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Using Physical Activity To Improve Reading Comprehension

Jensen Flanigan

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Jensen Flanigan

Northwestern College

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Abstract

Student reading proficiency lags grade-level expectations in the majority of the United States. Much research has demonstrated the moderating impact of student motivation on reading scores. The purpose of this action research was to study the effects of physical activity on reading motivation and reading comprehension, with a special focus on readers at risk for reading deficiencies as identified by FAST testing. The research was carried out on eighteen third grade students in rural Iowa, seven of whom were at risk for reading deficiency. The use of physical activity had a positive effect on both reading motivation and reading comprehension, with a larger reading comprehension impact for at-risk students. These findings suggest that teachers should use physical activity to motivate struggling readers.

Keywords: reading motivation, reading comprehension, struggling readers, motivation, physical activity

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Introduction

Many issues plague a child when they struggle to read. Nearly 30% of Iowa's students in grades K-3 are not attaining reading benchmarks (Petroski, 2018). On a national level, reading levels have continued to lag behind achievement in other subjects, most significantly math, according to a 2011 study of No Child Left Behind (Dee et al., 2011). This problem can be seen in classrooms across the country, as many students find it difficult to advance reading skills, let alone become proficient readers by the end of third grade.

What has been learned is that students' reading ability in the early grades sets the stage for what is to come. Erbeli, Hart, and Taylor (2018) found that word skills in early elementary predict student success in middle school and beyond. This research creates a knowledge base and gives a fresh perspective to educators. This knowledge base helps educators understand specific reading strategies and also challenges educators to use personal creativity to help each student reach his or her full potential.

A vicious cycle begins when students struggle to comprehend what they have read. These students lose motivation to read because they don't want to struggle, causing them to fall further behind. Some students struggle due to lack of time spent reading. The reading curriculum used in many schools is not emphasized any more than other subjects, despite the overwhelming evidence of the importance of reading and writing as it correlates to academic success in other content areas and to job skills. The students for whom reading does not come naturally are those impacted the most. These students are the ones the entire educational system is supposed to help, but these students are most easily left behind. Educators are also impacted as Title 1 and special education teachers find class sizes increasing each school year. Classroom teachers must adapt to execute differentiated instruction. It is incredibly difficult to create instruction as the skill gaps

widen during the upper elementary years. These gaps become challenging when students who never struggled to read in lower elementary find themselves lagging behind in reading comprehension. These students may not have acquired the higher-level reading skills after the initial stages of reading instruction. The classroom teacher is ill-equipped to handle the complex problem of integrating personalized instruction for the more complex reading topics of upper elementary amid larger skill gaps between the most and least skilled members of the class. Past researchers have clearly identified the link between reading comprehension and academic success. A positive correlation between reading motivation and reading comprehension has been founded. There are many opportunities to explore what increases reading motivation for the students who struggle the most.

The purpose of this action research was to determine the impact of physical activity on reading motivation among struggling readers. Many of the students who struggle to read also struggle to maintain focus during long reading sessions. Using physical activity to motivate students to read is a small gap in an area of much research on reading motivation. This idea is one way educators can think outside the box for more creative ways to reach struggling readers. This action research will report the reading comprehension test scores of struggling readers before and after the administration of a lesson plan that involves targeted physical activity.

An analysis of past research led to this research question: Does physical activity help motivate struggling readers? Research reviewed in the literature review showed the progression of thoughtful and thorough research starting with the big whys of elementary education and ending with the specific applications that shape modern pedagogy. Nearly all of the sources included were found using WorldCat through the DeWitt Library, with the balance found using

Google Scholar. The main themes of the research tied together reading comprehension, reading motivation, and student achievement across disciplines.

Review of the Literature

McClarty (2016) points to reading as one of the skills students need, regardless of what path they take in life. She studied the impact of early childhood school performance on future job success and found that students who were successful early in life were more likely to have higher paying jobs and experience higher levels of career satisfaction. Reading plays a significant role in academic success, even in subjects like math and science (Labby et al., 2016). Research highlights the importance for every student to learn to read effectively and also suggests educators can influence student motivation to learn to read (Chiang et al., 2019).

Discussion of the struggles that inhibit student achievement is also well documented. Researchers have done extensive work exploring ways to break the cycle of reading underachievement (Carreteiro, 2016; Young et al., 2020). This will be one main focus of this literature review. The discussion will explore past research into the efficacy of various reading interventions, the impact of motivation and self-perception, different types of reading deficits, and the impacts of early reading achievement on professional success.

Early Reading Proficiency and Future Success

The previous sections of this literature review focused on environmental factors that correlate to reading performance and interventions that exist to improve reading performance in students with reading deficits. Looking at the big picture, we must first understand why reading performance is important in the first place and whether or not it is an indicator of future success. This question should guide the goal setting of any educational institution. As we look at primary school reading performance, we must first determine the impact that early reading success has on

later reading ability, then correlate reading performance in general to professional success. The first of those topics was studied by Erbeli, Hart, and Taylor (2018). This team studied 724 pairs of twins to determine whether pre-reading skills were predictive of middle-school reading comprehension skills. Students were tested in kindergarten for their pre-reading skills, which included capital letter recognition and phoneme word-sound awareness. Students were tested again in first grade for reading ability using nonsense word detection. Finally, students were tested in seventh grade for reading ability using FCAT reading scores as a measure for reading comprehension and story structure. Findings showed a positive correlation ($r = 0.24$) between capital letter recognition in kindergarten and FCAT reading scores in 7th grade. This finding shows the correlation between early reading ability and higher-level reading success.

To prove that academic achievement leads to professional success, Ritchie and Bates (2013) studied the socioeconomic status of a set of 42-year-old participants in the National Child Development Study and compared those results to participant's reading and mathematics scores in school, controlled for specific influence. Results showed a standard path coefficient of 0.9 between reading ability at age seven and SES attained at age 42. Researchers attribute this correlation to many factors, including the value of reading skills in the marketplace as well as reading as a predictor for higher degree status attained, leading to higher qualifications. Regardless of why, students with higher reading performance reach higher levels of SES when controlled for all factors, including parental SES, proving the importance of success in reading on a student's future earning potential. Both studies mentioned are longitudinal, tracking large sample sizes of students over extended periods of time.

As outlined, research indicates that reading skills lead to better job prospects and future economic success. There are also significant correlations between early reading skills and

higher-level reading skills, providing significant reason for future study in this area. This knowledge, along with knowledge gained from previous sections of this literature review, should motivate educators to improve the reading scores of struggling readers. The studies discussed also prompted the study described below.

Reading Deficits

The focus of this research is specifically related to struggling readers. Students struggle with reading aptitude for several different reasons, but a major cause of reading struggles is ADHD, which will be the focus of this section. ADHD is a significant determinant for reading struggles (August & Garfinkel, 1990; Semrud-Clikeman et al., 1992; Miller et al., 2000). For educators to effectively communicate with and intervene for a struggling reader with ADHD, they must understand what causes the deficiency to occur and be effective at improving the deficiency by attacking the root cause of the issue. The section below will outline research into what causes ADHD to be a moderator for reading difficulties, as well as effective intervention techniques to improve student performance based on these causes.

To determine why ADHD is a moderator for reading deficiencies, Miller and fellow researchers studied the concept of working memory, sometimes referred to as short-term memory, as a clear link to issues in comprehension. Their research involved 103 children in elementary schools in Colorado. These researchers found that students with ADHD struggled to recall the main message of a story, scoring 10% lower than peers on story recall as measured by comprehension checks. Researchers attribute this finding to a “working memory deficit” experienced by those with ADHD (Miller et al., 2013). A study done by Kofler validated these findings by showing that as working memory demands increased, reading comprehension decreased more for students with ADHD when compared to a control group by a factor of 5-7

(Kofler et al., 2019). These studies show a link to working memory as a primary reason students with ADHD are more likely to fall behind in reading. These two studies show similar findings, helping to validate each. These links led to further research into working memory through a more specific approach taken by Friedman (2017), who studied the impact of ADHD on phonological short-term memory and visuospatial short-term memory. In this study, 61 elementary-aged boys were tested on the different facets of short-term memory. Results showed that ADHD had a significant negative impact on both visuospatial and phonological short-term memory, $d = -.84$ and $d = -.66$ respectively. These results further the findings of Miller and Kofler, leading to the challenge of how to effectively enhance the skills of students with reading deficiencies caused by ADHD.

The root cause of reading deficiencies caused by ADHD has been shown above. These results have helped researchers develop interventions aimed at aiding reading comprehension for students with ADHD. As discussed in the reading intervention section, Beike and team found that modulating content novelty increases the reading comprehension for students with ADHD (Beike et al., 2012). Other studies have also been successful in improving the reading abilities of individuals with ADHD. Friedman (2016) studied 24 adults with ADHD and/or dyslexia to determine how mindfulness meditation impacted reading abilities. Researchers hypothesized that this stress-relieving strategy would have a positive impact on the reading ability of the study's participants. Researchers found participants with ADHD showed much lower levels of reading error due to an increase in sustained attentiveness. Both articles discussed above were able to have a moderating impact on reading skills without direct intervention into any specific reading skill.

This section has highlighted past research into how reading deficiencies, specifically ADHD, impact reading performance. Discussion also brought forth multiple strategies tested to increase reading aptitude among those with ADHD. Going forward, further research is necessary in this field to determine other potential moderators on struggling readers' ability, as well as influential reading interventions that aid struggling readers to master concepts required by standards.

Reading Interventions

A reading intervention is a session of focused instruction for an individual or group of students with the intent of increasing reading and writing skills. Researchers have long attempted to find the most effective reading interventions and have frequently been able to buoy student achievement with minimally invasive practices (Young et al., 2020). A research team led by Mila Ronimus increased test scores after a digital reading intervention (Ronimus et al., 2019). She and her colleagues studied the impact of digital game-based learning on struggling readers' test scores. The results showed that students who participated in game-based learning increased reading comprehension scores by 89%, while the control group increased reading comprehension scores only by 56%. This study is not to suggest that game-based learning is the only way to improve student reading skills. The specific intervention can be varied, as proven by DeStefano (2017), who performed an experimental intervention involving the use of alliterative or rhythmic cartoons as a way to teach vocabulary. The study was designed to present a cartoon illustrating a content-area vocabulary word at each transition in or out of the classroom. Where a small sample size (eight students) was used, the below-proficient readers scored 50% higher on a vocabulary assessment vs. the control group. Although the sample size was only eight below-proficient

readers, the results were a 50% improvement over previous vocabulary knowledge. The findings in the above studies suggest that fun, engaging activities work well as reading interventions.

Researchers such as Evans (2015) have attempted to study the impacts of more traditional reading interventions. Their team performed quantitative research of 358 fourth grade students to determine the impact of SEM-R, a differentiated reading approach aimed at improving student reading comprehension. Evans also studied the impact of SEM-R on student attitudes towards reading, which is discussed in the attitudes and self-perception section of this literature review. The main difference between SEM-R and traditional school curriculum is the level of differentiation. Students in SEM-R are ideally taught based on their current abilities, rather than a benchmark. Evans and team divided students into groups randomly; half were given the SEM-R reading curriculum, while half were given their school's standard reading curriculum. Students who received the differentiated instruction, which is a type of intervention, had Iowa Test of Basic Skills test scores that were higher than those who received standard instruction when results were controlled for outside factors such as gifted status and prior year reading achievement (Evans et al., 2015).

Research shows that simple reading interventions not tied to skill development can have a significant impact on student reading comprehension and fluency. Beike et al., (2012) studied the relationship between content novelty and reading performance in 48 seven- to eleven-year-old boys, 32 of whom were considered to be at risk for reading problems based on surveys of students, their parents, and teachers. Students were either put into a group assigned to read highly interesting and attention-grabbing stories, or a group assigned to read stories classified as low novelty. Students then answered a series of comprehension questions about the stories read and rated the stories on a scale of interest. The results showed that the students at risk for reading

troubles earned scores 45% higher than the control group when tested on comprehension questions posed for the high novelty stories. These findings demonstrated that choosing interesting reading passages can be a powerful intervention for readers who would otherwise struggle to perform. This work affirmed the findings of Evans, who proved the importance of differentiated instruction for reading to help students perform to their potential. Beike's research showed clearly that differentiation in educational practices for students of different skill levels has a moderating effect on comprehension. This conclusion confirmed Evans' findings on differentiated instruction. Educators must continue to apply reading intervention on a personal level, rather than assuming each student will react the same way to a given intervention.

Many effective reading interventions do not require skill improvement at all. Consider research done by Schall (2016), who worked to correlate font size to reading comprehension and reading speed. The researchers investigated the relation between font size and reading speed, accuracy, and comprehension of 86 middle school students. Researchers found modulating the font size caused students' reading rate to decrease, as measured by number of words correct per minute but had little to no significant impact on student comprehension of passages. This finding opens the door to future research on ways to improve reading skills without directly enhancing the skills themselves.

Past research has shown that effective reading interventions can be both fun and simple yet remain effective in enhancing the test scores of struggling readers. Educators should learn from the academic research discussed above to build reading interventions based on the needs and skill levels of individual students.

Reading Motivation and Self-Perception

Student motivation to achieve can be fostered by thorough engagement from a teacher (Liu et al., 2019). Once a teacher creates a personal connection with a student, that student's motivation will increase, leading to further reading proficiency. This concept, that motivated readers are more likely to develop higher-level reading skills, has been proven by many competent researchers such as Judy Wang and John Guthrie (2004). They studied the correlation between reading motivation and reading performance. Their research studied 187 US fourth-graders and 197 Chinese fourth graders in an attempt to correlate intrinsic and extrinsic reading motivation to reading performance. Their research found that intrinsic reading motivation has a positive direct association with text comprehension with a standard path coefficient of 0.64. This result is the bedrock reason that educators should focus on motivation before focusing on skills. This is because the students who want to do well are more likely to learn and master the skills necessary to become proficient readers. Huang et al., (2019) added credibility to previous studies and tied the results to reading by studying the role of student motivational factors on reading achievement through retroactive data analysis of 3,875 4th grade students. Survey and test results showed that reading motivation was the mediating factor in determining whether higher intervals of reading instruction were beneficial to student test scores (ß =.068). More simply put, for students to work harder, they must first want to get better. Without that desire, educators cannot be as effective as they otherwise could be. Educators must first motivate, then teach. The opposite order would not lead to sustained success as intended by the instructor.

Many studies have been done to verify the findings that motivation to read improves reading comprehension. The studies mentioned above focused on absolute achievement, raising the question of causation versus correlation. Are students who do well more motivated to read? Or does the motivation to read predict how successful a student will be? To control for these

questions, Orellana et al., (2020) polled the reading motivation of over 1,000 Chilean upper elementary students, then tracked their reading comprehension scores on a standardized 45-question test to determine their improvement from the beginning of the school year to the end. Research findings showed that students with higher motivation earned larger gains in reading comprehension (ß = 2.13 P = .004) when compared to less motivated peers with similar starting levels. The combination of the studies above shows not only do motivated students score higher than peers, but these students are also more likely to continue to outpace classmates in reading comprehension and skill development.

After demonstrating the importance of motivation on reading proficiency and improvement, researchers zeroed in to determine the impacts of motivation on specific subsets of skills. The first of these researchers focused on reading motivation as a moderator for fluency, which is a cornerstone for reading proficiency. Hiebert et al. (2019) studied the impact of reading motivation on silent and oral reading fluency and comprehension. The study included 61 sixth-grade students in the southeast United States. Participants were given an 18-question inventory to determine reading efficacy as well as preference for challenge, curiosity, and involvement. Participants were then given a standardized sixth-grade oral reading fluency (ORF) exam. These participants read a passage for one minute, and scores were determined by the number of words read correctly in that minute. Students with higher scores on the Motivation to Read Index (MRI) had higher scores of reading fluency, as measured by speed and words correct per minute when adjusted for comprehension scores.

Proof that motivated readers read faster at the same comprehension level led to further research carried out by Cho et al., (2019) intending to correlate the motivational predictors of struggling readers' comprehension. This research team specifically studied the effects of

mindset, achievement goals, and engagement in 107 fourth and fifth-grade struggling readers from 14 classrooms. Students were given questionnaires to determine their self-efficacy and propensity to set goals. Research findings using an RMSEA analysis showed that, with all else constant, a student who believed they could accomplish individual goals performed better than a student with poor self-efficacy. This relation is supported by the fact that a fixed mindset had a negative correlation with reading comprehension (R = -.29). The study found no significant correlation between goal setting and reading achievement; in other words, the results of the study all pointed towards students' belief in themselves being the determining factor. This research casts doubt on goal setting when kept separate from a growth mindset. To determine the root cause of motivational deficits, Chinese researchers Liu et al., (2019) studied the impact of student-teacher interaction, specifically as viewed through the lens of socio-economic status, or SES. The study analyzed over 17,000 seventh and ninth graders in China. The results showed that as family SES increased, motivation to learn increased. This increase in motivation was stronger in English than in math and Chinese. English learning was positively correlated to SES with a predictor value of .101 units, while SES only modified math and Chinese with predictor values of .046 and .069 units respectively. When looking at student-teacher interactions, findings showed that students who have more interaction with educators are also more likely to be motivated to achieve with a predictor value of .193 units in English, nearly twice as impactful as SES. This proves that whereas a student may be at a disadvantage, simply having more interaction with a teacher can more than make up the original disadvantage.

Research into motivation and positive self-perception has shown both traits positively impact overall student achievement; specifically, they have a positive impact on reading skill development. Further research points to using motivation as a way to improve the specific

reading skills of fluency and comprehension. Lastly, the impact of student-teacher interaction and SES was studied concerning reading motivation to find that student-teacher interaction has a greater correlation to student motivation. Along with improving the reading skills of students, educators should implement motivational interventions involving significant student-teacher interactions.

Methods

Research Questions

The purpose of this action research project was to study the impact of physical activity as a reading intervention for struggling elementary readers. The main research question: Does physical activity improve the comprehension of struggling readers? A secondary question: How does physical activity impact reading motivation? Findings may help elementary educators determine the viability of physical activity as an intervention to improve reading motivation and comprehension for struggling readers.

Research Design

This research involved one section of 18 third-grade students in rural Iowa. The experiment involved six weeks of testing to gather baseline data in reading comprehension. Each week students were given a reading assignment. Major themes were then reviewed orally with the class. Next, students participated in group and individual comprehension checks. Each Friday for six weeks students were given a comprehension check and quantitative results were tracked. After the baseline data was gathered, research continued for four more weeks, with the modification that each week's large-group activity involved physical activity to motivate students. The comprehension checks were repeated to compare pretest and post-test performance. The four weeks involved comprehension activities in conjunction with activities

such as basketball, soccer, tag, and relay races. Students were given a survey after the last six lessons to gauge motivation level with the lesson. Students responded with a number 1-5 to portray how motivated each felt to learn and perform. Results were tabulated and analyzed.

Variables

The independent variable in this research is the whole-group reading activity chosen for each lesson. The dependent variables tested were the reading comprehension scores of the research subjects, as well as reading motivation as measured by student surveys and teacher observation.

Setting and Participants

This action research project took place in one third-grade section of reading in a rural Northwest Iowa elementary school. The entire building population was 110 students in grades 3-5. Of all students in the district (K-12), 34.1% of students qualify for free or reduced lunches. Of the eighteen students in the test population, seven were considered at-risk for reading deficiency as determined by FAST testing data. The sample consisted of nine boys and nine girls, with the struggling reader sample set of five boys and two girls. Two of the struggling readers were on IEP plans for reading during the school year. All students received the same instruction and the same tests. All testing was done in the students' normal environment.

Intervention

The intervention tested was the use of physical activity to motivate struggling readers. The first week's intervention involved basketball as a motivator. Students played P-I-G with the modification that each had to answer a reading comprehension question correctly before shooting. If a student missed the question, he or she was not allowed to shoot, and the opponent was granted a turn. In the second week, students played soccer. If a reading comprehension

question was answered correctly, students were allowed to shoot a free-kick at the goal. In the third week, students formed two different teams for a relay race. To run, students had to answer a comprehension question on the week's readings. In the final week, students played tag. If students answered a reading comprehension question correctly, the student became "it." Students participated until questions were exhausted. At the end of each week students were given comprehension tests on the week's readings and results were tabulated.

Data Collection Plan

Data was collected weekly for ten weeks to gather reading comprehension scores for each student. The first six weeks of collection were done to gather a control baseline. The last four weeks of testing were intended to analyze the effectiveness of the intervention performed. The test used was taken from the participating school's reading curriculum "Rooted in Reading." Each test included ten questions, six of which were multiple choice, one short answer, one true/false, and two essays. Essay questions were worth 2-7 points in total depending on the week. Results were tabulated weekly and entered into a spreadsheet for storage. Physical copies were maintained in a locked file cabinet. During the last six weeks of testing, students filled out a simple survey with responses from 1-5 to express excitement level for the lesson. Student responses of 1 expressed disinterest, while responses of 5 showed significant interest in the lesson. The data collection was intended to gauge student motivation. Reliability and validity information does not exist for either data collection tool.

Data Analysis Plan

The data analysis compared pre-intervention and post-intervention comprehension results using a dependent samples T-test. This test was used to determine the significance and confidence of the data variances seen in the samples. The analysis also used the dependent

samples T-test to determine if the intervention tested modified student attitudes and motivation as reported on student surveys. Mean and standard deviation values were also reported for all data. An independent samples T-test was also performed to determine if students at risk for reading deficiencies performed differently than those not at risk.

IRB Approval

An IRB exemption was granted by the Northwestern College IRB board with express permission to carry out student testing that is not substantially different from a normal school day and does not put students at risk for any ill effects. Physical activity and outside reading lessons were not determined to be outside of normal classroom operations. Each student who participated in the study received written consent from a legal guardian to participate in the physical activity interventions of the study. Hard copies of the permission slips were kept through the extent of testing. IRB Approval can be found in Appendix A.

Findings

Data Analysis

The researcher gathered data for ten weeks to determine the impact of physical activity on reading motivation and comprehension. Results can be seen in Appendix B. During the first six weeks, the teacher-researcher utilized standard lecture and discussion teaching methods. During weeks seven through ten, the participants were quizzed on the reading using physical activity with the intent to motivate students to learn. Each week, students took reading comprehension quizzes, and results were tabulated to analyze the whole-class, proficient readers only, and at-risk readers only (Table 1).

A dependent samples t-test was performed to analyze the impact of the intervention. During the control testing, students averaged 90.2 out of 100 ($M = 90.2$, $SD = 5.4$) on the

comprehension quizzes (Figure 1). After receiving the intervention, students averaged 95.6 out of 100 (M = 95.6, SD = 3.7). A dependent samples two-tailed t-test proves a significant difference between the intervention and non-intervention results, $t(17) = -3.98$, $p < .001$. Analyzing at-risk readers specifically, during baseline testing, these students were able to answer an average of 88.2 out of 100 (M = 88.2, SD = 5.5) on the comprehension checks. After the intervention, these students answered an average of 95.3 out of 100 (M = 95.3, SD = 4.2).

A dependent samples two-tailed t-test shows a significant difference between scores before and after intervention, $t(6) = -3.1$, $p = .021$.

Table 1

Comprehension Test Scores of 18 Students Before and After Intervention

Student ID	Struggling Reader Y/N	Pre-Intervention Average	Post-Intervention Average
1	N	98%	100%
2	Y	81%	100%
3	N	89%	100%
4	N	95%	96%
5	N	80%	94%
6	N	90%	96%
7	Y	83%	88%
8	Y	92%	98%
9	N	86%	92%
10	Y	91%	96%
11	Y	85%	92%
12	N	97%	90%
13	Y	96%	96%
14	N	94%	100%
15	N	95%	98%
16	N	92%	96%
17	N	92%	94%
18	Y	89%	98%

The results show a significant increase in student performance due to the intervention, and struggling readers saw a larger increase than proficient readers. Of the 18 readers, 16 saw an improvement in average test scores during the intervention period, one remained unchanged, and one received lower scores post-intervention.

The researcher also gathered data on student motivation through the use of surveys. Students were asked weekly to rate their motivation to perform on a scale of 1-5, with 1 being not motivated and 5 being very motivated (Figure 2). A dependent samples two-tailed t-test was performed to analyze both at-risk readers and proficient readers. The results for the at-risk readers showed motivation levels before intervention with an average of 2.1 out of 5 ($M = 2.1$, $SD = 1.45$).

Figure 1

Average Comprehension Test Scores Before and After Physical Activity Intervention

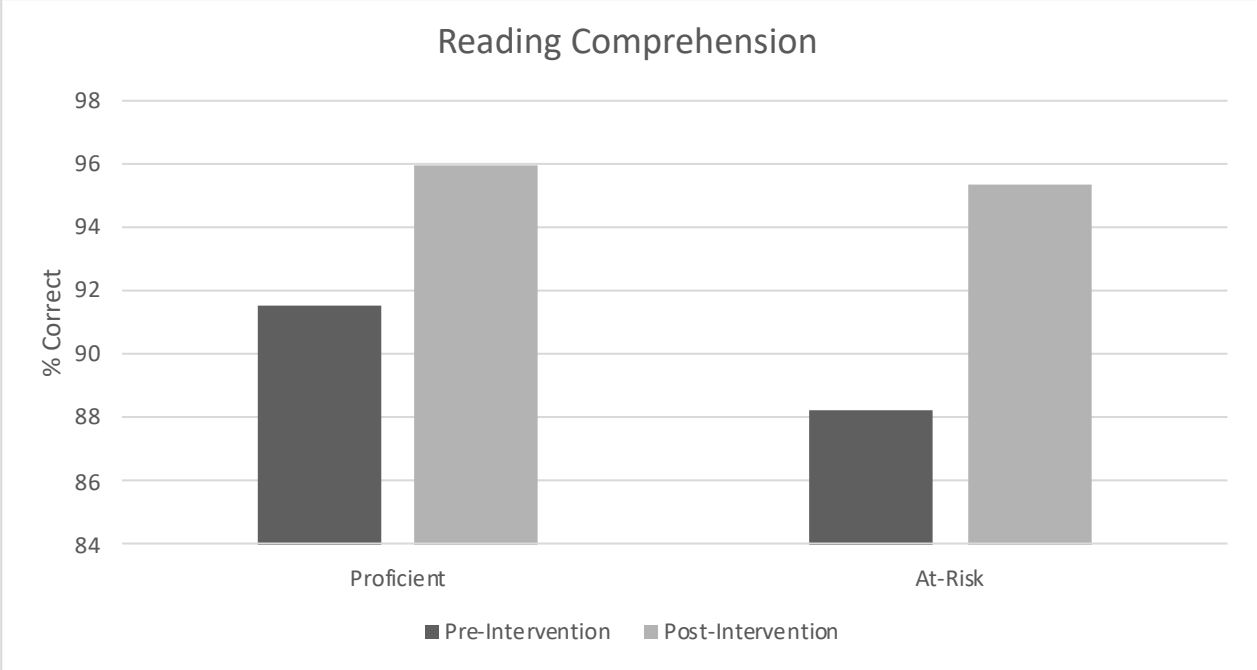
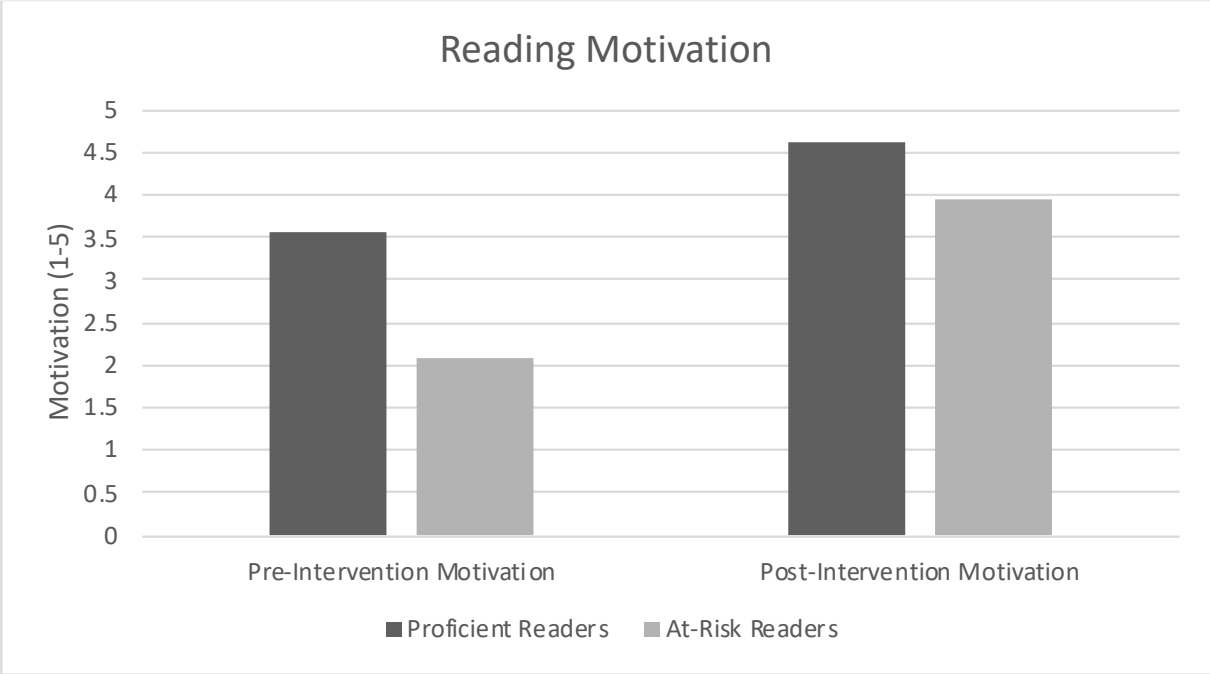


Figure 2

Average Motivation Level Before and After Physical Activity Intervention



After the intervention, at-risk readers reported an average of 4.0 out of 5 on the scale of motivation ($M = 4.0$, $SD = 1.07$). A dependent sample two-tailed t-test showed a significant increase in motivation for at-risk readers, $t(6) = -3.49$, $p < .05$. A similar result was seen among proficient readers, who saw before intervention average motivation of 3.5 out of 5 ($M = 3.5$, $SD = 0.72$) and an after intervention average motivation of 4.6 out of 5 ($M = 3.5$, $SD = 0.72$). The dependent samples two-tailed t-test showed a significant correlation between physical activity and motivation to read, $t(10) = -3.53$, $p < .01$. The intervention was able to significantly improve reading comprehension and motivation. Out of the 18 participants, 15 showed an increase in self-reported motivation, and the remaining three remained unchanged.

Students participated in four different physical activities during the four weeks of intervention. In order, from weeks 1-4, students participated in basketball, soccer, relay race, and tag. From most

physically demanding to least, the activities were relay race, tag, basketball, soccer. Figures 3 and 4 show the test scores and motivation of each activity. Student test scores were higher than control averages for three of four weeks, and motivation was higher than control during each week of intervention testing. When basketball was used as the motivator, student test scores were lower than the baseline test average. Basketball-week test scores averaged 89.4 out of 100 (M = 89.4, SD = 9.3) while the control period had average test scores of 90.2 out of 100 (M = 90.2, SD = 12.2). Overall average comprehension results from the above analysis still show a significant improvement in reading comprehension due to the intervention performed, despite the week-to-week variation.

Figure 3

Reading Comprehension Average Score by Physical Activity

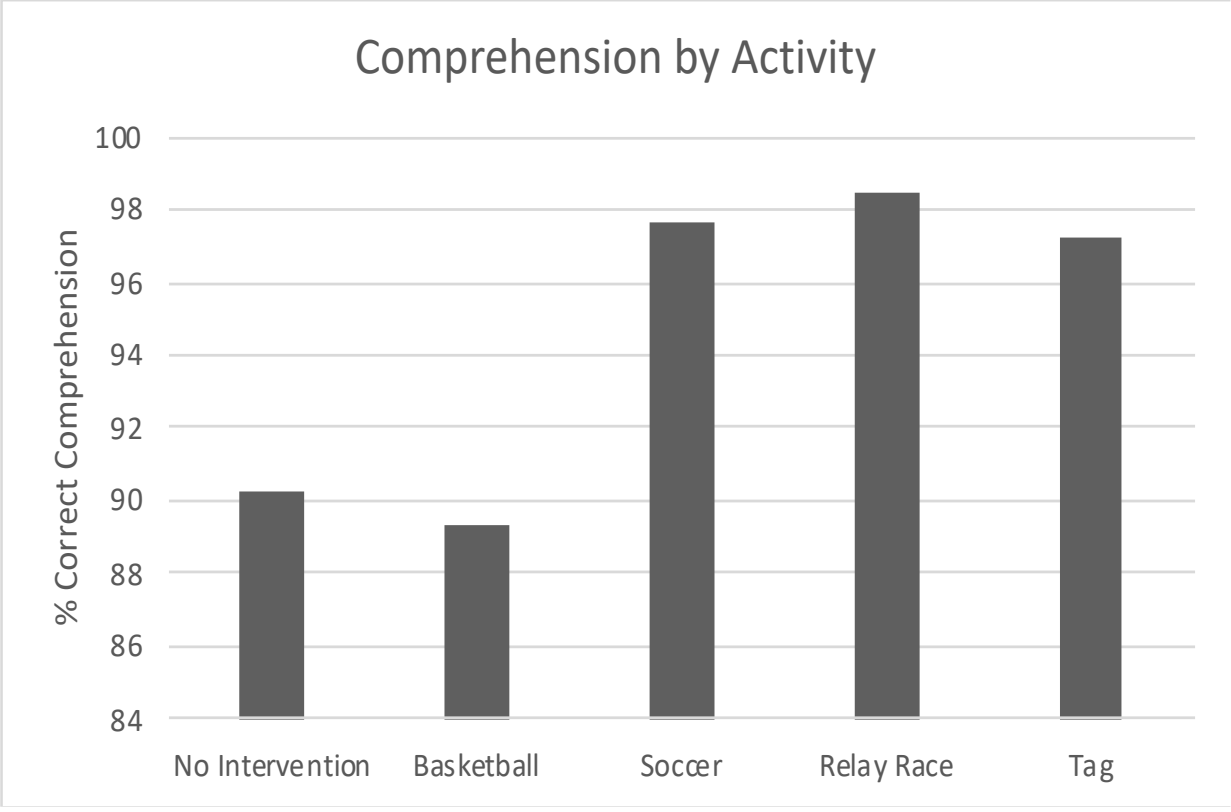
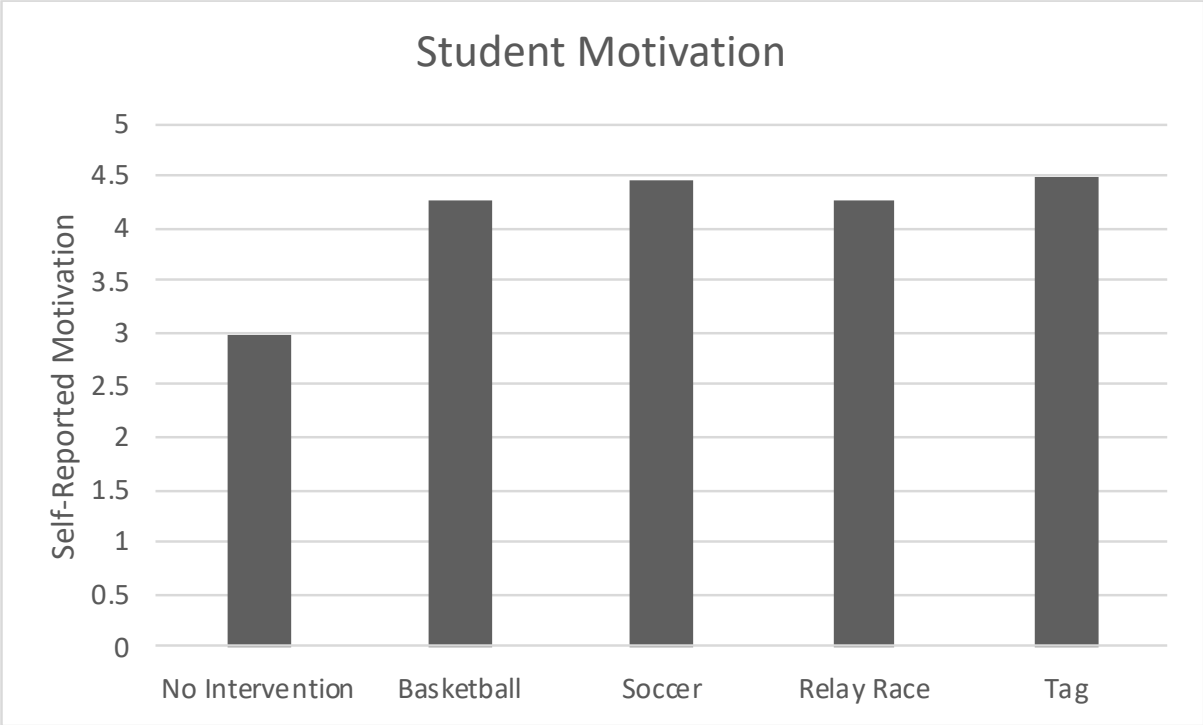


Figure 4

Self-Reported Average Motivation Score by Physical Activity



Student motivation was impacted very little by which physical activity students took part. The standard deviation of the average motivation per activity was 0.11 (M = 4.38, SD = 0.11). This result suggests that the specific activity matters less than simply being active.

Discussion

Summary of Major Findings

This research has demonstrated that the incorporation of physical activity improves student reading comprehension and student motivation. The data collected shows that the sample population of the study scored higher in reading comprehension scores on weeks where the

administration of the lesson involved some form of physical activity as a motivator. Student surveys also showed a statistically significant increase in self-reported motivation to learn during the weeks where the lesson involved physical activity.

Data analysis also shows that students who are deemed at-risk by FAST testing are more positively impacted by the physical activity intervention than are students not considered to be at risk. The intervention has a positive impact on all groups of students and simultaneously shrunk the performance gap between the at-risk and proficient students.

A secondary finding of this data shows that the intensity of the physical activity is not a significant moderator for either reading comprehension or motivation. Student performance is greatly impacted by the presence of physical activity, regardless of the intensity. It can be concluded from this research that periodic physical activity should be utilized during lessons to increase student motivation and reading comprehension.

Limitations of the Study

The study's major limitation is the sample size studied. The class sample size of 18 made a robust design of experiments difficult. Whereas the student motivation survey remained the same week over week, there was natural variation in the difficulty of the comprehension test questions. This accounted for some variation between weekly tests. A larger sample size of struggling readers would have made the results more dependable. A sample size of seven struggling readers would ideally be larger. Duration of study was also a limitation. Research began in March, with students gathering only until May. A longer time frame for study would have given results more validity. Another limitation was lack of diversity studied. The racial makeup of the sample set was 16 white and 2 Hispanic. A sample more representative of the world population would be beneficial.

Further Study

Based on the findings of this research, a future study into other means of motivation should be considered. These means of motivation could include incentive-based motivation, technology-based motivation, project-based motivation, or autonomy-based motivation. Another arena of future study could include a larger sample size examining similar research questions as this research. The use of a standardized test would also help to validate the results. A final area of future research could examine how varying the learning environment impacts student retention of reading material. The research conducted in this study included varied learning environments, which could have influenced results.

Conclusion

Reading scores across the country continue to fall below benchmark levels, and educators are tasked with finding ways to improve reading scores. Students who have difficulty reading fall into a vicious cycle that begins when reading comprehension becomes a struggle. These students lose motivation because of the struggle to read, causing them to fall further behind. As motivation has been linked to higher reading scores, educators must find ways to motivate students to read and learn. Many teacher interventions have also been proven to increase student reading comprehension, and reading proficiency is linked to later career success.

This action research study examined the effectiveness of using physical activity to increase motivation and reading comprehension for struggling readers in a third-grade classroom. The results of the study showed that the introduction of a competitive physical activity during the review stage of instruction has a positive effect on both student motivation and reading comprehension, as measured by student surveys and comprehension quizzes. Struggling readers also experienced larger gains in their reading comprehension than did proficient readers, but both

groups experienced increases. The findings of this research should be implemented into classrooms, both directly and as a basis for future exploration and action research.

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Appendix A

IRB Approval

NWC IRB Assessment – The IRB Committee will fill in this portion following review

Your application for the Educational Practice Exemption has been reviewed and approved. You may proceed with your research: Karissa Carlson for the IRB 5/2/2021

Appendix B

Raw Data Comprehension and Motivation

Student ID	Struggling Reader Y/N	Control Week 1	Control Week 2	Control Week 3	Control Week 4	Control Week 5	Control Week 6
1	N	100%	86%	100%	100%	100%	100%
2	Y	77%	91%	80%	85%	80%	73%
3	N	92%	91%	85%	85%	93%	87%
4	N	92%	100%	90%	92%	93%	100%
5	N	100%	100%	100%	92%	100%	87%
6	N	100%	86%	80%	85%	87%	100%
7	Y	100%	82%	80%	85%	87%	67%
8	Y	85%	100%	90%	77%	100%	100%
9	N	69%	100%	75%	92%	87%	93%
10	Y	92%	91%	80%	92%	100%	93%
11	Y	85%	91%	85%	85%	97%	67%
12	N	85%	100%	100%	100%	100%	100%
13	Y	100%	91%	100%	100%	100%	87%
14	N	85%	91%	90%	100%	100%	100%
15	N	85%	100%	90%	100%	93%	100%
16	N	92%	100%	80%	92%	87%	100%
17	N	92%	91%	90%	92%	87%	100%
18	Y	77%	91%	100%	92%	100%	73%

Table B1. Raw reading comprehension scores during control testing weeks 1-6.

Student ID	Struggling Reader Y/N	Basketball	Soccer	Relay Race	Tag
1	N	100%	100%	100%	100%
2	Y	100%	100%	100%	100%
3	N	100%	100%	100%	100%
4	N	83%	100%	100%	100%
5	N	83%	100%	92%	100%
6	N	100%	93%	100%	92%
7	Y	67%	100%	85%	100%
8	Y	92%	100%	100%	100%
9	N	83%	100%	100%	83%
10	Y	92%	100%	100%	92%
11	Y	83%	100%	100%	83%
12	N	83%	79%	96%	100%
13	Y	83%	100%	100%	100%
14	N	100%	100%	100%	100%
15	N	100%	93%	100%	100%
16	N	83%	100%	100%	100%
17	N	83%	93%	100%	100%
18	Y	92%	100%	100%	100%

Table B2. Raw reading comprehension test scores intervention weeks 6-10.

Student ID	Struggling Reader Y/N	Control Week 5	Control Week 6	Intervention Week 1	Intervention Week 2	Intervention Week 3	Intervention Week 4
1	N	3	3	5	5	5	5
2	Y	2	1	3	3	2	2
3	N	4	4	5	4	4	4
4	N	3	4	3	4	4	5
5	N	4	4	4	4	5	5
6	N	2	3	5	5	5	5
7	Y	1	3	5	5	4	5
8	Y	4	3	3	4	4	3
9	N	3	3	4	5	4	5
10	Y	4	4	5	5	5	5
11	Y	2	1	2	3	3	3
12	N	4	4	3	4	4	5
13	Y	1	1	5	5	4	5
14	N	4	4	5	5	5	5
15	N	5	5	5	5	5	5
16	N	2	2	5	5	5	5
17	N	4	4	5	4	5	5
18	Y	1	1	5	5	4	4

Table B3. Raw reading motivation scores weeks 4-10.