The Impact of Second and Third-Grade Male and Female Students' Preferred Learning Time on Reading Achievement

Gayle A. Creamer
B.F.A., Emporia State University, 1998
B.S., Emporia State University, 2000
M.S., Emporia State University, 2006

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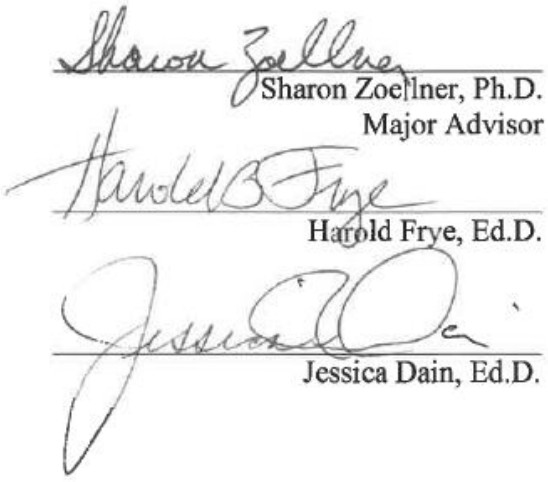

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Abstract

This study was conducted to examine whether a difference exists in second and third-grade students' reading achievement between students who received their reading instruction during their preferred learning time of day and students who were taught reading during their non-preferred learning time of day. The second purpose of the study was to investigate whether there was a difference in second and third-grade students' reading achievement between students who were administered the STAR Reading Assessment during their preferred learning time of day and students who were administered the STAR Reading Assessment during their non-preferred learning time of day. Additionally, the study sought to examine whether preferred learning time had a differential effect on reading achievement between males and females.

The results of this study indicated preferred learning time rendered better results on the STAR Reading Assessment but the difference was not statistically significant. The second finding indicated a significant interaction between receiving reading instruction during students' preferred learning time and gender. Males whose reading instruction matched their preferred learning time rendered higher gains than females whose reading instruction matched their preferred learning time. The third finding indicated the group who was administered the STAR Reading Assessment during their preferred learning time had lower gains than those who did not. The final finding showed that students' preferred learning time, when aligned with the time of day the reading assessment was administered, did not differentially impact gain scores on the STAR Reading Assessment for second and third-grade students by gender.

Dedication

This work is dedicated to my family, who has been extremely supportive and patient through this journey. To my husband Bill, thank you for believing in my ability to complete this very long process. You have been my rock and voice of reason when I did not have one. To my mom, thank you for cleaning my house for two years so I could follow a dream. I am blessed with the best mom ever.

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Chapter 1

Introduction

Throughout the evolution of education, researchers and teachers have studied, developed, and implemented practices to better meet students' individual learning styles. The question of how students best acquire skills continues to be relevant in the world of education, thus prompting continuous research about students' learning styles. Teaching a child to read with the hope of reading to learn can be a daunting task. As such, determining a child's learning style can help develop techniques to engage and motivate students during reading instruction (Dunn, Beaudry, & Klavis, 1989).

As educators determine how to effectively teach reading to their students, the time of day students learn best should be considered. According to Dunn et al. (1989), "every person has a learning style" (p. 50), and when teachers identify a student's learning style, the motivation of the student increases. Traditionally, elementary teachers have assumed students are more alert in the morning, prompting them to teach core subjects and administer standardized testing during this time (Wile & Shouppe, 2001). Carskadon, Vieira, and Acebo (1993) identified four preferred learning time categories: early morning learners, mid-morning learners, early afternoon learners, and late afternoon learners. They utilized the Morningness/ Eveningness Scale for Children (MESC) to determine whether students' preferred learning times were during the morning or afternoon. The MESC was adapted by Carskadon et al. (1993) from similar questionnaires constructed for use in adults; such as Horne and Ostberg's 1976 Swedish-language scale of morningness. The scale is a multiple-choice questionnaire that is completed by students and is used to determine the time-of-day children prefer to learn.

For this study, the four preferred learning time categories were combined into two categories and only the preferred learning times of morning and afternoon were considered.

Standardized testing has become more common since the advent of the No Child Left Behind (NCLB) Act approved by Congress in 2001(USDOE, 2001). NCLB was a major attempt to address United States educational competitiveness and outlined directives about public school accountability through standardized tests (Parker, 2009). "A crucial point of NCLB federal legislation, were efforts to increase Math and Reading scores by addressing curriculum and instruction instead of addressing diversified instruction" (Parker, 2009, p. 1). According to Dunn (1998), 28% of elementary students were "ready to learn" (p. 55) before 10:00 a.m., and "only one-third of the million students tested prefer learning in the early morning, with the majority preferring to learn in the late morning or early afternoon" (p. 55). Parker (2009) proposed that student success on standardized tests dictated instructional strategies to be used in the classroom, including the preferred learning time of the student. Therefore, teachers needed to be willing to change methods according to how and when students learned best.

In 2015, the United States Congress made another attempt to address educational competitiveness by reauthorizing the Elementary and Secondary Education Act (ESEA) and offering relief from the more onerous provisions of NCLB. According to the United States Department of Education (USDOE, 2015), the bipartisan bill upheld critical protections for America's disadvantaged students. It ensured that states and school districts held schools to account for the progress of all students and prescribed meaningful reforms to remedy underperformance in those schools failing to serve all

students. It excluded harmful provisions that would siphon funds away from the students and schools most in need and maintained dedicated resources and supports for America's vulnerable children. It also ensured that states and districts continue the work to ensure that all students had equitable access to excellent educators.

Caine and Caine (1998) suggested that in order to change traditional ways of educators; teachers must become more introspective regarding common instructional practices and their effectiveness. They contended that implementing current research into education and shifting the way we educate was a difficult feat (Caine & Caine, 1998).

> In some schools it is assumed that the time of day at which courses are taught, morning, noon or afternoon, does not significantly influence the quality of learning. Therefore, responsibility for scheduling is given to administrators, whose planning considerations are technical rather than psycho-educational. (Klein, 2001, p. 301)

There continues to be a need for educators to understand that not all students are morning alert; therefore, the commitment to consider student preferred learning time is warranted.

Caine's assertion of teachers becoming more introspective did not only apply to the time of day students learned best, but also applied to how males and females learn differently. Researchers have identified several variations in the physical, cognitive, personal, and social domains between the male and female brains (Bonomo, 2012). Furthermore, brain research has supported findings that the typical male is already developmentally two years behind the average female in reading and writing when he enters the first day of school (Salomone, 2006).

Background

At a time of increased accountability, educators are working to understand and monitor progress of student achievement. With the implementation of NCLB (2001) and the reauthorization of ESEA (2015), "student success in a standardized test reform movement dictates changes in instruction methods" (Parker, 2009, p. 2). This frequent measuring and reporting of student achievement allows educators to make decisions regarding individual instructional needs in a timely manner, and leads teachers to conduct a root cause analysis of academic success or lack thereof. A root cause analysis helps educators identify why a student is, or is not, being successful through the elimination of surface-level factors.

Organizations such as schools and hospitals are always searching for innovations that increase productivity with little to no increase in inputs (Pope, 2016). History has shown that simple innovations can collectively increase efficiency; thus providing increased profits, higher patient satisfaction, or improved student achievement (Pope, 2016). One might question what simple innovations educators could use to improve student performance, and preferred learning time may be the answer.

Dunn (1998) conducted many studies that found individuals categorized as morning or night people function best during their respective preferred times of day. Administrators and teachers often ignore these chronobiologic differences in students (Cramp, 1990). According to Dunn et al. (1989), "just as individuals have their unique signatures, they also have their learning styles" (p. 55). One aspect of learning style is preferred learning time.

However, the effects of preferred learning time may not impact males and females in the same manner. Gurian (2011) has conducted research on differential learning between genders. He found males and females have varied learning styles; such as males tend to be more abstract thinkers, whereas females tend to think more concretely. Additionally, females typically have a more sophisticated use of language than males. Gurian (2011) found that during the learning process females used more words as they learn, and males typically learn silently.

As learning styles continue to be researched, it has been shown that preferred learning time appears to influence the capacity to learn new and complicated material, to the extent of influencing standardized testing results (Callan, 1997). In our education system, teachers are often held accountable for standardized test scores, and frequently they are unaware of the pressure they put on students to perform well on these assessments. Taking tests can be challenging for students but understanding the difficult questions on the test may be easier for individuals depending on the time of day the test is administered (Callan, 1997).

The sample of participants for this study included second and third-grade students attending elementary schools in the Walton School District (name changed to protect anonymity). The Walton School District is in northeast Kansas.

Statement of the Problem

Throughout the history of education, theories have changed about the time of day at which students are at their optimal learning capacity. This has been problematic because teachers have not had a clear understanding of when students learn best, believing morning was an ideal time. Emerging evidence contradicts the idea that all

individuals learn best in the morning (Parker, 2009). Dunn (1998) found that nearly two-thirds of elementary students were more alert during the late morning or early afternoon. Beginning readers, and both low-ability and high-ability students, achieved greater gains when teachers conducted reading instruction in the afternoon (Davis, 1987). Folkard (1980) found that students performing below grade level were more alert and had longer attention spans in the afternoon than in the morning. Kim, Dueker, Hasher, and Goldstein (2001), however, refuted some of the earlier studies when they found a relationship between age and children's time of day preference; such that younger students' time of preference is more toward morningness whereas older students are more toward eveningness.

Every student in the second and third grades at Walton School District were taught whole group reading instruction during the morning hours. The scheduling of core subjects, such as reading, in the morning implies that teachers within the district do not understand the effects that time of day for instruction can have on young students' attention spans, short-term and long-term memories, and general alertness throughout the academic day.

Purpose of the Study

The first purpose of this study was to examine whether a difference existed in second and third-grade students' reading achievement between students who received their reading instruction during their preferred learning time of day (morning or afternoon) and students who were taught reading during their non-preferred learning time. The second purpose of the study was to investigate whether there was a difference in second and third-grade students' reading achievement between students who were

administered the STAR Reading Assessment during their preferred learning time of day and students who were administered the STAR Reading Assessment during their non-preferred learning time. Additionally, the study sought to examine whether preferred learning time had a differential effect on the reading achievement of males and females.

Significance of the Study

This study could be significant to elementary teachers as it provides information regarding how to schedule students' daily learning to ensure the effectiveness of reading instruction. Teachers could provide instruction during the optimal learning time of their students to increase learning and improve achievement. The results from this study could also help educators understand how preferred learning time impacts students' learning by gender.

This research study will provide information that could be useful for both administrators and counselors about scheduling testing times for optimal results. Elementary school teachers often believe assessing students in the morning will yield the highest scores. Educators could increase test scores and eliminate time of day biases by scheduling students to complete tests during their preferred learning time (Wrobel, 1999).

This study could also be significant to researchers who are conducting studies on preferred learning time. The majority of research regarding preferred learning time cites significantly older research to support claims. The results of this study will be beneficial to educational researchers by expanding upon existing research with additional information regarding preferred learning time.

Delimitations

Lunenburg and Irby (2008) define delimitations as "self-imposed boundaries set by the researcher on the purpose and scope of the study" (p. 134). There were three delimitations in this study. First, participants sampled for the study consisted of only second and third-grade students and were exclusive to one school district. The second delimitation of this research study was that it examined only reading achievement and other subjects such as math, science, and social studies were not considered. The third delimitation was that the reading achievement was measured with only one instrument; the STAR Reading Assessment.

Assumptions

Roberts (2004) indicated assumptions were factors taken for granted about a study. One assumption made for this study was students understood the questions and were honest when answering the MESC items so their preferred learning time could be accurately represented. Another assumption was that all second and third-grade students tested on the STAR Reading Assessment answered the questions on the test to the best of their ability. A third assumption was that the test was administered by teachers according to the administration protocol outlined in the pre-test section of the STAR Reading Assessment teacher manual. The final assumption made for the study was that teachers collaborated with their grade level Professional Learning Communities to help each other utilize best practices in reading instruction to maximize their students' learning.

Research Questions

This study examined whether preferred learning time impacted the reading achievement in second and third-grade students, and whether preferred learning time

differentially affected reading achievement by gender. The following questions guided the research:

RQ1. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, impact gain scores on the STAR Reading Assessment for second and third-grade students?

RQ2. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impact gain scores on the STAR Reading Assessment for second and third-grade students based on gender?

RQ3. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, impact gain scores on the STAR Reading Assessment for second and third-grade students?

RQ4. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, differentially impact gain scores on the STAR Reading Assessment for second and third-grade students by gender?

Definition of Terms

According to Lunenburg and Irby (2008), the definitions of significant terms key to any study should be listed. The following definitions were used in this study:

Afternoon learners. Afternoon learners are those who reach their peak body temperature at 6:00 a.m., two hours after morning learners (Parker, 2009).

Circadian rhythm. A circadian rhythm is "a 24-hour cycle in biochemical, physiological, or behavioral processes of people" (Wile & Shouppe, 2011, p. 21), thus impacting the storage and retrieval of information.

Learning style. A learning style is **"**a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others" (Dunn et al., 1989, p. 50).

Morning learners. Morning learners are those who reach their peak body temperature at 4:00 a.m., two hours before afternoon learners (Parker, 2009).

Preferred learning time. Preferred learning time is the time of day students prefer to learn.

Organization of the Study

This study contains five chapters. Chapter 1 included the introduction, background of the study, statement of the problem, and the purpose of the study. Additionally, it provided the significance of the study, listed the research questions, and provided an overview of the study. Chapter 2 includes the review of literature related to individual learning styles, standardized testing, and circadian rhythms' impact on memory. The research design, the rationale for the chosen method, participant selection method, further information needed to organize and conduct the study, and the data analysis procedures are described in Chapter 3. Chapter 4 includes the results of the data analysis and the hypothesis testing. Chapter 5 contains the summary and conclusions of the research, as well as implications of the results and recommendations for future research.

Chapter 2

Review of the Literature

The purpose of this study was to determine whether teaching students reading and administering reading assessments during their preferred learning time influenced reading achievement. As support for this study, a literature review was conducted to examine time of day influences on academic achievement in the classroom. Throughout the review of literature, topics discussed include biological implications for learning in children, time of day as it relates to standardized testing, and the influence on time of day and preference of learning styles

Biological Implications for Learning in Children

A circadian rhythm is a biological process in which the human body has an internal timing mechanism. This complex, independent, and self-directed cycle runs on a 24-hour, sleep-to-wake and day-to-night rotation (Parker, 2009). Cells possess internal 24-hour clocks, referred to as circadian rhythms. These clocks regulate daily activities. Humans possess specific inter-individual discrepancies in their biological rhythms. Some people tend to be more morning alert, while others are more alert during the evening hours. (Randler & French, 2009). Physiological measurements could be utilized to evaluate chronotype of people, by measuring the daily rhythm of the body temperature. People who are morning types have the lowest body temperature during the early part of the night, while evening types have the lowest temperature during the early morning. The hormone melatonin, that is deemed the sleep hormone, peaks several hours earlier in the early morning type than in the evening type (Randler & French, 2009). Because individual circadian rhythms are distinctive and affect sleep wake performance, natural

influences may have informative repercussions, affecting learning ability and academic achievement (Parker, 2009).

In the mid-1900s, the impact of brain research on learning was beginning to become a more prominent factor for educating students. Educators were beginning to see how key revelations of brain research could translate into effective strategies that could help students "develop better thinking skills and experience deeper learning" (Sousa, 2014, para. 2). However, as Caine (2000) points out:

> Taking neuroscience into the classroom is challenging because we cannot rely exclusively on brain research. People are too complex, individuals too unique, and contexts too unpredictable. Integrating brain research with other research and with an adequate model for instruction, however, can provide educators with a coherent foundation for excellent teaching. (p. 61)

Caine's review provided an understanding of how to apply brain research to time of day preferences in the classroom beginning with how it impacted memory.

Neuroscience research has made considerable progress in clarifying the nature of sleep and its functions, highlighting its role in learning and memory. According to McKibben (2014), sleep loss influences learning and memory. "You gather facts during the day and put them in your short-term memory. When you go to sleep your brain reviews that information, sorts it, decides what to store, and makes it retrievable" (p. 1). Additionally, the latest scientific studies suggest the capability of working memory in young folks is dwindling (Sousa, 2014). While no one knows why this is happening, a possible explanation was "the brain is learning that rather than retain large amounts of

information, it is easier to remember how to use modern technology to find it" (Sousa, 2014, para. 4).

Earlier researchers (Baddeley, Hatter, Scott, & Snashell, 1970; Blake, 1967; Hockey, Davis, & Gray, 1972; Laird, 1925) suggested that immediate memory recall was often greater when material was presented in the morning while long-term memory was greater when material was presented in the afternoon. In the late 1970s and early 1980s research was conducted on the rhythms of the sleep cycle and how they affected memory. A circadian rhythm was "a 24-hour cycle in biochemical, physiological, or behavioral processes of people" (Wile & Shouppe, 2011, p. 21). Folkard (1980) compiled data to evaluate the impact of circadian rhythms on the right and left hemispheres of the brain. He analyzed memory recall of stories read to children in the morning as opposed to the afternoon. Folkard (1980) found when teachers presented instruction in the morning students had "superior immediate retention of unimportant information" (p. 96) as opposed to the students who were presented information in the afternoon who had exceptionally delayed retention of important and unimportant information. After a seven-day delay, those children who heard the story in the afternoon had better retention of information than the students who heard it in the morning (Folkard, 1980).

Folkard (1980) contended that the left-hemisphere of the brain, dominant in the morning hours, controlled processing of acoustic data, short-term memory and routine activities. In his view the right hemisphere was dominant during the afternoon hours and was responsible for processing of visual information containing few semantic components and perceptual tasks which include organizational transformation of information and long-term memory (Folkard, 1979).

Moreover, Biggers (1980) found the school day accommodates the efficiency design of the morning-active student a lot better than the afternoon-active and evening-student. The majority of the school day occurred during the student's early morning-active peak time of emotional efficiency while another student was simply getting warmed up when school was dismissed. Baddeley et al. (1970) conducted a study on digit span and how well a participant could recall the sequence of numbers throughout different times of the day. They concluded there was a small effect on the efficiency of memory and how it varied with the time of day specifically noting that immediate memory is better in the morning than in the afternoon.

To be able to understand how the brain's memory may function differently at various times during the day, it was crucial to determine exactly how the brain processes as well as stores data. One way the brain's different memory types were classified was by short-term memory and long-term memory (Sjosten-Bell, 2005). These findings have motivated educational researchers to determine whether applying this research to the classroom setting can impact student achievement.

Davis (1987) conducted research on memory and reading achievement. She investigated whether time of day instruction was an important variable in reading development and whether it affected low and high ability readers differently. "Poor readers tend to have less well-developed metacognitive awareness about reading than do good readers, and it is believed that metacognitive knowledge is correlated with the acquisition of efficient memory" (p. 138). She discovered that because circadian rhythms influenced the way people code, store, and retrieve information, it is sensible to expect reading achievement will be much better for pupils who receive instruction in the late

afternoon than it would be for pupils who receive instruction at the start of the morning. Her reasoning was that because reading comprehension connects the information of the text to relevant background knowledge, the hemisphere activating the processing was utilized and stored into long-term memory (Davis, 1987). In Sjosten-Bell's (2005) synthesis of Davis' study she stated:

> The findings of all these studies may be a consequence of Folkard's result that long-term memory is stronger for those instructed in the afternoon. It is not clear from reading the Davis (1987a) report whether the test questions assess items that require short-term memory recall (such as questions after a short passage) or long-term memory recall (such as vocabulary, grammar and spelling questions) or, most likely, a combination of both. Because reading skills are developed over a substantial period of time, most skills used in reading rely on accessing long-term memory and therefore these findings speak in favor of having reading instruction in the afternoon rather than the morning. (p. 18)

Morton and Kershner (1985) suggested that gifted people perform better in the afternoon, during the phase of right hemisphere dominance, because of their superior ability to utilize long-term memory. They also theorized that the performance of children who fail at reading would not improve in the afternoon, because of the difficulty of relating texts to previous knowledge, an operation requiring exploitation of long-term memory resources. They found reading scores rose during the afternoon hours for skills connected to immediate and superficial processing of words. Daily differences in deep semantic processing of words were not observed. In tasks demanding analytical thinking, persons with low levels of cognitive ability had poorer reading scores in the afternoon.

The explanation given for this regression was that these people did well at activating verbal thought processes controlled by the left hemisphere but not those controlled by the right (Klein, 2001).

Oakhill (1988) found information with different degrees of significance inside a text is better remembered at various times of the day. She determined "that afternoon subjects are more likely than those tested in the morning to integrate information as they read" (p. 204). She also found that morning-tested students remembered more superficial aspects of the text whereas afternoon-tested students remembered more elaborate aspects of the text (Oakhill, 1988). Sjosten-Bell (2005) synthesized this to mean even though short-term memory may be more capable in the morning, it may support remembering less significant aspects of text.

Memory was but one variable in how the brain impacted learning. Another variable was attention span. Muyskens and Ysseldyke (1998) studied how ecological factors interacted with circadian rhythms so they could understand the learning environment and how the scheduling of a day could maximize student involvement and achievement. They observed 122 students in second through fourth-grade during one school day. They found that attention was higher in the morning. However, they noted that individualized learning that was more active took place in the morning while group learning took place primarily in the afternoon. The authors questioned whether "the variations of a student's day indicate when teachers schedule more individualized instruction time, active activities, and academic tasks, students had more academic response" (p. 421).

Klein (2001) studied math aptitude and levels of attention by surveying fifth and tenth-grade students using a questionnaire to determine self-assessed levels of attention span. He found that fifth-grade students' attention spans rose from morning to afternoon. However, the reverse was found in tenth-grade students. The attention level for the adolescent was higher in the morning than in the afternoon showing that "peak hours of effective attention varied with age" (p.305).

Sousa (2001) also studied the impacts of age and attention span on achievement. He pointed out, that ability to focus in pre-adolescents and post-adolescents rises in the morning and then remains steady until about mid-day when there is a significant drop (Sousa, 2001). Focus increases again in the evening, but not to as high a degree as in the morning. The focus for pre-adolescents and post-adolescents lowers from 12:00 p.m. to 2:00 p.m. It is significant to be aware that this pattern for the level of focus shifts for adolescents. In adolescents, the focus lowers generally one hour later and lasts from about 1:00 p.m. to 4:00 p.m. (Sjosten-Bell, 2005). Therefore, what may have been true in studies involving adolescents may not have held true for elementary-aged students.

Sousa (2001) also purported the brain is wired to consider something that is unexpected. With the demands on students' attention increasing through technology, he believed anything the brain recognized as not fitting the pattern of its present environment would support learning. If teachers could create different tools to break up expectations, Sousa (2001) concluded students would re-engage. He also challenged the fact that the brain can multi-task. According to Sousa (2011), the brain can only focus on one task at a time. What was oftentimes called multi-tasking was "alternate tasking, which is the brain shifting its attention from one

task to a second task, and then back to the first one" (Sousa, 2011, p. 39). He continued to explain how this would be implicated in the classroom:

> Each shift of the brain's attention requires increased mental effort and incurs a loss of information in working memory of the first task. In effect, the individual ends up doing two tasks poorly rather than one task well. Although using a variety of strategies in the classroom keeps students engaged, the shift from one activity to another should not be done before the first task is adequately learned. (p. 39)

Morton and Diubaldo (1995) reported no differences between the spelling scores of 12-year-olds in morning and afternoon classes. They recommended examination of the connection between timing of lessons and achievement at a variety of ages in subjects that are distinct, like mathematics, music, and art (Morton, & Diubaldo, 1995). Klein (2001) reported that there have been discrepancies in the relationship between attention span, scholastic achievement, and the time lessons take place. Underlying the above suggestion is the assumption that these disciplines require the use of various sets of cognitive abilities, which are not influenced by natural rhythms in the same fashion (Klein, 2001).

According to Klein (2001), compiled results point to the desire to map attention levels among students who stand for a broad spectrum of cognitive capacity at all hours of the school day, over a broad range of ages as well as in an assortment of disciplines representing different cognitive processes. These results show the need to facilitate transformation of class schedules in every school regarding the best learning times of its students.

In his article on how the time of day affects students' reading, Aarons (2016) analyzed the research from the past 40 years. He asserted that circadian rhythms as well as biorhythms trigger hormonal responses, which affect approximately 100 distinct human functions, and create the brain function for various forms of jobs throughout the day. Aarons (2016) reiterated what academic researchers found. Specifically, he found the hormonal responses prompted in early morning were best suited to short-term memory and routine math study and that the hormonal responses in the afternoon suited long-term memory activities, such as reading (Aarons, 2016).

Additionally, male and female brains are biologically distinctive causing them to learn differently. Kaufman and Elbel (2001) indicated the more profound distinction between males and females might not be the framework of the mind, but the size and sequence of development in the various areas of the human brain. Furthermore, male brains develop at a different time, order, and rate than female brains, in the regions of the brain involving language, spatial memory and motor coordination (Bonomo, 2012).

According to Gurian and Stevens (2004) females have more powerful neural connectors in their temporal lobes than males. These connectors result in far more sensually detailed memory storage, improved listening skills, and better discrimination among the different tones of voice. These differences allow females to use greater detail in writing assignments. "The male brain is set to renew, recharge, and reorient itself by entering what neurologists call a rest state." (Gurian & Stevens, 2004, p. 23). Males who sit in the back of the room and begin to drift off to sleep enter a neural rest state. The same is true when a teacher used many words. Males tended to zone out and go into rest state (Gurian & Stevens, 2004).

Matheus (2009) also studied biological implications of males and females. He discovered male brains have specific functions and structures. Besides having a greater cortical area for mechanical and spatial functioning, males use 50% more of the human brain space than females use for emotional and verbal processing. This leads to males encountering emotions and words very differently from females. Males have less serotonin as well as oxytocin. The former controls impulsivity, even though the latter controls human bonding. Because males have less of these chemicals, they are not as likely to sit still, or refrain from talking with a classmate (Matheus, 2009). Additionally, the male brain tends to lateralize its activity, compartmentalizing it in small areas of the brain (Gurian, 2011). In other words, males are more likely to have attention span problems. Females, on the other hand, process serotonin more efficiently than males and are much less prone to a hyperactive disorder. The female brain has more activity in certain center areas of the brain, such as the cingulate gyrus, which means that portion of the brain continually processes information between various regions of the brain. (Gurian, 2011).

Time of Day as it Relates to Standardized Testing

Standardized tests have become the roadmap to help decipher a student's academic ability and have been prevalent throughout global societies for decades (Bergmann, 2014). School systems and governments utilize standardized tests to provide data on the effectiveness of schools and curriculum (Sieversten, Gino, & Piovesan, 2016). Additionally, they are used as interventions, or tools, to improve the academic achievement of students and the efficiencies of schools (Bergmann, 2014).

There have been mixed results in determining whether the preferred learning time and time of day have an impact on achievement in standardized testing. The use of standardized testing is supported by two underlying assumptions: that the tests do not have a bias, and they accurately assess a student's academic knowledge (Koritz & Deibert, 1996). According to Sieversten et al. (2016), "when taking a standardized test, it is assumed that the substance of the test and its administration will be the same for all takers. The tests are identical, with identical degrees of difficulty and identical grading methods" (p. 4). Despite the goal of creating a standardized test without bias, Sieversten et al. (2016) found a potential psychological bias: the time at which students take the test.

Sieversten et al. (2016) found that students' performance on standardized tests decreased by 0.9% of a standard deviation for every hour later in the day an exam was taken. Their research showed that cognitive fatigue was the factor impacting the decreased scores. Cognitive fatigue is a human predicament that results from sustained cognitive engagement which taxes individual's mental resources. They found a "20 to 30-minute break improves average test scores. Importantly, a break causes an improvement in test scores that is larger than the hourly deterioration" (Sieversten et al., 2016).

Standardized testing continues to have slight bias toward males. Males tend to be deductive in their conceptualizations. Due to the fact they favor deductive reasoning, males tend to do better on standardized tests. They perform better on timed, multiple choice questions. The greater an individual is at creating a fast deduction, the better he does on the test, which depends on this skill (Gurian, 2011). Females on the other hand,

favor standardized tests with essays because they tend to use inductive reasoning and concrete examples.

Gurian (2011) conducted research on whether testing students as often as American society does was good for the learning brain. He concluded it was not. When NCLB was passed in 2001, the amount of standardized testing administered in schools increased. Not only did the amount of testing increase, but much younger students were being included. The purpose of NCLB was to hold schools accountable to obtain a certain standard. However, Gurian asserted that legislators, in a hurry to identify and help low performing schools, did not consult brain-development research. The difference in brain development between nine-year-old students and 17-year-old students is staggering. Simply stated, "the sheer variety in brain development and capacity among nine-year-olds makes present modes of standardization an impediment to learning" (Gurian, 2011, p. 190).

Influence on Time of Day and Preference of Learning Styles

The research on learning styles throughout the last few decades has yielded useful findings for educators as they refine their teaching methods. Dunn et al. (1989) defined learning style as a developmentally and biologically imposed set of individual characteristics which make the same teaching practice helpful for a few and inadequate for others. Dunn and Dunn (1993) list individual responses to sound, light, temperature, seating arrangements, perceptual strengths, intake, time of day, and mobility as biological factors where motivation, responsibility, and self-direction are developmentally related. The theoretical basis of adolescent learning and time of day preference is rooted in the field of cognitive psychology and neurophysiology (Parker, 2009).

Piaget (1947) defined learning as an assimilation of biological and environmental influences. To Piaget, cognitive development was a progressive reorganization of mental processes because of biological maturation and environmental experience. Children construct an understanding of the world around them, and experience discrepancies between what they already know and what they discover in their environment. His research was the first to document learning occurs in congruent stages and that learning only occurs when the child is biologically ready to learn.

Gardner (2011) developed the theory of multiple intelligences that determined humans have several different ways of processing information and these ways are relatively independent of one another. The fact the intelligences are independent of one another implies that a high ability in one intelligence does not require a high level in another (Gardner, 2011). He also believed some people might not be gifted at any one intelligence, but that the combination of intelligences could greatly benefit individuals. Gardner's work started an educational reform by introducing individualized instruction. Teachers began to realize that students learned best when delivery methods matched their students' individualized learning styles.

Learning style was a precise examination and diagnosis of the conditions under which an individual was most likely to learn, achieve, create, or solve problems (Dunn, Dunn, & Price, 1981). Over the last four decades, R. Dunn conducted research about how learning styles affected student achievement. She asserted “most teachers know what to teach, but don’t realize they can’t possibly know how to teach it without first identifying how their children learn” (Dunn, 1998, p. 50). She believed students’ learning styles could be categorized into five areas: environmental, emotional,

sociological, physiological, and psychological. Dunn and Dunn (1993) designed the Diagnosing Learning Style (DLS) assessment for students in fifth through twelfth-grade. By acknowledging time of day as an actual component of an individual's learning style, the DLS proved that learning often happened based on an age-related peak time (Parker, 2009).

Furthermore, Dunn and Honigsfeld (2006) defined ways teachers can recognize the learning style in which their students correlate. For example, robust analytic processors tend to focus with conversation or background music, curled up sitting in a comfortable chair, couch, or on the floor. Students classified as analytics absorb information one detail at a time and continue performing persistently until they perfect the assignment. In comparison, students classified as global processors tend to require quiet, intense light, formal seating at a desk or table, and eating or snacking after they have completed their tasks.

Dunn and Honigsfeld (2006) conducted research on the correlation of learning styles and reading achievement. They recognized the complexity different learning styles add to a classroom. However, they argued that regardless of the reading approach research has proven two separate ideas: 1) "some students learn well, some do not, and others either fail or are turned off" and 2) "failing readers often achieve statistically higher test scores when taught with an entirely different approach" (Dunn and Honigsfeld, 2006, p. 71). Therefore, the need for teachers to explore students' individual learning style, such as preferred learning time, has been warranted.

Barron, Henderson, and Spurgeon (1994) conducted research on the effects of time of day instruction and reading achievement of students who read below grade

level. Their research revealed a general increase in the average scores for the mastery of reading skills for below grade level students who were instructed in the afternoon as compared to below grade level students who had been taught in the morning (Barron et al., 1994). The results of this study indicated a need for educators to consider time of day instruction.

Armbruster and Anderson (1981), resolved that the techniques of underlining, note taking, outlining, writing summaries, and asking questions have not been established as effective in helping students learn. Farkas (2003) found that the achievement scores of students with teachers who matched their learning modalities with their instructional resources were statistically higher than were the scores of students who were not taught with their learning style methods. Students also demonstrated better attitudes when they were instructed with multi-sensory tasks as compared to conventional activities.

As educators continue to decipher how to improve reading achievement, individual learning styles could be forgotten by the next best method, such as a technological application. Teachers often deny using a one size fits all approach. They implement one approach, and when that does not work, they try another one (Dunn and Honigsfeld, 2006). According to Dunn and Honigsfeld (2006), this is not the solution to the problem of helping a child learn to read. They contend students must have an introduction to reading through their strongest perceptual strength and processing style. Instructional resources and conditions need to reflect how students learn.

This holds true for stereotypes of males and females. Dunn and Honigsfeld (2006) stated, “there is no point reporting that girls learn to read earlier, younger, and are better at it, than boys, or that more boys than girls have speech problems” (p. 70).

Visualize a child who does not read well. The stereotype teachers have of males has led them to look at the male who fidgets and drifts off in class (Gurian & Stevens, 2004). According to Gurian and Stevens (2004), new technologies to view the brains of males and females have provided reliable research in the differences of how males and females learn. Additionally, Bonomo (2012) conducted research on how males in single-sex schools perform in reading. She found males do not progress at the same rate in reading as females their same age due to the rate of brain maturity (Bonomo, 2012). In fact, the gap between genders in reading increases by 4% from fourth grade to eighth grade and another 4% from eighth grade to twelfth grade. More recently, an extra emphasis on literacy in the early years puts many males at a disadvantage (Whitmire, 2010). Literacy demands are being pushed into earlier and earlier grades due to school reform, and males are, in turn, at a developmental disadvantage when it comes to literacy (Whitmire, 2010). Males develop language skills later than females and males typically need more time to learn the same material.

Furthermore, several factors have been studied to understand precisely why males are staying behind females. The factors consist of the absence of male role models, cultural perceptions about gender, learning styles, insufficient inspiration, and the reality that males require physical movement and space. Additionally, it has been suggested that excessive use of online games increased utilization of ADHD drugs, and lack of attention in school might explain the disengagement of males in the classroom (Bonomo, 2012).

There has been minimal evidence about whether males and females differ in their preferred learning times. Most of the research indicated that males and females tended to shift their learning time preference to evening when they reached adolescence (Kim et al.,

2001). Pope (2016) found there were no clear systematic disparities in the time of day effect between males and females. However, Gurian and Stevens (2004) contended males and females learn differently within subject matters. Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI) technologies allowed them to look within the brains of males and females. They discovered structural and functional differences that greatly impacted human learning (Gurian and Stevens, 2004). The results of the PET and MRI technologies indicated that gender differences existed in learning.

Kim et al. (2001) conducted research on the difference of gender-preferred learning time. They found no significant difference in the preferred learning time of males and females. Additionally, Randler and French (2009) evaluated whether there was any gender similarity with preferred learning time. They too, found no significant difference in morningness/eveningness scores.

There have been some studies on the significance preferred learning time has on student achievement. Carskadon et al. (1993) investigated the delay in children's sleep and wake-up time determining whether biological or psychosocial factors influence phase sleep delay. They found evidence that biological, rather than psychosocial factors are related to sleep preference delay. Additionally, it was determined younger children's time of day preference was more toward morningness as compared to older children who preferred eveningness. Kim et al. (2001) conducted a study on children's time of day preference as well. Their findings were consistent with Carskadon et al. (1993). They noted that the shift toward eveningness occurs around the age of 13.

Goldstein, Hahn, Hasher, Wiprzycka, and Zelazo (2007) researched preferred learning time and time of day testing. They noted that while research had been conducted in the way children and adolescents perform across the day, none of these studies consistently tested the achievement of children or young adolescents as a function of their individual morningness or eveningness preference and the time at which testing occurred. Their findings confirmed a simultaneous effect for adolescents when taking a full-scale intelligence exam during optimal times of day. Specifically, they found a "six point difference in full scale IQ equivalents as a function of the match between an individual's circadian arousal pattern and the time of testing" (p. 5).

Summary

In conclusion, research reviewed in this chapter indicates that the field of education recognizes the importance of student learning styles and biological implications, and how each will make an impact in educating their students. This review focused on time of day influence on neurological factors, such as memory and attention. Circadian cycles and how they impact cognitive functioning was also a key aspect of this literature review. In the following chapter, the hypotheses associated with the study, research methods of the study, and data analysis procedures will be discussed.

Chapter 3

Methods

The current study was designed to examine if there were differences in second and third-grade students' reading achievement, as measured by the STAR Reading Assessment, based on receiving reading instruction during their preferred learning time. The study was also conducted to investigate whether there was a difference in second and third-grade students' reading achievement based on being administered the STAR Reading Assessment during their preferred learning time. Furthermore, the study examined whether receiving reading instruction and being tested during their preferred learning time had a differential effect by gender. Described in this chapter is the research design used for the study, the selection of the participants, the measurement instruments, and data collection procedures. Chapter 3 also includes the data analysis procedures, the researcher's role, and the limitations of the study.

Research Design

A multivariate factorial research design was used to investigate the research questions and their associated hypotheses. The independent nominal, categorical variables for this study were preferred learning time (morning or afternoon) and gender (male or female), as well as the time of day students were instructed and were tested in reading. Changes in scores from fall to spring, or gain scores, on the 2015-2016 STAR Reading Assessment were employed as the dependent variable measuring student reading achievement.

Selection of Participants

The target population for this study was elementary students within the Walton School District. Walton is in northeast Kansas. The district's three elementary schools are in session from 8:10 a.m. to 3:20 p.m., and the district's student population is comprised of several demographic groups. According to Ernst (2015), most of the students who attend Walton school district are dependents of active-duty military personnel who either attend the staff college or work as police officers. Some of the students are dependents of retired military personnel, dependents of Department of Defense (DOD) civilians, or dependents of families attached to Walton School District. The purposive sample consisted of students who were enrolled in either second or third-grade reading classes within three elementary schools: Washington Elementary School, Jefferson Elementary School, or Lincoln Elementary School (names changed to protect anonymity).

As with most military settings, the student population at Walton School District is highly mobile. Families move every one to three years, which leads to a 70% annual turnover rate for the district (Ernst, 2015). The total student population of Walton School District during the 2015-2016 school year was 1,725 students. Males comprised 51.8% of the population and 48.2% were females. Twelve percent of the students were economically disadvantaged. Within the sampled population of second and third-grade students, all were taught whole group reading during the morning. Second and third-grade students were specifically selected because there has been minimal research conducted on preferred learning time with this age group of students.

Measurement

The instrumentation utilized in this study consisted of two assessment tools: the Morningness/Eveningness Scale for Children (MESC) and the STAR Reading Assessment. The MESC (Carskadon et al., 1993) is a survey used to determine the preferred learning time based on questions regarding a child's sleep habits, alertness, and achievement (Parker, 2010). The MESC was adapted by Carskadon et al. (1993) from the original Morning-Eveningness Questionnaire (MEQ) created by Horne and Ostberg in 1976. The MESC contains 10 multiple-choice questions pertaining to the preferred time of activities such as recess, bed-time, testing, etc. (Carskadon et al., 1993). Examples of the multiple-choice questions include how easy is it for you to get out of bed in the morning and what time of day do you have the most energy to do your favorite things (Carskadon et al., 1993). For this study, the four preferred learning time categories were combined into two categories and only the preferred learning times of morning and afternoon were considered.

The scale of the MESC ranges from a total score of 10 (eveningness) to 42 (morningness). Total scores are derived by "associating points to each answer: a = 1; b = 2; c = 3; d = 4; e = 5, except as indicated by *, where point values are reversed" (Carskadon et al., 1993), then summing the points for the responses on each question. The MESC has been used previously in multiple research studies such as a study conducted by Carskadon et al. (1993) about the association between puberty and delayed phase preference. Additionally, Parker (2009) utilized the tool in a study on matching the time of day and preference for adolescent achievement.

According to Lunenburg and Irby (2008), "validity is the degree in which an instrument measures what it purports to measure" (p. 181). In their study on children's time of day preference, Kim et al. (2001) completed a reliability and validity analysis of the MESC. They compared the preference of time of day indicated from results of the original MEQ with the preference of time of day indicated from results of the MESC. Both the MEQ and MESC were completed by 109 students, and the correlation between these two test scores was significant ($r = 0.83$, $p < 0.05$). Furthermore, 12 Duke undergraduate students completed both the MEQ and the MESC, and the correlation between their two test scores was also significant ($r = 0.95$, $p < 0.05$). This evidence suggests the MESC, like the MEQ, shows adequate validity to accurately measure the time of day students prefer to learn (Kim et al., 2001). Additionally, Kim et al. (2001) conducted a reliability analysis of the MESC. They compared how students performed on the MESC taking it two weeks apart, known as test-retest reliability, which demonstrated instrument consistency over time. The correlation between the first and second MESC scores was significant ($r = 0.78$, $p < 0.05$).

The second tool used for this study was the STAR Reading Assessment, a computerized reading comprehension test comprised of 25 multiple-choice questions which takes approximately 9 to 15 minutes to complete. The purpose of the STAR Reading Assessment is to provide educators with quick, accurate estimates of reading comprehension, to evaluate reading achievement relative to national norms, and to consistently monitor development for all students (Renaissance Learning, 2012). Renaissance Learning (2012) designed the STAR Reading Assessment with three approaches to help teachers monitor reading comprehension for their students. Those

approaches included daily progress monitoring, periodic progress monitoring, and annual assessment results.

STAR uses four fundamental arguments to support the design of the reading test to obtain reliable and quick estimates of reading comprehension:

1. The vocabulary-in-text test items require reading comprehension. To achieve the correct answer, the student must be able to draw meaning from the text and select the answer from a multiple-choice list.
2. During the STAR test, students read, use context clues, and attempt to interpret the meaning of words within 20 to 25 cloze sentences (Renaissance Learning, 2012).
3. Vocabulary development is a major factor in determining a student's ability to comprehend written material. A fundamental component of reading comprehension is knowledge of word meaning.
4. The STAR Reading Assessment employs a proprietary Bayesian model Item Response Theory (IRT) estimation method for scoring until the student answered at least one item correctly and one item incorrectly (Renaissance Learning, 2012). Once the student has met the 1-correct 1-incorrect criterion, STAR Reading Assessment software switches to a "proprietary Maximum-Likelihood IRT estimation procedure to avoid any potential of bias in the Scaled Scores" (Renaissance Learning, 2012, p. 38).

The authors of the STAR Reading Assessment argue this approach to scoring enables STAR to provide scaled scores that are "consistently consistent and efficient" (Renaissance Learning, 2012, p. 38). The relationship between the STAR scaled scores

and grade level equivalency is shown in Table 1. For example, if a student scored a scaled score of 349 on the assessment, the grade equivalency is a 3.0. This score reflects how a student in third-grade would perform. However, if a student scored a scaled score of 400, the grade equivalency is a 3.5, indicating a reading level equivalent to students who are in the third-grade, fifth month of school.

Table 1

STAR Reading Assessment Scaled Score to Grade Level Conversions

Scaled Score Range		
Low	High	Grade Equivalent
198	213	2.0
279	295	2.5
345	354	3.0
397	408	3.5
446	452	4.0

Note. Adapted from Renaissance Learning. (2012). *Star reading technical manual.* Wisconsin Rapids, WI: Renaissance Learning, Inc.

Renaissance Learning uses multiple sources of data for determining the internal and external validity of the STAR Reading Assessment (2012). According to Bennicoff-Nan (2002), data from the STAR Reading Assessment showed a moderately strong to very strong correlation with the Stanford 9 Achievement Test (SAT) and the California Standards Test (CST). Comparing the three tests, the strongest correlation was with sixth-grade with $r = 0.86$, $p < 0.05$ for the SAT and $r = 0.83$, $p < 0.05$ for the CST (Bennicoff-Nan, 2002).

The writers for Renaissance Learning (2012) examined the validity of the STAR Reading Assessment in terms of both content and construct validity. Broad content is important for validity to ensure students received different questions each time they took the test. The 2012 reading bank for STAR reading 4.4 contained a total of 2,048 items: 1,620 vocabulary in-text items and 428 authentic text passage items (Renaissance Learning, 2012). According to Ernst (2015), one approach Renaissance Learning used to determine the level of validity was to conduct a study administering both the STAR Reading Assessment and the Degrees of Reading Power Reading Comprehension Assessment. A significant correlation of $r = 0.89$, $p < 0.05$ resulted. This exemplified concurrent validity by demonstrating the degree to which scores on one test correlated to scores on another test when administered at the same time.

Reliability is the "degree to which an instrument consistently measures whatever it is measuring" (Lunenburg & Irby, 2008, p. 182). The STAR Reading Assessment has been examined using three types of reliability analyses: internal reliability, split-half reliability, and alternate forms reliability (Renaissance Learning, 2012). The overall internal reliability of the scores was significant ($r = 0.95$, $p < 0.05$). Pearson correlation coefficients ranged from a low of 0.89 to 0.93 (Renaissance Learning, 2012) indicating the STAR Reading Assessment seems to be a reliable measure of reading achievement. Split-half reliability analysis was based on the first 24 items of the STAR Reading Assessment; and results based on the odd- and even-numbered items were calculated. The correlations between the two sets of results were corrected to a length of 25 items. Results indicated a Cronbach's alpha of 0.92 for the overall reliability of the scores, and

results from the alternate forms reliability indicated a Cronbach's alpha of 0.91 for the overall reliability of the scores (Renaissance Learning, 2012).

The STAR's item bank consisted of 1,409 items categorized into 54 difficulty levels (Renaissance Learning, 2012). "As a student progressed through a testing session, the program used adaptive branching to customize the passage difficulty level" (Lingelbach, 2012, p. 77). Adaptive branching is a process in which the computer program varies the item selection according to the student's ability to obtain a more precise measure of reading comprehension. If a student answers an item correctly the software increases the difficulty level on the next item, but if a student answers an item incorrectly the software lowers the difficulty level of the next item (Renaissance Learning, 2012).

Data Collection Procedures

Before conducting the study, approval was sought from the Walton School District by contacting the Deputy Superintendent to place the research proposal on the Board of Education meeting agenda. At the October 2012 school board meeting, the research proposal was presented and permission was requested to survey second and third-grade students with the MESC, and use of data from the STAR Reading Assessment was requested for purposes of the study. Permission was granted by the Board of Education with a vote of 3-0 in approval (see Appendix B).

Carskadon, author of the MESC, was contacted via electronic mail on July 28, 2015 for permission to use the instrument (see Appendix C), and permission was granted on July 30, 2015. The superintendent of Walton School District was contacted on October 20, 2015 via electronic mail asking to distribute parent consent forms to survey

second and third-grade students using the MESC, and to obtain 2015-2016 STAR Reading Assessment data for statistical analysis pertaining to the study. Permission for both activities was granted on October 23, 2015.

An informational email that included the parent consent letter was sent to the school principals requesting participation of their second and third-grade students (see Appendix D). A letter was also sent to second and third-grade teachers explaining the study and the role they would play in the study (see Appendix E). Second and third-grade teachers sent home the parent letters with their students asking permission for their child's participation in the study (see Appendix F). Parent permission slips were collected for students from each of the three elementary schools. All communication and permissions for research were completed in January 2016.

In late January of 2016, the MESC survey was administered to students by their teachers to identify students' preferred learning time. Prior to administration of the survey, second and third-grade teachers reviewed time frames with their students to help alleviate any confusion. The results were analyzed, and students' preferred learning times were identified using the morningness/eveningness scale according to their total scores. Daily classroom instructional schedules and STAR Reading Assessment schedules of participating teachers were collected from principals to determine which students received reading instruction and/or took the STAR Reading Assessment during their preferred learning time. For the variables of preferred learning time, time of day reading instruction occurred, and time of day the STAR Reading Assessment was administered, morning was coded as 1 and afternoon was coded as 2. Fall 2015 and Spring 2016 STAR Reading Assessment scores were collected for all participants

through the district technology department, and data included student gender. All student names were removed, and cases were numbered to ensure anonymity.

A request to conduct research was submitted to the Baker University Institutional Review Board (IRB) on May 25, 2016 (see Appendix G). Approval of the IRB was granted on June 10, 2016 (see Appendix H). Data to be analyzed in the study was not released until after this approval was secured.

Data Analysis and Hypothesis Testing

Quantitative research methods employing a multivariate factorial design were used to examine the reading achievement, as measured by the gain scores on the STAR Reading Assessment, of second and third-grade students who were instructed and/or tested during their preferred and non-preferred learning time. Students whose preferred learning time matched reading instruction were coded as 1 and students whose preferred learning time did not match reading instruction were coded as 2. Additionally, the impact of receiving reading instruction and/or taking the STAR Reading Assessment during students' preferred learning time on male and female student achievement was investigated. "Factorial designs are created by combining every level of one independent variable with every level of another" (Keppel &Wickens, 2004, p. 195). This allows the effects of two independent variables on the dependent variable to be tested separately but can also test the effect of the combination or interaction of the independent variables on the dependent variable.

The following research questions, hypotheses, and hypothesis tests were used to guide the data analysis of this study:

RQ1. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, impact gain scores on the STAR Reading assessment for second and third-grade students?

***H1*.** A student's preferred learning time, when aligned with the time of day the student receives reading instruction, impacts gain scores on the STAR Reading Assessment for second and third-grade students.

RQ2. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impact gain scores on the STAR Reading assessment for second and third-grade students based on gender?

***H2*.** A student's preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impacts gain scores on the STAR Reading assessment for second and third-grade students based on gender.

A two-way analysis of variance (ANOVA) was conducted with the two independent variables of reading instruction time (matching and not matching students' preferred learning time) and gender (males and females) being used to group the dependent variable of STAR Reading Assessment gain scores. To test H1, the main effect of reading instruction time (matching or not matching the students' preferred learning time) on the STAR Reading Assessment gain scores was used from the two-way ANOVA results. Significance was set at $p < 0.05$. To test H2, the interaction effect of reading instructional time (matching or not matching the students' preferred learning time) and gender (males and females) on the STAR Reading Assessment gain scores was used from the two-way ANOVA results. Significance was set at $p < 0.05$.

RQ3. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, impact gain scores on the STAR Reading assessment for the second and third-grade students?

***H3*.** A student's preferred learning time, when aligned with the time of day the reading assessment is administered, impacts gain scores on the STAR Reading assessment for the second and third-grade students.

RQ4. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, differentially impact gain scores on the STAR Reading Assessment for second and third-grade students based on gender?

***H4*.** A student's preferred learning time, when aligned with the time of day the reading assessment is administered, differentially impacts gain scores on the STAR Reading Assessment for second and third-grade students based on gender.

A two-way analysis of variance (ANOVA) was conducted with the two independent variables reading assessment administration time (matching and not matching students' preferred learning time) and gender (males or females) being used to group the dependent variable of STAR Reading Assessment gain scores. To test H3, the main effect of reading assessment administration time (matching or not matching the students' preferred learning time) on the STAR Reading Assessment gain scores was used from the two-way ANOVA results. Significance was set at $p < 0.05$. To test H4, the interaction effect of reading assessment administration time (matching or not matching the students' preferred learning time) and gender (males or females) on the STAR Reading Assessment gain scores was used from the two-way ANOVA results. Significance was set at $p < 0.05$.

Limitations

Limitations of a study are "factors that may have an effect on the interpretation of the findings or on the generalizability of the results" (Lunenburg & Irby, 2008, p. 133). The STAR Reading Assessment is one measure of reading achievement and is, therefore, an incomplete representation of what students could achieve; this posed a limitation to the study. Additionally, the skills and experience of each teacher may have had an impact on the level of effectiveness of their reading instruction provided to students; this could also have influenced reading achievement. The different strategies and methods teachers used to prepare students for the STAR Reading Assessment varied among schools and could have influenced their assessment scores. Another limitation was the MESC survey is based on the self-reported data by students on their learning preference, and students may not have answered the survey honestly to accurately reflect their learning preference. Furthermore, teachers for both second and third-grade levels taught whole group reading daily during the morning but taught guided reading twice per week during the afternoon, thus causing a limitation of determining whether afternoon reading instruction could have influenced the study.

Summary

This quantitative study employed a multivariate factorial design to examine whether differences existed on STAR Reading Assessment gain scores between groups matched and not matched on the students' preferred learning time with instructional reading time. The study also examined whether differences existed on STAR Reading Assessment gain scores between groups matched and not matched on the students' preferred learning time with reading assessment administration time, and whether these

group differences held constant regardless of gender. Throughout this chapter, a detailed explanation of the study's research design, selection of participants, measurement instruments, data collection, data analysis, and limitations of the study were discussed. Results of the data analysis are presented in Chapter 4.

Chapter 4

Results

This chapter provides an overview of the findings from the study. The first purpose of this study was to examine whether a difference existed in second and third-grade students' reading achievement between students who received their reading instruction during their preferred learning time of day and students who were taught reading during their non-preferred learning time of day. The second purpose of the study was to investigate whether a difference existed in second and third-grade students' reading achievement between students who were administered the STAR Reading Assessment during their preferred learning time of day and students who were administered the assessment during their non-preferred learning time of day. Additionally, the study sought to examine whether preferred learning time had a differential effect on reading achievement between males and females.

Descriptive Statistics

Originally data was collected on 166 students; however, three STAR Reading Assessment gain scores were greater than three standard deviations from the mean. These three identified outlier scores were omitted from the statistical analysis, and the data analyzed consisted of 163 students. Students from the sample attended one of three participating elementary schools from the Walton School District, with a total of 13 teachers participating. Second graders comprised 64% (n = 104) of the sample and third graders comprised 36% (*n* = 59). Forty-four percent of the participants were male (*n* = 72) while 56% were female (*n* = 91).

Sixty-eight percent (n = 110) of students' preferred learning time, as determined by their MESC scores, matched their time for reading instruction and 33% (n = 53) of students' preferred learning time did not match their time for reading instruction. The STAR Reading Assessment gain score means and standard deviations based on instructional reading time and gender can be found in Table 2.

Table 2

Descriptives for STAR Gain Scores by Instructional Reading Time and Gender

	Males			Females			Total		
Instruction and Preferred Learning Time	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Match	51	166.9	73.7	59	162.6	79.6	110	164.6	76.6
Not Match	21	190.1	91.4	32	125.5	87.7	53	151.1	93.9
Total	72	173.7	79.3	91	149.5	84.0	163	160.2	82.6

All statistical assumptions for the two-way ANOVA, with the categorical variables of matching instructional time and gender, and the STAR Reading Assessment gain scores as the dependent variable were checked and met. Homogeneity of variance was analyzed using Levene's Test for Equality of Variances, which showed that the variances among the groups analyzed did not differ significantly [$F(3,159) = 0.510$, $p = 0.676$].

Forty-eight percent (n = 78) of students' preferred learning time, as determined by their MESC scores, matched their STAR Reading Assessment time while 52% (n = 85) of students' preferred learning time did not match their preferred time for the STAR Reading Assessment. The STAR Reading Assessment gain score means and standard deviations based on assessment administration time and gender can be found in Table 3.

Table 3

Descriptives for STAR Gain Scores by Assessment Administration Time and Gender

Assessment and Preferred Learning Time	Males			Females			Total		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Match	35	181.6	78.4	43	139.0	75.6	78	158.1	79.3
Not Match	37	166.2	80.5	48	159.0	90.5	85	162.1	85.9
Total	72	173.7	79.3	91	149.5	84.0	163	160.2	82.6

All statistical assumptions for the two-way ANOVA procedure with the categorical variables of matching assessment time and gender, and the STAR Reading Assessment gain scores as the dependent variable were checked and met. Homogeneity of variance was analyzed using Levene's Test for Equality of Variances, which showed that the variances among the groups analyzed did not differ significantly [$F(3,159) = 0.371$, $p = 0.774$].

Hypothesis Testing

RQ1. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, impact gain scores on the STAR Reading assessment for second and third-grade students?

***H1*.** A student's preferred learning time, when aligned with the time of day the student receives reading instruction, impacts gain scores on the STAR Reading assessment for second and third-grade students.

RQ2. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impact gain scores on the STAR Reading assessment for second and third-grade students based on gender?

H2. A student's preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impacts gain scores on the STAR Reading Assessment for second and third-grade students based on gender.

The two-way ANOVA results pertaining to H1 and H2 are summarized in Table 4 below. Results for H1 showed no significant main effect for group difference in STAR Reading Assessment gain scores when students' preferred learning time matched their reading instruction time [$F(1,159) = 0.257$, $p = 0.613$]. Thus, the group where instruction matched preferred learning time rendered a higher mean ($M = 164.6$) than the group that did not match ($M = 151.1$), but the difference was not statistically significant.

Table 4

Summary of Two-Way ANOVA Test for Reading Instruction Time and Gender

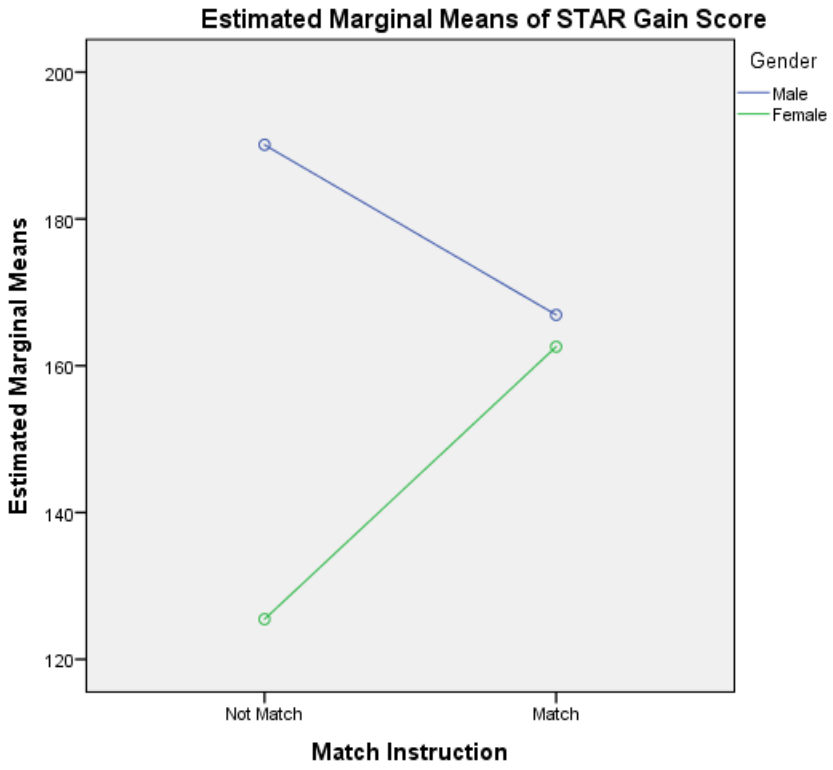
Variable and Source	*df*	*MS*	*F*	*p*	η^2
Reading Instruction Time	1	1686.14	0.257	0.613	0.002
Gender	1	41193.21	6.269	0.013	0.038
Reading Instruction Time x Gender	1	31499.53	4.794	0.030	0.029
Error	159	6570.89			

A significant main effect for gender was detected [$F(1,159) = 6.269$, $p = 0.013$], but was not of interest for this study. The mean STAR gain scores for males ($M = 178.5$) were statistically higher than the mean scores for females ($M = 144.03$) with a partial Eta squared effect size of 0.038. Using Cohen's rules of thumb for interpreting effect sizes (Morgan, Leech, Gloechner, & Barrett, 2013), this effect size would be considered an extremely small strength of association between the variables.

Regarding H2, the interaction between instructional reading time and gender was significant [$F(1,159) = 4.794$, $p = 0.030$]. Thus, the pattern in mean STAR Reading Assessment gain scores for students having their reading instruction time match or not match their preferred learning differed depending on gender. The resulting Eta squared effect size of 0.029 is a small measure of association between the variables, according to Cohen's rules of thumb for interpreting effect sizes (Morgan et al., 2013). Follow-up post hoc comparisons using the Bonferroni adjustment for alpha levels ($\alpha = 0.05$) were conducted to determine which pairs of means were statistically different. Males whose reading instruction time did not match their preferred learning time rendered a mean STAR Reading Assessment gain score of 190.1, which was 64.6 higher than females whose reading instruction time did not match their preferred learning time (125.5), and this difference was significant ($p = 0.031$). No other pairwise mean comparisons were statistically significant. However, as shown in Table 2, males whose reading instruction time did not match their preferred learning time experienced higher gain scores (M = 190.1) than females whose reading instruction matched their preferred learning time (M = 162.6). Males whose reading instruction matched their preferred learning time (M = 166.9 experienced much higher gains than females whose reading instruction did not match their preferred learning time (M = 125.5). Again, these group differences were not statistically significant. The mean patterns for the significant interaction between gender and matching reading instruction time with students' preferred learning time are shown in Figure 1 below.

Figure 1

STAR Reading Assessment Gain Scores for the Matching Instructional and Preferred Learning Time by Gender Interaction



RQ3. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, impact gain scores on the STAR Reading assessment for the second and third-grade students?

H3. A student's preferred learning time, when aligned with the time of day the reading assessment is administered, impacts gain scores on the STAR Reading assessment for the second and third-grade students.

RQ4. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, differentially impact gain scores on the STAR Reading Assessment for second and third-grade students based on gender?

H4. A student's preferred learning time, when aligned with the time of day the reading assessment is administered, differentially impacts gain scores on the STAR Reading Assessment for second and third-grade students based on gender.

The two-way ANOVA results pertaining to H3 and H4 are summarized in Table 5 below. Regarding H3, results showed no significant main effect for group differences in STAR Reading Assessment gain scores when the time the STAR Reading Assessment was administered at a time that matched or did not match students' preferred learning time [$F(1,159) = 0.031$, $p = 0.860$]. The group in which the administration of the STAR Reading Assessment matched preferred learning time rendered a lower mean ($M = 158.1$) than the group that did not match their preferred learning time ($M = 162.1$), but this difference was not statistically significant.

Table 5

Summary of Two-Way ANOVA Test for the Reading Assessment Time and Gender

Variable and Source	*df*	*MS*	*F*	*p*	η^2
Match Testing	1	208.30	0.031	0.860	0.000
Gender	1	24892.10	3.706	0.056	0.023
Match Testing x Gender	1	12634.63	1.881	0.172	0.012
Error	159	6716.72			

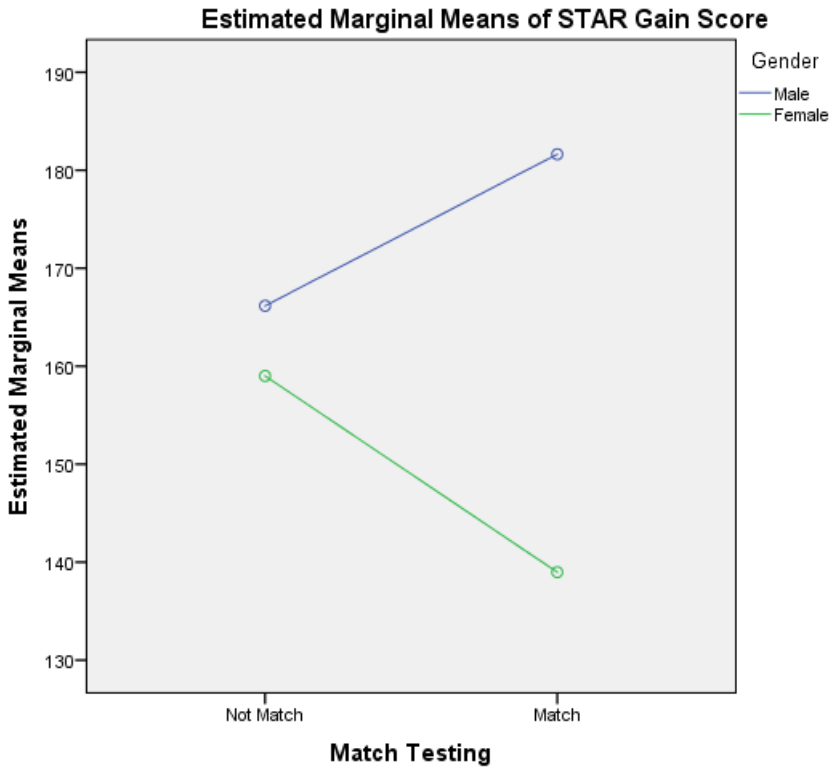
The main effect for gender group differences approached significance [$F(1,159) = 3.706$, $p = 0.056$], but was not of interest for this study. The mean STAR Reading Assessment gain score for males ($M = 173.9$) was higher than the mean score for females ($M = 149.0$), but this group difference was not statistically significant.

Regarding H4, the interaction between the STAR Reading Assessment administration time and gender was not significant [$F(1,159) = 1.881$, $p = 0.172$]. Thus,

the pattern in mean STAR Reading Assessment gain scores for students having the time the STAR Reading Assessment was administered match or not match their preferred learning time did not differ depending on gender. However, as shown in Table 3, males whose STAR Reading Assessment administration matched their preferred learning time (M = 181.6) experienced much higher gain scores than females whose assessment administration did not match their preferred learning time (M = 159.0). Males whose STAR Reading Assessment administration did not match their preferred learning time (M = 166.2) experienced higher gains than females who assessment administration matched their preferred learning time (M = 139.0). These group differences were not statistically significant. The mean patterns for the non-significant interaction between gender and matching reading assessment with students' preferred learning time are shown in Figure 2 below.

Figure 2

Plot of STAR Reading Assessment Gain Scores for the Matching Assessment Administration and Preferred Learning Time by Gender Interaction



Summary

Chapter 4 provided the findings of the two-way ANOVA procedures conducted for the study. The results of the analysis indicated there were no statistically significant differences between groups in terms of reading instructional time matching or not matching students' preferred learning time, and no statistically significant differences based on matching or not matching assessment administration time and students' preferred learning time. There was no significant interaction detected between matching or not matching students' preferred learning time with the time of reading assessment administration and gender. However, analysis detected a statistically significant

interaction between gender and matching or not matching students' preferred learning time with their reading instruction time. Males whose reading instructional time did not match their preferred learning time rendered significantly higher mean STAR Reading Assessment gain scores than females whose reading instruction time did not match their preferred learning time.

Chapter 5

Interpretation and Recommendations

Chapter 5 includes a summary of the study by restating the overview of the problem addressed, the purpose statement and research questions, as well as the research methodology, the major findings of the study, and a discussion of the study findings in context of the body of research surrounding the topic. The chapter concludes with implications for changes regarding instructional times for reading and the scheduling of assessment administration, recommendations for future research, and concluding remarks.

Study Summary

This study was conducted to investigate whether second and third-grade students from Walton School District received reading instruction and were administered their reading tests during their preferred learning time would have significantly different gain scores on their STAR Reading Assessment. The results of the analysis indicated there were no statistically significant differences between groups in terms of reading instructional time matching or not matching students' preferred learning time, and no statistically significant differences based on matching or not matching assessment administration time and students' preferred learning time.

The study also examined whether there were differential impacts on male and female STAR Assessment gain scores if they were taught reading and assessed during their preferred learning time. There was no significant interaction detected between matching or not matching students' preferred learning time with the time of reading assessment administration and gender. However, analysis detected a statistically

significant interaction between gender and matching or not matching students' preferred learning time with their reading instruction time. Males whose reading instructional time did not match their preferred learning time rendered significantly higher mean STAR Reading Assessment gain scores than females whose reading instruction time did not match their preferred learning time.

Overview of the problem. Student achievement is at the forefront of teachers' minds, however elementary school teachers have received conflicting information from research regarding the time of day students are at their optimal learning capacity, which has impacted the scheduling for instruction for core subjects such as reading. Additionally, there is little research on the impact preferred learning time has on standardized testing, yet schools schedule testing on the availability of computer labs as opposed to what may be best for students. While there has been an adequate amount of research conducted on how males and females learn differently, there is minimal evidence on whether preferred learning time affects males and females differently.

Purpose statement and research questions. The first purpose of this study was to examine whether a difference existed in second and third-grade students' reading achievement between students who received their reading instruction during their preferred learning time of day and students who were taught reading during their non-preferred learning time of day. The second purpose of the study was to investigate whether there was a difference in second and third-grade students' reading achievement between students who were administered the STAR Reading Assessment during their preferred learning time of day and students who were administered the STAR Reading Assessment during their non-preferred learning time of day. Additionally, the study

sought to examine whether preferred learning time had a differential effect on reading achievement between male and female students. A multivariate factorial research design was used to investigate the research questions and their associated hypotheses. Four research questions guided this study.

RQ1. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, impact gain scores on the STAR Reading assessment for the second and third-grade students?

RQ2. Does a student's preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impact gain scores on the STAR Reading Assessment for second and third-grade students based on gender?

RQ3. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, impact gain scores on the STAR Reading assessment for the second and third-grade students?

RQ4. Does a student's preferred learning time, when aligned with the time of day the reading assessment is administered, differentially impact gain scores on the STAR Reading Assessment for second and third-grade students based on gender?

Review of the methodology. The sample included a total of 163 second and third-grade students attending Walton School District during the 2015-2016 school year. Students were administered the MESC by their teachers to help identify their preferred learning time. Prior to administration of the survey, second and third-grade teachers reviewed time frames with their students to help alleviate confusion when responding to the survey items. Daily classroom instructional schedules and STAR Reading Assessment schedules of participating teachers were collected from principals.

Using a multivariate factorial research design, a two-way ANOVA was conducted to test the significance of any main effects or interactions between combinations of the independent variables: preferred learning time matching or not matching the time of reading instruction, students' preferred learning time matching or not matching the time of the reading assessments, and student gender. Change in scores from fall to spring, or gain scores, on the 2015-2016 STAR Reading Assessment were the dependent variable measuring student reading achievement.

Major findings. The first major finding of this study indicated no significant differences in STAR Reading Assessment gain scores between the groups of students whose reading instruction time matched or did not match their preferred learning time as indicated by the MESC. The mean STAR Reading Assessment gains were slightly higher for the group where instruction matched preferred learning time than for the group where the instruction did not match their preferred learning time, however this difference was not significant.

The second major finding of this study indicated a significant interaction effect in which students' preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impacted gain scores on the STAR Reading Assessment by gender. Males whose reading instruction did not match their preferred learning time rendered significantly higher gains than females whose reading instruction did not match their preferred learning time. Males whose reading instruction matched their preferred learning time also rendered higher mean gain scores on the STAR Reading Assessment than females whose reading instruction matched their preferred learning time.

The third major finding of this study indicated no significant differences in STAR Reading Assessment gain scores between the groups of students whose STAR Reading Assessment administration time matched or did not match students' preferred learning time as indicated by the MESC. The group in which the administration of the STAR Reading Assessment matched preferred learning time rendered a lower mean than the group where the assessment time did not match their preferred learning time, but this difference was not statistically significant.

The final major finding of this study indicated a non-significant interaction effect in which students' preferred learning time, when aligned with the time of day the student was administered the assessment, did not differentially impact gain scores on the STAR Reading Assessment based on gender. Thus, the pattern in mean STAR Reading Assessment gain scores for students whose STAR Reading Assessment administration time matched or did not match their preferred learning time were not differentially impacted by gender. Males whose STAR Reading Assessment administration matched their preferred learning time experienced much higher gain scores than females whose assessment administration matched their preferred learning time. Males whose STAR Reading Assessment administration did not match their preferred learning time experienced higher gains than females who assessment administration did not match their preferred learning time. However, these group differences were not statistically significant.

Findings Related to the Literature

Chapter 2 provided a description of related literature that included implications of attention and memory on student achievement, as well as the effects individual learning

styles can have on the success of students in the classroom. The literature in the review both supported and rebuked the major findings of this study. The first research question addressed whether a student's preferred learning time, when matched with the time of day the student receives reading instruction, would impact gain scores on the STAR Reading Assessment. The results from the study did not show statistically significant differences in gain scores between those students whose reading instruction time matched their preferred learning time and those students whose instruction and preferred learning time did not match.

Carskadon et al. (1993) investigated the delay in children's sleep and wake-up time determining whether biological or psychosocial factors influence sleep delay. They found evidence that biological, rather than psychosocial factors are related to sleep preference delay. Additionally, research has continually found that younger children's time of day preference was more toward morningness as compared to older children who preferred eveningness. Kim et al. (2001) conducted a study on children's time of day preference as well, and their findings were consistent with Carskadon et al. (1993). Although, Kim et al. (2001) did note that the shift toward eveningness occurs around the age of 13. The findings of the current study support these specific research studies surrounding young children's time of day preference. However, the findings from the current study also rebuke these specific research studies as preference of learning time, whether matched or not matched to the time of reading instruction, did not have a significant effect on students' reading growth.

The second research question addressed whether second and third-grade students' preferred learning time, when aligned with the time of day the student receives reading

instruction, differentially impacted gain scores on the STAR Reading Assessment by gender. The results of the data analysis showed a significant interaction between reading instruction time matching or not matching students' preferred learning time and gender. Students' preferred learning time, when aligned with the time of day the student received reading instruction, differentially impacted gain scores on the STAR Reading Assessment by gender. Males whose reading instruction time did not match their preferred learning time rendered a mean STAR Reading Assessment gains score that was significantly higher than females whose reading instruction time did not match their preferred learning time.

Bonomo (2012) found the regions of the brain involving language, spatial memory and motor coordination develop in males at a different time, order, and rate than do females' brains. Males do not progress at the same rate in reading skill attainment as females their same age due to the rate of brain maturity (Bonomo, 2012). Literacy demands are being pushed into earlier and earlier grades due to school reform, and males are, in turn, at a developmental disadvantage when it comes to literacy because males typically need more time to develop language skills (Whitmire, 2010).

Kim et al. (2001) conducted research on the differences in gender-preferred learning time and found no significant difference in the preferred learning time of males and females. Additionally, Randler and French (2009) evaluated whether there were any gender similarities with preferred learning time and found no significant difference in the morningness/eveningness scores between males and females. The findings of the current study support these specific research studies surrounding young children's time of day preference by gender because males' initial scores in the fall were much lower than

females. However, the findings from the current study also rebuke these specific research studies because there was a significant interaction between reading instruction time matching or not matching students' preferred learning time and gender.

The third research question addressed whether a student's preferred learning time, when matched with time of day the student was administered the assessment, would impact gain scores on the STAR Reading Assessment. The results from the study did not show statistically significant differences in gain scores between those students whose reading assessment time matched their preferred learning time and those students whose assessment and preferred learning time did not match.

Sieversten et al. (2016) believed there was a potential psychological bias with standardized testing: the time the student is administered the test, and they found that students' performance on standardized tests decreased by 0.9% of a standard deviation for every hour later in the day an exam was completed. However, Oakhill (1988) stated that morning-tested students remembered more superficial aspects of the text, whereas afternoon-tested students remembered more elaborate aspects of the text. The findings from the current study are not consistent with these specific research studies because there was not a statistically significant difference in gain scores between those students whose reading assessment time matched their preferred learning time and those students whose assessment and preferred learning time did not match, whether in the morning or in the afternoon.

The final research question addressed whether second and third-grade students' preferred learning time, when aligned with the time of day they were administered the STAR Reading Assessment, differentially impacted gain scores on the STAR Reading

Assessment by gender. The results of the data analysis showed a non-significant interaction between assessment administration time matching or not matching students' preferred learning time and gender. Students' preferred learning time, when aligned with the time of day the reading assessment was administered, did not impact gain scores on the STAR Reading Assessment differentially by gender.

Gurian (2011) conducted research on whether testing students as often as American society does was good for the learning brain. He concluded it was not. When NCLB was passed in 2001, the amount of standardized testing given by American schools increased. Not only did the amount of testing increase, but much younger students were being included. The purpose of NCLB was to hold schools accountable to obtain a certain standard. However, Gurian asserted that legislators, in a hurry to identify and help low performing schools, did not consult brain-development research. The difference of brain development between nine-year-old students and 17-year-old students is staggering. Simply stated, "the sheer variety in brain development and capacity among nine-year-olds makes present modes of standardization an impediment to learning" (Gurian, 2011, p. 190).

Standardized testing continues to have slight bias toward males. Males tend to be deductive in their conceptualizations. Due to the fact they favor deductive reasoning, males tend to do better on standardized tests because of the timed, multiple choice answers. The greater an individual is at creating a fast deduction, the better he does on the test, which depends on this skill (Gurian, 2011). Females on the other hand, favor standardized tests with essays because they tend to favor inductive reasoning and concrete examples. The findings of the current study both support and rebuke these

specific research studies surrounding preferred learning time when aligned with time of day the STAR Reading Assessment was administered by gender.

Conclusions

The learning styles and brain development of school-aged children continue to be at the forefront for educational researchers as they attempt to develop strategies for helping students achieve academic success. As the field of education evolves and the characteristics of students being educated change over time, teachers must have a better understanding of how learning styles and brain development impact learning to employ the appropriate instructional strategies for students. The evolution of the field of education impacts learning because teachers need to stay current on best practice, research, and advancements made with instructional methods and strategies. The characteristics of student maturity impact learning because the advancement of societal trends and technologies have a direct effect on the attention, memory, and learning styles of children; thus prompting educators to seek new ways to engage students in learning (Sousa, 2011). Teachers also need to understand the differences in brain development between males and females. The results of this study indicated that students' preferred learning time, when matched with the time reading instruction occurred, did not significantly impact overall gain scores when matched or not matched with the administration time of the STAR Reading Assessment. However, the results of the current study did indicate a significant interaction in which matching students' preferred learning time with their reading instruction time differentially impacts males and females in terms of mean gain scores.

Implications for action. Elementary schools traditionally schedule core academic classes in the morning and rarely take into effect biological implications for student learning. The results of this study indicated that matching students' preferred learning time to the time students receive their reading instruction did not have a statistically significant impact on reading achievement. However, students did have higher mean gains when preferred learning time matched reading instruction compared to those preferred learning time and instruction times that did not match. Schools should consider the impact time of day instruction has on short-term and long-term memory. Davis (1987) discovered that because circadian rhythms influenced the way people code, store, and retrieve information, it is sensible to anticipate reading achievement would be much better for students who receive instruction in the late afternoon than it would be for students who receive instruction at the start of the morning. Therefore, students whose preferred learning time is in the afternoon should yield higher reading achievement scores, than those whose preferred learning time is the in the morning. A point to consider would be to have reading class during both the morning and the afternoon.

Additionally, teachers must consider the differences in learning between males and females. Matheus (2009) found females use 50% more of the human brain space than males for emotional and verbal processing. The results of this study showed males rendered higher gain scores on the STAR Reading Assessment than females. Educators need to keep the differences of male and female learning capabilities in mind as they teach reading skills. This is important because the current study results showed males whose reading instruction time did not match their preferred learning time rendered a

mean STAR Reading Assessment gains score that was significantly higher than females whose reading instruction time did not match their preferred learning time.

Recommendations for future research. Recommendations for future research that could build upon the results of the current study include:

1. A quantitative research study could be conducted that examines the impact of students' preferred learning time matching their reading instruction and assessment time on their reading achievement, but administering a different form of reading assessment such as a performance assessment instead of a standardized test. This could provide a different type of assessment data to examine regarding how preferred learning time effects student achievement.
2. A qualitative research study could be conducted to examine teachers' and administrators' perceptions on time of day instruction and its impact on student achievement. Interviewing teachers and administrators regarding why and how they manage the timing of their classes could provide a deeper understanding of whether time of day instruction has any impact, within their perception, on student reading achievement.
3. A quantitative research study could be conducted that expands the methodology used for this study to other school districts and grade levels. The data analyzed for this study included 163 second and third-grade students but obtaining a larger sample size and other grade levels on which to conduct this study could provide a clearer picture on the effects of preferred-learning time and reading achievement.

Concluding remarks. Teachers are given the responsibility of meeting the needs of all learners. As students continue to evolve as learners, teachers must also evolve and adapt to fully meet the goals facing them. Throughout time, keeping up with current trends and best practices in education has been a challenge. However, the pressure put on educators has increasingly led them to grasp for new instructional strategies and more efficient teaching practices.

The results of this study showed that neither matching delivery of reading instruction nor matching the administration of the reading assessment with students' preferred learning time made statistically significant differences on the reading gain scores. Results also showed that students' preferred learning time, when aligned with the time of day the student receives reading instruction, differentially impacted gain scores on the STAR Reading Assessment by gender. Hopefully, this study has shed some light on the potential effects of students' preferred learning time and on their academic achievement. Administrators and teachers should consider these potential effects when scheduling classroom instruction and assessments and should be aware how these scheduling decisions could have different effects for male and female students.

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Appendices

Appendix A: Morningness/Eveningness Scale for Children

_____1)* Imagine: School is canceled! You can get up whenever you want to. When would you get out of bed? Between ...

a) 5:00 and 6:30 am
b) 6:30 and 7:45 am
c) 7:45 and 9:45 am
d) 9:45 and 11:00 am
e) 11:00 am and noon

_____2) Is it easy for you to get up in the morning?

a) No way!
b) Sort of
c) Pretty easy
d) It's a cinch

_____3)* Gym class is set for 7:00 in the morning. How do you think you'll do?

a) My best!
b) Okay
c) Worse than usual
d) Awful

_____4)* The bad news: You have to take a two-hour test. The good news: you can take it when you think you'll do your best. what time is that?

a) 8:00 to 10:00 am
b) 11:00 am to 1:00 pm
c) 3:00 to 5:00 pm
d) 7:00 to 9:00 pm

_____5)* When do you have the most energy to do your favorite things?

a) Morning! I'm tired in the evening
b) Morning more than evening
c) Evening more than morning
d) Evening! I'm tired in the morning

_____6)*Guess what? Your parents have decided to let you set your own bedtime. What time would you pick? Between . . .

a) 8:00 and 9:00 pm
b) 9:00 and 10:15 pm
c) 10:15 pm and 12:30 am
d) 12:30 and 1:45 am
e) 1:45 and 3:00 am

_____7) How alert are you in the first half hour you're up?

a) Out of it
b) A little dazed
c) Okay
d) Ready to take on the world

_____ 8)* When does your body start to tell you it's time for bed (even if you ignore it)? Between . . .

a) 8:00 and 9:00 pm
b) 9:00 and 10:15 pm
c) 10:15 pm and 12:30 am
d) 12:30 and 1:45 am
e) 1:45 and 3:00 am

_____ 9) Say you had to get up at 6:00 am every morning: What would it be like?

a) Awful!
b) Not so great
c) Okay (if I have to)
d) Fine, no problem

____10)* When you wake up in the morning how long does it take for you to be totally "with it?"

a) 0 to 10 minutes
b) 11 to 20 minutes
c) 21 to 40 minutes
d) More than 40 minutes

Morningness/eveningness scale for children. A score is derived by adding points for each answer: a=1, b=2, c=3, d=4, e=5, except as indicated by *, where point values are reversed. The maximum score is 42 (maximum morning preference) and the minimum is 10 (minimal morning preference).

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Appendix B: District Permission to Complete Study

4.1 Action to approve dissertation request. Ms. Gayle Bertram requested permission to complete her doctoral study with USD [redacted]. Ms. Bertram would like to examine [redacted] third grade data to analyze whether preferred learning time affects student achievement. [redacted] inquired about Ms. Bertram's thesis. Ms. Bertram stated her thesis is that preferred learning time does affect student achievement. [redacted] inquired about a timeline for Ms. Bertram's dissertation. Ms. Bertram answered that she would like to be complete by May 2014. [redacted] inquired about the reason for the use of third grade data. Ms. Bertram explained the lack of research for third graders. [redacted] inquired how the data would be analyzed. Ms. Bertram answered SPSS. A motion was made by [redacted], seconded by [redacted]. The motion carried a vote in favor 3 - opposed 0 - to approve the dissertation request by Ms. Gayle Bertram.

Appendix C: Author's Permission to Use

Dear Gayle:

There is no (zero) cost associated with using the scale.

Good luck with your research.

Cordially,

MAC

On Tue, Jul 28, 2015 at 11:41 AM, Gayle A Bertram <GayleABertram@stu.bakeru.edu> wrote:

Hi Dr. Carskadon,

I am a doctoral candidate at Baker University in Overland Park, Kansas. I am conducting a study over the effects of preferred learning time on reading achievement in primary aged students. As an elementary principal, I often hear from teachers that young students cannot be taught reading in the afternoon. They are simply too tired. Therefore, I am trying to determine whether this is an accurate assumption.

Through my research, I believe the MESC you developed will support my study on interpreting and determining the preferred learning time for second and third grade students. I am seeking your permission to use the MESC for my study. Please let me know if there is a cost associated with using the tool.

Thank you in advance for your consideration. I am excited to get the results from this study so I can continue to help my teachers and students learn and grow.

Respectfully,

Gayle Bertram

Appendix D: Letter to Principals

Dear USD [redacted] Principals,
I am finally in the throes of my dissertation and am conducting my research. I have shared many emails with [redacted] and he has asked me to fill you in on the details of the study. I am trying to determine whether 2nd and 3rd grade students have higher achievement in reading if they are taught during their preferred learning time. The same goes for testing and gender. I have attached the letter and survey (the survey will determine the preferred learning time) I am sending to parents via Skyward ([redacted] is actually doing this for me). Here is what I need from you:

- Please send me the times each 2nd and 3rd grade classroom took the STAR reading assessment.
- In order to graduate in May (fingers crossed), I need each 2nd and 3rd grade classroom to take the STAR reading assessment in the winter **at the same time they took it in the fall.**
- [redacted] is asking [redacted] to send me all of the assessment data, so you are off the hook on that one.
- Teachers are going to receive permission slips from students on whether parents will allow them to take the survey or not. I HAVE to have these in order to assign numbers to each student, so please reiterate this to them.
- I need teachers to administer the survey by holiday break. It should only take 10 minutes. I have talked to both 2nd and 3rd grade teachers and they feel the survey is appropriate for each grade. Teachers may read the survey to them (I am writing a note to teachers explaining this and ask that you send it to them...it is attached as well).
- Please send the attachments I have added to this email to all 2nd and 3rd grade teachers.

I think that is it for now. I hope I have not added too much to your plate. I have tried to make it as easy on the educators as possible. Thank you so much for your help!!! And please, please...ask any questions you may have.

Hope all is well,
Gayle

Appendix E: Letter to Teachers

January 13, 2016

Hello 2nd and 3rd grade teachers,

In 2012 the USD [redacted] Board of Education approved me to conduct a doctoral study through the three elementary schools in [redacted]. I am trying to determine whether the time of day students prefer to learn affects reading achievement. In order to determine students' preferred learning time, a survey must be given. The district is sending an email with a parent letter and the survey to all 2nd and 3rd grade parents. In the letter I have asked parents to give permission for their child to take the survey. The permission slips will come back to you. **I beg that you do everything possible to get every student's permission slip back** (thank you ☺). Please keep each permission slip, even if the parent did not give permission. Additionally, I need to you administer the survey. It is very short and should not take much time. You may read the survey to them and you may want to give them examples of the time frames. It is vital that students put their name on the survey. I would appreciate if you can give it by Wednesday, January 27th.

I have attached the letter and survey that is being sent to students. Please do not hesitate to ask me any questions. You can reach me at gayleabertram@stu.bakeru.edu.

Thank YOU for your help. I truly appreciate it.

Respectfully,

Gayle Creamer

Appendix F: Letter to Parents

January 13, 2016

Dear Parent/Guardian,

In the fall of 2012, the USD [redacted] Board of Education approved my doctoral dissertation study. I am studying whether the time of day second and third grade students are taught reading affects reading achievement. In order to complete the study, I need to give your child a short survey that determines his/her preferred learning time. The survey will determine whether your child likes to learn best in the morning or afternoon. Students' identities will not be used in my research. Each student will be given a number throughout the data collection process. The survey consists of 10 questions and should take about 15 minutes. The survey has been attached to help answer any questions.

Please sign the bottom of this paper giving permission for your child to take the survey and **send it back to school by Wednesday, January 20th**. Additionally, if you would like to see the aggregated results, please email me at gayleabertram@stu.bakeru.edu.

Thank you for your consideration in helping me obtain research for my study.

Respectfully,

Gayle Creamer
Doctoral Student

Child's Name _____ Teacher _____

_____ I give my child permission to take the preferred learning time survey.

_____ I do not give my child permission to take the preferred learning time survey.

Parent Signature

Appendix G: Institutional Review Board Application

BAKER UNIVERSITY

SCHOOL OF EDUCATION
GRADUATE DEPARTMENT

Date: 05/25/2016
IRB PROTOCOL NUMBER _____
(IRB USE ONLY)

IRB REQUEST
Proposal for Research
Submitted to the Baker University Institutional Review Board

I. Research Investigator(s) (Students must list faculty sponsor first)

Department(s) **School of Education Graduate Department**

Name	Signature	
1. Sharon Zoellner, Ph.D.	_____,	Major Advisor
2. Phillip Messner, Ph.D.	_____,	Research Analyst
3.		University Committee Member
4.		External Committee Member

Principal Investigator: Gayle Creamer A.B.D.
Phone: 913.449.7299
Email: gayleabertram@stu.bakeru.edu
Mailing address: 13559 W. 58th Terrace, Shawnee, KS 66216

Faculty sponsor: Sharon Zoellner, Ph.D.
Phone: 913.
Email: Sharon.zoellner@bakeru.edu

Expected Category of Review: ___Exempt X Expedited _ __Full

II: Protocol: (Type the title of your study)

Effects of Preferred Learning Time on Second and Third Grade Reading Achievement

Summary

In a sentence or two, please describe the background and purpose of the research.

The purpose of this study was to determine if there is a difference in second and third grade students' reading achievement between students who are taught reading during their preferred learning time of day and students who are taught reading during their non-preferred learning time of day. The second purpose of the study was to determine if there is a difference in second and third grade students' reading achievement between students who are administered the STAR Reading Assessment during their preferred learning time of day and students who are administered the STAR Reading Assessment during their non-preferred learning time of day. Additionally, the study was conducted to determine whether preferred learning time has a greater effect in reading achievement between boys and girls.

Briefly describe each condition or manipulation to be included within the study.

There are no conditions or manipulations in this study.

What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.

With permission from Dr. Mary Carskadon, one of the researchers who created the Morningness/Eveningness Scale for Children (MESC), I will measure what time of day children prefer to learn. The survey determines the preferred learning time of children through items regarding a child's sleep habits, alertness, and achievement. It asks multiple-choice questions that are derived from the responses of 10 questions about preferred time of activities such as recess, bed-time, and testing.

I will measure student reading achievement using the fall and spring scores on the STAR Reading Assessment.

Please see attached artifact A.

Will the subjects encounter the risk of psychological, social, physical, or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.

The participants will not encounter psychological, social, physical, or legal risk.

Will any stress to subjects be involved? If so, please describe.

Participants may experience some stress when completing the survey. Any who exhibit stress may cease completion of the survey without penalty.

Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.

Participants will not be deceived or misled in any way.

Will there be a request for information which subjects might consider to be personal or sensitive? If so, please include a description.

Participants will not be asked personal or sensitive information.
.

Will the subjects be presented with materials which might be considered to be offensive, threatening, or degrading? If so, please describe.

Participants will not be presented materials which might be considered to be offensive, threatening, or degrading.

Approximately how much time will be demanded of each subject?

The survey should take approximately 10 to 15 minutes to complete.

Who will be the subjects in this study? How will they be solicited or contacted? Provide an outline or script of the information which will be provided to subjects prior to their volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.

The study will consist of second and third grade students from [redacted]. Parents will receive an email from the school district with a consent letter allowing student participation in the survey.

See attached artifact B.

What steps will be taken to insure that each subject's participation is voluntary? What if any inducements will be offered to the subjects for their participation?

The following statement was included in the parent letter to ensure voluntary participation:

Please sign the bottom of this paper giving permission for your child to take the survey and send it back to school by Wednesday, January 20th. Additionally, if you would like to see the aggregated results, please email me at gayleabertram@stu.bakeru.edu.

How will you insure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.

Teachers will collect all parent consent forms to ensure which participants can participate in the study.

Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.

There will be no data obtained for the study that will be included in the participants' permanent record.

Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher or employer? If so, explain.

Participation or lack of participation in this study will not become part of any permanent record available to a supervisor, teacher or employer.

What steps will be taken to insure the confidentiality of the data? Where will it be stored? How long will it be stored? What will be done with it after the study is completed?

All participants of the study will be given a number to ensure confidentiality. The survey will be distributed and collected by the classroom teacher. The surveys will be stored at the principal investigator's home. Upon completion of the study, I will keep the data for three years and then destroy it per research protocol.

If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?

There are no risks involved in this study.

Will any data from files or archival data be used? If so, please describe.

No archival data will be used for this study.

Appendix H: Institutional Review Board Approval

Baker University Institutional Review Board

6/10/16

Dear Gayle Creamer and Dr. Zoellner,

The Baker University IRB has reviewed your research project application and approved this project under Expedited Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.

Please inform this Committee or myself when this project is terminated or completed. As noted above, you must also provide IRB with an annual status report and receive approval for maintaining your status. If you have any questions, please contact me at CTodden@BakerU.edu or 785.594.8440.

Sincerely,

Chris Todden EdD
Chair, Baker University IRB

Baker University IRB Committee
Verneda Edwards EdD
Sara Crump PhD
Erin Morris PhD
Scott Crenshaw