 2007 report also noted a correlation between low reading scores and school dropout, emphasizing the need for reading interventions (Kennelly & Monrad, 2007). These findings can explain the push to improve reading skills as early as possible. Although research has shown the positive impact of early reading intervention, not all schools can provide the necessary interventions during the preschool, elementary, and middle school years. Unfortunately, research has shown that students often struggle with their reading for years before they receive an adequate level of reading intervention, which can impact their motivation to read (Snowling & Hulme, 2011).

Universal Teaching Strategies or Interventions

Considering the Zone of Proximal Development (Vygotsky) teachers can scaffold reading instruction so that students are more likely to stay motivated and interested in the reading activities. The three levels of instruction that are based on a student's present levels of reading performance include Independent (99-100% word recognition; 90-100% comprehension), Instructional (95-99% word recognition; 75-89% comprehension), and Frustrational ($\leq 90\%$ word recognition; $\leq 50\%$ comprehension) (Betts, 1946; Halladay, 2012). Educational research has shown that developing readers need reading material at their instructional level that matches

their present levels of performance, and their homework should be matched to their independent level (Halladay, 2012). As they improve their reading, the reading instruction can be adjusted to slightly above their present level of performance (Halladay, 2012). Teachers can respond to individual student needs as they progress, provide systematic and intensive instruction, and use various teaching methodologies (an eclectic approach) to personalize the learning experience (Halladay, 2012).

The NICHD released the report of the National Reading Panel (April 2000), *Teaching Children to Read*, that listed strategies of effective reading instruction. The Reading Panel recommended that teachers focus their reading curriculum on (1) breaking apart and manipulating the sounds in words (phonemic awareness), (2) learning that these sounds are represented by letters that can be blended together to form words (phonics), (3) practicing what they've learned by reading aloud with guidance and feedback (guided oral reading), (4) and applying strategies to guide and improve reading comprehension.

Uhry and Clark (2005) emphasized that phonics instructional approaches need to be intensive and systematic to help students who have significant difficulties in reading. Systematic phonics instruction (e.g., synthetic phonics, analytic phonics, phonics through spelling, phonics in context, analogy phonics) was the preferred method of phonics instruction, which teaches “a planned sequence of phonics elements, rather than highlighting elements as they happen to appear in the text” (NRP, 2000). Synthetic phonics approaches include Orton-Gillingham (Gillingham & Stillman, 1997; Orton, 1966) and the Slingerland Approaches (Slingerland, 1988), which emphasize a multisensory approach with practice and review (Rooney, 1995).

Guided oral reading with an experienced teacher was found to be the most beneficial reading fluency intervention for struggling readers and had impacts on word recognition, reading

fluency, and comprehension (NRP, 2000). The reading fluency interventions were deemed appropriate and beneficial for all ages and were shown to be impactful with struggling high school readers. The Reading Panel (2000) stated, “Students who do not develop reading fluency, regardless of how bright they are, are likely to remain poor readers throughout their lives.” Various vocabulary instruction strategies were found to be effective: keyword method, incidental learning, repeated exposure, pre-teaching of vocabulary, restructuring reading materials, and context method. As for effective reading comprehension strategies, the Reading Panel chose eight that they believed to be the most effective out of the 203 research studies: comprehension monitoring, cooperative learning, graphic organizers, story structure, question answering, question generating, summarization, and multiple strategies.

The National Reading Panel noted that there were research studies that showed computers could be used in teaching basic reading skills (such as phonemic awareness) and other reading instruction, but more research is needed in this area. The NRP report also noted that using computers in reading instruction could be motivating for students due to their high interest in technology. The use of computers in reading instruction and intervention will be discussed later in this literature review.

Reading Difficulties in High School Population

What happens when the students continue to advance in grade level without receiving the appropriate amount of reading intervention for their needs? Students in high school without grade-level reading skills may have years of instruction to catch up on. Because of their reading disability, they must put in extra time to master the basic reading skills that their neurotypical peers have already mastered (Olson, 2011). They tend to read more slowly than their peers due to deficits in reading fluency (Uhry & Clark, 2005). This demonstrates how important it is to keep

struggling high school readers engaged, motivated, and interested in learning and practicing reading. A history of reading difficulties and a failure to gain foundational reading skills by third grade has been found to increase the likelihood of high school graduation delay or dropping out (Holopainen & Hakkarainen, 2019). Reading interventions can still be effective for middle/high school students, so this is an area of intervention that can make a substantial impact in the lives of the students (Daniel et al., 2021). Intervening at the high school level may help students prepare for college and feel more competent in pursuing further educational opportunities.

Researchers are trying to identify ways to keep struggling high school readers engaged in their learning and maintain an interest in reading for school and pleasure. Reschly (2010) explained that “Matthew Effects” come into effect when a student engages in reading, and the goal of schools and teachers should be to help students increase their positive interaction and experiences with reading. The National Reading Panel (2000) acknowledged that the motivation and enjoyment of reading could influence whether a student participates in reading-related activities. Quirk and Schwanenflugel (2004) noted that a lot of reading programs for low achievers are cognitive and do not explicitly work on motivational practices.

Merga (2018) investigated what caused some adolescents to engage in reading activities more than others and what barriers were getting in the way of students spending more time reading books. Preference for other activities (78%) or reading material online (49%) with the belief that reading books was boring (45%) were the top reasons. Skill deficit in reading (“I am not good at reading;” “I find reading hard”) impacted 22% of the research sample. These reasons further highlight that some high school students may not be able to read well or at their grade level (Gordon, 2010). The fact that the teens in the research study indicated that they did not

engage in reading due to not reading well showed the “Matthew Effect” in play. Stanovich (1986) stated:

Matthew Effect, by which the ‘rich get richer’ and the ‘poor, poorer’: ‘children with inadequate vocabularies—who read slowly and without enjoyment—read less, and as a result have slower development of vocabulary knowledge, which inhibits further growth in reading ability. (p. 381)

Finally, 54% of the teens reported physical or cognitive impairments (headaches; feeling sleepy) impacting their ability to read frequently, which could include attention, concentration, visual language processing, optical issues, or not being able to sit still.

Achievement Motivation Theory and Struggling High School Readers

Guthrie et al. (2012) demonstrate in their research that behavioral engagement in reading influences reading competence and that motivation to read influences behavioral engagement in reading. Research has shown that struggling readers tend to avoid reading at school and home and minimize the time and effort for them to read (Meece & Miller, 2001). When high-achieving readers are compared to low-achieving readers, the students who perform lower are also engaging in higher amounts of avoidance (Lee & Zentall, 2012). As noted in the study by Merga (2018), students may find reading boring, which is a barrier to reading engagement. Students have found the motivation to read “uninteresting information texts” when teachers have used the “importance rationale” that emphasized that the reading was crucial to their future professions, which resulted in an increased amount of reading and knowledge (Jang, 2008). Indicators of behavioral engagement in reading have included a students’ effort management and self-discipline (Duckworth et al., 2007).

The Achievement Motivation Theory classifies a student's motivations as either undermining or affirming and depending on which motivation is at play, the student's reading behavior will respond accordingly. The undermining motivations that lead to avoidance include peer devalue, perceived difficulty, and antisocial goals, and the affirming motivations that lead to engagement include intrinsic motivation, value, self-efficacy, and peer value. Guthrie et al. (2012) created a self-report survey (Motivation and Engagement Scales) that measures students' reading motivation and engagement by looking at undermining and affirming motivations and dedication and avoidance behaviors of reading engagement.

Undermining Motivations. Undermining motivations can cause students to avoid reading and lead them to actively discourage others from reading as well. *Avoidance* is the negative construct of behavioral engagement in reading (disengagement) that involves having an aversion toward reading and minimizing the time and effort expended on it (Meece & Miller, 2001). Students who perceive reading as useless, do not see the value of reading and perceive that their peers disrespect them because of their reading practices and opinions are influenced by *peer devalue*. McInerney et al. (2005) showed that the more a student believed that their peers held negative academic goals for them, the lower their high school GPA. *Perceived difficulty* has been found to strongly impact the reading performance of older children and is portrayed by feeling incompetent and having a sense that tasks are hard (Chapman & Tunmer, 1995). *Antisocial goals* describe when a student is motivated to belittle their peer's reading (Guthrie & Coddington, 2009). *Devaluing* refers to a student's rejection of the importance of academic work and disidentification with schooling (Legault et al., 2006) that can result in a negative influence on grades in Language Arts (Strambler & Weinstein, 2010).

Affirming Motivations. Affirming motivations help students stay positively and behaviorally engaged in reading by continuing to put in the effort, attention, time, concentration, and persistence to improve their reading abilities (Fredricks et al., 2004; Guthrie et al., 2012; Guthrie et al., 2014; Kindermann & Furrer, 2009). Dedication is the positive construct of behavioral engagement in reading that involves persistence, effort, time expenditure, and intention to learn from reading (Guthrie et al., 2012). *Intrinsic motivation* (Self-Determination Theory; Ryan & Deci, 2000) creates inherent enjoyment and interest in reading that provides the student with self-direction and positive feelings related to reading that encourages the student to read often (Gottfried et al., 2001). Intrinsic motivation has been found to increase reading activity and reading achievement (Baker & Wigfield, 1999). *Value* (Expectancy-Value Theory; Eccles & Wigfield, 2002) occurs when a student sees the importance and usefulness of reading for their future (Trauwein et al., 2006) and is connected to students' academic choices (Wigfield & Cambria, 2010). Finding value in reading has been shown to increase students' reading activity and academic achievement (Durik et al., 2006). *Peer Value* (Activity Theory-Shared Cognitive Activity; Leontiev, 1981) is when a student perceives that their peers value their reading practices and opinions, transforming reading ability into a prosocial goal, and increasing a student's social interaction and achievement in school (Furrer & Skinner, 2003). Guthrie and Ho (2013) found evidence that peer value positively correlates with reading comprehension, fluency, and grades. *Self-efficacy* (Social Cognitive Theory; Bandura, 1997) is a student's belief that they have the reading ability and skills to perform reading tasks well, and their perceived competence has been shown to influence their expectations for success in the future (Chapman & Tunmer, 1995). Self-efficacy has been shown to increase reading achievement and reading activity (Baker & Wigfield, 1999). *Perceived competence* was also found to be an affirming

motivation in some research literature that focused on a student's belief in their capacity to complete reading tasks successfully (Schunk, 2003).

The National Reading Research Center outlined teaching strategies that teachers and students reported helped keep them engaged in classroom reading, such as using multiple reading documents (including texts chosen by students), and engaging students in peer group discussions around reading content (Bauman & Duffy, 1997). Peterson et al. (2000) noted that motivation, decoding print, comprehension, and transactions with texts have been the focus areas of research literature to improve high school reading instruction.

What Works Clearing House lists the following evidence-based interventions that have shown to help improve students' literacy skills, including alphabets, comprehension, fluency, literacy achievement) and can be used with high school student populations: READ 180 (4th-10th grade), Fast ForWord (K-10th grade), Reading Plus (5th -9th grade), Reading Apprenticeship (9th grade), Passport Reading Journeys (6th – 9th grade), Xtreme Reading (9th grade), LANGUAGE! (9th – 10th grade), and Advancement Via Individual Determination (AVID) (<https://ies.ed.gov/ncee/wwc/FWW>).

Computer-Assisted Instruction and Computer-Based Reading Programs

The research literature has addressed the lack of teacher training in evidence-based reading instruction, helping students stay engaged in school through reading interventions, and addressing the academic gaps due to the pandemic. It is a critical point in history for students to receive the individualized interventions they need to read proficiently. The National Reading Panel Report (National Institute of Child Health and Human Development [NICHD], 2000) recommended explicit instruction in phonemic awareness and phonics, vocabulary, fluency, and

comprehension. Research evidence is promising for using information and communication technologies (ICT) in the classroom.

Research completed by McCaleb (2020) demonstrated a shortage of teachers to provide adequate and individualized reading instruction for students. McCaleb investigated teachers' level of knowledge of the five components of reading (NRP et al., 2000) and their ability to apply knowledge to instruct students at risk for dyslexia, finding that, on average, classroom teachers lacked an understanding of phonemic awareness and phonics. Because phonemic awareness and phonics are the building blocks of basic reading skills, this area of concern needs to be addressed. It was found that the teachers teaching 3rd grade and above had less knowledge about teaching basic reading skills. This may impact their ability to teach students promoted to the next grade level but who have not mastered basic reading skills. Teachers must be trained in evidence-based practices to provide adequate grade-level reading instruction and acquire the skills to adapt their teaching methods to unique student needs.

The number of students who require intervention to read proficiently at grade level outnumbers the number of qualified teachers that can adequately teach reading. Depending on each teacher's postsecondary educational experience, they may not have received adequate instruction in scientifically based research on reading or how to implement evidence-based teaching techniques in their classroom (Smartt & Reschly, 2007). It would be ideal for every teacher to receive the necessary training to fill in their knowledge gaps, but there needs to be an alternative solution when that is not feasible. For school districts or schools without adequate funding to provide the training needs of the teachers and hire additional teachers, computer-based reading programs (computer-based differential model) can step in and teach the

appropriate and research-based reading strategies that are needed for each student, while simultaneously supporting the teachers in their teaching abilities.

During the COVID-19 lockdown, teachers and students had the experience of using technology to replace in-person academic instruction (involuntarily). Some negative impacts of technology use within the classroom have been supported in research, such as increased student distraction (Bates, 2019; Islam & Gronlund, 2016). Still, teachers can learn to use technology (voluntarily) to build off in-person instruction. Teachers play an important role in instruction, even with ICT instruction being used in their classrooms. For example, Savage et al. (2013) recognized that the teacher's level of knowledge in technology use and willingness to combine the ICT instruction and other reading instruction (entry, adoption, adaptation) with higher levels of integration leads to better academic outcomes. Classroom teachers continue to lead reading instruction with their class while implementing the ICT instruction. They can continue to build off what was taught on the online format through additional reading and group activities in the classroom to encourage student reading engagement.

Mishra and Koehler (2006) created the technology pedagogy and content knowledge framework (TPACK) modeled after Schulman's (1986) pedagogical content knowledge (PCK) model, with the addition of "planning for the use of technology" (Lauritzen, 2018). This framework keeps technology an integral tool within a teacher's lesson planning tool kit. It provides space for teachers to think about their knowledge of technology, how to build off what they already know, and more effectively incorporate technology into teaching activities (Koehler et al., 2013). Olofson et al. (2016) pointed out that the TRACK framework aligns more closely with the constructivist model of teaching, versus the instructivist model of teaching, by helping

students engage in their learning with a more active role in the process and providing teachers the tools to guide them within a technology-centric society.

The theory of student engagement for technology-based learning (Kearsely & Schneiderman, 1998) focuses on students working in collaborative teams and engaging in learning activities that are project-based and give back to the community. This theory also emphasizes that computer-based learning can complement traditional instruction and encourage communication among students. Research continues to examine how adding technology in the classroom influences the learning experience. For example, research has shown that the use of technology has the potential to transform teaching and lead to positive effects on student engagement, motivation, and achievement (Apiola et al., 2011; Cristia et al., 2017; Keengwe et al., 2012).

Computer-adaptive online reading instruction can be a vital tool in providing a high level of individualized reading instruction in all five components of reading to assist students in their progress toward reading proficiency. Within the research literature, there are various terms used to indicate instruction delivered through the incorporation of computer technology: computer-managed instruction, intelligent tutoring systems (ITSs), information communication technology (ICT), computer-assisted intervention/instruction/learning/technology/program, and computer-based technology/teaching/program. Bippert and Harmon (2017) learned that teachers' use of various computer-based reading programs within their classrooms varied and that preferences for which programs to use differed (Read 180, Istation, Achieve3000). The results of their study showed that more research is needed in this area to find programs that are effective, and teachers feel comfortable using them consistently after thorough training. Grant et al. (2012) and Edwards Santoro and Bishop (2010) reviewed several ICT-based beginning reading interventions to look

at how their content and design aligned with theoretically informed models of reading instruction, and their reviews were mixed. Some of the weaknesses that were noted by Grant et al. (2012) included a lack of developmentally appropriate and sequential presentation of instruction, an absence of scaffolded learning or computer-adaptivity in response to student performance, insufficient feedback in response to errors, and inconsistency in the quality of instruction from skill to skill. More research is needed to look at the structure and effectiveness of computer-assisted reading interventions.

Impacts on Reading Achievement

There are various reading intervention approaches that create blended learning environments with twenty-first-century technology teaching practices, and research has shown the positive impact that technology can have on self-efficacy (Jozwik & Douglas, 2016; Wijekumar et al., 2017) and reading achievement (Chatterjee & Kothari, 2014). In particular, CAI has been found to improve phonological awareness, word attack knowledge, word identification skills, and rapid naming/word fluency (Macaruso et al., 2006; Saine et al., 2011). The blending learning approach involves using a computer-assisted program consistently within a classroom, usually focusing on teaching the reading skills recommended by the National Reading Panel (2000) and Common Core State Standards (Schechter et al., 2015).

Cheung and Slavin (2011) researched the effects of technology use on reading achievement in students from Kindergarten to 12th grade by reviewing 85 research studies with over 60,000 students. Their research found that comprehensive models with reading technology and teacher professional development had larger effects on reading achievement than supplementary digital programs.

Pre-school and Elementary School. The majority of research in this area has focused on the implementation of these programs with pre-school and elementary school students, including LEAD21 (phonemic awareness, phonics, fluency, vocabulary, language acquisition, writing, comprehension, communication, and collaboration), Lexia Reading (phonological awareness & word attack), Core5 (phonological awareness, phonics, structural analysis, automaticity/fluency, vocabulary, and comprehension), then stopping at the 5th-grade reading level (Schechter et al., 2015). Savage et al. (2009; 2010; 2013) demonstrated the effectiveness of the A Balanced Reading Approach for Children Always Designed to Achieve Best Results for All (ABRACADABRA) web-based literacy system on improving students' phonological blending ability, sight word reading, letter-sound knowledge, phoneme segmentation fluency, and reading comprehension.

Other programs that have been shown to help students improve their reading achievement and/or reading attitudes include RAVE-O (Brann et al., 2014), Project LISTEN (Brann et al., 2014), ABCMouse (Zamora & Pittman, 2018), Starfall (Zamora & Pittman, 2018), Fluency Tutor (Lange, 2019), Reading Plus (Bright, 2020), IntelliTools (Howell et al., 2000), Read Naturally (Keyes, 2010), Headsprout (Pindiprolu & Forbush, 2021), Funnix (Pindiprolu & Forbush, 2021), iReady, Plato Focus, and Waterford Early Learning Program.

High School. The current study focuses on implementing a computer-based reading program within a high school classroom, providing more research evidence for an age group that has not received as much intervention and research exposure. There have been research studies that have included high school students in their research study sample, and computer-based reading programs that have been found to help this age group improve their reading achievement are outlined below.

READ 180. Boulay et al. (2015) completed a robust investigation to implement ten reading interventions with struggling readers and measure their effectiveness. The study found READ 180 to positively impact reading achievement in three studies with students in 6th- 9th grade (Swanlund et al., 2012; The Education Alliance at Brown University, 2012) and students age 15 through 25 (Loadman et al., 2011) that all had significant positive effects. This computer-based reading intervention focuses on vocabulary, comprehension, spelling, and oral reading skills.

Xtreme Reading. The Bouley et al. (2015) research study found Xtreme Reading to show potentially positive effects in improving student reading achievement among 7th-10th grade students within two studies, with one study that has significant positive effects and one study finding no effects (Faddis et al., 2011; The Education Alliance at Brown University, 2012). Xtreme Reading is a supplemental reading curriculum that focuses on vocabulary, decoding, fluency, reading comprehension, and social skills (Boulay et al., 2015)

Learning Strategies Curriculum. This program was found to have potentially positive effects by the Bouley et al. (2015) research study through the intervention administered to 6th - 9th-grade students that showed significant positive effects (Cantrell et al., 2011).

Voyager Passport Reading Journeys. This program was found to have mixed effects by the Bouley et al. (2015) research study through the interventions administered to 6th-9th-grade students because one study found positive effects while two studies found no effects (Dimitrov et al., 2012; Schenck et al., 2012; Vaden-Kiernan et al., 2012). Lessons are incorporated into direct teacher instruction and technology (whole-class, small group, independent reading, video segments, and independent computer-based practice) to improve reading comprehension, vocabulary, word study, and writing skills for 6th through 12th grades (Boulay et al., 2015).

Achieve3000. Keane (2018) showed an increase in critical reading (Lexile Level) for high school students with learning disabilities. Speed (2020) discovered a significant relationship between the average scores of the reading tasks and improvements in reading achievement, demonstrating that practicing reading skills through intervention activities can improve reading achievement if done in a quality manner.

LANGUAGE! This is a language arts intervention that is geared for 3rd through 12th grade students in a daily lesson format to work on phonemic awareness and phonics (Word decoding), word recognition and spelling (encoding), vocabulary and morphology (word meaning), grammar and usage (understanding the form and function of words in context), listening and reading comprehension, and speaking and writing (What Works Clearinghouse).

Fast Forward. A computer-based reading intervention that has been used with 9th and 10th grade students, which includes seven adaptive practice lessons to work on auditory and language processing skills to develop and strengthen the cognitive skills necessary for successful reading and learning (Temple et al., 2003). Temple et al. (2003) administered this intervention and after 20 hours of intervention, the students showed improvements in word identification, word attack, passage comprehension, oral language, and rapid naming skills.

Impacts on Student Engagement

The research literature is very limited regarding the relationship between computer-based reading programs, student engagement, and school climate within the high school population. The following programs have been used in previous research to investigate the impact on student engagement and school climate.

Reading Plus. Bright (2020) looked at the influence that Reading Plus had on above level and gifted readers and whether the intentions of the program aligned with the students'

perceptions of it. Reading Plus is a computer-assisted reading program for grades three through twelve that personalizes the intervention based on the performance of the reader and provides reading based on their interests (e.g., sports, technology) and progresses through the curriculum with the student (pre-reading, decoding, eye training, word recognition, comprehension, fluency, speed) (Bright, 2020). The program stands out from other programs because it incorporates the students' interests into the program (with challenge and choice) to keep them engaged, motivated, and challenged to build confidence and interest (Bright, 2020). The program focuses on the motivational domains of self-efficacy, self-confidence, self-improvement, and self-belief. Bright (2020) acknowledged that Reading Plus met the standards for a "quality personalized learning tool for reading development," but it lacked the higher-level content to challenge, engage, and motivate high-achieving students in the way it has been shown to do with struggling readers.

Achieve3000. Speed (2020) examined the link between high school student behavioral engagement and reading achievement after completing the computer-assisted instruction in Achieve3000. The number of reading assignments completed (time spent on intervention) did not correlate with reading achievement, which aligned with the findings of other researchers. The number of reading activities completed did not correlate with higher reading achievement, because some students completed many activities but did not do well on them. The quality of the performance on the activities had a more positive impact on the reading achievement. Research has demonstrated the difficulty in getting struggling readers to commit to the time and resources allotted to work on their reading skills, which causes the research samples of students to vary in the amount of time spent on the intervention and improvements made in reading achievements (Bauer-Kealey & Mather, 2019; Hudson et al., 2020). Lauritzen (2018) studied the influence of

Achieve3000 on the reading engagement of Native American high school students. Although the Lexile Levels of the students did improve throughout the study, reading scores and student reading engagement did not statistically improve.

Online Adaptive Reading Technology (OART). The OART is a digital reading software that is self-paced and interactive and includes reading content, progress monitoring, tools, learning resources quizzes, and instructor visibility (Fransescucci et al., 2021). The technology in the OART adapts to the reader's understanding of the text through progress monitoring and review of the content as the reader progresses through the reading material. If a student does not pass the quizzes with 100%, they are provided more material on the content to continue to learn the topic. A study by Fransescucci et al. (2021) looked at whether the OART strategies (e.g., cooperation with the instructor, tracking of progress, quiz mastery, direct feedback, self-directed learning pace) to foster the psychological functioning of the students (e.g., motivation, self-efficacy, self-confidence, sense of progress, initiative, follow through) also influenced their academic achievement. The results demonstrated that students who participated and completed all the assigned reading through the OART had higher test scores and levels of engagement. Regardless of whether they were students who began the intervention with sufficient initiative and motivation, the OART proved to be a positive reading comprehension tool for college students and could be used within the high school setting as well.

Recovering after School Closures

Before the COVID-19 pandemic, students were routinely falling behind in basic reading skills, but additional students were impacted by the difficulties of school closures and attending school fully online. In the spring of 2020, without forewarning, students and teachers were required to transition from an interactive in-person classroom environment to a virtual classroom

format to mitigate the spread of the coronavirus (National Center for Education Statistics, 2021). The Household Pulse Survey collected in 2020 by the Census Bureau, National Center for Education Statistics, and Department of Education showed that the pandemic impacted 99.6 % of students (age 18 and under) classes, and 72% had transitioned to a distance learning format using online resources (April 23- May 5 data collection). From May 28 to June 2, 80% of the children's distance learning was using online resources, and higher household income increased the likelihood of available online resources (computers; internet). Digital inequality continued to be prevalent during the pandemic. Schools and school districts provided computers, when possible, but lower-income schools struggled to fill the need of their students, so paper materials were provided to families. Schools and families had to be flexible and innovative when adjusting to the learning format of the pandemic. By September 2020, the online format continued, with 67% of the students' classes using online resources.

Rapaport et al. (2020) noted that the quantity and quality of academic instruction reduced due to the transition from in-class to online instruction, negatively impacting student participation (especially from low-income families). Attendance was impacted, which impacts fundamental academic skills, such as reading. Based on a research survey completed by 221 education researchers, it is predicted that academic repercussions from the pandemic will increase the achievement gap (an extra half-year behind) in reading between low-income and higher-income families (Bailey et al. 2020).

This quick shift required teachers to adapt their traditional instructional methods to integrate technological tools; some teachers without prior training or experience with teaching online or incorporating technology into their lesson plans. Live online instruction became more prevalent with video conferencing platforms, such as Zoom, Microsoft Teams, Google

Classroom and H5P. Some students switched to fully self-paced online classrooms without live instruction rather than attending traditional teacher-led instruction through live video conferencing. With the changes in a classroom format came adjustments to expectations of teacher and student interactions and relationships and student engagement (Willermark, 2021). The quality of engagement and participation of the students prior to the COVID-19 lockdown influenced their ability to transition to fully learning online and stay engaged. Still, even for the most engaged student, the abrupt transition to online learning could have decreased their level of engagement, because research has shown a trend of lower student engagement number during the virtual COVID-19 lockdown learning (when compared to pre-covid student engagement numbers) (Khlaif et al., 2021).

The virtual classroom environment allowed some students to attend school more frequently, showing that prior to the pandemic, there were previous barriers or expectations that had made attending school consistently more difficult. Teachers noticed that the virtual environment encouraged some students to be more actively engaged with their peers. Still, over time some students' participation decreased, preferring not to keep their microphones and video on. There was also concern over digital inequality because not all families could have a device available for each school-aged child in the home, families had to pay for internet, lack of technical support, and parents had concerns over screen time use (Khlaif et al., 2021).

Transitioning to a fully online classroom impeded on the school climate and the quality of the teacher-student relationships, because the details of the interactions (facial expressions and gestures) were missed in the technology-mediated classroom (Willermark, 2021). Willermark (2021) concluded that student interaction level can be maintained or increased in the virtual

learning environment, if teachers design their lesson plans for interactivity and use the technology proactively.

In response to the school closures of the COVID-19 global pandemic, What Works Clearinghouse (WWC) conducted a rapid evidence review of available distance learning programming in the United States in 2021. The goal was to provide a list of research-based academic interventions (using instructional technology) for students to continue learning from home while attending school remotely. Nine studies met the WWC Group Design Standards with or without reservations but did not meet ESSA Tier 1 rating requirements. MindPlay Virtual Reading Coach was listed as an automated and supplemental educational software program delivered to students through its fully online platform at some cost. The cited study was conducted by Kloos et al. in 2019 with elementary school students. The only intervention listed in the rapid evidence review that targeted literacy within the high school population (9th– 12th-grade students) was the Content Acquisition Podcasts (CAPs). This automated supplemental program could be delivered fully online.

MindPlay Virtual Reading Coach

There is a push to redesign remediation courses, and the use of technology in aiding the academic achievement of struggling students has not been thoroughly studied (Bettinger & Long., 2005). There has not been adequate research on computer-assisted reading interventions with struggling high school readers. The computer-assisted reading intervention, MindPlay Virtual Reading Coach (MINDPLAY®, 2006-2015), provides instruction and feedback unique to the user while working on all five components of reading as outlined by the National Reading Panel, as well as grammar. Previous research studies and publications have evaluated the impact of the MVRC on elementary, high school, and community college student reading development.

The research evidence for MindPlay Virtual Reading Coach has not reached the depth where it is listed as an evidence-based reading intervention within the What Works Clearinghouse, with research findings to support its effectiveness with students. There has not been a study completed that solely focuses on high school students and looks at student engagement and authoritative school climate. The following section will describe the origin of MVRC, the reading development theories that have contributed to its structure and curriculum, previous research on its impact on reading skills, engagement, and classroom climate, and how MVRC can help to address the problems that struggling high school readers face.

Origin and Structure

Judith Bliss created MindPlay Virtual Reading Coach (www.mindplay.com) after her own history of dyslexia with the hope of helping her son and other students with dyslexia (Chambers et al., 2013). MVRC is structured after the Orton-Gillingham Approach (OGA), Multimodal Instruction, and was influenced by reading specialist and speech pathologist, Jim Larrabee (Mann, 2017; mindplay.com). The Orton-Gillingham Approach is “a systematic, sequential, multisensory, synthetic, and phonics-based approach to teaching reading” (Ritchey & Goeke, 2006, p. 171). The MVRC Manual ((MINDPLAY®, 2006-2015, p. 14) states, “MVRC provides multisensory learning, engaging students visually, auditorily, and kinesthetically, in order to strengthen associations between learned content (Kast et al., 2007) and reduce memory demands on individual’s cognitive systems (Lowe & Sweller, 2005).”

The program started out as an in-person program focused on the adult population (1999; Larrabee’s Bridge to Adult Literacy), and then expanded to ages seven and up (2000; MindPlay Larrabee’s Bridge to Literacy). MindPlay Lifelong Learning Center’s focus shifted from in-person interventions to fully online instruction when it released the *Embedded Teacher*

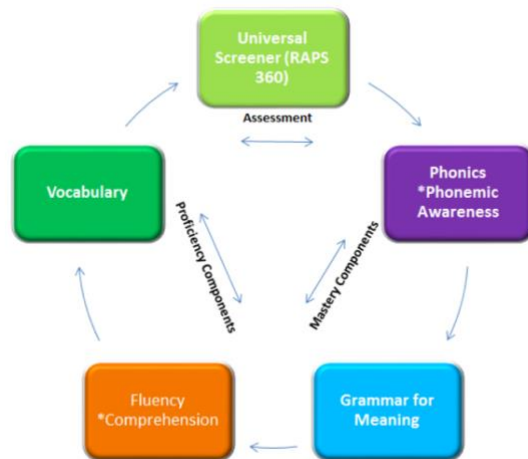
Intelligence: “My Reading Coach” (2003), “My Reading Coach Platinum” (2006), and “MindPlay Virtual Reading Coach” (2016). After the NRP Report was released, the MVRC curriculum was adjusted to focus on the areas that were emphasized by the National Reading Panel. Additional upgrades were completed in 2019, and in 2020 MindPlay added “Blended Learning” lessons so that teachers could provide additional support and intervention to struggling students. In 2021, Judith Bliss retired, and New Harbor Capital invested in MindPlay and acquired CF Educational Solutions, and foundational skills were added to the MVRC curriculum to support whole group phonological awareness instruction in the classroom. Then in 2022, “MindPlay Math” and “MindPlay Reading Ultra” (MVRC for adults) were launched. MindPlay has expanded and grown throughout the years, but the focus on providing science-based reading interventions has continued. Schneider-Richardson (2015) explained that MVRC “provides sequenced instruction consistent with the models of alphabetic and phonological development proposed by Ehri (2005) and Pufpaff (2009), as well as all of the instructional and interface design criteria identified by Bishop and Edwards Santoro (2006)” (p. 87). Research literature has continued to demonstrate the tie between systematic and explicit instruction in the sound-symbol correspondence of spoken and written language (phonics) to reading achievement, which is why the MVRC builds off that core skill (MINDPLAY®, 2006-2015). Because MVRC adapts to the strengths and weaknesses of each specific learner and their progress through the program, it is believed to foster instructional efficiency and student engagement through the interactive instruction model (Sims, 2003; MVRC Manual).

Using the computer-assisted reading intervention, MindPlay Virtual Reading Coach provides instruction and feedback unique to the user while working on all five components of

reading (1) phonemic awareness, (2) phonics, (3) fluency, (4) vocabulary, and (5) comprehension (National Reading Panel Report (National Institute of Child Health and Human Development [NICHD], 2000), as well as grammar. The program is self-paced, adaptive to student performance, and assessment-driven (three times per academic year). MVRC provides repeated exposure to the reading skills and concepts to help the student achieve proficiency and gathers progress monitoring assessment data every 14 days.

After a student completes the Universal Screener, the MVRC program will create an individualized syllabus (Prescriptive Reading Plan) with the specific lessons they need to master at 90% to advance through the program. The program requires mastery to confirm that students have gained the foundational skills before more advanced skills are introduced, which also promotes mastery (Guskey, 2010). As a student progresses through the educational content, the video instruction and remediation are delivered by virtual reading coaches (speech and language pathologists), with an emphasis on formative feedback versus corrective feedback because it has been shown to increase retention and decrease demands (Harris & Moreno, 2004). The Mastery level activities focus on phonemic awareness, phonics, and grammar, while the proficiency-level activities focus on fluency, vocabulary, comprehension, and spelling lessons. Figure 3 shows the process where students must achieve proficiency in the mastery level activities to progress to the next proficiency level of activities (MINDPLAY®, 2006-2015).

There is a built-in reward system that is based on student achievement and progress in the program that allows the student to receive coins for new program features, such as avatars and themes. Progress reports are sent to parents or teachers so that they can see the scores and time spent on the MVRC program to provide guidance to the students.

Figure 3*Mastery and Proficiency Components of MVRC*

The Universal Reading Screener (developed in 2004), Dyslexia Screener, and Math Screener are available on the website, with the full commercial program available to parents at home or educators at school to support students. The program description explains to teachers the following:

We do not replace teachers. We make them more successful. Our adaptive technology adjusts for each student’s individual skill level, giving them only the lessons they need. You receive real-time reporting on where your students are succeeding and struggling, allowing you to best serve your students. (mindplay.com)

It also explains to educators, “We supply you with the tools to measure your student and classroom performance. Our reporting is so easy. You’ll walk the halls with confidence every day knowing exactly how every classroom and student is succeeding” (mindplay.com). The website includes a platform titled, “MindPlay Academy Professional Development and Resources” that provides additional training for teachers and staff that facilitate the implementation of MVRC in their classrooms.

The MVRC program claims the program can help all readers, including students reading above grade level, at grade level, and below grade level to gain a range of reading skills that allow them to be engaged, motivated, and confident. It also reports being a good option for English Language Learners and students with profound reading challenges that need intervention and may be also receiving Special Educations services. As Kloos et al. (2019) pointed out, MVRC stands out from other computer-based reading programs, because it continues to be tied to teaching basic phonics and grammar skills, versus only focusing on increasing reading motivation through “content-rich activities of literacy,” which emphasizes that “training in foundational skills can improve reading fluency more so than mere reading practice” (Cordewener et al., 2018; Wise et al., 2000).

Impacts on Reading Achievement

Bliss participated in some research data collection to test out various aspects of the reading intervention and to make adaptations as necessary. In a 1998 research study Bliss demonstrated that the lower the level of reading that the middle school students began the intervention with, the longer amount of time it took them to complete the entire MVRC curriculum (34 hours was the average completion time). Still, regardless of the total time, all students showed improvements in their reading abilities. Then in 2000, Bliss completed a research study that showed MVRC could make a positive impact on high school students’ reading comprehension skills. In 2001 and 2002 Bliss et al. found evidence that MVRC was impactful for 2nd-grade students, and that the more lessons in the program were completed, the higher the reading improvement score.

Many of the research studies, publications, and articles that have looked at the impact of MVRC on reading achievement have involved elementary school students. As discussed in

previous sections of the literature review, preschool, and elementary-aged students are at the prime age to master basic reading skills. Still, many students require additional intervention after elementary school.

Elementary School. There is evidence for the efficacy of the MVRC with elementary school students (2nd grade) with improvements in reading fluency and spelling achievement following the completion of the reading intervention (Schneider et al., 2016; Schneider-Richardson, 2015). Students who completed 44 hours of intervention as part of Schneider-Richardson's dissertation study improved more than students in the comparison group. Additional dissertation studies have investigated the impact of MVRC on elementary school students' reading achievement in 2nd grade (Jensen, 2015; Mann, 2017; Sherrow, 2015), 3rd and 4th grade (Jensen, 2015; Reiser, 2018), and 5th grade (Jensen, 2015). Jensen (2015) did not find research evidence that MVRC positively impacted the students' reading scores. On the other hand, Reiser (2018) concluded that the students' scores on all the WJ IV reading measures (Broad Reading, Reading, Letter-Word Identification, Sentence Reading Fluency, and Passage Comprehension) improved from pre- to post-test for the intervention group after the 20-week MVRC intervention. Sherrow (2015) found spelling improvements for students who participated in the MVRC. In Mann's dissertation research study (2017), she examined the efficacy of MVRC with racially diverse and lower socioeconomic 2nd-grade students, including bilingual learners, and found that the program helped to increase the students' reading fluency, phonemic awareness, and comprehension.

Vaughn et al. (2004) looked at 2nd grade students and Vaughn et al. (2006) looked at 1st through 4th grade students and found that completing more of the lessons in MVRC reaped more reading skill improvements and that MVRC was highly beneficial for ELL students. Kloos et al.

(2019) found a significant effect between time spent on MVRC and improvements in reading fluency (more than in phonics or in listening vocabulary) in 2nd through 6th grade. They also concluded that the MVRC had a stronger effect on reading fluency than regular instruction and another online reading program in 2nd and 4th grade.

Elementary schools in Wisconsin, Arizona, Florida, Texas, Nevada, Arkansas, New Mexico, South Carolina, and Indiana and school districts in Wisconsin, Florida, and Indiana have shared the positive results of their elementary school students using the MVRC intervention. There has been a positive response to student improvement in reading achievement, and teachers who have implemented the intervention in their classrooms have mostly found the experience to be positive.

Middle School. Chambers et al. (2013) examined the impact of MVRC on middle school students' reading fluency by administering the TOSWRF before and after the students completed the MVRC curriculum. It was found that the MVRC program helped students improve in their reading fluency.

High School. Kloos (2019) discovered that the more time the students (3rd through 9th grade) from a high-poverty school district spent using the MVRC, the more improvements in their ELA assessment scores. Independent of their grade level, initial reading competence, gender, or identified ethnicity, students reaped benefits from their participation in MVRC. The type of school was a modulating factor in her research, with students attending non-failing elementary schools improving more than the students in the high schools, but further research is needed to study the structural barriers to MVRC learning.

Serido and Wilhem (2008) completed a research study with students in 1st grade through 12th grade at four elementary schools and one high school. They were able to show that MVRC

helped the students in the intervention group gain phonemic awareness and phonics skills more quickly than the students in the control group. Additional research is needed to build off prior studies (Kloos et al., 2019; Serido & Wilhem, 2008) in order to provide additional evidence for a reading intervention approach suitable for the high school student population.

Community College. Kealey (2017) examined how the MVRC improved community college students' reading achievement and reading attitudes after five weeks of the intervention. The students focused mainly on phonics and spelling due to their low levels of reading ability (rather than reading fluency and comprehension). The students improved significantly in phonics and spelling, as evident in the MVRC assessment of skills; the WJ ACH IV tests of Spelling, Word Attack, and Word Reading Fluency; and the TOSWRF-2 (Bauer-Kealey & Mather, 2018). Also, the students in the intervention increased their reading enjoyment level.

Study Variable: Student Engagement

Student engagement refers to students' motivation related to their academic and school-based efforts and the quality of their participation, involvement, and connections to school (Conner & Pope, 2013; Christenson et al., 2012; Fredricks et al., 2004; Fredricks et al., 2019). The following definition was offered by Reschly and Christenson (2012):

Student engagement refers to the student's active participation in academic and co-curricular or school-related activities and commitment to educational goals and learning. Engaged students find learning meaningful and are invested in their learning and future. It is a multidimensional construct that consists of behavioral (including academic), cognitive, and affective subtypes. Student engagement drives learning; requires energy and effort; is affected by multiple contextual influences; and can be achieved for all learners. (p. 816–817)

Skinner and Raine (2022) identified positive findings within the student engagement research literature that they believe have inspired researchers to continue focusing on this area of student development. They identified that student engagement has been shown to (1) predict academic outcomes (achievement, learning, performance, retention, and graduation), (2) protect against adolescent risks (e.g., dropout), (3) respond to intervention efforts, (4) and is understood as an important area of focus for teachers and school administration.

Types of Student Engagement

Research has varied on the number of dimensions within student engagement and how to define each dimension. There has been a consensus among student engagement researchers (Appleton et al., 2008; Fredricks et al., 2004) that Behavioral engagement, Cognitive engagement, and Emotional/Affective engagement are distinct areas of student engagement. Appleton et al. (2008) separated Behavioral engagement into Academic engagement and Behavioral engagement and have identified indicators for each subtype of student engagement: academic engagement (e.g., time on task and homework completion), behavioral engagement (e.g., attendance and classroom participation), cognitive engagement (e.g., self-regulation and value of learning), and psychological (affective) engagement (e.g., belonging and identification with school).

Mahatmya et al. (2012) noted the definitions that prominent researchers (Blumenfeld et al., 2005; Fredricks et al., 2004) created to define their conceptualization of the three subtypes of student engagement, which include the following:

Behavioral Engagement: Draws on the idea of participation; it includes involvement in academic and social or extracurricular activities. It is usually defined in three ways. The first entails positive conduct, as well as the absence of disruptive behaviors such as

skipping school. The second definition concerns involvement in learning and academic tasks and includes behaviors such as effort, persistence, concentration, attention, asking questions, etc. A third definition involves participation in school-related activities such as athletics or school governance. (p. 47)

Cognitive Engagement: Draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills. (p. 47)

Emotional/Affective Engagement: Encompasses positive and negative reactions to teachers, classmates, academics, and school, and is presumed to create ties to an institution and influence willingness to do the work. It refers to students' affective reactions in the classroom, including interest, boredom, happiness, sadness, and anxiety. (p. 47)

Overlap of Student Engagement and Motivation

The research literature has identified and examined the conceptual and theoretical overlap between constructs of motivation and engagement (Reschly & Christenson, 2012). There has not been a consensus made among researchers on whether student motivation falls within the student engagement construct (e.g., cognitive engagement) (Fredricks et al., 2004) or is a separate but related area of student intervention focus (Reschly & Christenson, 2012). Many believe that motivation is a precursor to student engagement while some argue that engagement cannot occur without motivation, identifying motivation as the intent and engagement as the action (Blumenfeld et al., 2006).

Research studies suggest that the interactions between teachers and students serve as an interpersonal context of student engagement. In a recent study, Tolinski (2015) found that

students' emotional and behavioral engagement correlates with students' perception of teacher affection, sympathy, dependability, and attention (e.g., high responsiveness and low demandingness). In contrast, classrooms with high demandingness and low responsiveness had less overall student engagement (Walker, 2008). Skinner and Belmont (1993) investigated how teacher behavior (involvement, structure, and autonomy support) influenced student engagement (behavioral and emotional) over the school year. They found that autonomy support and structure predict student motivation, creating a positive learning experience for the students. An interesting finding was that students who exhibited higher levels of student engagement at the beginning of the year received more positive teacher behaviors in class. Student engagement can influence teaching style, and teaching style can influence student engagement.

Teacher-Student Relationship in High School

Teaching styles impact the environmental and social factors of the classroom, such as a teacher's ability to provide their students with interactions that meet the developmental capacities and needs of their students, to promote their students' sense of belonging, motivation, and academic performance (Eccles & Roeser, 2011; Gillet et al., 2012). The transition to secondary school, including changes to relational, organizational, and instructional factors has been associated with a decrease in student engagement and the quality of teacher-student relationships (Eccles & Roeser, 2011). Unfortunately, with the change to the structure of the student's academic schedule, they encounter less time with teachers and instead switch teachers for each class period. This can lead to fewer opportunities to form quality teacher-student relationships, and teachers become less emotionally available and responsive and more focused on academic performance (Wang & Degol, 2016; Zimmer-Gembeck et al., 2006). As students reach adolescence and progress through high school, teacher-student relationships remain

important and a teacher's ability to provide feedback, scaffold, and acknowledge the student's perspective and ideas can positively impact their aspirations, sense of belonging, and competence (Hofkens & Pianta, 2022; Tillery et al., 2013).

Some research suggests that adult connections may become more vital in high school to help students stay connected as they go through the process of gaining more independence and desire to form meaningful connections (Wang & Eccles, 2013). Quality teacher-student relationships can serve as protective factors when students do not have strong parent or peer relationships (Allen & Kern, 2017; Shochet et al., 2011; Zimmer-Gembeck et al., 2006). It makes sense through a developmental and attachment framework that while an adolescent explores and takes risks behaviorally, cognitively, and socially at school, they would continue to rely on a secure base in the form of a positive teacher relationship that has been formed through positive and productive teacher interactions (Ainsworth, 1978; Bowlby, 1969; Hamre & Pianta, 2001; Hofkens & Pianta, 2022; Pianta, 1999).

When teachers respect and value their students, offer social support, and build positive rapport with their students they are making an impact on not only their academic functioning but also their social emotional functioning (Cemalcilar, 2010). Hattie and Yates (2013) ranked teacher-student relationships as a key contributor to student learning, and Allen and Kern (2017) found that teachers or staff relationships contribute significantly to students' sense of belonging at school. Teachers or staff who exhibit fairness and mutual respect, show that they care about their students, are available for their students, interact with their students in a positive manner, challenge their students to acquire new skills and master new situations, encourage their students' ideas, and serve as a resource for problem-solving more positively influenced their students' perceptions of school belonging (Allen & Kern, 2017; Roffey, 2012). Research literature

continues to identify teachers as important figures in the academic, social, and emotional development of students (Wang & Eccles, 2013), and when students perceive quality teacher-student relationships their academic participation and achievement increase (Sierens et al., 2009).

Teachers' expectations and interactions with students shape teacher-student relationships and classroom and school climate. For example, teachers who are supportive and affectionate to their students can create secure classroom climates that promote student confidence and positive academic risk-taking (Birch & Ladd, 1997). Skinner and Belmont (1993) found evidence for a reciprocal relationship between teachers' behaviors and student engagement. For example, teacher affection and dependability helped increase student happiness, enthusiasm, persistence through challenging work, and ability to recover after setbacks or failure because they felt that their psychological needs were met in the classroom (e.g., responsiveness) (Ryan & Patrick, 2001; Wang & Eccles, 2013). Previous research has shown that teachers' autonomy support improves student engagement in the classroom (e.g., self-determination theory; Reeve et al., 2004).

Such teaching styles, high in positive emotions, also foster better-coping strategies and more supportive adult relationships that positively influence classroom engagement and academic achievement (Allen et al., 2013; Reschly et al., 2008). Inayat and Ali (2020) examined the relationship between perceived teaching style (psychologically controlling or autonomous-supportive) and student engagement and found that teachers that exhibited more autonomous-supportive styles encouraged student engagement, curiosity, and exploration. After consistent and frequent positive and productive interactions with teachers, students are more equipped with the necessary skills and attitudes to manage academic challenges, but also feel safe to ask for

help or support when needed (Dawes & Larson, 2011; Eccles & Roeser, 2011; Patrick et al., 2007; Wang & Degol, 2016; Wentzel, 2009).

Student engagement has been found to be a protective factor that helps students to remain involved in school and feel connected to their school, teachers, and classmates. The research literature has demonstrated that students who struggle with belonging to their school, lack positive interactions and relationships with teachers and peers, and have peers that dropped out of school are more likely to drop out of school. Reeve and Lee (2014) examined student engagement (behavioral, emotional, cognitive, and agentic), course-specific motivation (psychological need satisfaction, self-efficacy, and mastery goals), and achievement in 313 high school students. Their findings suggest that student classroom engagement at the beginning of the semester can predict motivation in the middle and end of the semester and course achievement. Similarly, Alexander et al. (1993) investigated if indicators of student engagement early in a student's educational journey were predictive of dropping out of school prior to high school graduation. They found that students who ended up dropping out of high school had higher amounts of school absences in 1st grade than students who graduated high school, with each additional absence in the first grade increasing the likelihood of dropout by 5% (Alexander et al., 1993).

Adolescent Development

Mahatmya et al. (2012) investigated student engagement through the lens of adolescent development, considering the developmental tasks, opportunities, and challenges that adolescents encounter during that time in their lives. The research literature has shown a decrease in student engagement from elementary school to middle school and high school due to "poor person-environment fit," which means that the students' desire for more autonomy and relatedness is not

supported by the school structure (Eccles et al., 1993). Researchers argue that just when students' brains are increasing in the ability to self-regulate to thrive off intrinsic motivation, the educational system pushes extrinsic motivation (e.g., grades) on high school students which can negatively impact their developing cognitive engagement (Lepper et al., 2005; Gottfried et al., 2001; Mahatmya et al., 2012). With considerable focus on grades, there has been a rise in student academic anxiety and fear of failure, which has caused decreases in emotional and academic engagement in high school (Caraway et al., 2003). Davis et al. (2022) pointed out that as students get involved in academics and extracurricular activities, they can identify their interests and “start to think about possible future identities and consider how their future work will contribute to the world,” which can increase their engagement and motivation (p. 572).

Adolescence also involves a shift of focus on peer relationships, which has been shown to transfer into the classroom. For example, students may value academic achievement less because they value peer relationships more, causing them to invest more time into building friendships. Similarly, if a peer group does not value education it may negatively influence a student's views of school. On the other hand, students may get more involved with school extracurricular activities because of established friendships (or to make friends), which can increase their behavioral engagement, influence their sense of belonging at school (connect to other students with similar interests and life goals), increase academic achievement, and reduce the odds of them dropping out of high school (Davis et al., 2022; Feldman & Matjasko, 2005).

Student Engagement and Academic Achievement

Student engagement and academic achievement (performance, promotion, retention) can continue to influence one another as a student progresses in school (Griffith et al., 2022). Konold et al. (2018) examined the relationships among school climate, student engagement (cognitive

and affective), and academic achievement using a data set of 60, 441 students and 11,442 teachers. Their results indicated that schools with higher structure through teacher expectations and higher support through quality teacher-student relationships had students who reported more affective and cognitive engagement. They also found that academic outcomes were positively influenced by student engagement and that an authoritative school climate made a significant difference.

Marchard and Furrer (2014) examined the relationship between student engagement and reading achievement through questionnaires and reading measures with teachers and elementary school students. They found that student engagement was associated with better reading performance, especially among struggling readers in the sample. Another study by Galla et al. (2014) found evidence for the importance of student effortful engagement (e.g., self-regulatory behavioral engagement and effortful control) significantly predicted students' reading scores. These studies shed light on the importance of student engagement on academic achievement, particularly reading.

Measurement of Student Engagement

Considering the considerable impact that student engagement has been shown to have within schools (e.g., academic performance, behavior, mental health, high school dropout and graduation, and college enrollment) there has been a push for schools and teachers to measure student engagement to find the students academically at risk and then intervene where necessary (O'Donnell & Reschly, 2020).

Class grades and standardized achievement scores typically measure academic engagement, whereas class attendance, participation in extracurricular activities, and misbehavior measures behavioral engagement (Rumberger & Rotermund, 2012). Because

affective and cognitive engagement are more difficult constructs to measure through school data, the Student Engagement Instrument is a helpful tool to tap into the internal realm of student engagement (i.e., belonging, identification, and self-regulation) (Appleton et al., 2006). The survey addresses teacher-student relationships, peer support at school, and family support for learning to tap into student affective (psychological) engagement levels (perceived connection to others). Alternatively, to assess their levels of cognitive engagement (perceived relevance and motivation to learn), the students provide feedback on their future aspirations and goals, intrinsic motivation, and control and relevance of schoolwork. The creators of the measure conceptualize student engagement as a meta-construct and acknowledge that there is an overlap between their operationalization of cognitive engagement and some motivational concepts (e.g., intrinsic/extrinsic motivation, goal setting) (Fredricks et al., 2004; Reschly & Christenson, 2012). Sinclair et al. (2003) researched the Check & Connect intervention with high school students with emotional disabilities, which inspired the creation of the SEI.

Evidence-Based Interventions to Target Student Engagement

Researchers are actively investigating which interventions can help to increase student engagement with the most vulnerable students. Appleton and Silbergliitt (2019) demonstrated in their research how teachers and schools can translate student engagement data from the SEI into the intervention processes within the school, classroom, and teaching methods. They were also able to break down the results within the engagement of each individual student to put together a personalized intervention plan to work off the student strengths to improve their weaknesses and support their continued academic engagement academic. Cook et al. (2020) demonstrated in their research that a multi-tiered framework can be utilized to improve affective engagement to help all students maintain a strong baseline of engagement and then increased intervention for each

level of need. This approach could be used for all areas of student engagement as a framework for improvement at all levels of intervention.

Anderson et al. (2004) looked at the efficacy of the Check & Connect program with elementary and middle school students who had poor school attendance (low behavioral engagement). The quality and closeness of students' relationships with teachers and staff helped improve student engagement, both behaviorally and academically (better school attendance and preparedness). The model focuses on building relationship building, problem solving, and persistence.

Pohl and Nelson (2020) covered a myriad of strategies to help students increase in their cognitive engagement. One of the ideas that she posed was that students should learn how to view their effort, persistence, and growth positively, rather than just focusing on the end goal. This can be particularly important for students who are progressing slowly in an academic area and would benefit from recognizing their work ethic along the way. Struggling high school readers could reframe reading achievement and overall academic progress through a "growth mindset" to maintain engagement. Pohl and Nelson (2020) explained that mindsets impact students' ability to achieve their academic goals because mindsets shape their view of their academic skills as "fixed or malleable with effort," which influences their belief of what they are capable of and to strive to reach performance or mastery goals (p. 262). Overtime as students practice using a "growth mindset," they focus less on whether they fail or succeed, but more on their effort and hard work, which propels them forward.

Davis et al. (2022) explain how important it is to build the confidence of struggling high school students, because of their years of low achievement. As described within the self-determination theory literature, to feel academically motivated, students need to believe that their

efforts will amount to something (e.g., competence, self-efficacy), and this belief encourages them to remain engaged (Davis et al., 2022; Ryan & Deci, 2000; Schunk & Mullen, 2012). Of particular interest is how to spark engagement in high school students who are struggling academically, and then help them to maintain their engagement until high school graduation.

Study Variable: Authoritative School Climate

The U.S. Department of Education (2013) defined school climate as “a multi-faceted concept that describes the extent to which a school community creates and maintains a safe school campus, a supportive academic, disciplinary, and physical environment, and respectful, trusting, and caring relationships throughout the school community” (p. 2). The National School Climate Council (2007) stated that “school climate is based on patterns of people’s experiences of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures” (p. 4). The National School Climate Council (2007) also defined what a positive and sustained school climate involves a “sustainable, positive school climate fosters youth development and learning necessary for a productive, contributive, and satisfying life in a democratic society” (p.4).

Research has supported authoritative school climates, which exhibit disciplinary structure (demandingness) and student support (responsiveness; Cornell & Huang, 2016).

Teaching Styles

Teachers' interactions with students characterize teaching styles. They are described based on demandingness (e.g., behavioral and performance expectations) and responsiveness (e.g., warmth, support, positive feedback, and interest in students; Walker, 2008). Teachers who use consistent classroom management techniques that support student autonomy (e.g., demandingness) and show a personal interest in students (e.g., responsiveness) have an

authoritative teaching style, which correlates with better student social and academic adjustment (Walker, 2008). Authoritative teachers can provide their students with clear learning expectations and academic goals with structure and support so they can self-regulate their learning strategies and progress (Sierens et al., 2009). On the other hand, authoritarian teaching styles include consistent classroom management skills but lower support of student autonomy (e.g., higher demandingness) and less interest in students' personal lives (e.g., lower responsiveness). In contrast, permissive teaching styles are high in responsiveness (e.g., student support) and low in demandingness (e.g., inconsistent behavioral expectations or classroom management), resulting in a positive emotional environment with less organization and control. Walker (2008) demonstrated that although teacher responsiveness is important, teacher demandingness is also essential to learning. This teaching style correlates with lower academic achievement (Walker, 2008). Finally, the indifferent teaching style is low in responsiveness and demandingness, which creates a classroom with little emotional support or behavioral control (Chang, 2010). Pellerin (2005) found school-level indifferent socialization styles (based on the academic disciplinary approach) resulted in students with lowest academic engagement, compared to the three other socialization styles. Thus, teaching styles influence the overall school climate.

Walker (2008) examined the concept of parenting styles (authoritative, permissive, and authoritarian) in three teachers' classrooms to understand better the dynamics of the relationships and interactions between teachers and students. The research team completed teacher discourse analysis, teacher interviews, and student surveys to gauge teaching styles and compare them to parenting styles. The balance between demanding, responsive, supportive, and non-supportive statements differed based on the teaching style. For example, the authoritative teacher's dialogue

with students was 77% demanding and 97% supportive, with 23% of responsive speech and 0% of non-supportive speech, and demand statements focusing on management, tasks, and autonomy support. Like parenting styles, the authoritative teaching style had a balance of demandingness and responsiveness, with a tendency to emphasize high expectations and instill confidence in their students. Students in the authoritarian classroom reported higher self-handicapping, lower academic self-efficacy, and lower social self-efficacy compared to authoritative and permissive classrooms. The students in the permissive classroom had lower academic achievement. This study demonstrated that teaching styles encapsulate the way teachers interact with their students, like how parenting styles characterize parents' interactions with their children. The conclusions of this study showed that teaching style impacts teaching practices and student participation. Wentzel (2002) also examined the parallel between teaching styles and parenting styles, concluding that higher teacher expectations (demandingness) helped shape students' goals and interests, while negative teacher feedback (low responsiveness) negatively influenced student academics and social behavior.

Similarly, Turner et al. (2003) examined teacher discourse and student perceptions of affect and behavior in their classrooms. Classrooms with supportive instruction focused on student understanding, support for student autonomy and intrinsic motivation, positive affect, and collaboration benefited the students more (fewer student reports of negative affect and self-handicapping). These positive classroom qualities are consistent with the authoritative teaching style, high demandingness, and high responsiveness.

Birch and Ladd (1997) completed a critical study examining closeness, dependency, and conflict that influenced teacher-child relationships and student-school adjustment. They concluded that when students were too dependent on teachers, there were adverse effects on

school adjustment, academic performance, school attitudes, and engagement. The conflict caused students to have lower levels of school liking, self-directness, and cooperativeness in the classroom and higher levels of school avoidance. Teacher-student closeness helped increase academic performance, school liking, and self-directness. Based on self-determination theory, Reeve et al. (2004) investigated how supporting classroom autonomy can benefit student engagement. They found that the more the teachers encourage independence, the more engaged their students become.

Impact of Teaching Style on Academic Achievement

Allen et al. (2013) discovered that the quality of teacher-student interactions predicted the students' performance on achievement tests. In the study, the classrooms with a "positive emotional climate, sensitivity to adolescent needs and perspectives, use of diverse and engaging instructional learning formats, and a focus on analysis and problem-solving" influenced higher student achievement (p. 76).

Authoritative School Climate Model

Similar to the research literature on teacher-student relationships, the authoritative school climate model and theory are guided by the principles of authoritative parenting (authoritative discipline theory) by Baumrind (1968) (Konold & Cornell, 2015; Larzelere et al., 2013). In the same way that teaching styles describe interactions within a classroom, school climate describes overall interactions within a school. Research has demonstrated that an authoritative school climate is beneficial to students and their school, similar to the positive outcomes of an authoritative teaching style to students and their classroom. The classroom and school environment can model healthy relationships, communication, expectations, structure, and support that can guide students in their development of autonomy, independence, and identity

(Ryan & Patrick, 2001). In particular, high academic expectations coupled with a supportive high-quality teacher-student relationship can make a difference in the student's academic experience (Pellerin, 2005). Positive teacher relationships have been shown to improve student deviant behavior, school attendance and participation, academic achievement, and graduation (Reio et al., 2009). Walker (2008) concluded that demands for student autonomy, effective classroom management, and responsiveness produce the best environment for student engagement and learning. Because students spend one-quarter of their waking hours in the classroom, education research and policy have focused on learning how to engage students to improve their learning and development, and teacher-student relationships have been shown to play a vital role (Hofkens & Pianta, 2022).

Studies have shown the benefits of authoritative school climates. Cornell and Huang (2016) investigated the influence of an authoritative school climate with strict but fair discipline and supportive teacher-student relationships on student risk behavior. They found that the more authoritative the school climate, the lower the risk behavior. Huang et al. (2016) examined whether a demanding and supportive school climate would be a protective factor for academic achievement in students with one or no parents at home. With a sample of 56, 508 students, they concluded that student perceptions of disciplinary structure, academic demandingness, and student support (characteristics of an authoritative school climate) had positive associations with student grade point average (GPA). Pellerin (2005) found that high schools using authoritative practices had less truancy and fewer dropouts than schools using an authoritarian approach. Jia et al. (2015) also found evidence for the positive influence of teacher academic expectations and support on a high school student's ability to remain in school.

There has been a shift in the research literature to focus on improving high school climate because high school puts higher expectations on students and teachers expect more student autonomy and a greater time commitment from their students (Konold & Cornell, 2015). Because adolescence is a time of rapid changes developmentally and social emotionally, researchers believe that creating a supportive school climate can help protect students from additional academic stressors (achievement and motivation) (Wang & Eccles, 2013).

Measurement of Authoritative School Climate

The Authoritative School Climate Survey was created to measure student and teacher perceptions of demandingness (structure) and responsiveness (support) levels within individual classrooms and entire schools. It was also developed to gauge the influence that school climate has on student engagement and teasing, and bullying (Konold et al., 2014). The authoritative construct includes the Support domain, made up of the Student Support Scale (Respect for Students and Willingness to Seek Help) and the Structure domain made up of the Disciplinary Structure Scale and can include the Teacher Academic Expectations Scale. Some researchers have chosen to include the Teacher Academics Expectations Scale as part of the Structure domain and to calculate a total with the Disciplinary Structure Scale, while other researchers have decided to keep the Teacher Academic Expectations Scale separated from the total Structure domain. The Student Support Scale looks at how supportive teachers and other school staff members are of the students, including whether students feel respected (Respect for Students) and secure enough within their teacher-student relationships to ask for help when needed (Willingness to Seek Help) (Konold et al., 2014). The Disciplinary Structure Scale looks at whether school discipline is strict but fair (Konold et al., 2014). The Teacher Academic

Expectations Scale looks at the student's perception of whether their teacher has high academic standards for them (Konold & Cornell, 2015).

Authoritative School Climate and Student Engagement

School structure and support along with teacher emotional support influence behavioral, emotional, and cognitive engagement. Wang and Eccless (2013) examined middle school students' perceptions of the school environment, achievement motivation, and school engagement. This study provides more evidence for the positive impact of the school climate (school structure support and teacher emotional support) on students' achievement motivation and the three types of student engagement.

In addition, Lee (2012) demonstrated that an authoritative school climate (demandingness and responsiveness) is related to student engagement and student reading performance. Specifically, academic press (demandingness) and teacher-student relationships (responsiveness) impact behavioral and emotional student engagement, whereas teacher-student relationships (responsiveness) impact reading achievement.

Cornell et al. (2016) also established that an authoritative school climate in middle and high school can help to increase academic success at the school level (higher disciplinary structure → higher engagement and higher student support → higher engagement; grades) and student level (higher disciplinary structure & student support → higher student engagement; higher course grades; higher educational aspirations). Konold et al. (2018) also found that both structure and student support within a positive school climate increase high school student engagement, which then leads to higher student academic achievement. Their research sample included 60,441 students and 11,442 teachers in 298 high schools, so it provided more evidence that an authoritative school climate remains valuable in secondary school. Recognizing the

positive academic impact of the structure and support of the school and classroom can prompt schools and teachers to also intervene in these areas (rather than only focus on direct academic instruction) (Konold et al., 2018). They created a model to show the relationships among school climate, student engagement, and academic outcomes. They found that structure is directly associated with academic achievement, while the relationship between support and academic achievement was fully mediated by student engagement (Konold et al., 2018).

Konold and Cornell (2015) found evidence at the school and student level for the association between the two measures of support and the two measures of structure from the ASCS with higher student engagement (affective and cognitive) and lower peer aggression (prevalence of teasing and bullying) for both the student. This research study was pivotal because it demonstrated that the authoritative school climate model was relevant for high school students since the study sample was made up of 48,027 high school students from 323 public schools.

Thapa et al. (2013) completed a review of five essential dimensions of school climate: Safety, Relationships, Teaching and Learning, Institutional Environment, and the School Improvement Process. They highlighted the research literature that has found that school climate directly relates to academic achievement in high school (Lee & Bryk, 1989).

Barriers in High School Reading Interventions

As discussed in the previous chapter, the percentage of high school students meeting grade-level reading proficiency needs to improve. Struggling high school readers have been shown to have lower high school graduation rates (Reschly, 2010). Research literature has mentioned multiple barriers that have gotten in the way of high school students being able to

develop basic reading skills. These barriers are listed below, and how the current study believes MVRC helps remedy the current situation.

Barriers in Reading Interventions	What MVRC Can Do
There is a universal lack of teacher training to equip high school teachers to provide support and evidence-based curriculum in basic reading skills.	MVRC provides teacher professional development training and the platform to assist teachers in administering the MVRC curriculum for their students that is based on reading science.
High school readers are expected to have obtained basic reading skills to use in their content area classes to understand the material.	The MVRC provides instruction for basic reading skills and provides instruction in various ways to connect with each individual student. The program can help these students to understand the material and build the basic foundational skills before the higher-level reading skills. This can help them to build autonomy as they begin to master the basic reading skills that they have had difficulty with for so long (Ryan & Deci, 2009).
There is a shortage of qualified reading teachers to meet the need for reading interventions and there is not enough funding to support hiring additional teachers (e.g., lower SES areas).	School districts or schools can purchase the MVRC program for their students, which can increase the number of reading coaches available to students through the virtual format. There can be a focus on school-wide interventions to increase authoritative school climate.
There tend to be varying reading achievement levels among struggling readers, which results in each student progressing at a different rate. Heterogeneous deficits can make class format and group interventions more difficult.	MVRC can be used within a classroom setting, led by a teacher, while each individual student is progressing at their own pace within their individual program and plan. The virtual format can reach more students and each student can receive immediate feedback about their performance.
Struggling readers tend to avoid reading at school and at home.	MVRC provides structure and time requirements to help keep students committed and engaged. There is a classroom goal and an individual goal for time spent on the intervention. Because the teachers remain involved in the class and can monitor MVRC progress, they can also provide encouragement (Skinner & Belmont, 1993).
There tends to be lower student engagement among struggling readers.	The curriculum is structured around their progress, making it the right level to

	challenge them but not overwhelm them. The structure of the program helped to enable success, which has been found to be a positive aspect of individualized instructional approaches (Schunk & Pajares, 2009). There are rewards throughout the study to provide praise and encouragement for the students, which has been shown to help with student engagement (Brophy, 1981).
Struggling high school readers tend to not feel supported at school, which can result in lower motivation and lower grades (Li & Lerner, 2011).	There is a support system created within the virtual reading intervention and within the classroom with the teacher that is guiding the students through the program. Progress monitoring can help students to feel a sense of achievement and build their self-efficacy (Schunk & Zimmerman, 2007).
Struggling high school readers feel teachers do not expect much of them.	Collaboration between teachers and students empowers students to acquire literacy practices and cognitive proficiencies (Scribner & Cole, 1981) The program creates an individualized intervention plan to motivate the student and create built-in expectations for them. Collaborating and interacting with the program, the teacher, and peers in class can help to foster engagement and personal connection (Furrer & Skinner, 2003; Griffiths et al., 2012).

High school students who are at risk for dropping out of school would benefit from higher levels of engagement and improved school climates. Research literature has established the connection between difficulties in reading and lower student engagement, and researchers are interested in what can influence reading achievement and student engagement positively. The current study chose to investigate if participating in a computer-based reading intervention could improve student reading achievement, while simultaneously improving their levels of engagement and their perceptions of teacher expectations and teacher support. Schools can

intervene through various routes and more research in this area can identify which interventions can make the most impact.

CHAPTER 3: METHODOLOGY

Participants

Participants were selected by the principal and teacher at a local high school in Tucson, Arizona. The high school is an accredited public high school with an annual average enrollment of 190 students in 9th through 12th grade. The student enrollment numbers are kept low to foster positive student-teacher relationships within a personalized learning environment.

The participants were assigned to their groups (intervention and comparison groups) based on the school's reading achievement test; they were not randomly assigned. The eleven students who had the lowest reading scores on the assessment were identified for the reading support class and received the MVRC intervention. One student from the intervention group opted to leave the reading intervention class and not participate in the research study. The next group of low readers composed the comparison group; ten students taken from various classes. Two students did not submit the consent and assent forms, so they were removed from the comparison group. No students were classified as English Language Learners. The comparison group received the pre- and post-testing but did not receive the reading intervention. However, the students in the comparison group were invited to receive the program the following year at no cost. Table 1 summarizes the participants' demographic characteristics, including grade (44.4% 11th grade), gender (67.7% male), race (38.9% White/Caucasian), ethnicity (33.3% Hispanic or Latino), SPED classification (66.6%), and their score level on the AzMERIT ELA test (85.7% Level 1). The intervention group was 80% male, 70% 11th graders, and 70% students receiving Special Education Services. The age of participants was similar across the intervention and comparison groups. The 2018 Spring ELA scores ranged from 2504 to 2570 in the intervention group and

2502 to 2577 in the comparison group, showing a large range of scores in both groups due an outlier score above Level 1 in each group.

Table 1*Demographic Characteristics of Participants by Groups*

Characteristic	Intervention (<i>n</i> =10)		Comparison (<i>n</i> =8)		Total (<i>n</i> =18)	
	Number	%	Number	%	Number	%
Grade						
9 th	0	0	4	50	4	22.2
10 th	3	30	1	12.5	4	22.2
11 th	7	70	1	12.5	8	44.4
12 th	0	0	2	25	2	11.1
Gender						
Male	8	80	4	50	12	66.7
Female	2	20	4	50	6	33.3
Race						
American Indian or Alaska Native	0	0	1	12.5	1	5.6
Black or African American	1	10	2	25	3	16.7
White/Caucasian	4	40	3	37.5	7	38.9
2 or more race	5	50	2	25	7	38.9
Ethnicity						
Hispanic or Latino	4	40	2	25	6	33.3
Not Hispanic or Latino	6	60	6	75	12	66.7
SPED Classification						
None	3	30.0	3	37.5	6	33.3
Specific Learning Disability (SLD)	4	40.0	2	25.0	7	33.3
Other Health Impairment (OHI)	3	30.0	1	12.5	4	22.2
Autism	0	0.0	2	25	2	11.1
AzMERIT ELA						
Level 1	7	87.5 ^a	5	62.5 ^b	12	85.7 ^c
Level 2	1	12.5 ^a	0	0.0 ^b	1	7.1 ^c
Level 3	0	0.0 ^a	1	12.5 ^b	1	7.1 ^c

Note. Level 1= Minimally Proficient; Level 2= Partially Proficient; Level 3= Proficient. No

student scored Level 4 = Highly Proficient.

^aThis percentage reflects n= 8 for the intervention group; not all students completed testing.

^bThis percentage reflects n= 6 for the intervention group; not all students completed testing.

^cThis percentage reflects n=14 for total students.

As shown in Table 2, 50% of the participants had two parents living in their home, 38.9% were exposed to a language other than English at home, 83.3 % of parents graduated from high school, and 94.4% of students were expected to graduate high school.

Table 2

Individual and Family Characteristics as a Percentage of the Group or Total Sample

Characteristic	Intervention (n=10)	Comparison (n=8)	Total (n=18)
Parents Living in Home			
Two Parents	60.0	37.5	50.0
One Parent	40.0	50.0	44.4
No Parents	0.0	12.5	5.6
Language Other Than English Spoken at Home			
Yes	40.0	37.5	38.9
No	60.0	62.5	61.1
Parent/Guardian's Highest Level of Educational Obtainment			
Did not graduate from high school	10.0	25.0	16.7
Graduated from high school	40.0	62.5	50.0
Graduated from a two-year college or technical school	10.0	0.0	5.6
Graduated from a four-year college	40.0	12.5	27.8
Student School Expectations			
Might or might not graduate high school	0.0	12.5	5.6
Graduate high school	40.0	25.0	33.3
Graduate two-year college or technical school	20.0	12.5	16.7
Graduate four-year college	20.0	37.5	27.8
Complete post-graduate students after graduating from a four-year college	20.0	12.5	16.7

The comparison group did have a higher number of class period absences than the intervention group, which may be linked to their participation in the reading class. The intervention students may have been motivated to attend school to participate in the reading intervention. The intervention group had a mean of 3.8 excused absences for the reading intervention class, compared to the mean of 27.3 excused absences for total class periods.

Table 3

Vqvcn'Erucuu'Rgtkqf 'Cdugpegu'

Measure	Intervention (<i>p</i> =10)		Comparison (<i>p</i> =8)		Total (<i>p</i> =18)	
	Mean	SD	Mean	SD	Mean	SD
Unexcused Absences	13.80	16.26	25.25	49.17	18.89	34.20
Excused Absences	27.30	21.34	41.88	47.43	33.78	34.97
Medical/Court Excused Absences	00.20	00.63	01.63	3.81	00.83	2.60
Suspended Absences	00.70	2.21	0.00	0.00	00.41	1.70

Table 4

Vqvcn'Tgcfkpi 'Erucuu'Cdugpegu'ltq 'Kpvgtxgpvkqp'I tqwr 'Uwf gpvu'

Measure	Mean	SD
Unexcused Absences	1.90	2.64
Excused Absences	3.80	2.90
Medical/Court Excused Absences	0.10	0.32
Suspended Absences	0.20	0.63

Reading Intervention: MindPlay Virtual Reading Coach (MVRC)

MVRC was developed to offer engaging and dynamic individualized reading instruction by reading specialists and speech pathologists (their online virtual reading coach) through a computer. The program is meant to engage the students visually, auditorily, and kinesthetically, providing a multisensory learning experience (MINDPLAY®, 2006-2015). Based on the students' performance on the automated screener that covers the critical areas of reading

identified by the National Reading Panel (NRP), the program creates customized lesson plans tailored to students' strengths and weaknesses. The program adapts and progresses based on the students' progress, and the students receive immediate and specific feedback on their performance. The lessons were adapted and designed to help each individual student master the five critical elements of literacy instruction: phonemic awareness, phonics, fluency, vocabulary, and comprehension (MINDPLAY®, 2006-2015). For each student to progress to the next lesson (new concepts and skills), they had to reach 100% accuracy on the current lesson (initial concepts and skills). (MINDPLAY®, 2006-2015). If needed, MVRC focused on the mastery of phonemic awareness and phonics, which are essential for advancing reading abilities (MINDPLAY®, 2006-2015).

The MVRC manual defines phonemic awareness as “a subtype of phonological awareness, or understanding of the sound system of spoken language,” phonics as “knowledge of the correspondence between speech sound and the orthographic (spelling) patterns in written language,” fluency as “the speed and accuracy of reading,” vocabulary as “knowledge of the body of words used in a particular language,” and comprehension as “the ability to understand the message and meaning of the written text” (p. 14).

In the current study, ten participants used the MVRC in a remedial reading class at a high school for a goal of 150 minutes per week. The teacher discussed the intervention with the parents during the parent's night at the beginning of the 2017 academic year. At the beginning of the program, the weekly goal was to have each student access the reading program five times a week for 30-minute sessions (3 days in school and two days at home) with a laptop provided by the school. This approach was adjusted throughout the program to two 60-minute class sessions using the intervention and completing the remainder 30 minutes from home. Due to internet

connectivity issues at home and drops in the participants' motivation, it became essential to have the students fulfill most of the weekly intervention minutes in class with their peers while under teacher supervision.

MindPlay Virtual Reading Coach was implemented into the high school's remedial reading class curriculum, and the intervention class began using the MVRC program (on their own under the direction of the teacher) at the end of August. Once the IRB for the current study was approved in September 2017, the researcher was able to collect the student consent/assent forms and administer the study measures.

Throughout the implementation of the study, the researcher, the teacher, and the MVRC team discussed ways to help motivate the intervention group students. At the beginning of the study, the researcher and a member of the MVRC team met with the teacher to review the intervention process and what to expect. She was also trained to read the MVRC data to monitor her students' progress. The researcher communicated regularly with the teacher to support and encourage throughout the intervention process. Examples of these interactions and efforts to increase fidelity are documented below.

In September, the teacher expressed concern that her students were losing interest in the intervention because they deemed it too easy. The MVRC staff member continued to support the teacher to help her interpret the error reports and student progress to describe that to the students adequately. An additional MVRC staff member visited the classroom in October to offer encouragement and technical support for the program. At this point, it was decided to complete more of the intervention time in the high school library computer lab due to internet connectivity issues in the classroom. The program started at very basic reading levels, and to progress, students had to show mastery of the material. The teacher monitored the students' progress and

the fidelity of intervention completion through usage and error reports provided by MVRC. The teacher followed where each student was in the curriculum, how much time they committed to the intervention, and their error rates. The reading teacher used multiple strategies to help her students stay engaged in the reading intervention, such as teaming them up with mentors, connecting with them, offering incentives, and sharing their progress. She offered a class pizza party in September and a field trip to Get Air in December if the class could reach 10 hours per person.

By December, the researcher received mixed feedback from the teacher regarding student motivation and her efforts to encourage them. “The time is working a little better. The kids are still lacking the self-motivation we need to achieve what we need them to. I am feeling discouraged in trying to figure out how to motivate them. It comes down to their need to see why and how it is important to them.” Some factors that interfered with students spending more time on the intervention included receiving outside tutoring, the distraction of YouTube and other websites, and trouble motivating a student even to log in. The teacher requested that the researcher gather information from her students about their motivation and preferred reinforcement strategies. The researcher administered a motivation and reinforcement survey online on Qualtrics to the intervention students to learn how to motivate them to complete the intervention. Some things that the students reported as encouraging to come to their reading intervention class included “having a great teacher and the people in the class.”

On the reinforcement survey, five students reported that they were reinforced through Adult Approval, three students preferred receiving Independent Rewards, and two were reinforced through Peer Approval. The researcher shared these results with the teacher and attempted to provide preferred reinforcement methods. Nine of the students reported feeling

motivated to improve their reading skills to “help go through life, [they] need it, and [they] need to expand their vocabulary.” Some students reported that the MVRC program was “sometimes boring” and “[they] were not sure why [they] wanted to improve their reading skills.” At this point in the intervention, 60% of the students reported being slightly (n=4), moderately (n=1), or extremely satisfied (n=1) with the reading intervention. Seventy percent found the intervention slightly challenging, 20% found it moderately challenging, and 10% found it very challenging. One student reported not learning anything at all from the intervention, while the rest of the students said that they were learning a little (n=3), a moderate amount (n=4), a lot (n=1), and a great deal (n=1). Some motivating reasons for completing the MVRC included, “It will help me” and “Because we go places fun.” Other students noted, “I feel that the system is a great program, but it doesn’t really reach out to me,” and “I’m just not really motivated to do anything.”

When asked for ideas to help motivate them to complete the required 2.5 hours per week of the intervention, the students recommended receiving awards, help to remember, and food. Unfortunately, some students reported “nothing really” and “I would feel more motivated once I get my life together.” The teacher previously had discussions with her students regarding the role of detractors, passives, and promoters within organizations and likened the roles within her class to encourage each student’s part in working on the intervention. Forty percent of the students identified themselves as detractors, 40% as passives, and 20% as promoters when asked about their effort in completing the MVRC. Unfortunately, when asked about their roles in completing the 2.5 hours of intervention per week, 80% identified themselves as detractors.

To motivate the students to complete their MVRC minutes and help increase fidelity, the teacher instituted a reward system in class. If the class could complete their intervention minutes by Friday, they could have free choice on Friday. Otherwise, they would use that time to make

up their reading intervention minutes. There had been internet connection issues in their classroom, so the class schedule was adjusted to 1 hour of MVRC Tuesday and Thursday in the library computer lab. The teacher was concerned that her students were not able to see their growth. She shared the following with the principal investigator:

It was a self-fulfilling motivation issue- because the more they do, the more growth they would see, but because they are not doing time, they are not getting the results. The hard thing is helping them understand this. I think it is something they will have to see, and that means that I have to keep trying other motivators to get them to put in the time.

As December progressed the teacher began to see improvements in her students and shared their growth with the principal investigator in the following electronic exchange:

This group has come a LONG way. They are more of a community than ever; they trust each other, and they are starting to take real risks in front of each other and support each other through them. Last week on Monday, I broke them into two teams and gave them a strategy game they had never played before. They had to figure out the rules together and be able to play the game. I knew it would be complicated; I did not know just how complicated. But what I watched them do was struggle aloud and help each other. This is huge. Students, especially at this age, do not want anyone to know how much they struggle with reading. The fact they were struggling aloud and publicly shows they trust each other. I am not sure where these behind-the-scenes moments fit your research, but they should. There is so much more to the learning process than what their assessments say on the online program. That being said, I know how important the time spent on the program is for you and my students.

In January, the teacher requested to meet with the researcher to put together strategies to increase fidelity. The researcher participated in reading games during data collection days, such as Bananagrams, to build rapport with the students in the reading intervention class. The researcher also sent emails to the intervention students to provide positive reinforcement in the form of praise and encouragement. It was essential to the reading teacher that the students connected with the researcher and understood her commitment to their overall learning. The teacher shared the following with the principal investigator:

The students need to know the purpose and how it helps them. It has taken me months to build the relationship that I have with them right now, and it is a delicate one. These students have been marginalized and disengaged from their educations for most of their lives. They sit in rooms and do not have access to the knowledge because they cannot read and comprehend it. They hate school and let me know that daily. These are all the things we have to overcome before asking them to engage in a computer program and assessments.

On February 21st the researcher, teacher, and the class took a field trip to meet the creator of MVRC, Judith Bliss. She spoke with the students and commended them on their progress thus far in the reading intervention. She also discussed the research showing how MVRC can help students like them and encouraged them to continue in the program. She offered a \$25 gift card per intervention student who could reach 40 hours of intervention time by April; 6 of the students met this goal, with one going 50 hours. In March, the teacher continued to add reinforcing activities to her class schedule to keep her students engaged, such as a team-building challenge. She reflected, “Who knows what seeds are being planted and when the light will go on.”

Measures

Student Record

English-language learner (ELL) status, special education (SPED) status, attendance, and Reading and Writing composite scores from the 2017-2018 AzMERIT tests were collected from the students' records. The researcher received this information from school records for the 2017-2018 academic year. The school assessed the students' reading abilities using the Test of Silent Word Reading Fluency (TOSWRF-2), Spelling, Word Reading Fluency, and Sentence Reading Fluency (from the Woodcock-Johnson IV), and the Test of Word Reading Efficiency (TOWRE-2). The school-administered reading measures were provided to the researcher in September 2017.

Reading Achievement Measures

The pre-intervention reading scores for each participant included September 2017 reading achievement scores from the school records (TOSWRF-2, WJ IV Achievement Spelling, Word Reading Fluency, and Sentence Reading Fluency) and September 2017 reading assessment scores collected as part of the study. In September 2017, the researcher and graduate students administered individual reading measures to the intervention and comparison groups, including WJ IV Achievement Word Attack and Letter-Word Identification. After the reading program in May 2018, the researcher and graduate students administered individual reading measures, WJ IV Achievement Word Attack and Letter-Word Identification, and the TOWRE-2 to the intervention and comparison group students. The following measures were administered in group format: the TOSWRF-2, WJ IV Achievement Spelling, Word Reading Fluency, and Sentence Reading Fluency. Unfortunately, three students did not complete the TOSWRF-2 correctly (1 pre-test and 2 post-test), so their scores were not valid and were removed from the data.

May 2018 reading assessment scores from the study serve as the post-intervention reading scores for each participant. These measures were deemed appropriate to gauge the reading abilities of the participants because of the measures' high validity. The subtests were chosen to measure the areas of phonological awareness, decoding, reading fluency, reading rate, and spelling.

The researcher and graduate student assistants were extensively trained in administering and scoring psychoeducational standard assessments throughout their graduate training in a school psychology graduate program. The researcher met with the assistants to review the specific measures administered in this research study. They were deemed competent to administer and grade the assessments.

Woodcock-Johnson Tests of Achievement, Fourth Edition

The Woodcock-Johnson Tests of Achievement, Fourth Edition, measures the areas of reading, mathematics, written language, and knowledge to gauge students' academic achievement. The achievement battery was co-normed on a stratified random sample of 7,416 participants aged 2 to >90 years (Schrank et al., 2014). Mean alternate form and test-retest reliabilities across all age groups for Basic Reading Skills, Basic Writing Skills, and Phoneme-Grapheme Knowledge ranged from .94 to .95. The Woodcock-Johnson Tests of Achievement, Fourth Edition are standardized, well-researched and well-validated measures. Additionally, the tests selected were normed and developed for the assessment of students who are demographically similar to the participants in the research study. Age norms were used for all the standard scores.

Given the focus of the current study on the areas of reading and spelling, the following tests were used: Letter-Word Identification, Spelling, Word Attack, Sentence Reading Fluency,

and Word Reading Fluency. The Basic Reading Cluster (BRC) comprises the tests Letter-Word Identification and Word Attack. The Reading Rate Cluster (RRC) includes the Sentence Reading Fluency and Word Reading Fluency tests.

Letter-Word Identification measures an aspect of reading decoding by requiring students to identify and pronounce isolated letters and words. The alpha coefficient for the reliability of this subtest was reported to be .94 (McGrew et al., 2014). Spelling measures the ability to spell dictated words and requires the students to write the correct spelling of words presented orally. The alpha coefficient for the reliability of this test was reported to be .92 (McGrew et al., 2014). Word Attack measures phonological and orthographic coding aspects by requiring the participants to apply phonic and structural analysis skills to pronounce phonically regular nonsense words. The alpha coefficient for the reliability of this subtest was reported to be .90 (McGrew et al., 2014).

Sentence Reading Fluency measures reading rate by requiring students to read and comprehend simple sentences and then decide if the statement is true or false by marking yes or no with a 3-minute time limit. The alpha coefficient for the reliability of this subtest was reported to be .94 (McGrew et al., 2014). Word Reading Fluency measures vocabulary knowledge and semantic fluency by requiring students to mark two words that go together in a row of four words with a 3-minute time limit. The alpha coefficient for the reliability of this subtest was reported to be .92 (McGrew et al., 2014).

Test of Silent Word Reading and Fluency, Second Edition

The Test of Silent Word Reading and Fluency, Second Edition (TOSWRF-2; Mather et al., 2014) measures each student's ability to recognize printed words (sight words) accurately and efficiently by requiring them to draw slashes between words in a line of words in a three-

minute time frame. The TOSWRF-2 was normed on a nationwide sample of over 2,429 participants, ranging from six years and three months to 24 years and 11 months. The test re-test and alternate form reliabilities ranged from .84 to .91 (Allen et al., 2013). The TOSWRF-2 is a standardized, well-researched, and well-validated measure. Additionally, TOSWRF-2 is normed and developed for the assessment of students who are demographically similar to the participants in the research study. All scores were converted into standard scores to compare the students' scores to other students their age.

Test of Word Reading Efficiency, Second Edition

The Test of Word Reading Efficiency, Second Edition (TOWRE-2) comprises two subtests, Sight Word Efficiency, and Phonemic Decoding Efficiency. Sight Word Efficiency assesses the number of real printed words that can be accurately identified within 45 seconds, while Phonemic Decoding Efficiency measures the number of pronounceable printed nonwords that can be accurately decoded within 45 seconds. The TOWRE-2 are standardized, well-researched and well-validated measures. Additionally, the tests selected were normed and developed for the assessment of students who are demographically similar to the participants in the research study. All scores were converted into standard scores to compare the students' scores to other students their age.

MVRC Data

The MVRC program has embedded assessments, including before and after the program. The records kept by the school and MVRC program were provided to the researcher from August 2017 to May 2018 (the duration of the intervention). It included the frequency and duration of individual students' use of the MVRC online reading intervention, measured using software usage logs generated by the MVRC product. These logs are generated automatically every time a

participant uses the MVRC product. The program monitored reading progress by gauging levels of independent reading comprehension, words read per minute (fluency), phonics level, and listening vocabulary.

Table 5 reports total use, daily use, fidelity percent, and the dates of each student's first and last log-in into the MVRC program. The fidelity percentage reflects the amount of time completed out of the expected goal (76 hours 35 minutes (4,595 minutes, 150 minutes per week). The fidelity percentages ranged from 37% to 78%. Table 6 includes the duration of use of product components in minutes and individual students' progress toward achievement targets.

Table 5

MVRC Usage Data for Individual Students in Intervention Group

Data Category	Total Use	Daily Use	Fidelity	Start/End Date
Student 1	51 h 50 min	12 min	75%	8/28/17 - 4/30/18
Student 2	31 h 28 min	7 min	46%	8/28/17- 4/19/18
Student 3	25 h 43 min	6 min	37%	8/28/17- 5/10/18
Student 4	42 h 30 min	10 min	62%	8/28/17 – 4/19/18
Student 5	43 h 58 min	10 min	64%	8/28/17- 4/19/18
Student 6	28 h 10 min	6 min	41%	8/28/17 – 4/19/18
Student 7	37 h 10 min	8 min	54%	8/28/17- 4/19/18
Student 8	45 h 45 min	10 min	66%	8/28/17- 5/8/18
Student 9	45 h 46 min	10 min	78%	10/2/17 - 4/19/18
Student 10	39 h 26 min	9 min	57%	8/28/17 - 4/19/18
Group Mean	39 h 10 min			
Group SD	8 h 29 min			

Table 6*MVRC Usage Data for Intervention Group*

Data Category	Min	Max	Mean	SD
Duration of Use - Min	1543.00	3110.00	2350.40	508.62
Baseline Percentage	3.00	9.00	6.10	1.85
Percentage Gains	15.00	64.00	44.90	15.25
Achievement Percentage	18.00	73.00	51.00	16.89
Frequency of Daily Use - Min	6.00	12.00	8.80	1.99

Note. Baseline Percentage = the amount of the grade-level specific curriculum the students were considered to have mastered based on Phonics Test # 1 in MVRC. Percentage Gains= how much of the curriculum the students completed since the completion of the latest test set in MVRC. Achievement Percentage = the amount of the grade-specific curriculum requirements the students completed.

Online Survey

The online survey was administered to both the intervention and comparison groups in September 2017 and May 2018 using Qualtrics (<https://uarizona.col.qualtrics.com/>). The researcher and graduate assistants read the items in the online survey to the participants during administration.

Demographic Survey

Student demographic data, including student identification number, grade, sex, age, and race, were collected from the online demographic survey in September 2017. Other information gathered included parents living in the home, language spoken at home, expectations about school achievement, and parent education levels.

Student Engagement

The Student Engagement Instrument (SEI) measured the students' cognitive and affective engagement. This measure was designed and influenced by the Check & Connect intervention

model (Christenson et al., 2008). The SEI consists of 35 items on a 4-point Likert Scale (1=Strongly Disagree to 4=Strongly Agree). Affective Engagement comprises subscales that include Teacher-Student Relationships, Peer Support at School, and Family Support for Learning. Cognitive Engagement comprises Control and Relevance of School Work, Future Aspirations and Goals, and Intrinsic Motivation. Examples of items include: “My teachers are there for me when I need them” (*Teacher-Student Relationships*); “Other students at school care about me” (*Peer Support at School*); “When something good happens at school, my family/guardian(s) want to know about it” (*Family Support for Learning*); “When I do schoolwork I check to see whether I understand what I’m doing” (*Control and Relevance of School Work*); “I plan to continue my education following high school” (*Future Aspirations and Goals*); “I’ll learn but only if the teacher gives me a reward” (*Intrinsic Motivation*). The SEI has been found to have internal consistency estimates ranging from $\alpha = .72$ to $\alpha = .88$ using Cronbach’s alpha (Appleton et al., 2006).

From the Student Engagement Instrument (SEI), the following scores were included in the analyses: (1) Affective Engagement consisting of Teacher-Student Relationships, Peer Support at School, and Family Support for Learning, (2) Cognitive Engagement consisting of Control and Relevance of School Work, Future Aspirations and Goals, and Intrinsic Motivation, and (3) SEI Total (made up of Affective Engagement and Cognitive Engagement).

Authoritative School Climate

The Authoritative School Climate Survey (ASCS) measures the students’ perception of the school climate and academic expectations. This measure was influenced by the authoritative school climate theory that stresses the importance of structure and support within a school (Gregory & Cornell, 2009) as well as the concept of authoritative parenting (responsiveness and

demandingness, Baumrind, 1968) (Cornell, 2017). The ASC has been deemed appropriate to use on an individual student level or a school level (Cornell, 2017).

The School Disciplinary Structure Scale (7 items), the Student Support Scale – Respect for Students subscale (4 items), and the Student Support Scale- Willingness to Seek Help subscale (4 items) make up the Authoritative School Climate measure (15 items). The ASC also has a 5-item Academic Expectation Scale that can be included within the Authoritative School Climate total or interpreted as a separate construct. It was used as a separate construct within the current study. The survey items are rated on a 4-point Likert Scale (1=Strongly Disagree, to 4=Strongly Agree). Examples of items include: “The school rules are fair” (*School Disciplinary Structure Scale*); “My teachers and other adults at this school care about all students” (*Student Support Scale- Respect for Students subscale*); “There are adults at this school I could talk with if I had a personal problem” (*Student Support Scale- Willingness to Seek Help subscale*); “My teachers expect me to work hard” (*Academic Expectations Scale*). Konold and Cornell (2015) reported the following internal consistency estimates: $\alpha = .36$ to $\alpha = .75$ for the School Disciplinary Structure Scale; $\alpha = .85$ to $\alpha = .87$ for the Student Support Scale – Respect for Students subscale; $\alpha = .63$ to $\alpha = .81$ for the Student Support Scale-Willingness to Seek Help subscale; and $\alpha = .48$ to $\alpha = .93$ for the Academic Expectation. Overall, the ASCS has been found to demonstrate reliability and validity (Konold & Cornell, 2015).

Intervention Engagement Survey

The researcher administered a Social Validity Measure to the teacher at the termination of the MVRC intervention class. This was to gather teacher feedback on implementing the intervention with students. The Primary Intervention Rating Scale (Lane et al., 2002; IRP-15; Witt et al., 1985) comprises 15 items on a 6-point Likert Scale (1=Strongly Disagree,

2=Disagree, 3=Slightly Disagree, 4=Slightly Agree, 5= Agree, 6 = Strongly Agree). Examples of items include: “Most teachers would find this intervention appropriate for children with similar needs”; “I liked the procedures used in this intervention.” The Adapted Version of the Intervention Rating Profile-15 has been found to have internal consistency of .97 (.98 for 2 items) at the high school teacher level using Cronbach’s alpha and item-total correlations ranging from .57 to .91 (Lane et al., 2009).

Procedures

The Human Subjects Protection Program at the University of Arizona approved the procedures and measures of the research study. An external site authorization letter was obtained from the principal. The principal confirmed that additional approval from a school district was not necessary.

Parents completed a consent form to allow their children to participate in the study. The consent forms were distributed to parents at a parent information night held at school and were also sent home with the students to be returned to the researcher (the discretion was up to the teacher). The form described the purpose of the research study, the voluntary nature of participation, and other information about the involvement. In addition to the parental consent, students completed an assent form before the first day of data collection. There was one student over 18, so that student completed a consent form. The teachers administered these forms; they read the assent form for students as needed. Students were informed that the reading intervention they participated in was part of a research study and would participate in the pre- and post-test measures. Students were also told that they could withdraw from the study with no penalty or negative feelings and remain in the reading program if they chose to.

The school provided laptops (and internet access if needed) for the students to access at home since the required sessions were completed independently. The researcher used research funding from the College of Education at the University of Arizona to cover the cost of reading assessment materials, gift cards for the graduate research assistants, gift cards for the participants in the research study (teachers and students), and food rewards for the intervention reading class. Read Naturally donated the reading assessments intended to use for progress tracking. PRO-ED donated the TOWRE-2 test kit with the testing materials, and Dr. Nancy Mather from the College of Education donated TOSWRF-2 testing materials for the research study. Houghton Mifflin Harcourt provided a discount for the purchase of Woodcock-Johnson IV Tests of Achievement test records and response booklets.

The developers of the MVRC intervention provided support and assistance with implementation (e.g., ensuring that the participating school have the requisite equipment and Internet connectivity; providing online and telephone support; assisting with deployment of the intervention to study personnel at no charge. They provided free access to the program, which is \$149.00 per student, before volume discounting. The ten students in the reading class (intervention group) received the intervention during the 2017-2018 school year. The ten students in the comparison group were offered the option to receive the intervention the following academic year (2018-2019). The MVRC program ran through April 2018. The English teacher administered the intervention at school and monitored the students' fidelity to at-home completion. The students were required to complete the program independently on days that they did not complete the intervention in class.

All information was obtained specifically for research purposes. Only the researcher collected or had access to any individually identifying student data that was collected in class as

part of the research. Due to student absences, make-up dates were planned to gather all necessary data for the research study. The MVRC data reports were available to the teacher, students, and parents during their participation of the reading intervention.

To ensure participant privacy, secure connections to the MVRC servers were maintained during the reading intervention. Student identification numbers were used on all study-related documents and electronic files instead of participants' names. MVRC data reported included the student identification number and first name initial (or first and last name initial for similar first name initials). The principal investigator only had access to the student names connected to the student identification numbers during the data collection procedures at the high school to direct the students to their testing station. Many of the students did not know their student ID numbers, so the PI kept a document with their names and ID numbers. The teacher or school staff helped direct the students as well, but due to their inconsistent availability, it was helpful for the PI to have the document to reference.

Data Analysis

After data collection, all data (pre and post) were entered into SPSS. The reading achievement raw data were scored by hand and then converted into index or standard scores (depending on the measure) using the technical scoring manuals and the online computer scoring system of the TOSWRE-2, TOWRE-2, and the WJ IV Tests of Achievement. To ensure accurate scoring, the graduate research assistants scored the reading measures (in addition to the researcher), then scores were compared and corrected as needed.

Descriptive statistics for all study variables were completed by group and total students, such as mean, standard deviation, total, percentages, minimum, and maximum. Normality tests were conducted to ensure the normal distribution of dependent variable scores and

homoscedasticity. Group differences were examined using a one-way between-groups multivariate analysis of variance (MANOVA) for reading, student engagement, and school climate variables. Pearson correlations were computed to investigate the relationship between study variables at the pre-and post-test time points.

Table 7 displays the list of the research questions and corresponding statistical analyses completed for the current research study. In addition, to better understand the individual students' improvements in the reading intervention group, individual-level reading scores were examined for Hypothesis 1.1, Hypothesis 2.1, and Hypothesis 3.1. Effect sizes were computed for the pre-and post-test reading variables scores. Pre- and post-test student engagement scores, student sense of support, and academic expectations were compared. In addition, MVRC data (e.g., total duration of intervention time, Independent Reading Comprehension Level improvements, and Phonics level improvements) were also examined for each student in the reading intervention group.

Table 7

Research Questions, Hypotheses, and Statistical Analyses

Research Questions and Hypotheses	Variables	Statistical Analysis
Research Question 1: What effects does a computer-assisted reading intervention MindPlay Virtual Reading Coach (MVRC) have on students' reading and spelling skills?		
H _{1.1} : The intervention group will have higher post-test scores on the reading/spelling measures than pre-test scores.	<u>Within-subject Variables:</u> Pre- and post-test reading/spelling score	Paired Samples T-test (run with intervention group only)
H _{1.2} : The intervention group will have higher reading/spelling scores than the comparison group	<u>Within-subject Factor:</u> Pre- and post-test reading/spelling score <u>Between-subject Factor:</u>	Mixed Between-Within ANOVA

	Treatment group (comparison or intervention)	
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Research Question 2: Do high school students' engagement (affective and cognitive) levels improve after participating in the MVRC intervention?

H2.1: The intervention group will have higher post-test scores on the students' engagement (affective and cognitive) measures than pre-test scores.	<u>Within subject Variables:</u> Pre- and post-test students' engagement (affective and cognitive) measures	Paired Samples T-test (run with intervention group only)
H2.2: The intervention group will have higher student engagement (affective and cognitive) scores than the comparison group	<u>Within-subject Factor:</u> Pre- and post-test student engagement (affective and cognitive) scores <u>Between-subject Factor:</u> Treatment group (comparison or intervention)	Mixed Between-Within ANOVA

Research Question 3: Does the MVRC intervention promote students' sense of support and academic expectations?

H3.1: The intervention group will have higher post-test scores on the students' sense of support and academic expectations measures than pre-test scores.	<u>Within subject Variables:</u> Pre- and post-test students' sense of support and academic expectations measures.	Paired Samples T-test (run with intervention group only)
H3.2: The intervention group will have higher students' sense of support and academic expectations scores than the comparison group	<u>Within-subject Factor:</u> Pre- and post-test students' sense of support and academic expectations <u>Between-subject Factor:</u> Treatment group (comparison or intervention)	Mixed Between-Within ANOVA

Research Question 4: What is the relationship between authoritative school climate and student engagement? Are the high school students' perceptions of the authoritative school climate (structure and support) related to their engagement in the classroom?		
H ₄ : The more authoritative the school climate, the higher the student engagement.	<u>Dependent Variable:</u> Engagement (affective and cognitive) <u>Independent Variables:</u> Authoritative School Climate (School Disciplinary and Student Support)	Pearson Correlations

CHAPTER 4: RESULTS

This chapter describes the preliminary and main analyses for the research questions. A criterion alpha level of .05 was used to determine statistical significance. Cohen guidelines were used to classify the strength of the Pearson correlations, with $r = .10$ to $.29$ as a small correlation, $r = .30$ to $.49$ as a medium correlation, and $r = .50$ to 1.00 as a large correlation. The paired-samples t-tests were interpreted using Cohen's d to identify the magnitude of effect size with 0.2 = small effect, 0.5 = medium effect, and 0.8 = large effect (Cohen, 1988). The Mixed Between Within ANOVA findings were interpreted using guidelines by Cohen (1988) to interpret the magnitude of partial η^2 values with $.01$ = small effect, $.06$ = moderate effect, and $.14$ = large effect. Due to the small sample size in the current research study impacting the power to detect any significant group findings, individual student data was also examined to see the changes of reading scores after the intervention.

Preliminary Analyses

Descriptive Statistics

Data were checked for errors and outliers using descriptive statistics and frequencies. The tables below show the mean and standard deviation for the reading variable scores (Table 8), student engagement scores (Table 9), and school climate scores (Table 10).

Table 8*Descriptive Statistics for Reading Measures*

Measure	Intervention	Comparison	Total
	(<i>n</i> =10)	(<i>n</i> =8)	(<i>n</i> =18)
	Mean (SD)	Mean (SD)	Mean (SD)
TOSWRF-2			
Pre	70.30 (14.05)	77.43 (15.98)	73.24 (14.83)
Post	63.63 (15.77)	81.00 (14.36)	72.31 (17.11)
TOWRE-2 Sight Word Efficiency			
Pre	75.10 (11.74)	87.50 (12.99)	80.61 (13.52)
Post	74.60 (10.89)	82.63 (11.08)	78.17 (11.41)
TOWRE-2 PD Efficiency			
Pre	71.10 (3.32)	90.38 (16.64)	79.67 (17.47)
Post	71.50 (10.62)	87.63 (11.87)	78.67 (13.63)
WJ IV Spelling			
Pre	64.80 (15.35)	82.75 (14.23)	72.78 (17.10)
Post	66.70 (15.88)	83.25 (12.79)	74.06 (16.51)
WJ IV Word Reading Fluency			
Pre	71.10 (22.45)	84.25 (19.07)	76.94 (21.49)
Post	71.10 (20.46)	85.63 (19.86)	77.56 (20.95)
WJ IV Sentence Reading Fluency			
Pre	69.00 (19.57)	75.38 (17.48)	71.83 (18.41)
Post	67.70 (17.79)	82.75 (12.15)	74.39 (16.96)
WJ IV Word Attack			
Pre	72.90 (13.01)	85.38 (13.21)	78.44 (14.22)
Post	76.50 (17.55)	93.13 (17.69)	83.89 (19.08)
WJ IV Letter-Word Identification			
Pre	69.10 (14.41)	88.50 (13.22)	77.72 (16.75)
Post	73.00 (16.29)	87.50 (13.70)	79.44 (16.52)
WJ IV Basic Reading Skills Cluster			
Pre	68.70 (13.89)	86.25 (13.05)	76.50 (15.90)
Post	73.00 (14.97)	89.38 (15.96)	80.28 (17.13)
WJ IV Reading Rate Cluster			
Pre	67.90 (20.92)	77.63 (20.02)	72.22 (20.53)
Post	67.30 (18.64)	82.25 (17.32)	73.94 (19.13)

Note. Scores reported as standard scores. PD Efficiency = Phonetic Decoding Efficiency.

Table 9*Descriptive Statistics for Student Engagement Measures*

Measure	Intervention (<i>n</i> =10)	Comparison (<i>n</i> =8)	Total (<i>n</i> =18)
	Mean (SD)	Mean (SD)	Mean (SD)
Student Engagement Total			
Pre	101.00 (7.53)	113.00 (16.54)	106.33 (13.43)
Post	97.40 (9.59)	110.88 (14.62)	103.39 (13.57)
Affective Engagement			
Pre	56.60 (3.86)	63.00 (9.74)	59.44 (7.59)
Post	54.40 (4.38)	61.25 (9.08)	57.44 (7.51)
Teacher Student Relationships			
Pre	26.70 (2.11)	29.50 (4.31)	27.94 (3.47)
Post	25.40 (2.88)	28.88 (4.16)	26.94 (3.83)
Peer Support at School			
Pre	17.30 (1.64)	20.13 (3.48)	18.56 (2.91)
Post	17.40 (2.22)	19.00 (3.70)	18.11 (2.99)
Family Support for Learning			
Pre	12.60 (1.65)	13.38 (2.50)	12.94 (2.04)
Post	11.60 (1.90)	13.38 (2.20)	12.39 (2.17)
Cognitive Engagement Total			
Pre	44.40 (4.67)	50.00 (7.23)	46.89 (6.43)
Post	43.00 (6.48)	49.63 (6.28)	45.94 (7.07)
Control and Relevance of School Work			
Pre	24.70 (3.34)	28.38 (4.69)	26.33 (4.30)
Post	23.90 (4.75)	28.63 (3.96)	26.00 (4.92)
Future Aspirations and Goals			
Pre	15.20 (1.75)	17.25 (2.44)	16.11 (2.27)
Post	14.20 (2.20)	16.75 (2.12)	15.33 (2.47)
Intrinsic Motivation			
Pre	4.50 (.85)	4.38 (2.13)	4.44 (1.50)
Post	4.90 (1.79)	4.25 (4.61)	1.85 (1.98)

Table 10*Descriptive Statistics for Authoritative School Climate Measures*

Measure	Intervention (n=10)	Comparison (n=8)	Total (n=18)
	Mean (SD)	Mean (SD)	Mean (SD)
Authoritative School Climate Total			
Pre	44.00 (4.32)	46.00 (5.83)	44.89 (4.99)
Post	43.10 (4.53)	48.50 (5.73)	45.50 (5.66)
Total School Disciplinary Structure Scale			
Pre	19.20 (1.93)	19.63 (2.39)	19.39 (2.09)
Post	18.70 (1.89)	21.63 (3.16)	20.00 (2.87)
Student Sense of Support Total			
Pre	24.80 (2.53)	26.38 (3.89)	25.50 (3.20)
Post	24.40 (3.06)	26.88 (3.31)	25.50 (3.33)
Respect for Students			
Pre	12.30 (1.64)	13.25 (2.05)	12.72 (1.84)
Post	12.50 (1.72)	13.13 (1.96)	12.78 (1.80)
Willingness to Seek Help			
Pre	12.50 (1.27)	13.13 (1.89)	12.78 (1.55)
Post	11.90 (1.73)	13.75 (1.75)	12.72 (1.93)
Academic Expectations Scale			
Pre	14.20 (1.03)	15.38 (2.56)	14.72 (1.90)
Post	14.60 (1.27)	15.50 (2.88)	15.00 (2.11)

Tests of Normality

All research variables used in analyses were tested for the assumption of normality using the Shapiro-Wilk Test and examining the distribution of the variable scores on the Q-Q plots and boxplots. The results of the Shapiro-Wilk Test are reported by reading variables (Table 11), student engagement variables (Table 12), and school climate variables (Table 13).

Reading Measures

A Shapiro-Wilk test showed a significant departure from normality for the following reading variables (Table 11): TOWRE-2 Sight Word Efficiency (intervention group, pre and post-test, and comparison group post-test), WJ IV Word Reading Fluency (intervention group post-test), and WJ IV Sentence Reading Fluency (comparison group pre-test). A review of the

plots for TOWRE-2 Sight Word Efficiency revealed that a student in the comparison group scored significantly higher than other students, causing this student's reading scores on multiple measures to be outliers, as denoted by the boxplot for all student scores. In addition, two students in the intervention group scored significantly lower than the remaining students in the intervention group, causing their scores to be outliers in the boxplot for all student scores. The histograms showed these outlier scores for the intervention and comparison groups. Because the intervention and comparison groups were created based on low reading performance within the high school student population, it was expected that the participant's scores on the reading measures could be skewed.

Table 11*Normality Results for Reading Measures*

Variable	Intervention		Comparison		Total	
	W	df	W	df	W	df
TOSWRF-2						
Pre	.96	10	.97	7	.98	17
Post	.94	8	.95	8	.97	16
TOWRE-2 SWE						
Pre	.84*	10	.90	8	.94	18
Post	.78*	10	.76*	8	.85	18
TOWRE-2 PDE						
Pre	.95	10	.93	8	.95	18
Post	.89	10	.97	8	.96	18
WJ IV Spelling						
Pre	.91	10	.99	8	.97	18
Post	.88	10	.83	8	.92	18
WJ IV WRF						
Pre	.90	10	.91	8	.95	18
Post	.84*	10	.89	8	.95	18
WJ IV SRF						
Pre	.92	10	.79*	8	.97	18
Post	.92	10	.90	8	.93	18
WJ IV WA						
Pre	.89	10	.92	8	.93	18
Post	.97	10	.86	8	.95	18
WJ IV LWI						
Pre	.92	10	.96	8	.98	18
Post	.91	10	.92	8	.97	18
WJ IV BRC						
Pre	.95	10	.92	8	.96	18
Post	.92	10	.84	8	.93	18
WJ IV RRC						
Pre	.88	10	.88	8	.97	18
Post	.88	10	.88	8	.94	18

Note. SWE = Sight Word Efficiency; PDE = Phonetic Decoding Efficiency; WRF= Word Reading Fluency; SRF= Sentence Reading Fluency; WA= Word Attack; LWI= Letter Word Identification; BRC= Basic Reading Cluster; RRC= Reading Rate Cluster. W=Shapiro-Wilk Test Statistic value between 0 and 1 (normal distribution).

*p<.05.

Student Engagement Measures

A Shapiro-Wilk test showed a significant departure from normality for the following student engagement variables: SEI Total (intervention group post-test and total students pre-test), Affective Engagement (total students pre-test), and Cognitive Engagement (intervention group pre-test and comparison group post-test). Research has demonstrated that high school students who struggle with reading have historically struggled with engagement in school, so unsystematic variance is expected.

For the Student Engagement Inventory (SEI) scores, three students in the comparison group scored significantly higher compared to the other students in the comparison group. The Q-Q plot showed that the same students impacted the Affective Engagement. In addition, one student in the intervention group scored lower in student engagement than the group at the post-test time point. The histogram graph of Cognitive Engagement for the comparison group post-test has a skewed distribution to the right.

Table 12*Normality Results for Student Engagement Measures*

Variable	Intervention		Comparison		Total	
	df=10		df=8		df=18	
	W	p	W	p	W	p
SEI Total						
Pre	.87	.09	.90	.27	.88*	.03
Post	.83*	.03	.88	.18	.90	.05
Affective E						
Pre	.94	.58	.85	.10	.84*	.01
Post	.96	.74	.93	.56	.90	.06
Cognitive E						
Pre	.83*	.04	.90	.26	.91	.09
Post	.90	.22	.78*	.02	.94	.24

Note. SEI = Student Engagement Inventory; Affective E= Affective Engagement;

Cognitive E = Cognitive Engagement. W=Shapiro-Wilk Test Statistic value between

0 and 1 (normal distribution).

* $p < .05$.

Authoritative School Climate Measures

A Shapiro-Wilk test showed a significant departure from normality for the following school climate variables: Total School Disciplinary Structure (comparison group pre-test), Student Sense of Support Total (comparison group pre-test) and Academic Expectations (intervention group pre and post-tests, comparison group pre and post-tests, and total students pre and post-tests). The School Disciplinary Structure histogram for the comparison group was skewed to the right at the pre-test time point. For the Student Sense of Support Total, the comparison group lacked pre-test scores in the middle of the distribution of scores on the histogram. The Academic Expectations pre and post-test scores for all students combined and separated by group departed from the normal distribution. The boxplots for the pre-test scores by group showed four extreme scores for the intervention group.

Table 13

Normality Results for Authoritative School Climate Measures

Variable	Intervention		Comparison		Total	
	df = 10		df = 8		df = 18	
	W	<i>p</i>	W	<i>p</i>	W	<i>p</i>
ASC Total						
Pre	.95	.63	.83	.06	.94	.31
Post	.86	.07	.88	.20	.95	.44
Total SDS						
Pre	.95	.63	.72**	.00	.91	.08
Post	.88	.13	.91	.32	.91	.09
Student SST						
Pre	.97	.91	.77*	.01	.93	.20
Post	.93	.40	.92	.44	.95	.44
Academic E						
Pre	.76*	.01	.80*	.03	.76**	.00
Post	.56**	.00	.77*	.01	.70**	.00

Note. ASC Total = Authoritative School Climate Total; Total SDS = Total School Disciplinary Structure; Student SST = Student Sense of Support Total; Academic E = Academic

Expectations. W=Shapiro-Wilk Test Statistic value between 0 and 1 (normal distribution).

* $p < .05$; ** $p < .001$.

Group Differences

Reading Measures

A one-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate group differences in reading scores before implementing the reading intervention (pre-test scores). The following dependent variables were used: TOSWRF-2, TOWRE-2 Sight Word Efficiency, TOWRE-2 Phonetic Decoding Efficiency, WJ IV Spelling, WJ IV Word Reading Fluency, WJ IV Sentence Reading Fluency, WJ IV Word Attack, WJ IV Letter-Word Identification, WJ IV Basic Reading, and WJ IV Reading Rate. The independent variable was grouping (intervention or comparison group). There was no significant difference between intervention and comparison groups on the dependent variables, Wilks' Lambda = .40, $F(6,10) = .91$, $p = .58$.

Student Engagement Measures

A one-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate group differences in student engagement before implementing the reading intervention (pre-test scores). The following dependent variables were used: SEI, Cognitive Engagement, and Affective (Psychological Engagement). The independent variable was grouping (intervention or comparison group). There was no significant difference between intervention and comparison groups on the dependent variables, Wilks' Lambda = .79, $F(15,2) = 2.00$, $p = .17$.

Authoritative School Climate Measures

A one-way between-groups multivariate analysis of variance (MANOVA) was performed to investigate group differences in school climate before implementing the reading intervention (pre-test scores). The following dependent variables were used: Authoritative School Climate, School Disciplinary Support, Student Sense of Support, and Academic Expectations. The independent variable was grouping (intervention or comparison group). There was no significant difference between intervention and comparison groups on the dependent variables, Wilks' Lambda = $.89F(14,3) = .60, p = .63$. Based on the non-significant results of group differences at the pre-test time point, pre-test scores were not controlled when completing the statistical analyses comparing the intervention and comparison group scores.

Correlation Analyses

Table 14 presents a correlation matrix of study variables at pre and post-tests. At the pre-test, there was one statistically significant relationship between Cognitive Engagement and TOSWRF-2, $r(16) = -.50, p = .04$, but no other significant correlations were found at the pre or post-test time points.

Table 14*Pearson Correlations for Reading, Student Engagement, and School Climate Variables at Pre-and Post-Test*

	SEI	AE	CE	ASC	SDS	SSS	AcE
1. Spelling	.14 (.04)	.19 (.05)	.08 (.02)	.02 (.06)	-.02 (.13)	.05 (-.02)	.28 (.17)
2. WRF	-.14 (-.17)	-.07 (-.17)	-.20 (-.14)	-.12 (-.22)	-.05 (-.20)	-.16 (-.20)	.14 (.05)
3. SRF	-.38 (-.16)	-.30 (-.14)	-.44 (-.16)	-.30 (-.12)	-.21 (-.11)	-.33 (-.11)	-.05 (-.02)
4. WA	-.09 (-.15)	-.05 (-.13)	-.12 (-.15)	-.10 (.12)	-.21 (.18)	-.02 (.06)	-.02 (-.23)
5. LWI	.17 (-.18)	.22 (-.16)	.10 (-.19)	.07 (-.14)	-.08 (-.11)	.16 (-.14)	.36 (-.09)
6. BRC	.07 (-.18)	.12 (-.15)	.01 (-.18)	-.00 (-.02)	-.15 (.02)	.09 (-.05)	.23 (-.17)
7. RRC	-.27 (-.19)	-.20 (-.18)	-.33 (-.17)	-.23 (-.19)	-.15 (-.17)	-.27 (-.17)	.04 (.01)
8. TOS-2	-.46 (-.07)	-.39 (-.05)	-.50* (-.08)	-.42 (-.08)	-.39 (-.03)	-.42 (-.11)	-.15 (.08)
9. TO-2 SW	-.06 (-.22)	.02 (-.21)	-.14 (-.20)	-.12 (-.21)	-.18 (-.20)	-.08 (-.18)	.15 (-.12)
10. TO-2 PD	.09 (.04)	.11 (.09)	.05 (-.03)	-.09 (.18)	-.19 (.18)	-.02 (.15)	.24 (.11)

Note. Post-test correlations are given in parentheses. SEI= Student Engagement Total; AE = Affective Engagement; CE= Cognitive Engagement; ASC = Authoritative School Climate SDS = Total School Disciplinary Structure; SSS = Student Sense of Support; AcE = Academic Expectations; WRF= Word Reading Fluency; SRF= Sentence Reading Fluency; WA= Word Attack; LWI= Letter Word Identification; BRC= Basic Reading Cluster; RRC= Reading Rate Cluster; TOS-2=TOSWRF-2; TO-2 SW = TOWRE-2 Sight Word Efficiency; TO-2 PD = TOWRE-2 Phonetic Decoding Efficiency.

* $p < .05$.

Research Question 1

What effects does a computer-assisted reading intervention/computer-based reading program, MindPlay Virtual Reading Coach (MVRC), have on students' reading and spelling skills?

Hypothesis 1.1. The intervention group will have higher post-test scores on the reading/spelling measures than pre-test scores.

Paired-sample t-tests were conducted to investigate the impact of the MindPlay Virtual Reading Coach (MVRC) intervention on the reading scores of the students in the intervention group. Table 15 presents the results. There was a statistically significant improvement in two

reading scores: (1) the WJ IV Letter-Word Identification scores, $t(9) = 2.30$, $d = .25$, $p < .05$ and (2) the WJ IV Basic Reading Cluster scores from the pre-test ($M = 68.70$, $SD = 13.89$) to the post-test ($M = 73.00$, $SD = 14.97$), $t(9) = 2.83$, $p < .05$. The remaining paired-samples t-tests were not significant. Although not statistically significant, the WJ IV Word Attack indicated a small effect size ($d = .23$).

Table 15*Results of Paired Samples T-Test of Reading Measures for Intervention Group*

Reading Variable	Pre	Post	Paired Differences			
	<i>M (SD)</i>	<i>M (SD)</i>	t	Cohen's D	Mean Diff	95% CI
TOS-2	66.38 (12.78)	63.63 (15.77)	-1.30	-.19	-2.75	[-7.74, 2.24]
TO-2 SW	75.10 (11.74)	74.60 (10.89)	-0.52	-.04	-0.50	[-2.67, 1.67]
TO-2 PDE	71.10 (13.32)	71.50 (10.62)	0.22	.03	0.40	[-3.64, 4.43]
Spelling	64.80 (15.35)	66.70 (15.88)	1.64	.12	1.90	[-0.72, 4.52]
WRF	71.10 (22.45)	71.10 (22.46)	0.00	.00	0.00	[-4.40, 4.40]
SRF	69.00 (19.57)	67.70 (17.79)	-0.86	-.07	-1.30	[-4.72, 2.12]
WA	72.90 (13.01)	76.50 (17.55)	0.86	.23	3.60	[-5.89, 13.09]
LWI	69.10 (14.42)	73.00 (16.29)	2.30*	.25	3.90	[0.05, 7.75]
BRC	68.70 (13.89)	73.00 (14.97)	2.83*	.30	4.30	[0.86, 7.74]
RRC	67.90 (20.92)	67.30 (18.64)	-0.33	-.03	-0.60	[-4.71, 3.51]

Note. Mean Diff= Mean Difference; WRF= Word Reading Fluency; SRF= Sentence Reading

Fluency; WA= Word Attack; LWI= Letter Word Identification; BR= Basic Reading Cluster;

RR= Reading Rate Cluster; TOS-2=TOSWRF-2; TO-2 SW = TOWRE-2 Sight Word Efficiency;

TO-2 PD = TOWRE-2 Phonetic Decoding Efficiency. Df = 9 for all variables except TOSWRF-

2 where df = 7. Scores reported as standard scores.

* $p < .05$.

The Paired Samples T-Test results above noted that the students tended to improve in basic reading skills and phonological processing due to their lack of foundational reading abilities at the beginning of the intervention. Based on the progress and time spent on the MVRC during the study, most students were still mastering their phonics lessons at the end of the study, with none of them reaching the goal level of Advanced. Given the individual improvements made throughout the study, more time spent in the intervention would reap more gains. It is also important to note that the reading scores in the study were reported in standard scores rather than raw scores. A student may have increased their raw score, but their standard score remained the same because of the nature of the norm referenced assessment. A standard score remaining the same is meaningful because it indicates that the student's performance improved over time (otherwise the standard score would have decreased).

Due to the small sample size in the current research study impacting the power to detect significant group findings, individual intervention student data was also examined. This data illustrates the changes in reading scores of each student within the intervention group. The MVRC program tracked the progression of each student in the reading intervention class in the areas of Phonics and Independent Reading Comprehension.

As defined in each of the student's parent report "Phonics is the ability to sound out words and apply spelling rules to read and write." The phonics levels were classified as the following: Pre-Phonics (Level 0): Sounds; Foundational (Levels 1-3): Sound/letter correspondence, short vowels, consonants; Basic (Levels 4-5): 1 syllable words, blends; Intermediate (Levels 6-9): Words with long vowels, vowel teams, spelling rules; Advanced (Level 10): 3 syllable words, prefixes, Greek roots. The reading comprehension score identified

Hypothesis 1.2. The intervention group will have higher reading/spelling scores than the comparison group.

A mixed between-within subjects analysis of variance was conducted to assess the impact of the student's participation in the reading intervention group (versus the comparison group) on their scores on various reading measures across the two-time points (pre-intervention and post-intervention). Levene's Test of Equality of Error Variances (based on mean) showed that the variability of reading and spelling scores for each group was similar; no significant values were found.

Table 16 summarizes the results of these analyses. There were significant group differences (intervention and comparison group) for the following reading measures: TOWRE-2 Phonetic Decoding Efficiency, WJ IV Spelling, WJ IV Word Attack, and WJ IV Letter-Word Identification, and WJ IV Basic Reading Skills Cluster. The mean TOWRE-2 Phonetic Decoding Efficiency score for the intervention group increased 0.40 between the time points, while the mean score in the comparison group decreased 2.75; $F(1,16) = 8.51, p < .05$, partial $\eta^2 = .38$. According to the Cohen's guidelines, this result reflects a large effect. The mean WJ IV Spelling score for the intervention group increased to 1.90 between the time points, while the mean score in the comparison group increased by 0.50. This result reflects a large effect size, $F(1,16) = 6.33, p < .05$, partial $\eta^2 = .28$. The mean WJ IV Word Attack score for the intervention group increased by 3.60 between the time points, while the mean scores in the comparison group increased by 7.75. This result reflects a large effect size, $F(1,16) = 4.67, p < .05$, partial $\eta^2 = .23$. The mean WJ IV Letter-Word Identification score for the intervention group increased by 3.90 between the time points, while the mean scores in the comparison group decreased by 1.00. This result reflects a large effect size, $F(1,16) = 6.43, p < .05$, partial $\eta^2 = .29$. The mean WJ IV

Basic Reading Cluster score for the intervention group increased by 4.30 between the time points, while the mean scores in the comparison group increased by 3.13. This result reflects a large effect size, $F(1,16) = 5.79, p < .05$, partial $\eta^2 = .27$.

There was a significant main effect comparing time points when examining WJ IV Basic Reading Cluster scores, but there was no significant interaction between group and time. Both the intervention and comparison groups had significant score increases from the pre-test to the post-test. The intervention group increased from an average of 68.70 to 73.00, and the comparison group increased from an average of 86.25 to 89.38. According to the Cohen's guidelines, this result reflects a large effect size, Wilks' Lambda = .73, $F(1,16) = 6.41, p < .05$, partial $\eta^2 = .29$.

There were no significant interactions between group and time or no significant main effects comparing time points when examining the following reading measures: TOWRE-2 Phonetic Decoding Efficiency, WJ IV Spelling, WJ IV Word Attack, and WJ IV Letter-Word Identification. The results of TOSWRF-2, TOWRE-2 Sight Word Efficiency, WJ IV Word Reading Fluency, WJ IV Sentence Reading Fluency, and WJ IV Reading Rate.

Table 16*MIXED BETWEEN-WITHIN ANOVA: Summary Table for Reading Measures*

Variable	Intervention	Comparison	ANOVA			
	M (SD)	M (SD)	Effect	Wilks' Lambda	F	eta ²
TOSWRF-2						
Pre	70.30 (14.05)	77.43 (15.98)	T x G	0.87	1.97	.13
Post	63.63(15.77)	81.00 (14.36)	T	1.00	0.00	.00
			G		3.39	.21
TOWRE-2 Sight Word Efficiency						
Pre	75.10 (11.74)	87.50 (12.99)	T x G	0.86	2.52	.14
Post	74.60 (10.89)	82.63 (11.08)	T	0.81	3.81	.19
			G		3.64	.19
TOWRE-2 Phonetic Decoding Efficiency						
Pre	71.10 (13.32)	90.38 (16.64)	T x G	0.93	1.18	.07
Post	71.50 (10.62)	87.63 (11.87)	T	0.96	0.66	.04
			G		8.51*	.38
WJ IV Spelling						
Pre	64.80 (15.35)	82.75 (14.23)	T x G	0.98	0.27	.02
Post	66.70 (15.88)	83.25 (12.79)	T	0.95	0.78	.05
			G		6.33*	.28
WJ IV Word Reading Fluency						
Pre	71.10 (22.45)	84.25 (19.07)	T x G	0.99	0.09	.01
Post	71.10 (20.46)	85.63 (19.86)	T	0.99	0.09	.01
			G		2.12	.12
WJ IV Sentence Reading Fluency						
Pre	69.00 (19.57)	75.38 (17.48)	T x G	0.80	4.14	.21
Post	67.70 (17.79)	82.75 (12.15)	T	0.89	2.03	.11
			G		1.85	.10
WJ IV Word Attack						
Pre	72.90 (13.01)	85.38 (13.21)	T x G	0.97	0.49	.03
Post	76.50 17.55	93.13 (17.69)	T	0.82	3.63	.19
			G		4.67*	.23
WJ IV Letter-Word Identification						
Pre	69.10 (14.41)	88.50 (13.22)	T x G	0.89	1.95	.11
Post	73.00 (16.29)	87.50 (13.70)	T	0.96	0.68	.04
			G		6.43*	.29
WJ IV Basic Reading Cluster						
Pre	68.70 (13.89)	86.25 (13.05)	T x G	0.99	0.15	.01
Post	73.00 (14.97)	89.38 (15.96)	T	0.73	5.79*	.27
			G		6.41*	.29
WJ IV Reading Rate Cluster						
Pre	67.90 (20.92)	77.63 (20.02)	T x G	0.92	1.37	.08
Post	67.30 (18.64)	82.25 (17.32)	T	0.95	0.81	.05
			G		1.92	.12

Note. G= Group; T = Time; T x G = Time x Group. Df= 16 for all variables except TOSWRF-2 where df= 13. Scores reported as standard scores.

* $p < .05$.

Research Question 2

Do high school students' engagement (affective and cognitive) levels improve after participating in the MVRC intervention?

Hypothesis 2.1. The intervention group will have higher post-test scores on the students' engagement (affective and cognitive) measures than pre-test scores.

Paired-sample t-tests were conducted to investigate the impact of the MindPlay Virtual Reading Coach (MVRC) intervention on student engagement in the intervention group. Table 17 presents the findings of the paired-sample t-tests. There was no statistically significant improvement in student engagement scores. There was a significant decrease in the Affective Engagement scores from a mean of 56.60 to 54.40, $t(9) = -2.66$, $d = -.53$, $p < .05$ (two-tailed) with a medium effect size ($d = -.53$). The changes in student engagement between pre-and post-test also indicated no significant changes at individual student levels. Student 2 (4 points), Student 6 (6 points), and Student 10 (3 points) had increases in their Cognitive Engagement.

Table 17

Results of Paired Samples T-Test of Student Engagement Measures for Intervention Group

Reading Variable	Pre	Post	Paired Differences			
	<i>M (SD)</i>	<i>M (SD)</i>	<i>t (df=9)</i>	Cohen's D	Mean Diff	95% CI
SEI	101.00 (7.53)	97.40 (9.59)	-1.60	-0.42	-3.60	[-8.68, 1.48]
CE	44.40 (4.67)	43.00 (6.48)	-0.84	-0.25	-1.40	[-5.19, 2.39]
AE	56.60 (3.86)	54.40 (4.38)	-2.66*	-0.53	-2.20	[-4.07, 0.33]

Note. SEI = Student Engagement Total; CE= Cognitive Engagement; AE= Affective

Engagement; Mean Diff = Mean Difference.

* $p < .05$.**Table 18***Student Engagement Scores of Intervention Students*

	Pre	Post
Student 1		
Student Engagement Total	107	106
Affective Engagement	62	62
Cognitive Engagement	45	44
Student 2		
Student Engagement Total	96	100
Affective Engagement	51	51
Cognitive Engagement	45	49
Student 3		
Student Engagement Total	108	105
Affective Engagement	59	57
Cognitive Engagement	49	48
Student 4		
Student Engagement Total	106	104
Affective Engagement	57	57
Cognitive Engagement	49	47
Student 5		
Student Engagement Total	98	94
Affective Engagement	55	53
Cognitive Engagement	43	41
Student 6		
Student Engagement Total	101	103
Affective Engagement	57	53
Cognitive Engagement	44	50
Student 7		
Student Engagement Total	95	75
Affective Engagement	53	46
Cognitive Engagement	42	29
Student 8		
Student Engagement Total	106	101
Affective Engagement	58	57
Cognitive Engagement	48	44
Student 9		
Student Engagement Total	108	98
Affective Engagement	62	56
Cognitive Engagement	46	42
Student 10		
Student Engagement Total	85	88
Affective Engagement	52	52
Cognitive Engagement	33	36

Note. Bold scores show an increase from pre- to post-test.

Hypothesis 2.2. The intervention group will have higher student engagement (cognitive and affective) scores than the comparison group.

A mixed between-within subjects analysis of variance was conducted to assess the impact of the student's participation in the reading intervention group (versus the comparison group) on their scores of student engagement (cognitive and affective) across the two-time points (pre-intervention and post-intervention). Levene's Test of Equality of Error Variances (based on mean) showed that the variability of SEI total post-test and Cognitive Engagement scores at pre- and post-test for each group was similar. However, there were significant unequal variances for the following: the SEI total pre-test score ($F=9.14, p<.01$); the Affective Engagement pre-test ($F=16.64, p<.001$); and post-test ($F=5.27, p<.05$). Although the assumption of Homogeneity of Variance was violated, the statistical analyses were completed. According to Pallant (2020) and Stevens (1996), ANOVA is robust and can be run with groups of similar sizes even when Homogeneity of Variance is not met.

Table 19 summarizes the results of these analyses. There were significant group differences (intervention and comparison group) when examining the following measures: Total Student Engagement (SEI) and Cognitive Engagement. The mean SEI score for the intervention group decreased by 3.60 between the time points, while the mean score in the comparison group decreased by 2.12. According to the Cohen's guidelines, this result reflects a large effect size, $F(1,16) = 5.24, p < .05$, partial $\eta^2 = .25$. The mean Cognitive Engagement score for the intervention group decreased by 1.40 between the time points, while the mean score in the comparison group decreased by 0.37. This result reflects a large effect size, $F(1,16) = 5.11, p < .05$, partial $\eta^2 = .24$.

There was a significant main effect comparing time points when examining Affective Engagement scores, but there was no significant interaction between group and time. Both the intervention and comparison groups had significant score decreases from the pre-test to the post-test. The intervention group decreased from an average of 56.60 points to 54.40 points, and the comparison group decreased from an average of 63.00 points to 61.25 points. This result reflects a large effect size, Wilks' Lambda = .61, $F(1,16) = 10.17$, $p < .01$, partial $\eta^2 = .21$. There were no significant interactions between group and time or no significant main effects comparing time points when examining the following reading measures: SEI and Cognitive Engagement. The mean student engagement for all students, regardless of group type, decreased between pre-and post-test time points.

Table 19

MIXED BETWEEN-WITHIN ANOVA: Summary Table for Student Engagement Measures

Variable	Intervention	Comparison	ANOVA			
	M (SD)	M (SD)	Effect	Wilks' Lambda	F	η^2
Student Engagement Total						
Pre	101.00 (7.53)	113.00 (16.5)	T x G	0.99	0.22	.01
Post	97.40 (9.59)	110.88 (14.62)	T	0.83	3.35	.17
			G		5.24*	.25
Cognitive Engagement						
Pre	44.40 (4.67)	50.00 (7.23)	T x G	0.99	0.21	.01
Post	43.00 (6.48)	49.63 (6.23)	T	0.96	0.64	.04
			G		5.11*	.24
Affective Engagement						
Pre	56.60 (3.86-)	63.00 (9.74)	T x G	0.99	0.13	.01
Post	54.40 (4.38)	61.25 (9.08)	T	0.61	10.17**	.39
			G		4.18	.21

Note. G= Group; T = Time; T x G = Time x Group. Df= 16 for all variables.

* $p < .05$; ** $p < .01$.

Research Question 3

Does the MVRC intervention promote students' sense of support and academic expectations?

Hypothesis 3.1. The intervention group will have higher post-test scores on the students' sense of support and academic expectations than pre-test scores.

Paired-samples t-tests were conducted to investigate the impact of the MindPlay Virtual Reading Coach (MVRC) intervention on the students' sense of support and academic expectations. Table 20 presents the findings of the paired-samples t-tests. There was no statistically significant improvement in students' sense of support or academic expectations scores, but the academic expectations mean score improved from 14.20 to 14.60 with a small effect size ($d=.35$).

Table 20

Results of Paired Samples T-Test of Student Sense of Support and Academic Expectations for Intervention Group

Reading Variable	Pre	Post	Paired Differences			
	<i>M (SD)</i>	<i>M (SD)</i>	t (df=9)	Cohen's D	Mean Dif	95% CI
Student SS	24.80 (2.53)	24.40 (3.06)	-0.47	-0.14	-0.40	[-2.34, 1.54]
AcE	14.20 (1.03)	14.60 (1.27)	1.09	0.35	-0.40	[-0.44, 1.24]

Note. Student SS = Student Sense of Support; AcE = Academic Expectations; Mean Dif = Mean Difference.

The pre-and post-test scores of students' sense of support and academic expectations showed little positive changes at the individual student levels. Student 1 (2 points) and Student 4 (2 points) had increases in their Student Sense of Support. Both students' score increases in Student Sense of Support were due to the rise in their Respect for Students score. Student 3 (1

point), Student 6 (2 points), Student 7 (1 point), and Student 8 (2 points) had increases in their Academic Expectations score.

Table 21

School Climate Scores of Intervention Students

	Pre	Post
Student 1		
Student Sense of Support	24	26
Academic Expectations	14	14
Student 2		
Student Sense of Support	26	24
Academic Expectations	14	14
Student 3		
Student Sense of Support	25	24
Academic Expectations	14	15
Student 4		
Student Sense of Support	26	28
Academic Expectations	14	14
Student 5		
Student Sense of Support	24	29
Academic Expectations	14	14
Student 6		
Student Sense of Support	20	18
Academic Expectations	16	18
Student 7		
Student Sense of Support	25	24
Academic Expectations	13	14
Student 8		
Student Sense of Support	27	24
Academic Expectations	13	15
Student 9		
Student Sense of Support	29	25
Academic Expectations	14	14
Student 10		
Student Sense of Support	22	22
Academic Expectations	16	14

Note. Bold scores show an increase from pre- to post-test.

Hypothesis 3.2. The intervention group will have higher students' sense of support and academic expectations than the comparison group.

A mixed between-within subjects analysis of variance was conducted to assess the impact of the student's participation in the reading intervention group (versus the comparison group) on their scores of sense of support and academic expectations across the two-time points (pre-intervention and post-intervention). Levene's Test of Equality of Error Variances (based on mean) showed that the variability of Student Support total post-test score for each group was similar; no significant value was found. The Student Support total pre-test score ($F=5.66, p=.03$), the Academic Expectations pre-test ($F=14.64, p=.001$), and post-test ($F=5.69, p=.03$) scores were found to have significant values (unequal variances). Although the assumption of Homogeneity of Variance was violated, the statistical analyses were completed. According to Pallant (2020) and Stevens (1996), ANOVA is robust and can be run with groups of similar sizes even when Homogeneity of Variance is not met.

Table 22 summarizes the results of these analyses. There were no significant interactions between group and time, no significant main effects comparing time points, and no significant group differences (intervention and comparison group) when examining the student's sense of support and academic expectations. Although there were no significant results, there were effect sizes for group differences worth reporting. The mean Sense of Support score for the intervention group decreased by 0.40 between the time points, while the mean score in the comparison group decreased by 0.50. According to the Cohen's guidelines, this result reflects a large effect size, $F(1,16) = 2.15, p > .05, \text{partial } \eta^2 = .12$. The mean Academic Expectations score for the intervention group increased by 0.24 between the time points, while the mean score in the comparison group increased by 0.32. This result reflects a moderate effect size, $F(1,16) = 1.39, p > .05, \text{partial } \eta^2 = .08$.

Table 22

MIXED BETWEEN-WITHIN ANOVA: Summary Table for Students' Sense of Support and Academic Expectations

Variable	Intervention		Comparison		ANOVA			
	M (SD)		M (SD)		Effect	Wilks' Lambda	F	eta ²
Student Sense of Support								
Pre	24.80 (2.53)		26.38 (3.89)		T x G	0.97	0.54	.03
Post	24.40 (3.06)		26.88 (3.31)		T	1.00	0.01	.00
					G		2.15	.12
Academic Expectations								
Pre	14.20 (1.03)		15.38 (2.56)		T x G	0.99	0.15	.01
Post	14.60 (1.27)		15.50 (2.88)		T	0.97	0.56	.03
					G		1.39	.08

Note. G= Group; T = Time; T x G = Time x Group. Df= 16 for all variables.

Research Question 4

What is the relationship between authoritative school climate and student engagement in high school students? Are the students' perceptions of the authoritative school climate (structure and support) related to their engagement in the classroom?

Hypothesis 4. The more authoritative the school climate, the higher the student engagement.

Correlational analyses of 18 participants indicated that authoritative school climate and student engagement were significantly correlated. For pre-test, high levels of authoritative school climate are associated with high levels of student engagement (Affective Engagement, $r = .75$, $p < .001$; Cognitive Engagement, $r = .78$, $p < .001$; Total Engagement, $r = .80$, $p < .001$). High levels of school disciplinary structure (Affective Engagement, $r = .56$, $p < .05$; Cognitive Engagement, $r = .67$, $p < .001$; Total Engagement, $r = .64$, $p < .001$) and student support (Affective Engagement, $r = .81$, $p < .001$; Cognitive Engagement, $r = .78$, $p < .001$; Total Engagement, $r = .83$, $p < .001$) at pre-test were associated with high levels of student engagement. For post-test, high levels of authoritative school climate are associated with high levels of student engagement (Affective Engagement, $r = .60$, $p < .01$; Total Student Engagement, $r = .56$, $p < .05$). High levels of student

support (Affective Engagement, $r = .70$, $p < .001$; Total Engagement, $r = .62$, $p < .001$) at post-test were associated with high levels of student engagement.

Table 23

Pearson Correlations for Authoritative School Climate and Student Engagement at Post-Test

	<u>Authoritative School Climate</u>	<u>School Disciplinary</u>	<u>Student Support</u>
Affective Engagement	.75** (.60**)	.56* (.38)	.81** (.70**)
Cognitive Engagement	.78** (.44)	.67** (.35)	.78** (.44)
Total Student Engagement	.80** (.56*)	.64** (.39)	.83** (.62**)

Note. Post-test scores given in parentheses.

* $p < .05$; ** $p < .01$.

Intervention Engagement Survey

The teacher scored an 84 on the Primary Intervention Rating Scale, showing high acceptability of the intervention. She reported the MVRC was not consistent with interventions she has used previously in the classroom setting, but “The intervention was a success in class.”

Overall, at the end of the intervention, she provided positive feedback through the survey and directly to the creator of MVRC; “My students’ growth is visible, their confidence improved, and the personal connection to the company was an added bonus. I can tell that you care about the product you created, but so much more than that, the humans you are impacting.” The school created a remedial reading class the following academic year and purchased the MVRC program for the students enrolled in the class. Due to student enrollment and class schedule conflicts, not all comparison group students could continue with the MVRC intervention for the 2018-2019 school year.

CHAPTER 5: DISCUSSION

The purpose of this study was to investigate the impact of a computer-assisted reading intervention, MindPlay Virtual Reading Coach (MVRC), on the reading achievement, perceived engagement, teacher support, and teacher academic expectations of the lowest readers enrolled at a charter high school in Southern Arizona. After a thorough review of the research literature, it was apparent that reading achievement, student engagement, and authoritative school climate can significantly positively impact not only a high school student's academic experience but their ability to endure challenges and remain resilient to complete their studies. Most of the research completed with MVRC has not included high school students, which is a uniquely challenging population to support with a reading intervention. In addition, previous research on the effectiveness of computer-assisted reading instruction has not included student engagement and authoritative school climate measures.

Intervention Effects on Reading

Prior to the current study, there were less than ten research studies that investigated computer-assisted interventions and reading achievement among high school students (Cantrell et al., 2011; Faddis et al., 2011; Keane, 2018; Lauritzen, 2018; Loadman et al., 2011; Speed, 2020; Swanlund et al., 2012; The Educational Alliance at Brown University, 2012; Vaden-Kiernan et al., 2012) and only three additional research studies examined MVRC with high school/adolescent reading achievement (Bliss, 2000; Kloos et al., 2019; Serido & Wilhem, 2008).

The first research question examined the impact of the MVRC intervention on high school students' basic reading and spelling abilities. It was hypothesized that MVRC would have a positive impact on reading achievement. Results indicated significant improvements in two of

the reading scores: WJ IV Letter-Word Identification subtest and the WJ IV Basic Reading Cluster. The pre-and post-test scores for Word Attack subtest also indicated a small effect size, showing an improvement. It makes sense that the intervention students were able to improve in their phonemic awareness and basic reading skills given the majority of the MVRC lessons that they completed were the phonemic awareness and phonics lessons. They had not yet progressed to the reading skills within the proficiency components of the intervention program, which included the fluency lessons.

Individual intervention data (MVRC data and the study reading measures) showed the changes in the reading scores for each student. All the students (except for Student 3) in the intervention group showed improvements in their independent reading grade level scores. Many effect sizes for individual student scores showed noticeable improvements in the reading measures that were shown to improve at the group level, but also in all the additional reading measures in the study. This demonstrates that although students did not get to progress through the more advanced reading skill lessons, the time and work that they did put in during the intervention still had a positive impact on reading fluency.

It is promising that MVRC helped high school students significantly improve their phonological awareness abilities because the average student is expected to have mastered basic reading skills by the third grade. This intervention provided additional time for these students to gain vital reading skills needed to progress to higher reading skills that are within their “typical age group.” It also demonstrates that the program is relevant and appropriate for students with significant reading difficulties within the high school age group. The majority of the students in the intervention group were able to maintain their scores, showing their improvement. Two previous research studies completed with MVRC and the high school age group focused on

higher-level reading skills, such as reading fluency and reading comprehension (Bliss, 2000; Kloos et al., 2019).

The current study adds to the research literature by providing evidence for improvements in basic reading skills among adolescents. More specifically, it demonstrates that MVRC can help high school students improve their phonemic awareness abilities. This adds to the evidence Serido and Wilhem (2008) found in their study investigating MVRC's impact on phonemic awareness and phonic skills. They were able to show that the MVRC intervention positively impacted the students' reading achievement, but the students in their sample included both high school and elementary school students and the students spent time completing the MVRC phonemic awareness and phonics lessons and another online reading intervention for reading fluency instruction (FLRT). The current study is the first to look specifically at these basic reading skills within a research sample made up of only high school students who completed the MVRC intervention only.

Intervention Effects on Student Engagement

The current study hypothesized that MVRC would have a positive impact on student engagement, based on the premise that actively participating in a reading intervention would significantly increase student levels of engagement. Although some individual students improved in their cognitive engagement the change was not statistically significant. This finding is consistent with previous studies on the relation between other computer-assisted interventions and student engagement among high school students (Bright, 2020; Speed, 2020; Fransescucci et al., 2021; Lauritzen, 2018). These studies also did not find evidence for increased student engagement following the completion of a computer-based reading intervention. Speed (2020) investigated whether time spent on the reading intervention (behavioral engagement) correlated

with scores on the reading achievement measures, but the quality of the performance was more important than the quantity.

Another interesting finding was that when comparing the intervention and comparison groups, both groups decreased their levels of student engagement as the academic year progressed. This aligns with the research literature that has shown that when an academic area is challenging for a student, it can be challenging to maintain momentum and continue to progress as the academic year progresses (“Matthew Effects”) (Reschly, 2010). Reschly (2010) describes the process as a student increasing in their competence, which leads to increased motivation and engagement, whereas if they do not make sufficient progress (in the form of skill acquisition) their motivation and engagement will decrease.

The students in the current research study sample all were the lowest readers in the high school, placing them in the at-risk category for dropping out of high school. Because reading is hard for these students, it impacted their ability to remain cognitively and emotionally engaged in school. Even though the high school students in the intervention group made improvements slowly over time, their internal engagement was challenging to maintain because their progress was not achieved quickly (consistent with research for this age group). Some of the students maintained their behavioral engagement, because a lot of focus was put on meeting the intervention hours for the remedial reading class. If the research study had continued monitoring their student engagement over time after completing more reading intervention, there could have been a trend shift after hitting milestones within the MVRC program (e.g., transitioning from the basic reading skills to the more advanced reading skills). Continuing to progress in their reading could have helped them to also transition from more of a basic form of engagement (behavioral) to more of a complex form of engagement (cognitive and emotional). The Model of Reading

Engagement shows that as a student remains dedicated to reading activities and participation, it can lead to reading competence and increased motivation to read (Guthrie et al., 2012). That is a reason why orchestrating reading interventions with this age group can be monumental in helping them to see academic progress, gain feelings of self-efficacy and build autonomy as they begin to master the basic reading skills that they have had difficulty with for so long (Ryan & Deci, 2009).

Intervention Effects on Student Perception

It was hypothesized that MVRC would have a positive impact on student perceptions of teacher support and academic expectations. No previous research study has specifically looked at MVRC (or other computer-assisted interventions) and authoritative school climate with high school students. Although there were no significant results, both the intervention and control groups' perceived Teacher Academic Expectations increased. It is possible that the student sensed higher academic expectations from their teachers since they grew academically in the year and were progressing to the next grade level. Over the academic year, the students' perceived Sense of Support decreased, demonstrating that the MVRC intervention did not make a difference. Because all participant groups experienced a decrease in feeling supported by their teachers and school staff, it could describe a trend with struggling readers or the high school climate overall. The post-test measures were collected around the students' final exams, so the stress of grades and ending the academic year could have impacted the students' perceptions of school support.

Authoritative School Climate and Student Engagement

Consistent with previous research (Cornell et al., 2016; Konold et al., 2018), the current study found authoritative school climate and student engagement to be positively correlated.

These correlations expand on previous research because the study population was made up of struggling readers, and the results varied in the students' perceptions of the teacher support and the structure of their academic experience. The relationships between student perceptions of their teacher support and internal engagement (cognitive and affective) were stronger than disciplinary structure and internal engagement (cognitive and affective). These results showing a significant correlation between perceived student support and student engagement align with previous research that has shown that when struggling high school readers do not feel supported at school, it can result in lower motivation and lower grades (Li & Lerner, 2011). This finding also emphasizes that high school readers who are reading below grade level value support from their teachers and need that to be a focus of their academic experience at school. Previous research has also pointed out that struggling high school readers do not feel teachers expect much of them, which can take a toll on their development of cognitive and affective engagement.

These findings indicate that positive school climate characterized by student support and school disciplinary structure are critical for student engagement among high school students who are reading below grade level. High school students who struggle in a core academic subject, especially reading, are more at-risk for dropping out of school (Reschly, 2010). Continuing to build upon structure and support at school for this population of students can be another avenue to intervene and help them remain engaged and connected to their school. It is interesting that the correlation between student engagement and student support ($r=.83$ (pre-test) and $r=.62$ (post-test)) was stronger than the correlation between student engagement and school disciplinary structure $r=.64$ (pre-test) and $r=.39$ (post-test).

The ASCS measure identifies what a student perceives about the school disciplinary structure by asking about fairness, rules, and punishment. The teacher academic expectations can

also be added to the school disciplinary structure. The ASCS looks at a student's perception of support at school by asking if they feel heard, respected, cared about and whether teachers genuinely want them to do well. It also looks at whether a student is willing to seek out help when they need to. In the current study, these aspects of support are important, because over time struggling readers may not feel supported and then may stop reaching out for help and guidance from trusted teachers and staff. It is imperative to keep them active in the learning process, with a sense of safety and trust that they feel comfortable taking the academic risks to challenge themselves and progress. The SEI measure looks at a student's cognitive and emotional commitment to their academic journey, but without strong structure and support it would be hard for a student to find their academic purpose. A computer-based intervention like MVRC can provide the support and encouragement to help students commit to their academic journey. As noted in the current study, struggling high school readers require time and perseverance to see improvements in their engagement and reading skills.

Remaining engaged in school also entails seeing how the current academic difficulties in reading will pay off in the long run and lead to a career or academic pursuit in the future. The item on the SEI that states, "Most teachers at my school are interested in me as a person, not just as a student" demonstrates how a student can feel cognitively and emotionally safe at school because they feel that their teachers are equally as invested in them as they are in their academic work. Over time they can learn to recognize that their academic failures have not defined them, and they can continue to improve in their reading to make positive strides for their future. Until they see their potential in view, they can rely on the support and expectations of their teachers to put them on the right path.

Implications for Practitioners and Educators

Overall, the findings from this study support the current literature regarding evidence-based instructional techniques to teach basic reading skills. The study also demonstrated that the curriculum could be successfully taught through the computer and supported by the in-person teacher. The study also confirmed the difficulties that arise when working with high school students who have experienced repetitive instances of reading failure in their lives. Some of the students appeared motivated by MVRC, the built-in structure, the accountability of the remedial reading class, and the encouragement of the teacher. Once these students had a spark of motivation lit, they were able to feed off their enthusiasm and continue making progress in the intervention, while others did not complete learning activities in the classroom or at home. This pattern of low engagement and avoidance among high school students has been discussed in the literature on high school remedial education (Reschly, 2010). When intervening with struggling high school students, it would be beneficial for school staff or teachers to closely monitor the students' intervention fidelity with more frequent check-ins and measurements of progress. These practices would allow for adjustments to be made to improve intervention fidelity. In addition, increased communication between school staff and student family members could help increase the amount of intervention hours completed.

Although the teacher did not have teaching experiences with high school students performing so low in reading, she was passionate and motivated to try out MindPlay Virtual Reading Coach. The research literature has noted that teachers have to adjust to incorporating technology in their classrooms, and there was a transition period for the teacher and her students. There were some setbacks along the way with technology issues, questions about program implementation, and adjustments to the role of the in-person teacher during an online reading

intervention. One of the most difficult setbacks was how to motivate students who did not meet the usage time goals. Even with the setbacks, there were a lot of noted successes and the teacher expressed satisfaction and gratitude at the end of the school year. The school planned to continue using MVRC with a remedial reading class for future academic years because progress had been made.

One way that schools can continue to support and encourage blended learning in the classroom is to provide training for teachers on how to best incorporate technology for specific age groups. Programs like MVRC can be rolled out in high schools that require significant reading support for high school students, and the teachers in the schools can be better trained on how to teach basic reading skills to this high-risk age group (Muñoz & Chang, 2007).

Given that authoritative school climate was found to be significantly correlated with student engagement among struggling high school readers, it would benefit schools to put forth effort to increase structure and support for their students who fall within this at-risk population. By increasing the authoritative school climate (and classroom climate for remedial reading classes) within the school, it would positively influence the students' cognitive and affective engagement. Although the school structure changes from middle to high school, transitioning to more expectations being put on students to organize their work, commit to putting in the time to complete their work, and remain interested in their academic growth (Konold & Cornell, 2015), there is not enough discussion on what structures can remain in place to help students who struggle with their reading.

Virtual reading interventions, such as MVRC, can work to create an academic support system and structure within the classroom with the teacher who is guiding the students through the program. This structured and supportive approach allows struggling high school readers to

see their progress, feel a sense of achievement, and build their self-efficacy (Schunk & Zimmerman, 2007). Because these students tend to avoid reading, due to its challenging nature, the time requirements and reward system can keep students committed and engaged.

Individualized intervention plans can also motivate the students, because having personalized goals can create a built-in system for achievement expectations that are appropriate for their level (Schunk & Pajares, 2009).

School administration, teachers, and staff can also focus on improving the engagement levels of all high school students (including struggling readers) by targeting the school climate within their school or classroom. For example, schools can measure the quality of teacher-student interactions and work to improve where necessary. An increase in the number of positive interactions with teachers can help struggling high school students feel more supported at school. A school could incorporate My Teaching Partner-Secondary (MTP-S) into the professional development training to provide teachers with individualized feedback, and examples of positive teacher-student interactions (Pianta et al., 2012). The training would also equip high school teachers with the skills to communicate their expectations of autonomy, emphasize relevance of academic work (and reading for career development), and integrate peers as resources (Hofkens & Pianta, 2022).

It would be a protective factor for struggling high school readers to develop a supportive peer group as they endure the academic challenges of high school. A program like MTP-S could guide teachers on how to help high school students work together and help one another. Within the current study, the remedial reading class served as a supportive group of peers to encourage students to complete intervention minutes and serve as examples to one another of the benefits of hard work. Throughout the various team building activities, it was apparent that the students

were able to share positive comments to one another to encourage one another to work towards increasing their participation in the reading intervention.

Limitations of the Study

The present study explored the influence of MVRC on reading achievement, student engagement, and student perceptions of teacher support and academic expectations. It also examined the relationship between authoritative school climate and student engagement in high school students. The students chosen for both groups were based off reading abilities (not by random assignment), to target the high school students with the most need for a reading intervention. Given that the students were part of a small remedial reading class, the intervention group was bound to be small within the charter high school and the research study was quasi-experimental. This size also was manageable by the teacher, but she could have used an additional teacher assistant to help with keeping the students motivated. As the teacher observed the students completing the MVRC program, she walked around the classroom to assist and answer questions. This limited her ability to monitor “time on task” for students that lacked motivation to use all of the intervention time allotted them in the classroom. Another staff member present in the classroom would allow for closer monitoring and support. The smaller size of the groups did impact the power of the statistical analysis, so increasing the number of participants would help. Rather than increasing the size of the intervention class, additional intervention groups (within or separate from remedial classes) could be formed to add more students to the research groups.

The research study could have benefited from collecting additional measures looking specifically at reading engagement (Reading Engagement Index) or reading motivation (Reading Motivation Scale). Given the theoretical background for student engagement and the overlap

with motivation, the current study was based on the conceptualization that motivation is embedded within student engagement and is captured within the Student Engagement Instrument (SEI). Data did not suggest that the participants in the research study were motivated (based on their intervention fidelity and student engagement scores), but additional qualitative questions targeting student motivation would have provided more information. For example, it would have been informative to have a separate measure of academic motivation specific to reading tasks among high school students to examine if by participating in the MVRC the students experienced higher level of motivation to read, which then impacted their engagement in reading, and resulted in improvements in their reading abilities.

The current study relied on student reports of student engagement and authoritative climate. It could have also been helpful to have administered the authoritative school climate survey from the perspective of the teachers or classroom observations. Konold et al. (2018) pointed out in their research that having both student and teacher perspectives can help researchers better understand the results of the study and how to intervene adequately. Given that MindPlay supports educators in the implantation of the MVRC and provides a structure for the educational activities and lessons for the students, the intervention could impact the classroom climate from the perspective of the teacher. A teacher may feel like some of the difficulties of lesson planning, preparing class materials, and completing reading progress measures are taken care of by the MVRC program allowing teachers more time to spend on building supportive relationships with their students and communicating their expectations and encouragement in the classroom. They also have data available to gauge behavioral engagement in the form of time spent on the intervention and academic engagement as to whether their reading scores are

improving. Given these potential opportunities for teacher-student relationships, it could be valuable to gather teacher information.

Given the fact that the current study only had one teacher involved in administering the MVRC and working with the intervention students, it was difficult to decipher if the students' perspectives of teacher academic expectations and support were based on changes within the way their teacher approached teaching reading and the supportive environment of the remedial reading class or other factors. The measure is worded as "teachers" and "school" and could have been adjusted to ask specifically about "reading teacher" and "reading classroom."

In addition, the structure domain within the Authoritative School Climate Survey (ASCS) could have included the perceived Teacher Academic Expectations, which would have also been included in the total score of the ASCS measure. The theoretical underpinnings of the ASCS adapted since the data was collected for the current study, in that the measure added the flexibility to include or not include the Teacher Academic expectations measure into the structure domain. Although, this area was investigated in research question three, it could have been informative to see if the totals for the structure domain or the ASCS measure differed significantly with the additional items added.

There could have been a more structured approach to keeping the lowest readers in the class motivated to continue with the intervention to increase the intervention fidelity, which ranged from 37% to 78%. Muñoz and Chang (2007) point out that "building motivation to read is a major challenge facing the secondary teacher." The "Matthew Effect" phenomenon (Reschly, 2010) took place with a few students (e.g., Student 3) who appeared to not get enough momentum to increase their participation in the reading intervention. There could have been another intervention within the study that directly targeted student motivation rather than

indirectly targeting it through the reading intervention. Research has shown that improved reading skills can increase engagement and motivation, which was relied upon in the current study. However, particular students did not see this occur in their reading progress because they did not make enough improvement or commit enough intervention time to activate the positive ramifications. There also could have been a focus on retraining and reframing thought and emotional patterns that have been reinforced through more and more difficulties in reading, like the PHAST intervention, which incorporates attributional retraining, reorienting/retraining negative motivational perspectives, unproductive attributions, and misguided beliefs about effort and achievement (Lovett et al., 2021).

Directions for Future Research

The results of the present study provide several possibilities for future research. There needs to be more research on computer-based reading interventions for high school students. With the aftermath of the COVID-19 pandemic and the current statistics of high school students reading below their grade level, it is a critical time to find some solutions to help remedy the situation (Graves, 1999).

It would be helpful for future research to investigate whether providing direct interventions to improve student engagement can also improve reading achievement. Previous research has shown that increasing student engagement through an intervention approach can enhance academic achievement, but this has yet to be empirically tested with high school students and reading achievement. Another interesting endeavor would be to simultaneously administer MVRC and a student engagement intervention that explicitly teaches the students how to engage in their academic work. It would also be helpful to incorporate more

psychological reframing techniques for struggling high school readers to have a growth mindset when working on difficult academic tasks (Pohl & Nelson, 2020).

Conclusion

The current study contributed to the research literature and evidence-backing of the MindPlay Virtual Reading Coach with high school readers. In addition, more evidence was collected for the significant influence of school climate on student engagement, continuing to encourage schools and classrooms to focus on building communication between teachers, staff, and students and providing safe learning environments where students can grow and actively engage with their learning.

The pattern of changes in student engagement, perceptions about teacher support, and academic expectations may reflect significant levels of academic challenges that these high school students experience. Patterns of student engagement have developed over time, and by the time students with reading difficulties reach high school, they have become accustomed to engaging in a certain way. Especially for students with reading difficulties, it will take time for their internal engagement to increase and for their perceptions of teachers' support and expectations to adapt. Improving basic reading skills is possible but changing the way students see themselves and their role at school and adjusting what they believe they are capable of will take time and multiple experiences of academic improvements.

It is imperative that struggling high school readers get the attention and intervention they need to help them improve their reading achievement and feel connected to their school through teacher-student relationships and a commitment to their learning to reach the expectations they perceive their teachers have for them.

Appendix A: Individual Student Data

Student 1. This student spent 51 hours and 50 minutes on the MindPlay Virtual Reading Coach Intervention. Student 1 started the study with an initial independent reading comprehension grade level of 1st grade (measured by MVRC) and ended in the 4th-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the foundational phonics level and improved to the basic phonics level. Looking at the reading data collected as part of this study, Student 1 showed consistent scores across pre-and post-test time points, increasing Test of Word Reading Efficiency- 2 SW and Test of Word Reading Efficiency-2 PD.

Table 24

Reading Scores and Effect Sizes of Student 1

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	64	59	-.33
Test of Word Reading Efficiency-2 SW	73	75	.13
Test of Word Reading Efficiency-2 PD	72	74	.13
Spelling	66	66	.00
Word Reading Fluency	50	50	.00
Sentence Reading Fluency	59	59	.00
Word Attack	66	66	.00
Letter-Word Identification	58	58	.00
Basic Reading Cluster	60	60	.00
Reading Rate Cluster	50	50	.00

Note. SW =Sight Word Efficiency; PD = Phonetic Decoding Efficiency. Intervention hours = 51 h 50 min. Scores reported as standard scores.

Student 2. This student spent 31 hours and 28 minutes on the MindPlay Virtual Reading Coach Intervention. Student 2 started the study with an initial independent reading comprehension grade level of 5th grade (measured by MVRC) and ended in the 7th-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the basic

phonics level and improved to the intermediate phonics level. Looking at the reading data collected in this study, Student 2 improved multiple scores. Using Cohen's guidelines, the increased scores in the Test of Word Reading Efficiency -2 SW ($d=.20$), Test of Word Reading Efficiency -2 PD ($d=.27$), and Word Reading Fluency ($d=.33$) had small effect sizes. Similarly, there were medium effect sizes in the improved scores of Spelling ($d=.60$) and Basic Reading ($d=.67$). Finally, Student 2's most improved area was Word Attack, which jumped from a score of 62 to 90 with a large effect size ($d=1.87$). Their Reading Rate Cluster standard score also increased from 62 to 64.

Table 25*Reading Scores and Effect Sizes of Student 2*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	75	70	-.33
Test of Word Reading Efficiency-2 SW	71	74	.20
Test of Word Reading Efficiency-2 PD	63	67	.27
Spelling	56	65	.60
Word Reading Fluency	64	69	.33
Sentence Reading Fluency	69	67	-.13
Word Attack	62	90	1.87
Letter-Word Identification	73	68	-.33
Basic Reading Cluster	67	77	.67
Reading Rate Cluster	62	64	.13

Note. SW=Sight Word Efficiency; PD= Phonetic Decoding Efficiency. Intervention hours = 31 h 28 min. Scores reported as standard scores.

Student 3. This student spent 25 hours and 43 minutes on the MindPlay Virtual Reading Coach Intervention. Student 3 started the study with an initial independent reading comprehension grade level of Kindergarten (measured by MVRC) and ended at the Kindergarten level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the foundational phonics level and continued at the foundational phonics level. Looking at the

reading data collected as part of this study, Student 3 showed consistent scores across pre-and post-test time points, decreasing in Test of Silent Word Reading Fluency-2 and Word Attack.

Table 26

Reading Scores and Effect Sizes of Student 3

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	55	40	-1.0
Test of Word Reading Efficiency-2 SW	55	55	.00
Test of Word Reading Efficiency-2 PD	55	55	.00
Spelling	40	40	.00
Word Reading Fluency	40	40	.00
Sentence Reading Fluency	40	40	.00
Word Attack	59	52	-.47
Letter-Word Identification	40	40	.00
Basic Reading Cluster	40	40	.00
Reading Rate Cluster	40	40	.00

Note. SW=Sight Word Efficiency; PD= Phonetic Decoding Efficiency. Intervention hours = 25 h

43 min. Scores reported as standard scores.

Student 4. This student spent 42 hours and 30 minutes on the MindPlay Virtual Reading Coach Intervention. Student 4 started the study with an initial independent reading comprehension grade level of 5th grade (measured by MVRC) and ended in the 6th-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the foundational phonics level and improved to the intermediate phonics level. Looking at the reading data collected as part of this study, student 4 performed consistently across pre-and post-test time points, increasing Test of Silent Word Reading Fluency- 2, Test of Word Reading Efficiency-2 PD, Word Attack, Letter-Word Identification, and Basic Reading. Using Cohen's guidelines, the increased scores in Test of Word Reading Efficiency-2 PD ($d=.27$), Letter-Word Identification ($d=.40$), and Basic Reading ($d=.27$) had small effect sizes.

Table 27*Reading Scores and Effect Sizes of Student 4*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	43	44	.07
Test of Word Reading Efficiency-2 SW	55	55	.00
Test of Word Reading Efficiency-2 PD	60	64	.27
Spelling	40	40	.00
Word Reading Fluency	40	40	.00
Sentence Reading Fluency	40	40	.00
Word Attack	82	84	.13
Letter-Word Identification	56	62	.40
Basic Reading Cluster	66	70	.27
Reading Rate Cluster	40	40	.00

Note. SW=Sight Word Efficiency; PD= Phonetic Decoding Efficiency. Intervention hours = 42 h 30 min. Scores reported as standard scores.

Student 5. This student spent 43 hours and 58 minutes on the MindPlay Virtual Reading Coach Intervention. Student 5 started the study with an initial independent reading comprehension grade level of 9th grade (measured by MVRC) and ended in the 11th-grade level. These scores fell into the approaching and exceeding grade-level range. The student's phonics abilities (measured by MVRC) started at the basic phonics level and improved to the intermediate phonics level. Looking at the reading data collected in this study, Student 5 improved multiple scores. Using Cohen's guidelines, the increased scores in the Test of Word Reading Efficiency -2 SW ($d=.20$), Spelling ($d=.20$), and Basic Reading ($d=.20$) had small effect sizes. Similarly, a medium effect size was found in the improvements of Letter-Word Identification ($d=.53$).

Table 28*Reading Scores and Effect Sizes of Student 5*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	68	64	-.27
Test of Word Reading Efficiency-2 SW	81	84	.20
Test of Word Reading Efficiency-2 PD	73	75	.13
Spelling	72	75	.20
Word Reading Fluency	92	84	-.53
Sentence Reading Fluency	94	84	-.67
Word Attack	80	76	-.27
Letter-Word Identification	82	90	.53
Basic Reading Cluster	80	83	.20
Reading Rate Cluster	92	82	-.67

Note. SW=Sight Word Efficiency; PD= Phonetic Decoding Efficiency. Intervention hours = 43 h 58 min. Scores reported as standard scores.

Student 6. This student spent 28 hours and 10 minutes on the MindPlay Virtual Reading Coach Intervention. Student 6 started the study with an initial independent reading comprehension grade level of 9th grade (measured by MVRC) and ended in the 10^h-grade level. These scores both fell into the critical and approaching grade level range. The student's phonics abilities (measured by MVRC) started at the foundational phonics level and improved to the basic phonics level. The reading data collected in this study showed that the reading scores both increased and decreased. Using Cohen's guidelines, the increased scores in Spelling ($d=.33$) and Basic Reading ($d=.40$) had small effect sizes, while the increase in Letter Word Identification had a medium effect size ($d=.67$).

Table 29*Reading Scores and Effect Sizes of Student 6*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	83		
Test of Word Reading Efficiency-2 SW	85	80	-.33
Test of Word Reading Efficiency-2 PD	84	73	-.73
Spelling	80	85	.33
Word Reading Fluency	100	91	-.60
Sentence Reading Fluency	84	77	-.47
Word Attack	63	62	-.67
Letter-Word Identification	80	90	.67
Basic Reading Cluster	71	77	.40
Reading Rate Cluster	91	82	-.60

Note. SW=Sight Word Efficiency; PD= Phonetic Decoding Efficiency. Intervention hours = 28 h 10 min. Scores reported as standard scores.

Student 7. This student spent 37 hours and 10 minutes on the MindPlay Virtual Reading Coach Intervention. Student 7 started the study with an initial independent reading comprehension grade level of 6th grade (measured by MVRC) and continued in the 6th-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the basic phonics level and improved to the intermediate phonics level. The reading data collected in this study showed that the reading scores both increased and decreased. Using Cohen's guidelines, the increased scores in the Test of Silent Word Reading Fluency -2 ($d=.20$) and Basic Reading ($d=.40$) had small effect sizes. Student 7's most improved area was in Word Attack, which jumped from a score of 98 to 110 with a large effect size ($d=.80$).

Table 30*Reading Scores and Effect Sizes of Student 7*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	85	88	.20
Test of Word Reading Efficiency-2 SW	85	85	.00
Test of Word Reading Efficiency-2 PD	97	96	-.07
Spelling	85	83	-.13
Word Reading Fluency	89	85	-.27
Sentence Reading Fluency	83	78	-.33
Word Attack	98	110	.80
Letter-Word Identification	85	86	.07
Basic Reading Cluster	90	96	.40
Reading Rate Cluster	84	80	-.27

Note. SW=Sight Word Efficiency; PD= Phonetic Decoding Efficiency. Intervention hours = 37 h 10 min. Scores reported as standard scores.

Student 8. This student spent 45 hours and 45 minutes on the MindPlay Virtual Reading Coach Intervention. Student 8 started the study with an initial independent reading comprehension grade level of 5th grade (measured by MVRC) and ended in the 5^h-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the intermediate phonics level and continued at the intermediate phonics level. Looking at the reading data collected in this study, Student 8 improved multiple scores. Using Cohen's guidelines, the increased scores in the Test of Silent Word Reading Fluency -2 ($d=.20$), Sentence Reading Fluency ($d=.27$), and Letter Word Identification ($d=.20$) had small effect sizes. Similarly, there were medium effect sizes in the improved scores of the Reading Rate Cluster ($d=.60$). Finally, Student 2's improved scores in Word Reading Fluency ($d=.80$), Basic Reading ($d=.80$), and Word Attack ($d=1.53$) demonstrated large effects.

Table 31*Reading Scores and Effect Sizes of Student 8*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	69	72	.20
Test of Word Reading Efficiency-2 SW	79	78	-.07
Test of Word Reading Efficiency-2 PD	71	70	-.07
Spelling	73	72	-.07
Word Reading Fluency	64	76	.80
Sentence Reading Fluency	56	60	.27
Word Attack	68	91	1.53
Letter-Word Identification	69	72	.20
Basic Reading Cluster	67	79	.80
Reading Rate Cluster	55	64	.60

Note. SW = Sight Word Efficiency; PD = Phonetic Decoding Efficiency. Intervention hours = 45

h 45 min. Scores reported as standard scores.

Student 9. This student spent 45 hours and 46 minutes on the MindPlay Virtual Reading Coach Intervention. Student 9 started the study with an initial independent reading comprehension grade level of 5th grade (measured by MVRC) and ended in the 8th-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the basic phonics level and continued at the basic phonics level. Looking at the reading data collected in this study, Student 9 improved multiple scores. Using Cohen's guidelines, the increased scores in Sentence Reading Fluency ($d=.33$), Basic Reading Cluster ($d=.40$), and Reading Rate Cluster ($d=.20$) had small effect sizes. Similarly, a medium effect size was found in the improved scores of the Test of Word Reading Efficiency-2 PD ($d=.67$). Finally, Student 9's most improved area was Letter Word Identification, which jumped from a score of 66 to 79 with a large effect size ($d=.87$). The Word Reading Fluency score also increased from 83 to 84.

Table 32*Reading Scores and Effect Sizes of Student 9*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	72	72	.00
Test of Word Reading Efficiency-2 SW	80	79	-.07
Test of Word Reading Efficiency-2 PD	56	66	.67
Spelling	64	63	-.07
Word Reading Fluency	83	84	.07
Sentence Reading Fluency	76	81	.33
Word Attack	64	60	-.27
Letter-Word Identification	66	79	.87
Basic Reading Cluster	63	69	.40
Reading Rate Cluster	77	80	.20

Note. SW = Sight Word Efficiency; PD = Phonetic Decoding Efficiency. Intervention hours = 45

h 46 min. Scores reported as standard scores.

Student 10. This student spent 39 hours and 24 minutes on the MindPlay Virtual Reading Coach Intervention. Student 10 started the study with an initial independent reading comprehension grade level of 7th grade (measured by MVRC) and ended in the 7th-grade level. These scores both fell into the critical range. The student's phonics abilities (measured by MVRC) started at the basic phonics level and improved to the intermediate phonics level. Looking at the reading data collected as part of this study, Student 10 showed improvements in multiple scores and a decrease in some scores. Using Cohen's guidelines, the increased scores in Spelling ($d=.40$), Word Reading Fluency ($d=.20$), Letter Word Identification ($d=.20$), and Reading Rate ($d=.20$) had small effect sizes. The Sentence Reading Fluency score also increased from 89 to 91.

Table 33*Reading Scores and Effect Sizes of Student 10*

	Pre	Post	Effect Size
Reading Variables			
Test of Silent Word Reading Fluency-2	89		
Test of Word Reading Efficiency-2 SW	87	81	-.40
Test of Word Reading Efficiency-2 PD	80	75	-.33
Spelling	72	78	.40
Word Reading Fluency	89	92	.20
Sentence Reading Fluency	89	91	.13
Word Attack	87	74	-.87
Letter-Word Identification	82	85	.20
Basic Reading Cluster	83	79	-.27
Reading Rate Cluster	88	91	.20

Note. SW = Sight Word Efficiency; PD = Phonetic Decoding Efficiency. Intervention hours = 39

h 24 min. Scores reported as standard scores.

Appendix B: Human Investigation Committee Approval Letters



Research
Office for Research & Discovery

Human Subjects
Protection Program

1618 E. Helen St.
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Date: September 13, 2017
Principal Investigator: Caitlyn Noelle Francis
Protocol Number: 1708746655
Protocol Title: The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement
Level of Review: Exempt
Determination: Approved
Documents Reviewed Concurrently:

Data Collection Tools: *Appendix_J_WJIV_ACH_Protocol.pdf*
Data Collection Tools: *Authoritative School Climate Survey Research Summary 7-11-17.docx*
Data Collection Tools: *Demographic Survey.docx*
Data Collection Tools: *SEI.pdf*
Data Collection Tools: *SEI Administration, Scoring, and Results Use ICI.pdf*
Data Collection Tools: *TOSWRF2P1.JPG*
Data Collection Tools: *TOSWRF2P2.JPG*
Data Collection Tools: *TOSWRF2P3.JPG*
Data Collection Tools: *TOWRE2P1.JPG*
Data Collection Tools: *TOWRE2P2.JPG*
Data Collection Tools: *TOWRE3P3.JPG*
Data Collection Tools: *TOWRE3P4.JPG*
HSPP Forms/Correspondence: *appendix_a_children FINAL.doc*
HSPP Forms/Correspondence: *CF.F200 FINAL.doc*
HSPP Forms/Correspondence: *Signature Page*
HSPP Forms/Correspondence: *VerificationFormFINAL.doc*
Informed Consent/PHI Forms: *18StudentConsent.docx*
Informed Consent/PHI Forms: *18StudentConsent.pdf*
Informed Consent/PHI Forms: *Consent to Participate CHS Parent FINAL.doc*
Informed Consent/PHI Forms: *Consent to Participate CHS Parent FINAL.pdf*
Informed Consent/PHI Forms: *StudentAssentForm FINAL.docx*
Informed Consent/PHI Forms: *StudentAssentForm FINAL.pdf*
Other Approvals and Authorizations: *mindplay research permission.pdf*
Other Approvals and Authorizations: *MVRCLetter.docx*
Other Approvals and Authorizations: *SiteAuthorizationLetterpdf.pdf*

This submission meets the criteria for exemption under 45 CFR 46.101(b). This project has been reviewed and approved by an IRB Chair or designee.



Human Subjects
Protection Program

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Date:	June 06, 2018
Principal Investigator:	Caitlyn Noelle Francis
Protocol Number:	1708746655A001
Protocol Title:	The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement
Determination:	Approved
Expiration Date:	September 12, 2022
Change Description:	\$500 of research funds to the PI were received by the College of Education at the University of Arizona. Personnel Added, Kendall Welliver, Kimberly Anderson, and Texana Sonnefeld. Updating the four consents to reflect compensation. For the student consent form, assent form, parental consent, they will receive a 10 dollar amazon gift card for the completion of the study. The teacher consent form reflects 20 dollar gift card to amazon. The teacher consent form was added priory, as it did not constitute as an amendment change to the IRB, per my discussion with an IRB associate.
Documents Reviewed Concurrently:	<p>Grant/Contracts: <i>EmailMessage.png</i></p> <p>HSPP Forms/Correspondence: <i>amendment_CF.6.1.18.pdf</i></p> <p>HSPP Forms/Correspondence: <i>VerificationForm05.16.doc</i></p> <p>Informed Consent/PHI Forms: <i>18StudentConsent (1).docx</i></p> <p>Informed Consent/PHI Forms: <i>18StudentConsent (1).pdf</i></p> <p>Informed Consent/PHI Forms: <i>Consent to Participate CHS Parent FINAL (1).doc</i></p> <p>Informed Consent/PHI Forms: <i>Consent to Participate CHS Parent FINAL (1).pdf</i></p> <p>Informed Consent/PHI Forms: <i>StudentAssentForm FINAL (1).docx</i></p> <p>Informed Consent/PHI Forms: <i>StudentAssentForm FINAL (1).pdf</i></p> <p>Informed Consent/PHI Forms: <i>TeacherConsent.docx</i></p> <p>Informed Consent/PHI Forms: <i>TeacherConsent.pdf</i></p>
Regulatory Determinations/Comments:	<p>This project has been reviewed and approved by an IRB Chair or designee.</p> <ul style="list-style-type: none"> • The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218). • All research procedures should be conducted according to the approved protocol and the policies and guidance of the IRB. • Amendments to exempt projects are required. See the Guidance on Minimal Risk or Exempt Research for a list of changes that would require an amendment be submitted to the office.

Appendix C: Letters of Support

July 17, 2017




To Whom it May Concern:

My company is happy to support the proposed study at [REDACTED] that will start this September. I understand that Caitlyn Francis, a doctoral student in the school psychology program, is conducting this study for her dissertation through the University of Arizona, under the directorships of Dr. Jina Yoon and Dr. Nancy Mather. We are delighted to support research that explores the efficacy of our online reading program, the Mindplay Virtual Reading Coach. To help support this study, we are willing to provide [REDACTED] licenses for no charge to students who are struggling readers at this school. We are also willing to provide free access to the program the following school year for students who are in the control group this year. Our company will also provide teacher training and technical support as needed for no charge. We look forward to supporting you in this research project, and most importantly, to seeing your results!



Judith Bliss
Judith Bliss
CEO
MindPlay



To Whom It May Concern:

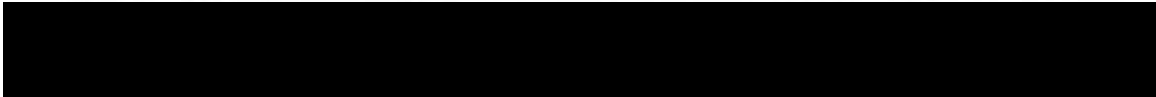
After reviewing the proposed research study, The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement, presented by the University of Arizona by Caitlyn Francis, a doctoral candidate in the Department of School Psychology and Dr. Nancy Mather and Dr. Jina Yoon, Professors of Disability and Psychoeducational Studies, I,  principal and founder of  have granted permission for the study to be conducted at .

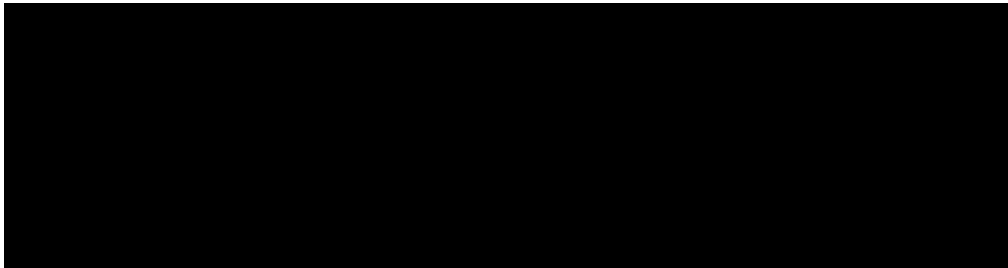
The purpose of the study is to evaluate the efficacy of the MindPlay Virtual Reading Coach, an online reading intervention designed to help students in high school who are below grade level in their reading ability make gains toward reaching grade level. In addition, school climate and student engagement will be examined. I understand that the primary research activities will include: demographic information and pre- and post-test measures that will include reading achievement testing and student questionnaires on school climate and student engagement. The primary intervention will be online supplemental reading instruction with MindPlay Virtual Reading Coach, 30 minutes a day, 5 days a week, at no additional cost to the district.

For the research to proceed, a minimum of  participants in ninth through twelfth grade will be required. All participants will complete pre- and post-test measures, and the intervention will be provided to the treatment group participants for 30 minutes per day, five days per week, throughout the intervention period  with the exception of school holidays, school functions, and school testing days. Pre-testing will occur the week immediately preceding the intervention, and post-testing will occur the week immediately following the intervention.

Pre-, post-test measures will each require approximately 90 minutes of participants' time (two class periods) and consist of standardized measures of reading and spelling achievement to be administered individually or in whole-class groups by qualified examiners. Pre- and post-testing will occur during the school day and during the regular academic year.

I understand that the proposed research will include the collection of the following student records that are protected under the Family Educational Rights and Privacy Act (FERPA) of 1974: grade in school, sex, date of birth, English-language learner (ELL) status, special education (SPED) status, and Reading and Writing composite scores from the 2017-2018 AzMERIT test.






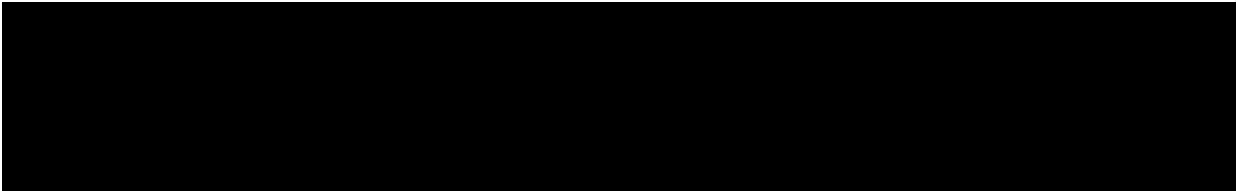
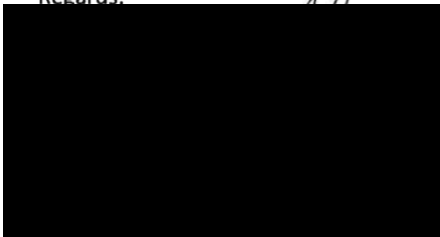
September 8, 2017

Re: Caitlyn Noelle Research Project on use of MindPlay 

To Whom It May Concern,

Since  is a charter school and is not affiliated with a school district, we do not need approval in addition to the school principal for participating in this research project. Please contact me with any questions you may have. Thank you.

Regards,



Appendix D: Parent Consent Form

University of Arizona Consent to Participate in Research

Version 5/30/2018

Study Title: The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement

Principal Investigator: Caitlyn Francis, M.A.

This is a consent form for research participation. It contains important information about this study and what to expect if you and your child decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

Why is this study being done?

The purpose of this research study is to determine the effects of a computer-assisted reading program, MindPlay Virtual Reading Coach on the reading and spelling skills of high school students. In addition, the school climate and student engagement will be considered.

What will happen if my child takes part in this study?

In September 2017, your child will complete a variety of pre-tests to gain information about their current reading level, their school environment, and their engagement as a student. This will span over 1-2 class periods.

If your child is in the reading support class, the following classes (three times a week) will be a time to ask questions and talk about their progress, and to complete 30 minutes of the reading program. If your child is in the additional class, they will not be required to complete the reading intervention.

In April 2018, your child will complete post-tests to see if their reading and spelling ability have improved. They will also be asked about their school climate and student engagement at the end of the study. This will span over 1-2 class periods.

The students in the additional class not participating in the reading intervention, will have the opportunity to participate during the 2018-2019 school year.

Your child will receive a \$10.00 Amazon gift card at the termination of this study as a thank you for full participation.

How long will my child be in the study?

If your child is in the reading support class, they will be required to participate in the MindPlay Virtual Reading Program 5 days a week for 30 minutes a day (3 days in school and 2 days out of school) and complete the pre- and post-test measures. Otherwise, they will only be required to complete the pre- and post-test measures in September 2017 and April 2018.

Page 1 of 5

Your child's participation will last from September 2017 to April 2018.

How many people will take part in this study?

10 students ranging from 9th to 12th grade enrolled in the reading support class will complete the online reading program. An additional class with 10 students will serve as the comparison group and will not complete the reading program, but will complete the pre- and post-tests.

Can my child stop being in the study?

Your child's participation in completing the study measures is voluntary. You may refuse to allow your child to participate in this study. If you decide to allow your child to take part in the study, your child may leave the study at any time. No matter what decision you make, there will be no penalty to your child and your child will not lose any of their benefits. Your decision will not affect your child's future relationship with [REDACTED] or the University of Arizona. If you are a student or employee at the University of Arizona, your decision will not affect your grades or employment status.

What risks, side effects or discomforts can my child expect from being in the study?

There are no risks associated with this research, other than the potential risk of the loss of your child's confidentiality if their participation must be disclosed or researchers share their information without permission. For example, if the court of law required that their participation be disclosed, the PI would have to oblige. Your child will receive a reading intervention at no cost to them. The program will be part of the regular classroom activities and homework.

What benefits can my child expect from being in the study?

Your child may or may not benefit as a result of participating in this study. The potential benefits to your child may include advances in reading ability specifically word recognition, spelling, and reading rate. In addition, it is apparent from the current literature, that the use of CAI to teach basic reading skills including word recognition, spelling and vocabulary skills using a phonics-based approach is not readily available. Therefore, conducting research on the use of MVRC to teach basic reading skills to high school students is a valuable addition to the present research literature, which may show increases in student academic engagement.

Also, the findings of this study may inform teachers whether students' perception of the authoritative school climate (demandingness and responsiveness) influences their cognitive and affective engagement in the classroom. Whether support and discipline influence student engagement can help inform classroom interventions to promote positive classroom climates. The students' input can be seen as a valid source of information to help create interventions in the classroom to improve student engagement. Furthermore, MVRC may impact all four areas of the engagement of the students. The students' mindsets about their academic abilities may

improve, as well as their motivation. Their academic performance and class participation may increase. Students may feel more support and perceive higher academic expectations from their teachers after successfully completing an intervention in an academic area of weakness (as shown by the Student Support Scales of the Authoritative School Climate Survey). It is important that struggling students have supportive relationships with their teachers who are encouraging to help motivate them.

What other choices does my child have if they do not take part in the study?

You may choose not to allow your child to participate in this study without penalty or loss of benefits to which they are otherwise entitled.

Will my child's study-related information be kept confidential?

Efforts will be made to keep your child's study-related information confidential. To ensure participant privacy, secure connections to the MVRC servers will be maintained during treatment, and student identification numbers will be used on all study-related documents and electronic files, in lieu of participants' names. The principal investigator will not have access to the student names that are connected to the student identification numbers. The teacher will hold access to the document with the link between the student participants' names and their student identification number. The link will be destroyed in May 2020. No personally identifying information will be used in any reports or publications. Test protocols, observation protocols, and other study-related data, as well as hard disks containing soft copies of study-related data, will be kept in a locked filing cabinet in Room 414 of the University of Arizona's College of Education. Only research personnel involved in this study will have access to the files. All laptops and stationary computers used to store research data will be password protected and the data will be encrypted. Consents will be kept at least ten years past the conclusion of the study or six years past the time when the youngest participant turns 18, whichever is longer.

However, there may be circumstances where this information must be released. For example, personal information regarding your child's participation in this study may be disclosed if required by state law.

Also, your child's records may be reviewed by the following groups:

- The University of Arizona Institutional Review Board
- [REDACTED]
- MVRP

De-identified data of this study may be shared in the principal investigator's dissertation project, presentations, publications, etc. to inform the public about the findings.

Will educational records be accessed?

Educational records are protected under the federal Family Educational Rights and Privacy Act (FERPA) of 1974. Records cannot be released without your written consent. Your consent gives the researcher permission to access the records identified below for

research purposes. Educational records are being requested as part of this research project.

- We will request information, including your child's student identification number, age, grade in school, sex, ethnicity/race, English language learner status, and special education status. We will also request reading and writing scores from the AzMERIT exam for the 2017-2018 school year as well as attendance. This information is helpful when describing the demographics of the study population in the research study. Only the researcher will have access to this information. The name of your child will not be collected, instead their student identification number will be used to keep track of their reading intervention records and study measures.
- We will also request your child's results of the following reading achievement measures that were collected by the school.
 - Test of Silent Word Reading Fluency (TOSWRF-2)
 - Spelling, Word Reading Fluency and Sentence Reading Fluency (from the Woodcock Johnson IV)
 - Test of Word Reading Efficiency (TOWRE-2)

Who can answer questions about the study?

For questions, concerns, or complaints about the study you may contact Caitlyn Francis at [REDACTED].

For questions about your child's rights as a participant in this study, or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at <http://rgw.arizona.edu/compliance/human-subjects-protection-program>.

If your child is injured as a result of participating in this study or for questions about a study-related injury, you may contact Caitlyn Francis at [REDACTED].

An Institutional Review Board responsible for human subjects research at the University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and policies designed to protect the rights and welfare of participants in research.

Signing the consent form

I have read (or someone has read to me) this form and I am aware that my child is being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to have my child participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject's parent or guardian

Signature of subject's parent or guardian

Printed name of student

Date and time AM/PM

Appendix E: Student Assent Form

██████████d University of Arizona Minor Assent Form
Version 5/30/2018

Study Title: The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement

Principal Investigator: Caitlyn Francis, M.A.

We are asking students to participate in a research study being done by the University of Arizona. This study will look at reading levels of students, as well as the school climate and student engagement.

If you decide that you want to be part of this study, you will be asked to complete some short reading and spelling activities and fill out surveys that ask you about your school experiences as a student. You will do this over 1-2 class periods in the fall and again in the spring. You will also be required to participate in the reading intervention weekly for at least 5 sessions of 30 minutes if you are in the reading class.

Educational records are protected under the federal Family Educational Rights and Privacy Act (FERPA) of 1974. Records cannot be released without your parental written consent and your written assent. Your parent's consent and your assent gives the researcher permission to access the records identified below for research purposes. Educational records are being requested as part of this research project.

- We will request information, including your student identification number, age, grade in school, sex, ethnicity/race, English language learner status, and special education status. We will also request reading and writing scores from the AzMERIT exam for the 2017-2018 school year as well as attendance. This information is helpful when describing the demographics of the study population in the research study. Only the researcher will have access to this information. Your will not be collected, instead your student identification number will be used to keep track of your reading intervention records and study measures.
- We will also request your results of the following reading achievement measures that were collected by your school.
 - Test of Silent Word Reading Fluency (TOSWRF-2)
 - Spelling, Word Reading Fluency and Sentence Reading Fluency (from the Woodcock Johnson IV)
 - Test of Word Reading Efficiency (TOWRE-2)

Not everyone who takes part in this study will benefit. A benefit is something good that you get from participating in the study. We may be able to help and benefit others because of your answers to our questions.

When we are finished with this study we will write a report about what was learned. This report will not include your name or that you were in the study.

An Institutional Review Board responsible for human subjects research at the University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and policies designed to protect the rights and welfare of participants in research.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too. Your grades in school will not be affected by your choice to participate. Your parents know about the study, too.

You will receive a \$10.00 Amazon gift card at the termination of this study as a thank you for full participation.

If you decide you want to be in this study, please sign your name.

I, _____, want to be in this research study.

(Sign your name here)

(Date)

Name and Email of Supervisor:

Caitlyn Francis Graduate Student, The University of Arizona

Appendix F: Student Consent Form

██████████ and University of Arizona Consent to Participate in Research
Version 5/30/2018

Study Title: The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement

Principal Investigator: Caitlyn Francis, M.A.

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

Why is this study being done?

The purpose of this research study is to determine the effects of a computer-assisted reading program, MindPlay Virtual Reading Coach on the reading and spelling skills of high school students. In addition, the school climate and student engagement will be considered.

What will happen if I take part in this study?

In September 2017, you will complete a variety of pre-tests to gain information about your current reading level, school environment, and engagement as a student. This will span over 1-2 class periods.

If you are in the reading support class, the following classes (three times a week) will be a time to ask questions and talk about your progress, and to complete 30 minutes of the reading program. If you are in the additional class, you will not be required to complete the reading intervention.

In April 2018, you will complete post-tests to see if your reading and spelling ability have improved. You will also be asked about your school climate and student engagement at the end of the study. This will span over 1-2 class periods.

The students in the additional class not participating in the reading intervention, will have the opportunity to participate during the 2018-2019 school year.

You will receive a \$10.00 Amazon gift card at the termination of this study as a thank you for full participation.

How long will I be in the study?

If you are in the reading support class, you will be required to participate in the MindPlay Virtual Reading Program 5 days a week for 30 minutes a day (3 days in school and 2 days out of school) and complete the pre- and post-test measures. Otherwise, you will only be required to complete the pre- and post-test measures in September 2017 and April 2018.

Your participation will last from September 2017 to April 2018.

How many people will take part in this study?

10 students ranging from 9th to 12th grade enrolled in the reading support class will complete the online reading program. An additional class with 10 students will serve as the comparison group and will not complete the reading program, but will complete the pre- and post-tests.

Can I stop being in the study?

Your participation in completing the study measures is voluntary. You may refuse to participate in this study. If you decide to take part in the study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your benefits. Your decision will not affect your future relationship with [REDACTED] or the University of Arizona. If you are a student or employee at the University of Arizona, your decision will not affect your grades or employment status.

What risks, side effects or discomforts can I expect from being in the study?

There are no risks associated with this research, other than the potential risk of the loss of your confidentiality if your participation must be disclosed or researchers share your information without permission. For example, if the court of law required that your participation be disclosed, the PI would have to oblige.

You will receive a reading intervention at no cost to you. The program will be part of the regular classroom activities and homework.

What benefits can I expect from being in the study?

You may or may not benefit as a result of participating in this study. The potential benefits to you may include advances in reading ability specifically word recognition, spelling, and reading rate. In addition, it is apparent from the current literature, that the use of CAI to teach basic reading skills including word recognition, spelling and vocabulary skills using a phonics-based approach is not readily available. Therefore, conducting research on the use of MVRC to teach basic reading skills to high school students is a valuable addition to the present research literature, which may show increases in student academic engagement.

Also, the findings of this study may inform teachers whether students' perception of the authoritative school climate (demandingness and responsiveness) influences their cognitive and affective engagement in the classroom. Whether support and discipline influence student engagement can help inform classroom interventions to promote positive classroom climates. The students' input can be seen as a valid source of information to help create interventions in the classroom to improve student engagement. Furthermore, MVRC may impact all four areas of the engagement of the students. The students' mindsets about their academic abilities may improve, as well as their motivation. Their academic performance and class participation may increase. Students may feel more support and perceive higher academic expectations from their teachers after successfully completing an intervention in an academic area of weakness (as

shown by the Student Support Scales of the Authoritative School Climate Survey). It is important that struggling students have supportive relationships with their teachers who are encouraging to help motivate them.

What other choices do I have if I do not take part in the study?

You may choose not to participate in this study without penalty or loss of benefits to which you are otherwise entitled.

Will my study-related information be kept confidential?

Efforts will be made to keep your study-related information confidential. To ensure participant privacy, secure connections to the MVRC servers will be maintained during treatment, and student identification numbers will be used on all study-related documents and electronic files, in lieu of participants' names. The principal investigator will not have access to the student names that are connected to the student identification numbers. The teacher will hold access to the document with the link between the student participants' names and their student identification number. The link will be destroyed in May 2020. No personally identifying information will be used in any reports or publications. Test protocols, observation protocols, and other study-related data, as well as hard disks containing soft copies of study-related data, will be kept in a locked filing cabinet in Room 414 of the University of Arizona's College of Education. Only research personnel involved in this study will have access to the files. All laptops and stationary computers used to store research data will be password protected and the data will be encrypted. Consents will be kept at least ten years past the conclusion of the study or six years past the time when the youngest participant turns 18, whichever is longer.

However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law.

Also, your records may be reviewed by the following groups:

- The University of Arizona Institutional Review Board
- [REDACTED]
- MVRP

De-identified data of this study may be shared in the principal investigator's dissertation project, presentations, publications, etc. to inform the public about the findings.

Will educational records be accessed?

Educational records are protected under the federal Family Educational Rights and Privacy Act (FERPA) of 1974. Records cannot be released without your written consent. Your consent gives the researcher permission to access the records identified below for research purposes.

Educational records are being requested as part of this research project.

- We will request information, including your student identification number, age, grade in school, sex, ethnicity/race, English language learner status, and special

education status. We will also request reading and writing scores from the AzMERIT exam for the 2017-2018 school year as well as attendance. This information is helpful when describing the demographics of the study population in the research study. Only the researcher will have access to this information. Your name will not be collected, instead your student identification number will be used to keep track of their reading intervention records and study measures.

- We will also request your results of the following reading achievement measures that were collected by your school.
 - Test of Silent Word Reading Fluency (TOSWRF-2)
 - Spelling, Word Reading Fluency and Sentence Reading Fluency (from the Woodcock Johnson IV)
 - Test of Word Reading Efficiency (TOWRE-2)

Who can answer questions about the study?

For questions, concerns, or complaints about the study you may contact Caitlyn Francis at [REDACTED]

For questions about your rights as a participant in this study, or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at <http://rgw.arizona.edu/compliance/human-subjects-protection-program>.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Caitlyn Francis at [REDACTED]

An Institutional Review Board responsible for human subjects research at the University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and policies designed to protect the rights and welfare of participants in research.

Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of student

Signature of student

Date and time

AM/PM

Appendix G: Teacher Consent Form

██████████ and University of Arizona Consent to Participate in Research
Version 5/30/2018

Study Title: The Effects of a Computer-Assisted Reading Intervention on Authoritative School Climate and Student Engagement

Principal Investigator: Caitlyn Francis, M.A.

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

Why is this study being done?

The purpose of this research study is to determine the effects of a computer-assisted reading program, MindPlay Virtual Reading Coach on the reading and spelling skills of high school students. In addition, the school climate and student engagement will be considered.

What will happen if I take part in this study?

Your first group of students will complete the reading intervention as part of their reading intervention class throughout the 2017-2018 school year. The comparison group will participate in the reading intervention class for the duration of the 2018-2019 school year.

After your students have completed participation in the reading intervention in May 2018, you will be asked to complete the Social Validity Measure, Adapted Version of the Intervention Rating Profile- 15. In addition, you will be asked to provide the following information to the Principal Investigator about the students participating in this study: grade, age, sex, ethnicity, ELL status, SPED status, attendance, AZMERIT Reading and Writing scores.

In addition, it will be asked that you help disperse gift cards to the students that participated in the research study.

How long will I be in the study?

You students will participate in the study from September 2017 to May 2018, but your participation will be May 2018 through May 2019.

How many people will take part in this study?

10 students ranging from 9th to 12th grade enrolled in the reading support class will complete the online reading program for the 2017-2018 school year. An additional class with 10 students will serve as the comparison group and will not complete the reading program, but will complete the pre- and post-tests. They will have the opportunity to complete the reading intervention program for the 2018-2019 school year.

Can I stop being in the study?

Your participation in completing the study measures is voluntary. You may refuse to participate in this study. If you decide to take part in the study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your benefits. Your decision will not affect your future relationship with [REDACTED] or the University of Arizona. If you are a student or employee at the University of Arizona, your decision will not affect your grades or employment status.

What risks, side effects or discomforts can I expect from being in the study?

There are no risks associated with this research, other than the potential risk of the loss of your confidentiality if your participation must be disclosed or researchers share your information without permission. For example, if the court of law required that your participation be disclosed, the PI would have to oblige.

Your students will receive the reading intervention at no cost to you. The program will be part of the regular classroom activities and homework.

What benefits can I expect from being in the study?

You may or may not benefit as a result of participating in this study. The potential benefits to you may include advances in your students' reading ability specifically word recognition, spelling, and reading rate. In addition, it is apparent from the current literature, that the use of CAI to teach basic reading skills including word recognition, spelling and vocabulary skills using a phonics-based approach is not readily available. Therefore, conducting research on the use of MVRC to teach basic reading skills to high school students is a valuable addition to the present research literature, which may show increases in student academic engagement.

Also, the findings of this study may inform teachers like you whether students' perception of the authoritative school climate (demandingness and responsiveness) influences their cognitive and affective engagement in the classroom. Whether support and discipline influence student engagement can help inform classroom interventions to promote positive classroom climates. The students' input can be seen as a valid source of information to help create interventions in the classroom to improve student engagement. Furthermore, MVRC may impact all four areas of the engagement of the students. The students' mindsets about their academic abilities may improve, as well as their motivation. Their academic performance and class participation may increase. Students may feel more support and perceive higher academic expectations from their teachers after successfully completing an intervention in an academic area of weakness (as shown by the Student Support Scales of the Authoritative School Climate Survey). It is important that struggling students have supportive relationships with their teachers who are encouraging to help motivate them.

In addition, you will receive a \$20 Amazon gift card as a thank you for participating in this research study.

What other choices do I have if I do not take part in the study?

You may choose not to participate in this study without penalty or loss of benefits to which you are otherwise entitled.

Will my study-related information be kept confidential?

Efforts will be made to keep your study-related information confidential. To ensure participant privacy, secure connections to the MVRC servers will be maintained during treatment, and student identification numbers will be used on all study-related documents and electronic files, in lieu of participants' names. The principal investigator will not have access to the student names that are connected to the student identification numbers. The teacher will hold access to the document with the link between the student participants' names and their student identification number. The link will be destroyed in May 2020. No personally identifying information will be used in any reports or publications. Test protocols, observation protocols, and other study-related data, as well as hard disks containing soft copies of study-related data, will be kept in a locked filing cabinet in Room 414 of the University of Arizona's College of Education. Only research personnel involved in this study will have access to the files. All laptops and stationary computers used to store research data will be password protected and the data will be encrypted. Consents will be kept at least ten years past the conclusion of the study or six years past the time when the youngest participant turns 18, whichever is longer.

However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law.

Also, your student records may be reviewed by the following groups:

- The University of Arizona Institutional Review Board
- [REDACTED]
- MVRP

De-identified data of this study may be shared in the principal investigator's dissertation project, presentations, publications, etc. to inform the public about the findings.

Will educational records be accessed?

Educational records are protected under the federal Family Educational Rights and Privacy Act (FERPA) of 1974. Records cannot be released without your written consent. Your consent gives the researcher permission to access the records identified below for research purposes.

Educational records are being requested as part of this research project.

- We will request information, including your students' identification number, age, grade in school, sex, ethnicity/race, English language learner status, and special education status. We will also request reading and writing scores from the AzMERIT exam for the 2017-2018 school year as well as attendance. This information is helpful when describing the demographics of the study population in the research study. Only

the researcher will have access to this information. Your students’ names will not be collected, instead your student identification number will be used to keep track of their reading intervention records and study measures.

- We will also request your results of the following reading achievement measures that were collected by your school.
 - Test of Silent Word Reading Fluency (TOSWRF-2)
 - Spelling, Word Reading Fluency and Sentence Reading Fluency (from the Woodcock Johnson IV)
 - Test of Word Reading Efficiency (TOWRE-2)

Who can answer questions about the study?

For questions, concerns, or complaints about the study you may contact Caitlyn Francis at [REDACTED]

For questions about your rights as a participant in this study, or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at <http://rgw.arizona.edu/compliance/human-subjects-protection-program>.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Caitlyn Francis at [REDACTED]

An Institutional Review Board responsible for human subjects research at the University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and policies designed to protect the rights and welfare of participants in research.

Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of teacher

Signature of teacher

Date and time AM/PM

Appendix H: Permission Letters



April 18, 2018

ID: C10223

University of Arizona
Caitlyn Francis
Student

████████████████████
████████████████████
████████████████████
████████████████████

Thank you for your interest in the *Woodcock-Johnson IV™ (WJ IV™)*. This letter is in response to your recent request for use of the materials described below in your research project *The Effects of a Computer-Assisted Reading Intervention* - which you anticipate will be conducted between October 1, 2017 and May 14, 2018.

Houghton Mifflin Harcourt is happy to offer a research discount for the following:

Quantity	Product Description	Discount %
1	Woodcock Johnson IV Achievement Standard & Extended, Form A Test Records & Subject Response Booklets pkg. 25, (1622313)	40%

Send a copy of this letter with your order, along with a fully completed current test purchaser qualification form from the catalog, <http://forms.hmhco.com/virtual-catalog> and mail, fax or email to:

Houghton Mifflin Harcourt, Attn: Customer Experience Support – Assessments
255 38th Avenue, Suite L, St. Charles, IL 60174
Fax: 630.467.7192, AssessmentsOrders@hmhco.com

The permission granted to use the material in your research is non-exclusive and is not transferable to other persons or institutions. Credit for use of the material will be given as follows:

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This agreement will expire in one year, on April 18, 2019. If a renewal is needed, please resubmit a request.

It is requested, that upon completion, a copy of your research results shall be forwarded to my attention at Houghton Mifflin Harcourt, One Pierce Place, Suite 900W, Itasca IL 60143 or Kristin.Riggs@hmhco.com

Sincerely,

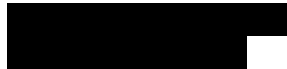
Kristin Riggs
IP Analyst

**Approval of Permission to Use PRO-ED Test Material**

April 18, 2018

Reference Permission Request #T3898

Ms. Caitlyn Francis
University of Arizona



For permission to use Form B of the Test of Word Reading Efficiency-- Second Edition (TOWRE-2) Complete Kit

by Torgeson, Wagner, Rashotte, Pearson, , Austin: PRO-ED. Kit 13910. Number of copies: 40
No fee assessed..

USAGE: Research for Master's Thesis or Dissertation

Looking at how a reading intervention (MindPlay) helps improve reading in a group of high school students in Tucson. We will use the TOSWRF-2 and TOWRE-2 with each student in the intervention and control groups. There will be 20 students in the study for pre- and post-testing.

LIMITATIONS:

Permission is granted to utilize the TOSWRF-2 and the TOWRE-2 kits in this dissertation study. Requester agrees not to copy, modify, or otherwise alter the tests or their components. The requester shall receive a complimentary TOWRE-2 kit for the study.

PAYMENT: No fee assessed.

Total Paid: \$

APPROVAL:

The foregoing application is hereby approved provided that the form of credit and copyright notice, as specified in the sixth edition of the *Publication Manual of the American Psychological Association* or an equally recognized format, gives full identification of author, publisher, copyright date, and title and states, "Used with Permission." This permission is solely for adaptation to non-original formats and should not be construed as a transfer of any rights, title or interest in the PRO-ED publication. This permission includes the right to approve, without charge, the publication or transcription in Braille, large print, audio or other formats, only for the use by print impaired individuals or to accommodate student IEP requirements and only if such an edition is not for commercial use. Should PRO-ED, Inc. in its sole discretion, determine the use of our material by you, the client, is contrary to the original intent as we understood it in your letter requesting permission, we reserve the right to demand that you cease and desist in your use of PRO-ED, Inc.'s material and remove it from the marketplace. PRO-ED

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Terri Cooter

Terri Cooter

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April 18, 2018

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Appendix I: Student Online Demographic Survey Questions

- 1) How old are you?
- 2) What grade in school are you in?
- 3) What gender do you identify with?
- 4) What is the best description of your race?
- 5) What ethnicity do you identify as?
- 6) How many of your parents live with you? Include biological parents and adoptive parents.
- 7) Does your family speak a language other than English at home?
- 8) How far do you expect to go in school?
- 9) How far did your mother, father, or other guardian go in school? (Pick the one who went the furthest).

Appendix J: Copyright Clearance Documentation

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REFERENCES

- Ainsworth, M. D. S. (1978). The Bowlby-Ainsworth attachment theory. *Behavioral and Brain Sciences, 1*(3), 436-438. <http://dx.doi.org/10.1017/S0140525X00075828>
- Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First-grade classroom behavior: Its short and long-term consequences for school performance. *Child Development, 64*, 801–814. <http://dx.doi.org/10.2307/1131219>
- Allen, E. A., Morey, M. E., & Hammill, D. D. (2013). Using the TOSWRF-2 to identify students with specific learning disabilities (White paper). Council for Learning Disabilities, Austin, TX: Pro-Ed Inc.
- Allen, J., Gregory, A., Mikami, A., Lun, J., Hamre, B., & Pianta, R. (2013). Observations of effective teacher-student interactions in secondary school classrooms: Predicting student achievement with the Classroom Assessment Scoring System—Secondary. *School Psychology Review, 42*(1), 76-98. <http://dx.doi.org/10.1080/02796015.2013.12087492>
- Allen, K. A., Kern, M. L. and SpringerLink. (2017). *School Belonging in Adolescents Theory, Research and Practice*. SpringerBriefs in Psychology. Web.
- American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). <https://doi.org/10.1176/appi.books.9780890425787>
- Amitay, S., Ahissar, M., & Nelken, I. (2002). Auditory processing deficits in reading disabled adults. *JARO: Journal of the Association for Research in Otolaryngology, 3*(3), 302. <http://dx.doi.org/10.1007/s101620010093>
- Anderson, A. R., Christenson, S. L., Sinclair, M. F., & Lehr, C. A. (2004). Check & Connect: The importance of relationships for promoting engagement with school. *Journal of School Psychology, 42*(2), 95-113. <http://dx.doi.org/10.1016/j.jsp.2004.01.002>

- Apiola, M., Tedre, M., & Oroma, J. O. (2011). Improving programming education in Tanzania: Teachers' and students' perceptions. *2011 Frontiers in Education Conference (FIE)*, F3G-1-F3G-7. IEEE. <http://dx.doi.org/10.1109/FIE.2011.6142787>
- Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the Schools*, 45(5), 369–387. <http://dx.doi.org/10.1002/pits.20303>
- Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*, 44, 427-445. <http://dx.doi.org/10.1016/j.jsp.2006.04.002>
- Aunola, K., & Nurmi, J. E. (2005). The role of parenting styles in children's problem behavior. *Child development*, 76(6), 1144-1159. <http://dx.doi.org/10.1111/j.1467-8624.2005.00840.x-i1>
- Bachman, J.G., Green, S., Wirtanen, I.D., 1971. *Youth in Transition: Volume 3. Dropping Out—Problem or Symptom?* University of Michigan, Ann Harbor Institute for Social Research.
- Bailey, D. H., Oh, Y., Farkas, G., Morgan, P., & Hillemeier, M. (2020). Reciprocal effects of reading and mathematics? Beyond the cross-lagged panel model. *Developmental Psychology*, 56(5), 912-921. <https://doi.org/10.1037/dev0000902>
- Baker, L., & Wigfield, A. (1999). Dimensions of children's motivation for reading and their relations to reading activity and reading achievement. *Reading research quarterly*, 34(4), 452-477. <http://dx.doi.org/10.1598/RRQ.34.4.4>
- Bateman, B. (1965). Learning disabilities—an overview. *Journal of School Psychology*, 3(3), 1-12. [http://dx.doi.org/10.1016/0022-4405\(65\)90034-8](http://dx.doi.org/10.1016/0022-4405(65)90034-8)

- Bates, A.W. (2022). *Teaching in a Digital Age – Third Edition*. Tony Bates Associates Ltd.
<https://pressbooks.bccampus.ca/teachinginadigitalagev3/>
- Bauer-Kealey, M., & Mather, N. (2019). Use of an online reading intervention to enhance the basic reading skills of community college students. *Community College Journal of Research and Practice*, 43(9), 631-647.
<http://dx.doi.org/10.1080/10668926.2018.1524335>
- Bauman, J. F., & Duffy, A. M. (1997). Engaged reading for pleasure and learning: A report from the National Reading Research Center. Athens, GA: National Reading Research Center.
- Baumrind, D. (1968). Authoritarian vs. authoritative parental control. *Adolescence*, 3(11), 255–272.
- Baumrind, D. (1991). The influence of parenting styles on adolescent competence and substance use. *The Journal of Early Adolescence*, 11(1), 56 - 95.
<https://psycnet.apa.org/doi/10.1177/02724316911111004>
- Beidas, H., Khateb, A., & Breznitz, Z. (2013). The cognitive profile of adult dyslexics and its relation to their reading abilities. *Reading and Writing*, 26, 1487-1515.
<http://dx.doi.org/10.1007/s11145-013-9428-5>
- Bettinger, E. P., & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. *New Directions for Community Colleges*, 129, 17–26.
<http://dx.doi.org/10.1002/cc.182>
- Betts, E. A. (1946). *Foundations of reading instruction, with emphasis on differentiated guidance*. American Book Co..

Birch, S. H., & Ladd, G. W. (1997). The teacher–child relationship and children's early school adjustment. *Journal of School Psychology, 35*(1), 61-79.

[http://dx.doi.org/10.1016/S0022-4405\(96\)00029-5](http://dx.doi.org/10.1016/S0022-4405(96)00029-5)

Bippert, K., & Harmon, J. (2017). Middle school teachers' perceptions of computer-assisted reading intervention programs. *Reading Psychology, 38*(2), 203-230.

<http://dx.doi.org/10.1080/02702711.2016.1245691>

Bishop, M. J., & Edwards Santoro, L. E. (2006). Evaluating beginning reading software for at-risk learners. *Psychology in the Schools, 43*(1), 57–70.

<http://dx.doi.org/10.1002/pits.20129>

Bliss, J., Larrabee, J., & Schnitzler, P. (2002). The performance of a new computer-based reading tutor. *Unpublished manuscript available from MindPlay.*

Blum, R. W., & Libbey, H. P. (2004). Executive summary. *Journal of School Health, 74*(7), 231–232. <http://dx.doi.org/10.1111/j.1746-1561.2004.tb08278.x>

Blumenfeld, P. C., Kempler, T. M., & Krajcik, J. S. (2006). Motivation and Cognitive Engagement in Learning Environments. In R. K. Sawyer (Ed.), *The Cambridge handbook of: The learning sciences* (pp. 475–488). Cambridge University Press.

<http://dx.doi.org/10.1017/CBO9780511816833.029>

Blumenfeld, P. C., Modell, J., Bartko, W. T., Secada, W., Fredricks, J., Friedel, J., & Parks, A. (2005). School engagement of inner city students during middle childhood. In C. R. Cooper, C. Garcia-Coll, W. T. Bartko, H. M. Davis, & C. Chatman (Eds.), *Developmental pathways through middle childhood: Rethinking diversity and contexts as recourses* (pp. 145–170). Mahwah, NJ: Lawrence Erlbaum.

- Boulay, B., Goodson, B., Frye, M., Blocklin, M., & Price, C. (2015). Summary of research generated by striving readers on the effectiveness of interventions for struggling adolescent readers (NCEE 2016-4001). National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- Bowlby, J. (1969). *Attachment and loss: Attachment* (1st ed., Vol. 1). Basic Books.
- Brann, A., Gray, T., Zorfass, J., & WORKS, P. W. (2014). Using Multimedia to Support Reading Instruction. *Reading Rockets*. <http://www.Readingrockets.org/article/using-multimediasupport-reading-instruction>
- Breznitz, Z., & Misra, M. (2003). Speed of processing of the visual–orthographic and auditory–phonological systems in adult dyslexics: The contribution of “asynchrony” to word recognition deficits. *Brain and Language*, 85(3), 486-502.
[http://dx.doi.org/10.1016/S0093-934X\(03\)00071-3](http://dx.doi.org/10.1016/S0093-934X(03)00071-3)
- Bridgeland, J. M., DiIulio, Jr. J.J., & Morison, K.B., (2006). The silent epidemic: Perspectives of high school dropouts. Washington, D.C.: Civic Enterprises. Online at <http://www.gatesfoundation.org/nr/downloads/ed/thesilentepidemic3-06final.pdf>
- Bright, S. (2020). *How do personalized learning programs’ instructional designs match gifted students’ experiences in using them?* (Publication No. 27995373) [Doctoral dissertation, Purdue University]. ProQuest Dissertations Publishing.
- Brophy, J. (1981). Teacher praise: A functional analysis. *Review of educational research*, 51(1), 5-32. <http://dx.doi.org/10.3102/00346543051001005>
- Cantrell, S.C., Almasi, J.F., Carter, J.C., & Rintamaa M. (2011). *Striving Readers Final Evaluation Report: Danville, Kentucky*. Collaborative Center for Literacy Development, University of Kentucky.

- Caraway, K., Tucker, C. M., Reinke, W. M., & Hall, C. (2003). Self-efficacy, goal orientation, and fear of failure as predictors of school engagement in high school students. *Psychology in the Schools, 40*(4), 417-427. <http://dx.doi.org/10.1002/pits.10092>
- Cemalcilar, Z. (2010). Schools as socialisation contexts: Understanding the impact of school climate factors on students' sense of school belonging. *Applied psychology, 59*(2), 243-272. <https://doi.org/10.1111/j.1464-0597.2009.00389.x>
- Chang, Y. C. (2010). *Students' perceptions of teaching styles and use of learning strategies* [Unpublished master's thesis]. University of Tennessee. https://trace.tennessee.edu/utk_gradthes/782
- Chatterjee, A., & Kothari, P. (2014) "Bridging achievement gaps amongst school students through a technology-based blended learning model," *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, Madrid, Spain, 2014, pp. 1-8.
- Chambers, A., Mather, N., and Stoll, K. (2013). MindPlay Virtual Reading Coach: Initial Research Study. <https://mindplay.com/wp-content/uploads/2022/10/SummerResearch-20131-1.pdf>
- Chapman, J.W., & Tunmer, W.E. (1995). Development of young children's reading self-concepts: An examination of emerging subcomponents and their relationship with reading achievement. *Journal of Educational Psychology, 87*(1), 154 – 167. <https://doi.org/10.1037/0022-0663.87.1.154>
- Cheung, A. C., & Slavin, R. E. (2011). The Effectiveness of Education Technology for Enhancing Reading Achievement: A Meta-Analysis. *Center for Research and reform in Education*.

Christenson, S. L., Reschly, A. L., Appleton, J. J., Berman, S., Spanjers, D., & Varro, P. (2008).

Best practices in fostering student engagement. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology* (5th ed., pp. 1099–1119). National Association of School Psychologists.

Christenson, S., Reschly, A. L., & Wylie, C. (2012). *Handbook of research on student engagement* (Vol. 840). Springer. <http://dx.doi.org/10.1007/978-1-4614-2018-7>

Christenson, S. L., Stout, K., & Pohl, A. (2012). Check & Connect: A comprehensive student engagement intervention: Implementing with fidelity. Institute on Community Integration. Comprehensive School Reform Quality Center. (2006). CSRQ Center report on middle and high school comprehensive school reform models. Washington, DC: American Institutes for Research.

Conner, O.J., & Pope, D.C. (2013). Not just robo-students: Why full engagement matters and how schools can promote it. *Journal of Youth and Adolescence*, 42, 1426-1442. <http://dx.doi.org/10.1007/s10964-013-9948-y>

Cook, C. R., Thayer, A. J., Fiat, A., & Sullivan, M. (2020). Interventions to enhance affective engagement. In A. L. Reschly, A. J. Pohl, & S. L. Christenson (Eds.), *Student engagement: Effective academic, behavioral, cognitive, and affective interventions at school* (pp. 203–237). Springer Nature Switzerland AG. http://dx.doi.org/10.1007/978-3-030-37285-9_12

Cordewener, K. A., Hasselman, F., Verhoeven, L., & Bosman, A. M. (2018). The role of instruction for spelling performance and spelling consciousness. *The Journal of Experimental Education*, 86(2), 135-153. <http://dx.doi.org/10.1080/00220973.2017.1315711>

- Cornell, D., Shukla, K., & Konold, T. (2016). Authoritative school climate and student academic engagement, grades, and aspirations in middle and high schools. *AERA Open*, 2, 1-18.
<http://dx.doi.org/10.1177/2332858416633184>
- Cristia, J., Ibararán, P., Cueto, S., Santiago, A., & Severín, E. (2017). Technology and child development: Evidence from the one laptop per child program. *American Economic Journal: Applied Economics*, 9(3), 295-320. <http://dx.doi.org/10.1257/app.20150385>
- Daneman, M., & Merikle, P. M. (1996). Working memory and language comprehension: A meta-analysis. *Psychonomic bulletin & review*, 3(4), 422-433.
<http://dx.doi.org/10.3758/BF03214546>
- Daniel, J., Capin, P., & Steinle, P. (2021). A Synthesis of the Sustainability of Remedial Reading Intervention Effects for Struggling Adolescent Readers. *Journal of Learning Disabilities*, 54 (3), 170 -186. <http://dx.doi.org/10.1177/0022219420972184>
- Dawes, N. P., & Larson, R. (2011). How youth get engaged: grounded-theory research on motivational development in organized youth programs. *Developmental psychology*, 47(1), 259. <http://dx.doi.org/10.1037/a0020729>
- Davis, M.H., Spring, C.L., Balfanz, R.W. (2022). Engaging high school students in learning. In: Reschly, A.L., Christenson, S.L. (eds) *Handbook of Research on Student Engagement*. Springer, Cham. http://dx.doi.org/10.1007/978-3-031-07853-8_27
- Dimitrov, D., Jurich, S., Frye, M., Lammert, J., Sayko, S., & Taylor, L. (2012). Year One Evaluation Report/Impact Study: Illinois Striving Readers. Arlington, VA: RMC Research Corporation.

- Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of personality and social psychology*, 92(6), 1087. <http://dx.doi.org/10.1037/0022-3514.92.6.1087>
- Durik, A.M., Vida, M., & Eccles, J.S. (2006). Task values and ability beliefs as predictors of high school literacy choices: A developmental analysis. *Journal of Educational Psychology*, 98 (2), 382 –393. <http://dx.doi.org/10.1037/0022-0663.98.2.382>
- Edwards Santoro, L. E., & Bishop, M. J. (2010). Selecting software with caution: An empirical evaluation of popular beginning reading software for children with early literacy difficulties. *Computers in the Schools*, 27(2), 99–120.
- Ehri, L. C. (1998). Grapheme-phoneme knowledge is essential to learning to read words in English. In J. L. Metsala & L. C. Ehri (Eds.), *Word recognition in beginning literacy* (pp. 3-40). Mahwah, NJ: Lawrence Erlbaum Associates.
- Ehri, L. C., & Metsala, J. L. (Eds.). (1998). *Word Recognition in Beginning Literacy: A Beginning Literacy Program for At-Risk and Delayed Readers*. L. Erlbaum Associates.
- Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, 21(1), 225-241. <http://dx.doi.org/10.1111/j.1532-7795.2010.00725.x>
- Eccles, J. S., Wigfield, A., Midgley, C., Reuman, D., Iver, D. M., & Feldlaufer, H. (1993). Negative effects of traditional middle schools on students' motivation. *The Elementary School Journal*, 93(5), 553-574. <http://dx.doi.org/10.1086/461740>
- Faddis, B. J., Beam, M., Maxim, L., Gandhi, E. V., Hahn, K., & Hale, R., (2011). *Portland Public School's Striving Readers Program: Year 5 Evaluation Report*. Prepared for the U.S. Department of Education Office of Elementary and Secondary Education.

- Feldman, A. F., & Matjasko, J. L. (2005). The role of school-based extracurricular activities in adolescent development: A comprehensive review and future directions. *Review of Educational Research, 75*(2), 159-210. <http://dx.doi.org/10.3102/00346543075002159>
- Finn, J. D. (1989). Withdrawing from school. *Review of educational research, 59*(2), 117-142. <http://dx.doi.org/10.3102/00346543059002117>
- Finn, J. D. (1993). School engagement and students at risk (NCES 93-470). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109. <http://dx.doi.org/10.3102/00346543074001059>
- Fletcher, J. M. (2009). Dyslexia: The evolution of a scientific concept. *Journal of the International Neuropsychological Society, 15*(4), 501-508. <http://dx.doi.org/10.1017/S1355617709090900>
- Francescucci, A., Kellershohn, J., & Pyle, M. A. (2021). Using online class preparedness tools to improve student performance: The benefit of “all-in” engagement. *Journal of Management Education, 45* (4), 558-578. <http://dx.doi.org/10.1177/1052562920960205>
- Fraysier, K. & Reschly, A. L. (2022). The role of high school student engagement in postsecondary enrollment. *Psychology in the Schools, 59*(11), 2183–2207. <http://dx.doi.org/10.1002/pits.22754>
- Fredricks, J. A., Parr, A. K., Amemiya, J. L., Wang, M. T., & Brauer, S. (2019). What matters for urban adolescents’ engagement and disengagement in school: A mixed-methods

- study. *Journal of Adolescent Research*, 34(5), 491-527.
<http://dx.doi.org/10.1177/0743558419830638>
- Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology*, 95(1), 148–162.
<http://dx.doi.org/10.1037/0022-0663.95.1.148>
- Galla, B. M., Wood, J. J., Tsukayama, E., Har, K., Chiu, A. W., & Langer, D. A. (2014). A longitudinal multilevel model analysis of the within-person and between-person effect of effortful engagement and academic self-efficacy on academic performance. *Journal of School Psychology*, 52(3), 295-308. <http://dx.doi.org/10.1016/j.jsp.2014.04.001>
- Gillet, N., Vallerand, R. J., & Lafreniere, M.-A. K. (2012). Intrinsic and extrinsic school motivation as a function of age: The mediating role of autonomy support. *Social Psychology of Education*, 15(1), 77–95. <http://dx.doi.org/10.1007/s11218-011-9170-2>
- Gillingham, A., & Stillman, B. W. (1997). *The gillingham manual*. Cambridge, MA: Educators.
- Gordon, T. (2010). *Teacher effectiveness training: The program proven to help teachers bring out the best in students of all ages*. Crown Archetype.
- Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of educational psychology*, 93(1), 3-13. <http://dx.doi.org/10.1037/0022-0663.93.1.3>
- Grant, A., Wood, E., Gottardo, A., Evans, M. A., Phillips, L., & Savage, R. (2012). Assessing the content and quality of commercially available reading software programs: Do they have the fundamental structures to promote the development of early reading skills in children? *NHSA Dialog*, 15(4), 319-342.
<http://dx.doi.org/10.1080/15240754.2012.725487>

- Graves, M. F. (1999). Fostering high levels of reading and learning in secondary students. (ERIC Document Reproduction Service No. ED443090).
<http://www.readingonline.org/articles/graves1/index.html>
- Gregory, A., & Cornell, D. (2009). "Tolerating" adolescent needs: Moving beyond zero tolerance policies in high school. *Theory Into Practice*, 48, 106–113.
<http://dx.doi.org/10.1080/00405840902776327>
- Griffith, J. S., Statti, A. L., & Torres, K. M. (2022). Applying chickering and gamson's principles to engage today's online learner: A Literature Review. *Cases on Innovative and Successful Uses of Digital Resources for Online Learning*, 284-301.
<http://dx.doi.org/10.4018/978-1-7998-9004-1.ch013>
- Griffiths, A. J., Lilles, E., Furlong, M.J., & Sidhwa, J. (2012). The relations of adolescent student engagement with troubling and high-risk behaviors. In S.L. Christenson, A.L. Reschly, & C. Wylie (Eds.), *Handbook of Research on Student Engagement* (pp. 563 – 584). Springer. http://dx.doi.org/10.1007/978-1-4614-2018-7_27
- Guskey, T. R. (2010). Lessons of mastery learning. *Educational leadership*, 68(2), 52-57.
<https://tguskey.com/wp-content/uploads/Mastery-Learning-3-Lessons-of-Mastery-Learning.pdf>
- Guthrie, J. T. & Wigfield, A. (1999). How motivation fits into a science of reading. *Scientific Studies of Reading*, 3(3), 199-205. http://dx.doi.org/10.1207/s1532799xssr0303_1
- Guthrie, J. T., & Wigfield, A. (2000). Engagement and motivation in reading. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of Reading Research*, (Vol. 3, pp. 403–422). Lawrence Erlbaum Associates Publishers.
- Guthrie, J. T., Wigfield, A., & You, W. (2012). Instructional contexts for engagement and achievement in reading. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.),

Handbook of Research on Student Engagement (pp. 601– 634). Springer.

http://dx.doi.org/10.1007/978-1-4614-2018-7_29

Halladay, J. L. (2012). Revisiting Key Assumptions of the Reading Level Framework. *The Reading Teacher*, 66(1), 53–62. <http://dx.doi.org/10.1002/TRTR.01093>

Hamre, B. K., & Pianta, R. C. (2001). Early teacher–child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development*, 72(2), 625-638. <http://dx.doi.org/10.1111/1467-8624.00301>

Harris, M., & Moreno, C. (2004). Deaf children's use of phonological coding: Evidence from reading, spelling, and working memory. *Journal of Deaf Studies and Deaf Education*, 9(3), 253-268. <http://dx.doi.org/10.1093/deafed/enh016>

Hattie, J., & Yates, G. C. (2013). *Visible learning and the science of how we learn*. Routledge. <http://dx.doi.org/10.4324/9781315885025>

Hofkens, T. L., & Pianta, R. C. (2022). Teacher–student relationships, engagement in school, and student outcomes. *Handbook of Research on Student Engagement*, 431-449. Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-031-07853-8_20

Holopainen, L., & Hakkarainen, A. (2019). Longitudinal effects of reading and/or mathematical difficulties: The role of special education in graduation from upper secondary education. *Journal of Learning Disabilities*, 52(6), 456-467. <http://dx.doi.org/10.1177/0022219419865485>

Howell, R. D., Stanger, C., Erickson, K., & Wheaton, J. E. (2000). Evaluation of a computer based program on the reading performance of first grade students with potential for reading failure. *Journal of Special Education Technology*, 15(4), 5–14. <http://dx.doi.org/10.1177/016264340001500401>

- Huang, F. L., Eklund, K., & Cornell, D. G. (2016). Authoritative school climate, number of parents at home, and academic achievement. *School Psychology Quarterly*, 32(4), 480-496. <http://dx.doi.org/10.1037/spq0000182>
- Hudson, A., Koh, P. W., Moore, K. A., & Binks-Cantrell, E. (2020). Fluency interventions for elementary students with reading difficulties: A synthesis of research from 2000–2019. *Education Sciences*, 10(3), 52. <http://dx.doi.org/10.3390/educsci10030052>
- Inayat, A., & Ali, A. Z. (2020). Influence of Teaching Styles on Students' Engagement, Curiosity and Exploration in the Classroom. *Journal of Education and Educational Development*, 7(1), 87- 102.
- Islam, M. S, & Grönlund, Å. (2016). An international literature review of 1:1 computing in schools. *Journal of Educational Change*, 17(2), 191 - 222. <http://dx.doi.org/10.1007/s10833-016-9271-y>
- Jensen, J. W. (2015). *The effect of my reading coach on change in reading scores* [Unpublished doctoral dissertation]. Baker University.
<http://72.14.178.173:8080/xmlui/handle/123456789/504>
- Jia, Y., Konold, T., & Cornell, D. (2015). Authoritative school climate and high school dropout rates. *School Psychology Quarterly*, 31, 289-303. <http://dx.doi.org/10.1037/spq0000139>
- Jozwik, S. L., & Douglas, K. H. (2016). Effects of semantic ambiguity detection training on reading comprehension achievement of English learners with learning difficulties. *Multiple Voices for Ethnically Diverse Exceptional Learners*, 16(2), 37-57. <http://dx.doi.org/10.56829/1547-1888.16.2.37>

- Kealey, M. (2017). *Meeting the diverse needs of community college students: using computer assisted instruction to improve reading skills* [Unpublished doctoral dissertation]. University of Arizona. <https://repository.arizona.edu/handle/10150/625372>
- Keane, R. V. (2018). *The effects of computer-assisted instruction for students with learning disabilities in a self-contained social studies setting* (Publication No. 10814573) [Doctoral dissertation, Rowan University]. ProQuest Dissertations Publishing.
- Keengwe, J., Schnellert, G., & Mills, C. (2012). Laptop initiative: Impact on instructional technology integration and student learning. *Education and Information Technologies, 17*, 137-146. <http://dx.doi.org/10.1007/s10639-010-9150-8>
- Kennelly, L., & Monrad, M. (2007). Approaches to dropout prevention: Heeding early warning signs with appropriate interventions. Washington, DC: National High School Center at the American Institutes for Research.
- Keys, S. E. (2010). *The effects of a computer-assisted reading program on the oral reading fluency, comprehension, and generalization of at-risk, urban second-grade students* [Unpublished doctoral dissertation]. The Ohio State University. https://etd.ohiolink.edu/acprod/odb_etd/ws/send_file/send?accession=osu1249578049&disposition=inline
- Khlaif, Z. N., Salha, S., & Kouraichi, B. (2021). Emergency remote learning during COVID-19 crisis: Students' engagement. *Education and information technologies, 26*(6), 7033-7055. <http://dx.doi.org/10.1007/s10639-021-10566-4>
- Kloos, H. (2019). *Relation between MVRC and ELA Standards: Exploration of One-Year Data from a High-Poverty Urban School District*. MindPlay Resources: White Paper. <https://mindplay.com/wp-content/uploads/2022/06/Relation-between-MVRC-and-ELA->

Standards-Exploration-of-One-Year-Data-from-a-High-Poverty-Urban-School-District-1.pdf

- Kloos, H., Sliemers, S., Cartwright, M., Mano, Q., & Stage, S. (2019). MindPlay virtual reading coach: does it affect Reading fluency in elementary school? *Frontiers in Education*, 4, 1-13. <http://dx.doi.org/10.3389/feduc.2019.00067>
- Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193(3), 13-19. <http://dx.doi.org/10.1177/002205741319300303>
- Konold, T. & Cornell, D. (2015). Measurement and structural relations of an authoritative school climate model: A multi-level latent variable investigation. *Journal of School Psychology*, 53(6), 447–461. <http://dx.doi.org/10.1016/j.jsp.2015.09.001>
- Konold, T., Cornell, D., Huang, F., Meyer, P., Lacey, A., Nekvasil, E., Heilbrun, A., & Shukla, K. (2014). Multi-level multi-informant structure of the authoritative school climate survey. *School Psychology Quarterly*, 29(3), 238-255. <https://doi.org/10.1037/spq0000062>
- Konold, T., Cornell, D., Jia, Y., & Malone, M. (2018). School climate, student engagement, and academic achievement: A Latent Variable, Multilevel Multi-Informant Examination. *AERA Open*, 4(4). <http://dx.doi.org/10.1177/2332858418815661>
- Kulp, M. T., Edwards, K. E., & Mitchell, G. L. (2002). Is visual memory predictive of below-average academic achievement in second through fourth graders? *Optometry and Vision Science*, 79(7), 431-434. <http://dx.doi.org/10.1097/00006324-200207000-00011>

Lane, Kalberg, J. R., Mofield, E., Wehby, J. H., & Parks, R. J. (2008). Preparing Students for College Entrance Exams. *Remedial and Special Education, 30*(1), 3–18.

<http://dx.doi.org/10.1177/0741932507314022>

Lange, A. A. (2019). Technology, instructional methods, and the systemic messiness of innovation: improving reading fluency for low socio-economic elementary school students. *Educational Technology Research and Development, 67*, 1333-1350.

<http://dx.doi.org/10.1007/s11423-019-09675-2>

Lauritzen. (2018). *Using a computer-based reading program to provide culturally-responsive instruction for Native American students*. (Publication No. 10824456) [Doctoral dissertation, Northcentral University]. ProQuest Dissertations Publishing.

Legault, L., Green-Demers, I., & Pelletier, L. (2006). Why do high school students lack motivation in the classroom? Toward an understanding of academic amotivation and the role of social support. *Journal of Educational Psychology, 98*(3), 567.

<http://dx.doi.org/10.1037/0022-0663.98.3.567>

Lee, J. S. (2012). The effects of the teacher-student relationship and academic press on student engagement and academic performance. *International Journal of Educational Research, 53*, 330-340. <http://dx.doi.org/10.1016/j.ijer.2012.04.006>

Lee, V. E., & Bryk, A. S. (1989). A multilevel model of the social distribution of high school achievement. *Sociology of Education, 172*-192. <http://dx.doi.org/10.2307/2112866>

Lee, J., & Zentall, S. S. (2012). Reading motivational differences among groups: Reading disability (RD), attention deficit hyperactivity disorder (ADHD), RD+ ADHD, and typical comparison. *Learning and Individual Differences, 22*(6), 778-785.

<http://dx.doi.org/10.1016/j.lindif.2012.05.010>

- Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology, 97*(2), 184. <http://dx.doi.org/10.1037/0022-0663.97.2.184>
- Li, Y., & Lerner, R. M. (2011). Trajectories of school engagement during adolescence: implications for grades, depression, delinquency, and substance use. *Developmental Psychology, 47*(1), 233. <http://dx.doi.org/10.1037/a0021307>
- Loadman, W. E., Moore, R. J., Ren, W., Zhu, J., Zhao, J., & Lomax, R. (2011). Striving Readers Year 5 Project Evaluation Report: Ohio. An Addendum to the Year 4 Report. *Ohio State University*. <https://files.eric.ed.gov/fulltext/ED601053.pdf>
- Lovett, M. W., Frijters, J. C., Steinbach, K. A., Sevcik, R. A., & Morris, R. D. (2021). Effective Intervention for Adolescents with Reading Disabilities: Combining Reading and Motivational Remediation to Improve Outcomes. *Journal of Educational Psychology, 113*(4), 656 -689. <http://dx.doi.org/10.1037/edu0000639>
- Macaruso, P., Hook, P. E., & McCabe, R. (2006). The efficacy of computer-based supplementary phonics programs for advancing reading skills in at-risk elementary students. *Journal of Research in Reading, 29*(2), 162-172. <http://dx.doi.org/10.1111/j.1467-9817.2006.00282.x>
- Mahatmya, D., Lohman, B. J., Matjasko, J. L., & Farb, A. F. (2012). Engagement across developmental periods. *Handbook of Research on Student Engagement, 45-63*. http://dx.doi.org/10.1007/978-1-4614-2018-7_3
- Mann, K. (2017). *Effects of the mindplay computer program on student reading achievement: an action research study* [Unpublished doctoral dissertation]. University of South Carolina. <https://scholarcommons.sc.edu/etd/4082/>

- Masten, A. S., Burt, K. B., & Coatsworth, J. D. (2006). Competence and psychopathology in development. In D. Cicchetti & D. Cohen (Eds.), *Developmental Psychopathology, Vol 3, Risk, Disorder and Psychopathology* (2nd ed., pp. 696–738). Wiley.
<http://dx.doi.org/10.1002/9780470939406.ch19>
- Masten, A. S., Nelson, K. M., & Gillespie, S. (2022). Resilience and student engagement: Promotive and protective processes in schools. In *Handbook of Research on Student Engagement* (pp. 239-255). Cham: Springer International Publishing.
http://dx.doi.org/10.1007/978-3-031-07853-8_12
- Mather, N., Hammill, D. D., Allen, E. A., & Roberts, R. (2014). *Test of Silent Word Reading Fluency* (2nd Ed.). Austin, TX: Pro-Ed.
- McCaleb, A. L. (2020). *Understanding classroom teachers' knowledge and practices for teaching reading to students at-risk for dyslexia*. (Publication No. 28258130) [Doctoral dissertation, University of Arkansas at Little Rock]. ProQuest Dissertations Publishing.
- McInerney, D. M., Dowson, M., & Yeung, A. S. (2005). Facilitating conditions for school motivation: Construct validity and applicability. *Educational and Psychological Measurement*, 65(6), 1046-1066. <http://dx.doi.org/10.1177/0013164405278561>
- Meece, J. L., & Miller, S. D. (2001). A longitudinal analysis of elementary school students' achievement goals in literacy activities. *Contemporary Educational Psychology*, 26(4), 454-480
- Monroe, M. (1932). Children who cannot read; the analysis of reading disabilities and the use of diagnostic tests in the instruction of retarded readers.
<http://dx.doi.org/10.1006/ceps.2000.1071>
- Merga, M. K. (2018). *Reading engagement for tweens and teens: What would make them read more?* Libraries Unlimited (ABC-CLIO). <http://publisher.abc-clio.com/9781440867996>

MINDPLAY®. (2006-2015). *MINDPLAY® PRESENTS MVRC™-MindPlay Virtual Reading*

Coach Resource Guide (Version 2.0). Division of Methods & Solutions, Inc.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017-1054.

<http://dx.doi.org/10.1111/j.1467-9620.2006.00684.x>

Muñoz, M. A., & Chang, F. C. (2007). The elusive relationship between teacher characteristics and student academic growth: A longitudinal multilevel model for change. *Journal of Personnel Evaluation in Education*, *20*(3–4), 147–164.

<http://dx.doi.org/10.1007/s11092-008-9054-y>

National Center for Education Statistics. (2021). Impact of the Coronavirus Pandemic on the Elementary and Secondary Education System. *Condition of Education*. U.S. Department of Education, Institute of Education Sciences.

<https://nces.ed.gov/programs/coe/indicator/tcb>.

National Center for Education Statistics. (2023). Public High School Graduation Rates. *Condition of Education*. U.S. Department of Education, Institute of Education Sciences. <https://nces.ed.gov/programs/coe/indicator/coi>.

National Center for Education Statistics. (2023). Status Dropout Rates. *Condition of Education*.

U.S. Department of Education, Institute of Education Sciences.

<https://nces.ed.gov/programs/coe/indicator/coj>.

National Center for Education Statistics. (2023). Students with Disabilities. *Condition of Education*. U.S. Department of Education, Institute of Education Sciences.

<https://nces.ed.gov/programs/coe/indicator/cgg>.

- National Reading Panel. (2000). Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups (National Institute of Health Publication No. 00-4769). Washington, DC: National Institute of Child Health and Human Development.
<https://www.nichd.nih.gov/sites/default/files/publications/pubs/nrp/Documents/report.pdf>
- National Research Council and Institute of Medicine. 2004. *Engaging Schools: Fostering High School Students' Motivation to Learn*. The National Academies Press.
<https://doi.org/10.17226/10421>
- Nevo, E., & Breznitz, Z. (2011). Assessment of working memory components at 6 years of age as predictors of reading achievements a year later. *Journal of Experimental Child Psychology, 109*(1), 73-90. <http://dx.doi.org/10.1016/j.jecp.2010.09.010>
- No Child Left Behind (NCLB) Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002).
<http://www2.ed.gov/policy/elsec/leg/esea02/107-110.pdf>
- O'Donnell, K., & Reschly, A. L. (2020). Assessment of student engagement. In A. L. Reschly, A. J. Pohl, & S. L. Christenson (Eds.), *Student Engagement: Effective Academic, Behavioral, Cognitive, and Affective Interventions at School* (pp. 55-76).
http://dx.doi.org/10.1007/978-3-030-37285-9_3
- Olofson, M. W., Swallow, M. J. C., & Neumann, M. D. (2016). TPACKing: A constructivist framing of TPACK to analyze teachers' construction of knowledge. *Computers & Education, 95*, 188-201. <http://dx.doi.org/10.1016/j.compedu.2015.12.010>
- Olson R. K., Keenan J. M., Byrne B., Samuelsson S., Coventry W. L., Corley R., Wadsworth S. J., Willcutt E.G., Defries J.C., Pennington B.F., & Hulslander J. (2011). Genetic and

- environmental influences on vocabulary and reading development. *Scientific Studies of Reading*, 15(1): 26-46. <http://dx.doi.org/10.1007/s11145-006-9018-x>
- Orton, J. L. (1966). *The Orton-Gillingham approach*. Orton Dyslexia Society.
- Parrila, R. (2008). The multiple systems model of reading: Understanding reading disabilities and their effect on academic achievement across individuals and orthographies. *Japanese Journal of Special Education*, 45(6), 383-404.
https://www.jstage.jst.go.jp/article/tokkyou/45/6/45_KJ00005615463/_pdf
- Parrila, R. K., & McQuarrie, L. M. (2015). Cognitive processes and academic achievement: Multiple systems model of reading. In T. C. Papadopoulos, R. K. Parrila, & J. R. Kirby (Eds.), *Cognition, intelligence, and achievement: A tribute to J. P. Das* (pp. 79–100). Elsevier Academic Press. <https://doi.org/10.1016/B978-0-12-410388-7.00005-1>
- Patrick, H., Ryan, A. M., & Kaplan, A. (2007). Early adolescents' perceptions of the classroom social environment, motivational beliefs, and engagement. *Journal of Educational Psychology*, 99(1), 83. <http://dx.doi.org/10.1037/0022-0663.99.1.83>
- Pellerin, L. A. (2005). Applying Baumrind's parenting typology to high schools: Toward a middle-range theory of authoritative socialization. *Social Science Research*, 34, 283-303.
<http://dx.doi.org/10.1016/j.ssresearch.2004.02.003>
- Pianta, R. C. (1999). *Enhancing relationships between children and teachers*. American Psychological Association. <http://dx.doi.org/10.1037/10314-000>
- Pianta, R. C., Hamre, B. K., & Allen, J. P. (2012). Teacher-student relationships and engagement: Conceptualizing, measuring, and improving the capacity of classroom interactions. In S. L. Christenson, A. L. Reschly, C. Wylie (Eds.), *Handbook of Research*

- on Student Engagement*. (pp. 365-386). New York, NY: Springer Science + Business Media. http://dx.doi.org/10.1007/978-1-4614-2018-7_17
- Pindiprolu, S. S., & Forbush, D. E. (2021). Comparative Effects of Computer-Based Reading Programs on the Early Literacy Skills of At-Risk Students. *Journal of Educational Technology Systems*, 50(2), 255-272. <http://dx.doi.org/10.1177/00472395211040048>
- Pohl, A. J., & Nelson, J. A. G. (2020). Promoting Growth Mindset to Foster Cognitive Engagement. *Student Engagement: Effective Academic, Behavioral, Cognitive, and Affective Interventions at School*, 293-307. http://dx.doi.org/10.1007/978-3-030-37285-9_16
- Quirk, M. P., & Schwanenflugel, P. J. (2004). Do supplemental remedial reading programs address the motivational issues of struggling readers? An analysis of five popular programs. *Literacy Research and Instruction*, 43(3), 1-19. <http://dx.doi.org/10.1080/19388070509558408>
- Rapaport, A., Saavedra, A., Silver, D., & Polikoff, M. (2020). *Surveys show things are better for students than they were in the spring: Or do they?* Brown Center Chalkboard, Brookings Institution. <https://www.brookings.edu/blog/brown-center-chalkboard/2020/11/18>
- Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion*, 28(2), 147-169. <http://dx.doi.org/10.1023/B:MOEM.0000032312.95499.6f>
- Reeve, J., & Lee, W. (2014). Students' classroom engagement produces longitudinal changes in classroom motivation. *Journal of Educational Psychology*, 106(2), 527-540. <http://dx.doi.org/10.1037/a0034934>

- Reiser, D. A. (2018). *An impact analysis of computer assisted instruction on the reading skills of students with disabilities*. (Publication No. 10871533) [Doctoral dissertation, Ashland University]. ProQuest Dissertations Publishing.
- Reschly, A. L. (2010) Reading and School Completion: Critical Connections and Matthew Effects. *Reading & Writing Quarterly*, 26(1), 67-90.
<http://dx.doi.org/10.1080/10573560903397023>
- Reschly, A. L., Betts, J., & Appleton, J. J. (2014). An Examination of the Validity of Two Measures of Student Engagement. *International Journal of School & Educational Psychology*, 2(2), 106-114. <http://dx.doi.org/10.1080/21683603.2013.876950>
- Reschly, A. L., & Christenson, S. L. (2006). Prediction of dropout among students with mild disabilities: A case for the inclusion of student engagement variables. *Remedial and Special Education*, 27(5), 276–292. <http://dx.doi.org/10.1177/07419325060270050301>
- Reschly, A. L., & Christenson, S. L. (2012). Jingle, jangle, and conceptual haziness: Evolution and future directions of the engagement construct. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of Research on Student Engagement* (pp. 3–19). Springer.
http://dx.doi.org/10.1007/978-3-031-07853-8_1
- Reschly, A. L., Huebner, E. S., Appleton, J. J., & Antaramian, S. (2008). Engagement as flourishing: The contribution of positive emotions and coping to adolescents' engagement at school and with learning. *Psychology in the Schools*, 45(5), 419-431.
<http://dx.doi.org/10.1002/pits.20306>
- Ritchey, K., & Goeke, J. (2006). Orton-Gillingham and Orton-Gillingham-based reading instruction: A review of the literature. *The Journal of Special Education*, 40, 171–183.
<http://dx.doi.org/10.1177/00224669060400030501>

- Roeser, R. W., Midgley, C., & Urdan, T. C. (1996). Perceptions of the school psychological environment and early adolescents' psychological and behavioral functioning in school: The mediating role of goals and belonging. *Journal of Educational Psychology, 88*(3), 408–422. <http://dx.doi.org/10.1037/0022-0663.88.3.408>
- Roffey, S. (2012). Pupil wellbeing—Teacher wellbeing: Two sides of the same coin? *Educational and Child Psychology, 29*(4), 8. <http://dx.doi.org/10.53841/bpsecp.2012.29.4.8>
- Rooney, E. (1995). Better read than dead: Althusser and the fetish of ideology. *Yale French Studies, (88)*, 183-200. <http://dx.doi.org/10.2307/2930107>
- Rumberger & Rotermund, S. (2012). The Relationship Between Engagement and High School Dropout. In Reschly, A.L., Christenson, S.L. (eds) *Handbook of Research on Student Engagement* (pp. 491–513). Springer US. http://dx.doi.org/10.1007/978-1-4614-2018-7_24
- Ryan, R. M., & Deci, E. L. (2009). Promoting self-determined school engagement: Motivation, learning, and well-being. In K. R. Wenzel & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 171–195). Routledge/Taylor & Francis Group.
- Ryan, R. M., & Deci, E. L. (2000). The darker and brighter sides of human existence: Basic psychological needs as a unifying concept. *Psychological Inquiry, 11*(4), 319–338. https://doi.org/10.1207/S15327965PLI1104_03
- Ryan, A. M., & Patrick, H. (2001). The classroom social environment and changes in adolescents' motivation and engagement during middle school. *American Educational Research Journal, 38*(2), 437-460. <http://dx.doi.org/10.3102/00028312038002437>

- Saine, N. L., Lerkkanen, M. K., Ahonen, T., Tolvanen, A., & Lyytinen, H. (2011). Computer-assisted remedial reading intervention for school beginners at risk for reading disability. *Child Development, 82*(3), 1013-1028. <http://dx.doi.org/10.1111/j.1467-8624.2011.01580.x>
- Santoro, L. E., & Bishop, M. J. (2010). Selecting software with caution: An empirical evaluation of popular beginning reading software for children with early literacy difficulties. *Computers in the Schools, 27*(2), 99-120. <http://dx.doi.org/10.1080/07380561003801582>
- Savage, R., Abrami, P. C., Piquette, N., Wood, E., Deleveaux, G., Sanghera-Sidhu, S., & Burgos, G. (2013). A (Pan-Canadian) cluster randomized control effectiveness trial of the ABRACADABRA web-based literacy program. *Journal of Educational Psychology, 105*(2), 310-328. <http://dx.doi.org/10.1037/a0031025>
- Shaywitz, B. A., & Shaywitz, S. E. (2020). The American experience: towards a 21st century definition of dyslexia, *Oxford Review of Education, 46*(4), 454-471. <http://dx.doi.org/10.1080/03054985.2020.1793545>
- Shaywitz, S. E., & Shaywitz, B. A., Fulbright, R. K., Skudlarski, P., Mencl, W. E., Constable, R. T., Pugh, K. R., Holahan, J. M., Marchione, K. E., Fletcher, J. M., Lyon, G. R., & Gore, J. C. (2003). Neural systems for compensation and persistence: young adult outcome of childhood reading disability. *Biological Psychiatry, 54*(1), 25-33. [http://dx.doi.org/10.1016/S0006-3223\(02\)01836-X](http://dx.doi.org/10.1016/S0006-3223(02)01836-X)
- Schechter, R., Macaruso, P., Kazakoff, E. R., & Brooke, E. (2015). Exploration of a blended learning approach to reading instruction for low SES students in early elementary grades.

Computers in the Schools, 32, 183–200.

<http://dx.doi.org/10.1080/07380569.2015.1100652>

Schenck, A., Jurich, S., Frye, M., Lammert, J., & Sayko, S. (2012). *Evaluation Report/Impact Study: Virginia Striving Readers Initiative (VSRII)*. Arlington, VA: RMC Research Corporation. <https://files.eric.ed.gov/fulltext/ED600907.pdf>

Schneider, D., Chambers, A., Mather, N., Bauschatz, R., Bauer, M., & Doan, L. (2016). The effects of an ICT-based reading intervention on students' achievement in grade two. *Reading Psychology*, 37(5), 793-831.

<http://dx.doi.org/10.1080/02702711.2015.1111963>

Schneider-Richardson, D. A. (2015). *The effects of the use of an ICT-based reading intervention on students' achievement in grade two*. (Publication No. 3727463) [Doctoral dissertation, The University of Arizona]. ProQuest Dissertations Publishing.

Shochet, I. M., Smith, C. L., Furlong, M. J., & Homel, R. (2011). A prospective study investigating the impact of school belonging factors on negative affect in adolescents. *Journal of Clinical Child & Adolescent Psychology*, 40(4), 586-595.

<http://dx.doi.org/10.1080/15374416.2011.581616>

Schrank, F.A., McGrew, K.S., & Mather, N. (2014). *Woodcock-Johnson IV*. Rolling Meadows, IL: Riverside Publishing.

Schunk, D. H., & Mullen, C. A. (2012). Self-efficacy as an engaged learner. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 219–235). Springer Science + Business Media. [https://doi.org/10.1007/978-1-4614-2018-](https://doi.org/10.1007/978-1-4614-2018-7_10)

7_10

- Schunk, D.H., & Pajares, F. (2009). Self-efficacy theory. In K.R. Wentzel & A. Wigfield (Eds.), *Handbook of Motivation at School* (pp. 35–53). Routledge/Taylor & Francis Group.
- Schunk, D.H., & Zimmerman, B.J. (2007). Influencing children's self-efficacy and self-regulation of reading and writing through modeling. *Reading & Writing Quarterly*, 23(1), 7–25. <http://dx.doi.org/10.1080/10573560600837578>
- Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Harvard University Press.
<http://dx.doi.org/10.4159/harvard.9780674433014>
- Serido, J., & Wilhelm, M. S. (2008). Evaluation and research study of My Reading Coach and FLRT: A fluent reading trainer, year two report. Tucson, AZ: University of Arizona
- Sesma, H. W., Mahone, E. M., Levine, T., Eason, S. H., & Cutting, L. E. (2009). The contribution of executive skills to reading comprehension. *Child neuropsychology*, 15(3), 232-246. <http://dx.doi.org/10.1080/09297040802220029>
- Shaywitz, S. E., Shaywitz, B. A., Fulbright, R. K., Skudlarski, P., Mencl, W. E., Constable, R. T., Pugh, K. R., Holahan, J. M., Marchione, K. E., Fletcher, J. M., Lyon, G. R., & Gore, J. C. (2003). Neural systems for compensation and persistence: Young adult outcome of childhood reading disability. *Biological Psychiatry*, 54(1), 25-33. [https://doi.org/10.1016/S0006-3223\(02\)01836-X](https://doi.org/10.1016/S0006-3223(02)01836-X)
- Shellard, E. (2001). Critical issues in developing a high-quality reading program. *ERS Spectrum*, 19(4), 4–11.
- Sherrow, Breanna L. (2015). *The effects of MindPlay Virtual Reading Coach (MVRC) on the spelling growth of students in second grade*. (Publication No. 3706315) [Doctoral dissertation, The University of Arizona]. ProQuest Dissertations Publishing.

- Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009). The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning. *British Journal of Educational Psychology, 79*(1), 57-68.
<http://dx.doi.org/10.1348/000709908X304398>
- Sims, C., & Miskel, C. (2003). The punctuated equilibrium of national reading policy. *Studies in Leading and Organizing Schools, 2*, 1.
- Sinclair, M. F., Christenson, S. L., Lehr, C. A., & Anderson, A. R. (2003). Facilitating student engagement: Lessons learned from check & connect longitudinal studies. *The California School Psychologist, 8*, 29–42. <http://dx.doi.org/10.1007/BF03340894>
- Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal Of Educational Psychology, 85*(4), 571-581. <http://dx.doi.org/10.1037/0022-0663.85.4.571>
- Skinner, E. A., & Raine, K. E. (2022). Unlocking the positive synergy between engagement and motivation. In *Handbook of Research on Student Engagement* (pp. 25-56). Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-031-07853-8_2
- Slingerland, B. H. (1988). An adaption based on the Orton-Gillingham approach for classroom teaching of reading. *Australian Journal of Remedial Education, 20*(4), 5-15.
- Smartt, S. M., & Reschly, D. J. (2007). Barriers to the Preparation of Highly Qualified Teachers in Reading. *TQ Research & Policy Brief*. National Comprehensive Center for Teacher Quality. <https://files.eric.ed.gov/fulltext/ED520775.pdf>
- Snow, C.E., Burns, M.S., & Griffin, P. (1998). *Preventing reading difficulties in young children*. National Academy Press. <https://files.eric.ed.gov/fulltext/ED416465.pdf>

- Snowling, M. J., & Hulme, C. (2011). Evidence-based interventions for reading and language difficulties: Creating a virtuous circle. *British Journal of Educational Psychology, 81*(1), 1-23. <http://dx.doi.org/10.1111/j.2044-8279.2010.02014.x>
- Speed, K. D. (2020). *Relationship Between Computer-Assisted Instruction and Student Achievement in Elementary Schools*. (Publication No. 28087497) [Doctoral dissertation, Walden University]. ProQuest Dissertations Publishing.
- Stanovich, K. E. (2009). Matthew effects in reading: some consequences of individual differences in the acquisition of literacy. *Journal of Education, 189*(1–2), 23–55. <https://doi.org/10.1177/0022057409189001-204>
- Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360–407.
- Strambler, M. J., & Weinstein, R. S. (2010). Psychological disengagement in elementary school among ethnic minority students. *Journal of Applied Developmental Psychology, 31*(2), 155-165. <http://dx.doi.org/10.1016/j.appdev.2009.11.006>
- Swanlund, A., Dahlke, K., Tucker, N., Kleidon, B., Kregor, J., Davidson-Gibbs, D., & Hallberg, K. (2012). *Striving Readers: Impact Study and Project Evaluation Report: Wisconsin Department of Public Instruction (with Milwaukee Public Schools)*. Naperville, IL: American Institutes for Research. <https://eric.ed.gov/?id=ED595200>
- Temple, E., Deutsch, G., Poldrack, R., Miller, S., Tallal, P., Merzenich, M., & Gabrieli, J. D. E. (2003). Neural deficits in children with dyslexia ameliorated by behavioral remediation: Evidence from functional MRI. *Proceedings from the National Academy of Sciences, 100*(5), 2860–2865. <http://dx.doi.org/10.1073/pnas.0030098100>

- Thapa, A., Cohen, J., Guffey, S., & Higgins-D'Alessandro, A. (2013). A review of school climate research. *Review of Educational Research, 83*(3), 357-385.
<http://dx.doi.org/10.3102/0034654313483907>
- Tillery, A. D., Varjas, K., Roach, A. T., Kuperminc, G. P., & Meyers, J. (2013). The importance of adult connections in adolescents' sense of school belonging: Implications for schools and practitioners. *Journal of School Violence, 12*(2), 134-155.
<http://dx.doi.org/10.1080/15388220.2012.762518>
- Torgesen, J. K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research & Practice, 15*(1), 55–64. http://dx.doi.org/10.1207/SLDRP1501_6
- Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (2012). *Test of Word Reading Efficiency* (2nd Ed.). Pro-Ed.
- Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Herron, J., & Lindamood, P. (2010). Computer-assisted instruction to prevent early reading difficulties in students at risk for dyslexia: Outcomes from two instructional approaches. *Annals of Dyslexia, 60*, 40–56.
<http://dx.doi.org/10.1007/s11881-009-0032-y>
- Turner, J. C., Meyer, D. K., Midgley, C., & Patrick, H. (2003). Teacher discourse and sixth-graders' reported affect and achievement in two high-mastery/high-performance mathematics classrooms. *Elementary School Journal, 103*(4), 357–430.
<http://dx.doi.org/10.1086/499731>
- Uhry, J. K., & Clark, D. B. (2005). *Dyslexia: Theory & practice of instruction* (3rd ed.). York Press.

- Vacca, R. T., & Vacca, J. L. (1999). *Content area reading: Literacy and learning across the curriculum* (6th ed.). Addison-Wesley Longman.
- Vaden-Kiernan, M., Caverly, S., Bell, N., Sullivan, K., Fong, C. & Atwood, E. (2012). *Louisiana Striving Readers: Final Report*. Austin TX: Southwest Educational Development Laboratory. <https://eric.ed.gov/?id=ED595145>
- Vaughn, S., & Coleman, M. (2004). The role of mentoring in promoting use of research-based practices in reading. *Remedial and Special Education, 25*(1), 25-38.
<http://dx.doi.org/10.1177/07419325040250010401>
- Vaughan, J., Serido, J., & Wilhelm, M. (2006). The effects of My Reading Coach on Reading Achievement of elementary education students. Phoenix, AZ: Arizona Board of Regents.
- Walker, J.M. (2008). Looking at teacher practices through the lens of parenting style. *Journal of Experimental Education, 76*(2), 218-240. <http://dx.doi.org/10.3200/JEXE.76.2.218-240>
- Wang, M. T., & Degol, J. L. (2016). School climate: A review of the construct, measurement, and impact on student outcomes. *Educational Psychology Review, 28*, 315-352.
<http://dx.doi.org/10.1007/s10648-015-9319-1>
- Wang, M., & Eccles, J. (2013). School context, achievement motivation, and academic engagement: A longitudinal study of school engagement using a multidimensional perspective. *Learning and Instruction, 28*, 12-23.
<http://dx.doi.org/10.1016/j.learninstruc.2013.04.002>
- Wentzel, K. R. (2009). Students' relationships with teachers as motivational contexts. In K. R. Wentzel & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 301–322). Routledge/Taylor & Francis Group. <https://doi.org/10.4324/9780203879498>

- Wentzel, K. R. (2002). Are effective teachers like good parents? Teaching styles and student adjustment in early adolescence. *Child Development, 73*(1), 287-301.
<http://dx.doi.org/10.1111/1467-8624.00406>
- What Works Clearinghouse: <http://www.whatworks.ed.gov/>
- Wigfield, A., & Cambria, J. (2010). Students' achievement values, goal orientations, and interest: Definitions, development, and relations to achievement outcomes. *Developmental Review, 30*(1), 1–35. <http://dx.doi.org/10.1016/j.dr.2009.12.001>
- Wijekumar, K. K., Meyer, B. J., & Lei, P. (2017). Web-based text structure strategy instruction improves seventh graders' content area reading comprehension. *Journal of Educational Psychology, 109*(6), 741–760.
- Willermark, S. (2021). Who's there? Characterizing interaction in virtual classrooms. *Journal of Educational Computing Research, 59*(6), 1036-1055.
<http://dx.doi.org/10.1177/0735633120988530>
- Wise, B. W., Ring, J., & Olson, R. K. (2000). Individual differences in gains from computer-assisted remedial reading. *Journal of Experimental Child Psychology, 77*(3), 197-235.
<http://dx.doi.org/10.1006/jecp.1999.2559>
- U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2019 Reading Assessment.
- U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2022 Reading Assessment.

Zamora, V., & Pittman, R. T. (2018). The Effects of Two Computer-Based Reading Software Programs on Student Reading Performance. *Texas Association for Literacy Education Yearbook*, 5, 56-62. <https://eric.ed.gov/?id=EJ1291084>

Zimmer-Gembeck, M. J., Chipuer, H. M., Hanisch, M., Creed, P. A., & McGregor, L. (2006). Relationships at school and stage-environment fit as resources for adolescent engagement and achievement. *Journal of Adolescence*, 29(6), 911-933.
<http://dx.doi.org/10.1016/j.adolescence.2006.04.008>

Zimmerman, B. (1995). Self-efficacy and educational development. In A. Bandura (Ed.), *Self-Efficacy in Changing Societies* (pp. 202-231). Cambridge: Cambridge University Press.
<http://dx.doi.org/10.1017/CBO9780511527692.009>