CREATING HEALTHIER CHILDREN ONE STEP AT A TIME:

AN EXPLORATORY STUDY THROUGH LiiNK

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CREATING HEALTHIER CHILDREN AFTER SCHOOL ONE STEP AT A TIME: AN EXPLORATORY STUDY THROUGH LiiNK

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ABSTRACT

The purpose of this study was to examine the physical activity levels and emotional state differences in elementary school children during school. A total of 81 first grade students and 84 second grade students from two North Texas public elementary schools affiliated with The LiiNK Project (Let's inspire innovation 'N Kids) participated in this study. The intervention school students (N=98, male=46, female=52) received four unstructured, outdoor play breaks and one 15-minute character development lesson daily, whereas the matching comparison school students (N=67, male=35, female=32) had two 15-minute recess periods daily and no character development program. The first graders (males= 39, female = 42) wore the accelerometers the first two weeks and the second graders (male = 40, female = 44) wore the accelerometers during the 3rd and 4th week. A 5th week was used to collect additional data for the children whose accelerometers malfunctioned. While the devices were monitored daily, the research team also observed these children on the playground for emotional expressions captured through non-verbal cues and body language. A MANOVA revealed significant physical activity intensity differences between schools, Wilks Lambda=0.0692, $F(3,155)=2.68$, $p<0.05$, grades, Wilks Lambda=0.939, $F(3,155)=3.36$, and genders, Wilks Lambda=0.951, $F(3,155)=4.04$. A univariate ANOVA revealed interaction for steps between schools, $F(1,164)=37.929$, $p<0.0001$, grades, $F(1,164)=8.498$, $p<0.01$, genders, $F(1,164)=7.535$, $p<0.01$. A univariate ANOVA revealed significant differences in positive emotional states by school, $F(1,54)=6.554$, $p<0.0001$. For not positive emotional states, univariate ANOVA revealed a significant main effect by school, $F(1,54)=4.583$, $p<0.05$. The results of this study support the intervention position that multiple unstructured, outdoor play breaks may be more beneficial for the whole child as shown through improved physical activity levels and overall happiness.

CHAPTER 1: INTRODUCTION

In elementary schools across the United States, the purpose and structure of recess has slowly disappeared over the past 30 years. Due to the state and federal educational assessment policies and pressures to meet specific outcomes, administrators have all but removed the arts, physical education, and recess from the curriculum in order to have teachers focus predominately on English/Language Arts, Math, Science, and Social Studies. As a result, the importance and necessity of recess has been lost due to America's competitive spirit to be the best in the world academically.

Recess over the years has been known as a break in the day for children to engage in physical activity and play independently of adults (Parish, Okley, Stanley, & Ridgers, 2013). This type of break has also been known to create opportunities for children to socialize and be creative (Ramstetter, Murray, & Garner, 2010). Sadly, since children have had fewer opportunities to engage in recess throughout a school day, some organizations such as PlayWorks feel the need to introduce structured play into the school day to increase the physical activity levels of the children (Beyler, Bleeker, James-Burdumy, Fortson, & Benjamin, 2014). Conversely, other researchers and organizations feel it is important for children to engage in "regularly scheduled periods of at least 20 minutes within the elementary school day for unstructured physical activity and play" (CDC, 2016a; National Association for Sport and Physical Education, 2015).

None of these specific definitions are federal or state mandated. Therefore, each state has control over the academic requirements of the schools and as a result, have all but removed recess from the school day in order to meet the other state and federal academic mandates (Russ

& Dillon, 2011). Some studies have also reported that physical education and recess provide similar physical activity results for children, therefore, some states are requiring a total number of minutes and allowing local schools to determine how to apply those minutes to physical education and recess. Physical education and recess are both needed for the health of the whole child, but are not getting equal time (Murray & Ramstetter, 2013).

As a result of less unstructured, play opportunities, increased technology opportunities, increased safety concerns, and a decline in academic learning in schools, there has also been a tendency for children to engage in less unstructured play at home as well (Parish et al., 2013). In the 1960's, children would frequently spend their free time after school outdoors playing with their friends. In recent times, children spend the majority of their time indoors doing homework, watching TV, or playing video games. Even the school day is centered around children being seated at a desk absorbing as much instruction as possible in a seven-hour day (Mahar, 2011).

The decline in physical activity and play in the American culture has led to major health concerns for this generation of children (Gray, 2011). According to the CDC (2016), children should be engaging in at least 60 minutes of physical activity daily. Between 40 and 100% of the daily recommended amount of physical activity can be provided through physical education and recess in a 7-hour day if these qualities are implemented daily (Rhea, Rivchun, & Pennings, 2016; Ridgers et al. 2010). However, studies have demonstrated that only 21.6% of children ages 6-19 years old are actually meeting these guidelines (Katzmarzyk et al., 2016).

Sedentary lifestyles in children can increase their chances of becoming overweight and obese. Children who are overweight are more likely to experience cardiovascular health problems, pre-diabetes, and other health issues. Obesity is present in 17% or 12.7 million children across the United States (CDC, 2016b). Unfortunately, this number has remained stable

over the past decade suggesting that inactivity is becoming normalized (CDC, 2016a). Physical activity has many benefits including improved cardiovascular health, social/emotional health, and decreased physical issues such as obesity (CDC, 2016b).

Emotional health has been significantly ignored which has led to increased anxiety & depression among children over the past 30 years. Between 2-3% of children ages 6-12 are shown to suffer from depression with another one in eight who show symptoms of anxiety (Anxiety and Depression Association of America, 2017). As a result, parents are spending more resources on psychological support for their children than ever before (ADAA, 2017). Teachers are also reporting a higher number of negative behaviors and emotions among students during the school day than normal (Turner, Chriqui, & Chaloupka, 2013). Unstructured, outdoor play is a great forum to enhance children's socialization skills and create many different emotional experiences to strengthen emotional stability in children especially when offered regularly throughout the school day (Clark & Rhea, 2017; Gray, 2011).

The benefits physical activity provides for physical and mental health are becoming more apparent as physical activity and recess research in this field increases. Younger children need unstructured play as much as the air they breathe (Gray, 2011). Children's bodies and minds need unstructured, outdoor play in order to develop brain health, learn how to learn, and create emotional and social stability (Gray, 2011). The research has shown ample evidence that the more school's focus on providing time for unstructured play and quality classroom content sessions, the better chance the American culture has of reducing chronic health diseases in children and improving academic outcomes.

Statement of Purpose

The primary purpose of this study was to examine physical activity differences among grades 1 and 2 children during unstructured, outdoor play when recess is offered at different amounts of time daily across two elementary schools. A secondary purpose was to explore how emotional states in these children might differ with varying amounts of unstructured, outdoor play daily.

CHAPTER 2. REVIEW OF LITERATURE

Previous research shows that physical activity and play are important to the health and well-being of children (Biddle & Asare, 2011; Gray, 2011). Even with the widely known benefits of an active lifestyle from early childhood through the elderly, physical activity levels in all ages has declined exponentially (CDC, 2016a). This literature review will explore the benefits of physical activity and play, the importance of movement to the whole child, and the impact of unstructured play and character development throughout the day on the development of social/emotional health, physical health, and cognitive/brain health. This literature review will also explore what is known about emotional states and the influence play and physical activity may have on the health of elementary children.

Physical Activity

Researchers have shown that children should participate in at least 60 minutes of moderate to vigorous physical activity daily to yield the optimal physiological and psychological health benefits (CDC 2016a; Parish et al., 2013). Unfortunately, only 21.6% of children are reported to meet these physical activity recommendations (CDC, 2016a). These patterns of inactivity and sedentary lifestyles increase risks of negative health effects such as obesity, heart disease, type II diabetes, emotional disorders, and other chronic diseases early in a child's life (Lee et al., 2012; Pearson & Biddle, 2011).

Physical activity benefits

Research shows that moderate to vigorous physical activity (MVPA) yields the best physiological health improvements in children (Janssen & LeBlanc, 2010). Moderate intensity physical activity is defined as any activity that gets heart rate levels to 50-70% of max and

include activities such as walking briskly or swinging on a playground. Vigorous intensity physical activity is 70-85% of one's max heart rate and include activities such as sprinting or jumping rope. At least 60 minutes of MVPA a day can reduce risk of obesity, cardiovascular disease, type 2 diabetes, metabolic syndrome, and the risk of the development of some cancers (CDC, 2016a; Janssen et al., 2010). Among children 4-6 years old, percent of total body fat is inversely related to minutes of daily moderate to vigorous physical activity (Burgi et al., 2011). In addition, when tracking the daily steps of children, those that do not meet the daily recommendation of 12,000 steps a day are twice as likely to be overweight or obese (Colley, Janssen, Tremblay, 2012). Studies have shown that when children ages 6-11 get 60 minutes of MVPA, they will take an average on 12,000 steps. Conversely, high levels of physical activity are correlated with lower levels of depression, anxiety, and stress among children and adolescents (Ahn & Fedewa, 2011). Adolescents who are athletes or who engage in frequent physical activity experience lower anxiety-depression scores and improved physical health than those who are inactive (Eime, Young, Harvey, Charity, & Payne, 2013). In addition, children and preadolescents who participate in regular physical activity report higher levels of self-esteem, mood status, and quality of life (Lees & Hopkins, 2013). Hartmann and colleagues (2010) also found that children who received extra physical education classes, several short activity breaks throughout the day, and physical activity homework increased their psycho-social quality of life rating from pre-to posttest over the school year (Hartmann, Zahner, Pushe, Kriemler, 2010).

Researchers are continually discovering improved physiological and psychological benefits of physical activity in children. However, children are engaged in less physical activity and play sessions presently, while physical and mental health problems are on the rise (Ann &

Fedwa, 2011). Physical activity studies focused on children show that only 21.6% of children ages 6-19 years old are getting at least 60 minutes of physical activity daily (Katzmarzyk et al., 2016). This percentage will decrease as children mature into adolescents, suggesting that inactivity at a young age may also influence physical activity later in life. Edwards and colleagues (2013) tracked physical activity levels in children over time and discovered that children who are inactive at a young age will remain inactive as they mature (Edwards, Khoury, Kalkwarf, & Woo, 2013). Even if children are active at a young age, they still run the risk of becoming inactive when they are adolescents and eventually adults (Finne, Bucksch, Lampert, & Kolip, 2013).

Risks of inactivity

Individuals who are frequently inactive will significantly increase their chances of developing chronic diseases. Obesity is one of the health problems that will result from inactivity and may start a cascade of other physical and mental health problems to develop. Physically, obesity will increase the chances chorionic diseases such as heart disease, high blood pressure, stroke, type 2 diabetes, and osteoarthritis to develop (American Heart Association, 2015). Children who are diagnosed with one of these chronic diseases will engage in less physical activity and have lower cardiovascular fitness levels than healthy children without chronic disease (Maggio et al., 2010). The results of this study show that children with chronic disease are at risk of becoming obese due to inactivity. These children have the potential to make their chronic disease worse by continuing to have low levels of physical activity as they grow older into adolescence.

Inactivity and the onset of obesity may also cause the development of many psychological health problems. Low self-esteem and depressive symptoms due to body image

are highly correlated with obesity and are occurring earlier in life than ever before (Kremer et al., 2014). By the year 2020, the world health organization predicts that depression will be second as the world's leading cause of disability among children. The development of depressive disorders at a young age will commonly reoccur and continue into adulthood, making it important that adults prevent the onset of these disorders in children (Costello, Copeland, & Angold, 2011). As a result of mental health problems due to inactivity, children will also struggle with socialization skills. Physical activity and play allow children to interact with their peers and develop intrapersonal skills that are not as available in the classroom or at home (Gray 2013, Rhea et al., 2016). They will learn to interact with other children and appreciate what each other brings to the table (Gray, 2013).

As children become adolescents, the amount of physical activity they are able to achieve daily will decline (Finne et al., 2011). This may cause the number of children who develop chronic disease in elementary school to increase from 40% to 46% by the time they reach middle school (Datar, Shier, & Sturm, 2011). Good mental health in children can have a positive effect on performance in the classroom. Physical activity is shown to enhance brain development and cognitive ability of primary school students, which results in higher academic outcomes on national and state standardized assessments (Hillman, Kamijo, & Scudder, 2011)

Cognitive ability

The cognitive ability and brain development of children is of utmost importance when examining long term effects in adults. Through the use of MRI technology, it is known that increased aerobic fitness will enhance brain structure and function in older adults (Erickson et al., 2011). The participants in this study participated in a randomly controlled trial in which 60 of them participated in an aerobic exercise and the other 60 participated in a controlled stretching

group for six months. The results showed that the exercise group had an increase in hippocampal volume and memory performance when compared to the control group (Erickson et al., 2011). These individuals were able to store and recall information at a higher rate than the control group due to the increase in hippocampal volume. The results of this study and ones similar to it has sparked an initiative by researchers to see how physical activity can affect the development of the brain during childhood and adolescents.

The human brain will be 95% developed by the time an individual will reach the age of 6. However, the brain will continue to grow throughout an individual's life and will constantly experience change in neurological pathways and structure (Khan & Hillman, 2014). Childhood and adolescence are crucial periods of brain structure in which executive function, inhibition, working memory, and cognitive flexibility will develop (Khan & Hillman, 2014). The hippocampus area of the brain is responsible for learning in individuals as it stores both long and short-term memory. The bigger the hippocampus the better the brain is able to store and recall information (Chaddock et al., 2010). Chaddock and colleagues examined how physical activity would affect the growth of the hippocampus in children from 9-10 years old. This study compared the hippocampus size and the individual's ability to recall information in both fit and un-fit children. The results showed that the fit children had a larger hippocampus volume as well as getting a better score on the recall test (Chaddock et al., 2010). The lower-fit children had smaller bilateral hippocampal volumes and poorer relational memory task performance compared to higher-fit children. Play and physical activity has also shown to promote changes in the prefrontal cortex of the brain. The prefrontal cortex is the region of the brain that is responsible for emotion regulation and problem solving. Children that receive an unstructured,

outdoor play break will be able to reset their brain and be able to engage in learning better than students who only receive short breaks in the classroom (Erickson, Hillman, & Kramer, 2015).

Physical activity has also shown to decrease the symptoms of ADHD in children. Attention deficit hyperactivity disorder occurs when there is an ongoing pattern on inattention and or hyperactivity that interferes with development and functioning (National Institute of Health, 2015). Physical activity will increase the release of the hormones dopamine and norepinephrine, which both play key roles in attention regulation in individuals. The more active a child is, the higher their baseline levels of these hormones will be, thus resulting in the body using a self-remedy to counter act the effects of ADHD. Smith and colleagues examined how physical activity would affect ADHD symptoms in children in grades K-3. The children in this study completed a 26-minute continuous moderate to vigorous physical activity daily over the period of eight weeks. The children in this physical activity group saw an improvement in cognitive, motor, social, and behavioral functioning tests after the intervention was completed (Smith et al., 2011). Children without ADHD will also experience an increase in these hormones which also results in increased attention, which can be most beneficial when in the classroom.

Several research studies have shown a positive association between student's physical activity levels and academic performance (Davis et al., 2011; Howie, Schatz, & Pate, 2015). Preschoolers and primary school children demonstrate improved attention to a lesson after 30-minutes of an activity break using gross motor skills when compared to a sedentary cognitive break including reading or arts and crafts (Palmer, Miller, & Robinson, 2013). Fidgeting (shaking leg, twirling hair, etc.) during a lesson can affect children's ability to maintain attention to a lesson (Mahar, 2011). When students receive unstructured, outdoor play breaks throughout a school

day, they demonstrate improved on-task behaviors, significantly less fidgeting, improved emotional states, less attentional fatigue, and improved academic outcomes in reading and math (Clark & Rhea, 2017; Rhea et al., 2016). The unstructured and self-directed break from instruction children gain from recess allows for a mental change and release of energy that is evident in many aspects of the classroom (Ramstetter & Murray, 2017; Pellegrini & Bohn-Gettler, 2013). The increase in attention in the classroom will result in an increase in their cognitive ability and performance on exams. A study that examined fourth and fifth grade students discovered that students earned higher math scores after 10 to 20 minutes of physical activity compared to control group students who were inactive during that time (Howie et al., 2015). Additionally, elementary school children ages 7-9 who were exposed to a 9-month after school physical activity program saw enhanced cognitive performance and brain function (Hillman et al., 2014). Many researchers argue that the increased performance in cognitive ability in students may be due to improvement in attentional focus following a break from instruction.

Previous literature demonstrates that physical activity has significant effects on the physical and physiological health of children. In addition, unstructured play offers the opportunity for children to improve their social and cognitive skills with classmates and teachers (Gray, 2013; Rhea et al., 2016). Children are able to interact and socialize with peers in a way that they typically do not get in the classroom (Gray, 2013). Children that are social at a young age will learn social interaction skills that they can use throughout the rest of their lives.

Social development

The state and national standards for education are more focused on improving academic achievement in the core areas of reading, writing, science, and math than other subjects taught in

elementary school (Ann & Fedwa, 2011). As a result, children can spend up to 7 hours of the school day seated at a desk in hopes that increased classroom time will result better test scores and academic achievement (Howie & Pate, 2012). However, bad behaviors in the classroom are more likely to occur the longer children remain in a classroom, even if movement is implemented in the classroom throughout the day (Rhea & Rivchun, 2018; Turner et al., 2013). In addition, the increased emphasis on the core subjects has created neglect for behavioral, social, and character engagement in the classroom (Rhea & Rivchun, 2018). The combination of seated classroom time and lack of character development has led to an increase in bullying and behavioral problems in schools (Pellegrini, & Bohn-Gettler, 2013). Children who are disliked, aggressive and disruptive, and are unable to develop close relationships with other children at a young age are at risk of developing social isolation as they age (Lindsay & Colwell, 2013). The long-term risk for children who lack socialization skills are poor mental health, low academic success, and the development of eating disorders and obesity (Lindsay & Colwell, 2013).

Children who engage in opportunities to develop strong social skills will have better mental health, stronger relationships with peers, healthier lifestyles, and more success in school. Schools that implement social development programs show improvement in all of these areas in children (Snyder et al., 2010). Unstructured, outdoor play provides opportunities for children to develop these social skills and improve their socialization capabilities during the school day without the implementation of a specific behavioral program (Gray, 2011). During these outdoor play breaks, children are able to learn how to use their social communication skills which can control their behaviors towards others, participate in social exchange, express opinions or feelings, and obtain and relay information to others (Gray, 2011). The development of social competence has the ability to decrease bullying, behavior problems, and mental health problems

in children (Gray, 2011). In addition, studies have found that children that are taught social skills in the classroom will enhance their ability to develop social skills and problem solve on their own (Davis & Cooper, 2011). Happiness in children is vital to their psychological development and is an area that needs more research focus (Rhea, 2016). If children enjoy coming to school then improvements in academic achievement, social competency, and emotional regulation can occur (Rhea, 2016).

Emotional development

Throughout the day, children may experience many different emotions based on their environment and physical feeling. Emotional states are defined as "state of arousal characterized by alteration of feeling tones and by physiologic behavioral changes" (Amsterlaw, Lagattuta, & Meltzoff, 2009, p. 116). A positive emotional state would include feelings of happiness or enjoyment while a negative emotional state would include sadness or anger. Nearly five million children in the United States are diagnosed with some type of serious mental illness including ADHD, depression, and anxiety (CDC, 2016c). Many cases of anxiety and depression involve emotional instability in children (CDC, 2016c). Physical activity is shown to be inversely related with symptoms of anxiety and depression among children (Biddle & Asare, 2011). Children without mental disorders from ages 9-11 may experience more positive emotional states after moderate intensity physical activity because they feel less tired and more energetic (Dunton et al., 2014). The results of these studies show that physical activity can potentially increase the positive emotional states in an individual, especially children.

Negative emotional states and dysregulation can also have a negative impact on the physical and psychological health of children. Kelly and colleagues (2016) examined the effects of emotion dysregulation and its impact on loss of eating control. Children 8-17 years that

experienced more emotional dysregulation experienced decreased energy intake on a daily basis, which may ultimately lead to the onset of obesity (Kelly et al., 2016). Improvements in emotional regulation and positive emotional states can lead to overall happiness and well-being when children mature into adults (Kelly et al., 2016). Well-being refers to positive states of emotions with a meaning in life, the ability to get along with others, and feeling good (Tugade, Shitota, & Kirby, 2014). Adults who report high levels of happiness engage in better social relationships, marriage, job satisfaction, activity level, and enjoyment from life events (Tugade et al., 2014). It appears that positive emotional states at a young age are important for happiness and well-being experienced as an adult.

Hoffman and Russ determined that there is a positive link between pretend play, creativity, and emotion regulation among children K-4 (2012). Clark and colleagues examined how increasing the number of outdoor, unstructured play breaks during the school day would affect the emotional state of children in grades K-2. The results showed that children who engaged in more play periods would display more positive emotions and less negative emotions than children that only received one play break (Clark & Rhea, 2017). Play time may provide children a chance to practice experiencing and overcoming many different emotional states (Gray, 2011; Hoffman & Russ, 2012). For example, during play, children may become angry with the outcome but will learn to overcome their anger to allow play to continue. Increasing the frequency of play may improve children's ability to control their emotions. The past 30 years has seen an increase in mental disorders in children and a decrease in unstructured outdoor play (Rhea, 2016; Turner et al., 2013). Many researchers have begun to draw a connection between the two concluding that the increase in mental disorders among children may be due to the decline of unstructured outdoor play (Gray, 2013: Rhea, 2016).

Play

Play in an outdoor setting provides children the chance to encounter, challenge, and develop skills encountered in everyday life. These aspects can be an important part of a child's mental health and may influence physical, social, and emotional development (Russ & Dillon, 2011). Peter Gray defines play as "an activity that is freely chosen and directed by the participants and is undertaken for its own sake, not consciously pursued to achieve ends that are distinct from the activity itself" (Gray, 2011, p. 444). Play is self-directed and players choose to participate for the enjoyment that the activity brings to them. He states that social play is a form of behavior that requires cooperation, fairness, and setting aside dominance so that each individual can participate (Narvaez, Valentino, Fuentes, & Gray, 2014, p.193). Children learn to interact with others and create compromises to continue play for the enjoyment that it brings them, which will help enhance their social skill development and emotion regulation (Mainella, Agate, & Clark, 2011). Play requires that each child voluntarily participate and corporate with each other so that the activity can continue. Children will also enhance their creativity capabilities by making up rules and using their imagination to set the scene during the game (Gray, 2011). They have the freedom to choose what character they want to pretend to be, or create a battle scene on the ocean with different obstacles on the playground representing different islands. The imaginative capabilities of children during play could be endless (Hoffman & Russ, 2012). Some social and creative experiences that children engage in during play cannot be taught in the classroom. Theories developed around outdoor play suggest that play, creativity, and emotional regulation are connected (Hoffman & Russ, 2012; Mainella et al., 2011).

Outdoor play

A steady decline over the past few decades has been shown in the amount of outdoor play time children engage in (Bassett, John, Conger, Fitzhugh, & Coe, 2015). Researchers have concluded reasons for this low percentage of outdoor play may be due to concerns about safety and crime, increased electronic and social media, and entertainment (Bassett et al., 2015). Children between the ages of 8 and 18 spend an average of seven hours each day on some kind of electronic device, which can total almost 53 hours weekly (Bassett et al., 2015). High levels of screen time are shown to increase the chances of children being inactive (Herman, Sabiston, Mathieu, Tremblay, & Paradis 2014). Low levels of outdoor play are also being seen in elementary schools across the United States in exchange for an increase in classroom time (Ramstetter & Murray, 2017; Robert Wood Johnson Foundation, 2013).

Expectations from parents and teachers for children to excel in school are higher than they have ever been (Murray & Ramstetter, 2013). Some teachers and administrators believe that the more time children spend seated and learning in the classroom, the better their academic performance will be (Howie & Pate, 2012). However, children in preschool and elementary schools are shown to exhibit no significant difference in test performance when receiving multiple play breaks daily compared to when they do not (Dills, Morgan, Rotthoff, 2011; Rhea & Rivchun, 2016). Outdoor, unstructured play breaks also encourage the development of social and emotional learning by allowing children to engage in play and practice using essential social skills with peers (Ramstetter & Murray, 2017).

Outdoor play can benefit the physical, mental, cognitive, social, and emotional health of children. Children from ages 10 to 12 are shown to achieve higher accelerometer counts and daily MVPA when playing outdoors compared to children who do not (Stone, Faulkner, Mitra, &

Buliung, 2014). Children also report that they prefer to engage in physical activity in an outdoor setting when compared to an indoor setting (Liu et al., 2015). Multiple outdoor play periods have also shown to increase the frequency of positive emotional states in children (Clark & Rhea, 2017). In Finland, higher emotional well-being was associated with outdoor physical activity, leading to more positive emotional states in those individuals (Pasanen, Tyrvainen, & Korpela, 2014).

Evidence shows the amount of time dedicated to outdoor play is decreasing and even disappearing from schools across America (Ramstetter & Murray, 2017; Rhea & Rivchun, 2018; Robert Wood Johnson Foundation, 2013). The National Association of Elementary School Principals (NAESP) have reported that 96% of schools in 1989 provided at least one 30-minute recess period a day, which was reduced to 70% 10 years later in 1999. Recently, Russ & Dillon (2011) discovered that 77% of principals reported their schools remove recess as a punishment to children. A reason for this may be due to inconsistent laws and guidelines for recess across the United States. Many state laws suggest that schools provide at least 20 minutes for recess during the day, with many schools meeting the minimum requirements or less (NASPE, 2015). In other countries, such as Finland, a 15-minute recess period is provided every hour to enhance the physical activity, cognitive abilities, and classroom behaviors of children.

Let's inspire innovation 'N Kids (LiiNK Project)

Finland's structure and approach to the education system is very different than what is seen in the United States. Standardized testing among elementary-aged students has been eliminated, children receive less homework, and receive equal instruction time for all core classes, physical education, and play (LiiNK, 2018). Children are also provided 15-minute recess breaks every hour, which totals an hour of recess during the shortened 4-5-hour school day. As a result of this

structure to the education system, Finland is consistently ranked among the top nations in the world for academics (LiiNK, 2018). In Texas, a project titled Let's Inspire Innovation 'N Kids (The LiiNK Project) is modeled after the Finnish education system (Rhea, 2016). The LiiNK Project's primary focus is to improve classroom behaviors and the social, emotional, and physical skills of children. To accomplish this, the LiiNK project adds four 15-minute recess periods throughout each school day. Students typically receive two recesses before lunch and two additional recces after lunch. In addition, students receive a minimum of four 15-minute character development lessons weekly to promote social development of students. The project first launched as a pilot study in two private schools with a matching comparison school for each in grades K and 1, Fall, 2013. The pilot intervention schools then added a grade level each year following 2013 so the intervention is now included in grades K-3. In Fall of 2015, four public intervention schools along with their matching comparison schools joined the project for a three-year period.

Results

The first two years of the LiiNK project has shown the intervention children are demonstrating significantly higher percentages of on task behaviors than their matching comparison schools (Rhea et al., 2016). In addition, intervention school children are showing increased attentional focus during classroom time which is resulting in higher math and reading scores (Rhea et al., 2016). Children are also demonstrating more social growth and development through increased peer interactions at recess (Clark & Rhea, 2017). Misbehavior and bullying during recess has significantly decreased in LiiNK children. The LiiNK Project has preliminary results to show steady positive changes in the social, emotional, and academic development of children (Rhea et al., 2016). The LiiNK project also has examined the physical activity and

emotional states of students in private intervention and comparison schools (Clark & Rhea, 2017). Results showed that children in grades K, 1 and 2 experienced higher levels of physical activity compared to students who did not receive the intervention. In addition, these students experienced more positive and less negative emotional states during recess than children at matching comparison schools. Further investigation is needed to determine if there are differences in the physical activity levels and emotional states of children in public intervention schools versus children in matching public comparison schools.

Summary

Previous has literature clearly demonstrated that physical activity and play are vital to the health and development of children. However, it is evident that the amount of play time that children receive during the school day and at home has been steadily declining in the last 30 years (Bassett et al., 2015). This, in turn, causes the levels of physical activity that children engage in to also decline. Prior studies have examined the influence of physical activity on emotional states in adults and adolescents (Tugade et al., 2014). Scant research has explored how physical activity can impact the emotional states of children. This study investigated the effects that physical activity and play can have on the emotional states in children. This study specifically examined how these factors may differ in children who are part of the LiiNK project. Accelerometers were be used to measure physical activity of children during the school day, since they offer the most accurate representation of intensity, duration, and frequency of movement. Observations during recess were used to investigate positive emotional states of children.

Research Questions and Hypotheses

This study will test the following research questions and hypotheses based on the findings in previous research:

Question 1: Are there physical activity time, duration, and intensity differences by school, gender, and grade during unstructured, outdoor play times throughout the school day?

Hypothesis 1: Intervention school students will demonstrate significantly higher physical activity patterns than comparison school students during unstructured, outdoor play times offered throughout the school day.

Hypothesis 2: Intervention school males will demonstrate higher physical activity patterns than intervention school females and all comparison school students.

Question 2: Are there emotional differences by school, grade level, and gender during unstructured, outdoor play times throughout the school day?

Hypothesis 3: The intervention school students will demonstrate higher percentages of positive emotional states than the comparison school students during the different daily play breaks.

Question 3: What is the relationship between positive emotional states during the day and multiple recesses daily?

Hypothesis 4: A positive relationship will be found between amount of time given to unstructured, outdoor play during a school day and positive emotional states.

CHAPTER 3. METHODS

This study examined the physical activity levels and positive emotional states among public school children in grades 1-2 during the school day and recess. Due to the known benefits of physical activity and happiness, it is important to measure the physical activity levels of children and their emotional states when they receive additional unstructured, outdoor recess periods. In addition, the results of the first and second year of The LiiNK project make it necessary to further explore this relationship in elementary aged students. This chapter will detail the participants, measures, procedures, and design that were used in this study.

Participants

Participants were selected from a convenience sample of two North Texas public elementary schools participating in The LiiNK Project. The primary focus of The LiiNK Project is to improve classroom behaviors and the social, emotional, and physical skills of children. To accomplish this, The LiiNK project adds three to four 15-minute recess periods throughout each school day. Students will typically receive two recesses before lunch and two additional recces after lunch. In addition, students receive four 15-minute character development lessons during the week to promote social development of students. The two schools include one intervention school (N=98, grade 1=46, grade 2=52, M=47, F=51) and one comparison school (N=67, grade 1=35, grade 2=32, M=32, F=35). Initially, an equal number of participants were going to be chosen from each school. However, due to various inconsistencies with the accelerometers, many participants' data had to be excluded. The students in the intervention school (LiiNK) received four 15-minute recess periods daily as well as a 15-minute character development

lesson four times weekly. Children in the comparison school received two 15 minute recesses daily and no added character development weekly.

Measures

Three instruments were used in this study: a demographic survey, accelerometers, and an observation tool to measure positive emotional states expressed during recess.

Demographic questionnaire. A demographic questionnaire was administered to the teachers at each school to collect data on grade level, gender, and race.

Accelerometers. Accelerometers were worn to measure physical activity patterns in grades 1 and 2 children during the school day, approximately 8 hours of data daily. To assure that a consistent amount wear time was seen across subjects, each student had to wear the device for four 24 hour days to be included in data analysis. The device chosen for this study is the Actigraph wGT3X-BT accelerometer. The wGT3X-BT is designed to be worn on the non-dominant wrist of the user to accurately track movement (Ekblom, Nyberg, Bak, Ekelund, & Marcus, 2011) and has shown to be effective with children between the ages of 5 and 8 years (Evenson, Cateiller, Gill, Ondrak, & McMurray, 2008). This accelerometer uses tri-axial acceleration sensors (vertical, horizontal, & perpendicular) to measure changes in movement on a per epoch basis. An epoch is a time sampling interval in which the device will record its orientation. An algorithm present in the device will then be able to determine the number of steps, time, and intensity of physical activity during each epoch.

***Intensity*.** Intensity of physical activity is calculated in the data as counts per minute (CPM). An algorithm present in the device uses metabolic equivalents, age, height, and weight to determine CPM for each child. Once CPM is calculated, a filter is then used to categorize sedentary, light, moderate, and vigorous activity. For the purpose

of this study, the Puyau (2002) filter was used. Sedentary activity was set at 0-799 CPM, light was 800-3199, moderate was 3200-8199, and vigorous was anything above 8200 CPM.

Time. This device records raw data during the day and this can be converted to examine different epoch time intervals. Shorter epoch time intervals (15s, 30s) has been shown to more accurately track physical activity of children when compared to longer 60s time intervals (Rowlands, Powell, Humphries, & Eston, 2006). The total time that each student spent in sedentary, light, moderate, or vigorous activity was calculated per hour and per day. The time during the day in which students were the most active could be seen by the hourly breakdown of the data

Steps. The total steps taken throughout the day was recorded by the device. Like physical activity, steps could be broken down into totals per hour or totals per day for each participant. An algorithm present in the device used the raw data recorded by changes in the position of the device and converted that into total steps.

The wGT3X-BT has no buttons or screens and is waterproof which eliminates the possibility of children becoming distracted or damaging the device. In addition, this prevented children from disrupting any data collection during the study by pressing a wrong button. No screens on the device prevented the children from knowing their steps during that day and trying to increase those steps by shaking the device. The wrist strap is simple and children were able to put on the device with minimal assistance from a teacher. The accelerometer also has an ambient light senor that tracks lux values in each epoch. A comparative interpretation of location is then given based on the lux levels in each epoch. For example, a lux level of 50 was interpreted as in areas of low levels of

light such as a family living room, while a lux level of 10,000 would be outside on a sunny day. Data on the device can be saved from 38-120 days. The purchased accelerometer was piloted by a team of graduate students to test the validity and reliability. The researchers also tested the reliability of the device to record, save, and retrieve the data after five consecutive days of wear to gather higher levels of activity throughout the day.

Observations. The emotional states of children were observed during recess. The observers verbally recorded the facial, bodily, or vocal behaviors of one child for one recess period (15 minutes) (e.g. child skips over to swing set smiling). The researchers then met as a group to transcribe the recordings. Once transcribed, the observers highlighted any bodily, facial, or vocal actions seen during the recess period. From the above example, the behaviors of skipping and smiling would be highlighted. The actions that were marked were then categorized based on the operational definitions created by Clark (2017) (Appendix C). Clark classified these behaviors as expressions of emotion which could be categorized as either positive, not positive, or other. For example, a bodily action of hopping or skipping would be classified as an expression of joy or excitement which would be coded a positive emotion according to Clark. In addition, the facial expression of smiling would also be an expression of joy and categorized as a positive emotion. An example of behaviors that would be categorized as not positive would be a child frowning or becoming angry with a classmate as these display emotions of anger and sadness. Behaviors and emotions that do not categorize as either positive or not positive were categorized as other (e.g. Child watching classmates with neutral expression on face). The research team met as a group and discussed any discrepancies that occurred in the observational data.

Procedures

The LiiNK Project was approved by the Institutional Review Board (IRB) at Texas Christian University. The application for the IRB included information about the proposed cover letter, the measures, and the procedures used in The LiiNK Project. Schools and parents were then notified (Fall 2016) of the additions to The LiiNK Project that occurred during the Spring semester in 2017. Letters with information about the current study and informed consent for children to participate was sent and completed by parents/legal guardians. Students were not allowed to participate if informed consent was not obtained from parents, teachers, and administrators. A meeting with teachers and parents of participants was held approximately a week before data collection to review the procedures, accelerometers, and participation required.

A training was held for the primary graduate researcher to teach the other graduate students how to operate the accelerometer and how to verbally record and transcribe recess observations. During training, researchers learned how to verbally record situational data (date, time, temperature, humidity) and the observational data (emotional state) into a recording device. The researchers then practiced using the observation tool by watching recess at a LiiNK school located near the TCU campus. Observers were then trained on how to transcribe the voice-recordings and then code the behaviors according to the operational definitions created by Clark (2017).

The researchers piloted the observational model to ensure that the observations were similar in each observer. The recess observation tool was piloted five times (on different days) during the (Winter 2017) until observations were consistent. During the pilot, researchers attended one recess at a LiiNK intervention school as a team and randomly selected one child to observe. The researchers then spread themselves across the playground so they are not within an

earshot of each other while verbally recording the actions of the child. When the recess was complete, observers transcribed the data and coded the behaviors as positive, not positive, or other (Durbin, 2010) and discussed any discrepancies in the data. Solutions were formed to ensure that observations were consistent among researchers after discussion and reasoning is done after the pilot. The researchers piloted recess until there was no discrepancies among the observations. The primary advisor then reviewed the transcribed data and confirmed that the results were consistent and reliable. In the Spring of 2017 data collection began which allowed enough time to pilot the accelerometers and observational tool.

Accelerometers. Approximately 120 accelerometers were purchased for the purpose of this study. A rotation was implemented so that 1st graders wore the devices for the first two weeks and 2nd graders would wear them for the next 2 weeks of data collection. Forty-six accelerometers were worn by the 1st grade intervention students and thirty-five worn by the comparison grade level during the first two weeks of data collection weeks. Fifty-two 2nd grade students in the intervention school and thirty-two students at the comparison school then wore the accelerometers for the next two weeks. A minimum wear time of four school days were required for student's data to be used in data collection. Because of this requirement, some students were de-selected and their data was not included in final data analysis. Each student was assigned an accelerometer number so that it could be tracked throughout the study.

Researchers were present on the first day of data collection at both intervention and comparison schools to provide any additional help to teachers and students about wearing the accelerometer. The participants were instructed to wear the devices from when they arrive in school on the first day at approximately 7:35 am and keep them on for the entire school day. The students would put the same device back on the next day that they wore the day before when

arrived in their classroom the 2nd day of data collection. Children wore the accelerometers until approximately 2:40 pm on the fifth and final day of the week before turning them in for the week-end. The accelerometers were collected at the end of the school day on Friday and redistributed on Monday of the 2nd week. The same procedure was utilized during the 2nd week of school and another five days of data during the school day was collected. At the conclusion of each grade level, the accelerometers were collected from the grade level studied, given new student ID numbers, and passed out to the next grade level in the study for the next two weeks of data collection. Children continued to wear the accelerometer after school as that data will be used for another research study involving the same participants.

Participants were instructed to place the device on their non-dominant wrist on the first day of the study as soon as the children entered the classroom and found their seats (approximately 8:00am). From that point forward through the five days of that collection week, the accelerometer was on their non-dominant wrist. The researchers analyzed every hour of every day that children wore the devices to assure that they did not come off. If a student took of the device, their data for that day was not used. Teachers were instructed to monitor students and try to address any problems that might occur during the day. Any problem that the teacher noticed was communicated to the researcher at the end of the school day so the device could be fixed or replaced.

To monitor consistency of data collection, teachers monitored the students wearing the devices to ensure they were not performing any extra movement activities (running in a circle during class to get more steps). At the end of each school day, teachers recorded if any student left early, arrived late, went to the nurse, or was absent and relayed this information to the lead researcher. This data was not included in the final analysis. The weather conditions for each day

were also recorded. Class schedules were collected to note any abnormal activities that occurred during the school day that would interfere with recess or cause an abnormal change in physical activity. Data from the accelerometers was saved on the device per day and could be retrieved by a computer up to 120 days later. As a result, the accelerometers were collected from the students and the data from the week was downloaded and saved on the lead researchers computer. If any days of data collection were lost (due to field trips, cancellations, assemblies), that day was given a new data collection day between one and three weeks after the initial date.

Recess observations. Positive and negative emotional states were observed during recess and then voice-recorded in a recording device. Each observer verbally described any action or facial expression (e.g. smiling and running, laughing while sliding down slide, frowning) shown by a student for 15 minutes an intervention school and one full recess (15 minutes) at a comparison school. After each recess observation, researchers then individually transcribed their own observations and situational information exactly as it was stated on the recording into a typed document. When the observations were transcribed, the lead researcher met with the other observers to discuss and review the transcript. The goal of this meeting was to identify any emotional characteristic and to validate that the observer correctly identified an emotion. The individual that completed the observation would provide any additional supplemental information if any discrepancies arise so that the emotion is correctly coded. When all individual meetings were complete, the group met as a whole and reviewed all the transcripts and further discussed any problems with the data. The emotional descriptors were coded using Clarks (2017) observational definitions. The emotions recorded were assigned to either “positive”, “not positive”, or “other”, or none based on the observational definitions. The total number of positive and not positive emotions was counted and then compared to the total

expressions observed. A percentage of positive, not positive, and other emotional states was then calculated from this total.

Recess observations were completed at the intervention (N=26) and comparison schools (N=30). The observers randomized the recess observations so that data would be collected for each grade and gender. Each researcher recorded their observations for a minimum of 10 and a maximum of 15 minutes at both schools.

Statistical Design

Descriptive statistics were used to determine the means and standard deviations of the demographic data (gender and age). The first research question was tested using an ANOVA to determine the differences of the independent variables of school type, gender, and grade, with the dependent variable being steps taken, duration, and intensity of physical activity. The second research question was tested using a MANOVA to determine any interactions or differences in school type, gender, or grade level with the dependent variables of physical activity and positive emotional states during the day. The third research question was tested using univariate ANOVA to determine any significant differences of positive and not positive emotions by school, grade level, and gender.

CHAPTER 4. RESULTS

The results from this study represent the physical activity levels and observed positive and not-positive emotional states of 1st and 2nd grade children in two North Texas public elementary schools (one intervention and one comparison school). The intervention school students involved in the LiiNK Project received four 15-minute unstructured, outdoor play breaks daily; two before lunch and two after lunch and a character development lesson daily. The comparison school students followed their schedules as usual. Their school district has required two 15-minute recesses daily for each of the non-LiiNK schools. The following research questions were asked regarding physical activity and emotional states during the school day: (1) Are there physical activity time, duration, and intensity differences by school, gender, and grade during unstructured, outdoor play times throughout the school day? (2) Are there emotional differences by school, grade level, and gender during unstructured, outdoor play times throughout the school day? (3) What is the relationship between positive emotional states during the day and multiple recesses daily? This chapter is divided into three sections that describe the results of each research question. The first section provides the descriptive statistics for the participants of the study. The second section provides the results for physical activity patterns, and the final section describes the results for the emotional states.

Descriptive statistics

Originally, 200 1st and 2nd grade students and parents volunteered to participate in this study. Parents were required to complete consent forms for their children to participate. Eighteen of these students decided to withdraw from the study and 17 students did not meet the minimum wear time of four 24 hour days. Most children decided to withdraw from the study

because the accelerometer felt uncomfortable on their wrist. Three students from 1st grade and three students in 2nd grade at the intervention school withdrew from the study. Five students from comparison in 1st grade withdrew from the study and zero students from 2nd grade. Five students from each the comparison and intervention schools in the 1st grade did not have four days of data. Four students from intervention and ten students from comparison in the 2nd grade also did not have enough data. Therefore, 165 students (Intervention=98, Comparison=67) completed the study. This was a 17.5% attrition rate for this population of children and parents. Table 1 shows the participant break-down by school, grade, and gender. Participant numbers were fairly similar within each school (Intervention = 23-28; Comparison = 16-19), however the comparison school had a few less children participating than the intervention school.

Table 1.
Participants by School, Grade, and Gender

School	Grade	Gender	N
Intervention			
	1st	Male	23
	1st	Female	23
	2nd	Male	24
	2nd	Female	28
	Total		98
Comparison			
	1st	Male	16
	1st	Female	19
	2nd	Male	16
	2nd	Female	16
	Total		67
Total			165

The heights and weights were collected from the nurses of each school in the fall of 2016. Males and females were not separated by their heights and weights since at that young of an age, there are no significant differences between genders. Table 2 provides the average height, weight, and age of the participants.

Table 2.

Average Height, Weight, and Age of Participants

Grade	Age	Height	Weight
1st	6	47.11	52.17
2nd	7	49.81	59.37

Physical activity

The first research question examined the differences in time spent in different physical activity intensities throughout the four-day data collection period. Accelerometers were worn on each intervention and comparison school student's wrist to measure the physical activity levels daily over a two-week period. Each week was identified as Monday morning when they first arrived in the classroom to Friday afternoon in the last 15 minutes before the end of the school day. Not all accelerometer proved to be reliable for each of the 24-hour days for both weeks. It was decided that in order to collect consistent data across all students included in the study, a lower number of days would be used that included all students. So, the descriptive analysis showed that there were four 24-hour days of accumulated data that all students could be included. A Multivariate Analysis of Variance (MANOVA) revealed significant main effects for schools, Wilks Lambda=0.0692, $F(3,155)=2.68$, $p<0.05$, grade, Wilks Lambda=0.939, $F(3,155)=3.36$, and gender, Wilks Lambda=0.951, $F(3,155)=4.04$. There were no significant interaction effects for any of the combinations. Table 3 shows the main effect and interaction equations for where the significant differences were.

Table 3.
MANOVA for Total Physical Activity by School, Gender, and Grade

Source	df	Wilk's Lambda	f	p
School***	3,155	.0692	23.045	.0001
Grade*	3,155	.0943	3.115	.03
Gender*	3,155	.0940	3.311	.02
School by Grade	3,155		2.106	.10
School by Gender	3,155		0.226	.88
Grade by Gender	3,155		1.914	.13
School by grade by gender	3,155		0.316	.81

Note. *p<0.05, **p<0.01, ***p<0.0001

Post hoc results for intensity by school (sedentary, light, moderate, and vigorous) showed several differences. Means and standard deviations of total minutes for each intensity level of physical activity by school is displayed in Table 4. Intervention school students had significantly less total minutes in sedentary, $p<0.01$, and light, $p<0.0001$ physical activity. In addition, intervention school students displayed significantly higher minutes of moderate, $p<0.0001$, and vigorous, $p<0.0001$ physical activity. This is an indication that the intervention children in grades 1 and 2 were significantly more active than the comparison school students. They were also hitting a higher intensity for longer periods of time. These results support the first hypothesis of this study which stated that intervention school students would demonstrate significantly higher physical activity patterns than the comparison school. Means and standard deviations by school is displaying in Table 4.

Table 4.
Means and Standard Deviations of Total Physical Activity by School

	Intervention		Comparison			
	Mean	SD	Mean	SD	*f*	*p*
Sedentary	470.53	111.28	522.53	102.85	8.46	.004
Light	621.20	55.82	674.75	51.62	38.44	<0.0001
Moderate	451.31	83.73	396.02	66.37	19.25	<0.0001
Vigorous	136.94	49.79	86.67	27.90	56.02	<0.0001

Post hoc results for gender by intensity level revealed that males spent significantly more time in vigorous activity than females in both schools, $p<0.05$. This indicates that males reached a higher intensity of physical activity for longer periods of time than females. There were no significant differences by gender in sedentary, light, and moderate activity. The second hypothesis of this study stated that males in the intervention school would demonstrate higher physical activity patterns than females and all students at the comparison school. Although males demonstrated greater time in vigorous activity, females demonstrated more time in moderate physical activity. The average amount of time spent in MVPA between males and females were very similar which ultimately rejects the second hypothesis. Means and standard deviations for physical activity by gender is displayed in Table 5.

Table 5.
Means and Standard Deviations of Total Physical Activity by Gender

	Male		Female			
	Mean	SD	Mean	SD	*f*	*p*
Sedentary	492.22	103.80	491.11	117.14	0.00	.99
Light	671.06	49.51	678.13	53.98	0.19	.66
Moderate	422.83	72.44	434.40	89.28	0.65	.42
Vigorous*	123.45	51.83	110.18	45.46	4.00	.04

Post hoc results for grade by intensity level revealed that students in grade 2 spent significantly less time in light physical activity when compared to students in grade 1 in both

schools, $p<0.01$. There were no significant differences in sedentary, moderate, and vigorous physical activity between the two grades. Table 6 displays the means and standard deviations of physical activity by grade level

Table 6.
Means and Standard Deviations of Total Physical Activity by Grade

	1st		2nd			
	Mean	SD	Mean	SD	*f*	*p*
Sedentary	497.98	107.23	485.53	114.10	0.11	.73
Light*	657.19	57.87	629.20	59.32	7.01	.009
Moderate	415.81	75.50	441.45	85.68	2.21	.13
Vigorous	109.00	39.37	123.80	55.90	2.40	.12

Physical activity during recess breaks

The final piece in answering the first research question was to examine the physical activity differences of children during outdoor, unstructured play breaks during the school day. Since the LiiNK intervention school was receiving 60 minutes of unstructured, outdoor play while the comparison school was receiving 30 minutes of unstructured, outdoor play, the question was which school was moving more during their breaks? A MANOVA revealed a significant interaction between gender and grade, Wilks Lambda=0.948, $F(3,155) = 2.809$, $p<0.05$. There were no significant interactions between gender and school, grade and school, or between gender, grade, and school. The analysis also revealed main effects for school, Wilks Lambda=0.951, $F(3,155) = 2.686$, $p<0.05$, gender, Wilks Lambda=0.927, $F(3,155) = 4.045$, $p<0.05$, and grade, Wilks Lambda=0.939, $F(3,155) = p<0.05$. Table 7 reflects the interaction and main effect results for recess steps by school, gender, and grade.

Table 7.
Main Effects for Total Physical Activity by School, Gender, and Grade During Recess

Source	*df*	*Wilks Lambda*	*f*	*p*
School*	3,155	0.951	2.68	.04
Grade*	3,155	0.939	3.36	.02
Gender**	3,155	0.951	4.04	.008
School by Grade	3,155		0.45	.71
School by Gender	3,155		0.43	.72
Grade by Gender*	3,155	0.948	2.80	.04
School by grade by gender	3,155		0.38	.76

Note. *p<0.05, **p<0.01, ***p<0.0001

Post hoc results between grade and gender revealed that females in 2nd grade had significantly greater amount of time in moderate physical activity when compared to all other students, p<0.01. Table 8 displays the means and standard deviations between gender and grade.

Table 8.
Means and Standard Deviations of Total Physical Activity Between Gender and Grade

	1st Grade				*2nd Grade*					
	Male		Female		Male		Female			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	P
Sedentary	1.52	0.86	1.66	0.99	1.45	1.15	1.28	0.74	1.42	0.23
Light	3.62	1.05	3.87	0.95	3.17	1.02	3.47	0.88	0	0.97
Moderate*	5.8	0.88	5.76	0.9	5.65	0.98	6.44	0.93	8.21	0.005
Vigorous	4.05	1.44	3.69	1.41	4.71	4.38	3.81	1.43	0.94	0.33

Post hoc results for school revealed significant differences in vigorous activity between the intervention and comparison school, with the comparison school having a higher mean, p<0.05. This indicates that comparison school students reached vigorous physical acidity during recess for longer periods of time when compared to intervention school children. These results reject the first hypothesis that states that intervention school students would display higher levels of physical activity than comparison during recess. Table 9 displays means and standard deviations for each intensity of physical activity by school.

Table 9.

Means and Standard Deviations of Total Physical Activity by School During Recess

	Intervention		Comparison			
	Mean	SD	Mean	SD	*f*	*p*
Sedentary	1.50	0.94	1.43	0.97	0.36	.54
Light	3.63	0.90	3.38	1.11	3.34	.69
Moderate	6.03	0.94	5.76	1.00	2.69	.10
Vigorous*	3.82	1.36	4.42	1.83	6.43	.01

Post hoc results for grade reveled that there were significant differences between 1st and 2nd grade in light physical activity, $p<0.01$. Students in 1st grade had significantly more time spent in light physical activity which indicates that they were not meeting a high intensity of physical activity during recess. Students in 2nd grade displayed a significantly more time in vigorous activity when compared to 1st grade students. Means and standard deviations for physical activity by grade level is displayed in Table 10.

Table 10.

Means and Standard Deviations of Total Physical Activity by Grade During Recess

	1st		2nd			
	Mean	SD	Mean	SD	F	P
Sedentary	1.59	0.93	1.35	0.96	2.78	.09
Light*	3.74	1.00	3.32	0.96	8.83	.003
Moderate	5.78	0.89	6.05	1.03	2.62	.10
Vigorous*	3.87	1.43	4.25	1.72	3.79	.05

Post hoc results for gender revealed that there were significant differences between males and females for moderate, $p<0.05$, and vigorous physical activity, $p<0.01$. Females displayed significantly more time in moderate physical activity during recess when compared to males while males displayed significantly more time in vigorous activity. The second hypothesis is again rejected which stated that males would display higher levels of physical activity when compared to females. These results show that the physical activity patterns between genders

were similar. Table 11 displays the means and standard deviations of physical activity by gender.

Table 11.
Means and Standard Deviations of Total Physical Activity by Gender During Recess

	Male		Female			
	Mean	SD	Mean	SD	*F*	*P*
Sedentary	1.48	1.01	1.45	0.89	0.00	.97
Light	3.39	1.05	3.66	0.93	3.22	.07
Moderate	5.72	0.93	6.11	0.97	6.57	.01
Vigorous	4.38	1.71	3.75	1.41	7.13	.008

Accelerometer steps

The first research question also examined the differences in steps between school, grade, and gender. A univariate ANOVA revealed significant interactions between schools, $F(1,164)=37.929$, $p<0.0001$, grades, $F(1,164)=8.498$, $p<0.01$, genders, $F(1,164)=7.535$, $p<0.01$, and between school and grade, $F(1,164)=8.689$, $p<0.01$. There were no significant interactions between school and gender, $F(1,164)=0.004$, $p=0.952$, grade and gender, $F(1,164)=0.027$, $p=0.869$, and between school, grade, and gender, $F(1,164)=0.275$, $p=0.601$ for total steps taken during the week.

Post hoc results revealed significant differences for school, $p<0.0001$, grade, $p<0.01$, gender, $p<0.01$, and between school and grade, $p<0.01$. There were no significant differences for school and gender, $p=0.952$, grade and gender, $p=0.869$, or between school, grade, gender, $p=0.601$. This indicates that intervention school students took significantly more steps then comparison school students which supports the first hypothesis. Males also took significantly more steps than females throughout a school day which also supports the second hypothesis. Grade 2 students took significantly more steps than students in grade 1. Finally, 1st and 2nd grade

students at the intervention school took significantly more steps than 1st and 2nd grade students at the comparison school. Means and standard deviations of total steps is displayed in Table 12.

Table 12.
Means and Standard Deviations of Total Steps by School, Gender, and Grade

	Mean	*SD*	*df*	*f*	*p*
School					
Intervention	35584.67	4849.59	1, 164	37.92	<0.0001
Comparison	31551.96	3200.30			
Gender					
Male	34819.34	4781.50	1, 164	7.53	.007
Female	33145.94	4479.80			
Grade					
1st	32727.84	3857.60	1, 164	8.49	.004
2nd	35122.90	5121.88			
School by Gender					
Intervention					
1st	33649.57	4146.43			
2nd	37296.50	4816.21			
Comparison			1, 164	8.68	.004
1st	31516.43	3098.22			
2nd	31590.81	3357.74			

Accelerometer steps during recess

In addition to total physical activity during recess, the first research question also addressed total steps taken during recess between schools, gender, and grades. A univariate ANOVA revealed a significant main effect for total steps taken during recess by school, $F(1,164) = 17.566$, $p<0.0001$, and by gender, $F(1, 164) = 16.07$, $p<0.0001$. There were no other significant effects. Table 13 displays the main effect and interaction effect results for steps taken during recess.

Post hoc results revealed comparison school students took significantly more steps during recess when compared to intervention students. These results reject the first hypothesis that

stated that intervention school students would demonstrate higher step counts than comparison school students. Males took significantly more steps than females which supports the second hypothesis. Table 13 displays means and standard deviations of steps for schools and genders.

Table 13.
Means and Standard Deviations for School and Gender During Recess

School	Mean	SD	*df*	*f*	*p*
Intervention	547.64	84.54	1, 164	17.56	<0.0001
Comparison	608.65	116.4	1, 164		
Gender					
Male	600.94	109.82	1, 164	16.07	<0.0001
Female	544.9	87.89	1, 164		

Emotional states

Fifty-five recess observations were completed by the team of researchers during the spring of 2017. Each researcher would choose one child at random and watch them for a 15-minute outdoor, unstructured play period. Thirty observations were completed at the comparison school, and twenty-five observations were completed at the intervention school. Due to time constraints and inclement weather, four observations at the intervention school were not able to be completed. One observation from the intervention school was not included in data analyses since it was considered an outlier when compared to the other observations. This particular child continuously displayed emotions of sadness and anger in order to get attention and sympathy from other students, which was a type behavior not seen in any other observation. Each observation ranged from a minimum of 10 minutes to a maximum time of 15 minutes.

Researchers transcribed these recordings and then coded the emotional expressions of children on the playground as positive, not positive, or other. These emotional expressions were coded based on the operational definitions created by Clark (2016). Table 14 defines what was

considered positive, not positive, and other emotions along with the behaviors that were observed during recess

Table 14.
Positive and Not Positive Emotional Expressions and Behaviors Observed During Recess

Category	Emotions	Behaviors
Positive		
	Happiness/joy, content, excitement, surprise, celebration	Smiling, laughing, giggling, positive statement, jumping, clapping, hopping, skipping, cheering
Not positive		
	Sad/upset, angry, aggressive, annoyed/irritated, frustrated	Frowning, scowling, pouting, negative statements, kicking, hitting, angry or frustrated expressions
Other		
	Concentrated, perplexed, element of surprise	Determined expression, hit in the face with object and surprised reaction

Positive emotional states

The second research question examined the differences in emotional states during recess between school, gender, and grade. A univariate ANOVA revealed a significant main effect for positive emotional states by school, $F(1,54)=6.554$, $p<0.0001$. Table 15 shows there were no other significant differences for positive emotional states.

Post hoc results revealed that the intervention school students were happier during recess than the comparison school students and displayed a significantly higher percentage of positive emotions. These results support the third hypothesis which stated that intervention school students would display significantly higher percentages of positive emotional states during recess. Means and standard deviations for positive emotions is displayed in Table 15.

Table 15.
Means and Standard Deviations of Positive Emotions by School

	Intervention		Comparison				
	Mean	SD	Mean	SD	*df*	*f*	*p*
%Positive Emotions	90.51	12.24	78.40	20.24	1,54	6.55	.01

Not-positive emotions

The second research question also examined the not-positive emotional expressions children would display during recess. A univariate ANOVA revealed a significant main effect for not-positive emotional states by school, $F=(1,54)=4.583$, $p<0.05$. Table 16 shows there were no other significant differences for not-positive emotional states.

Post hoc results revealed that intervention school children displayed significantly less not-positive emotions than comparison school students. The means and standard deviations for percentage of not-positive emotions displayed during recess is in Table 16.

Table 16.
Means and Standard Deviations of Negative Emotions by School

	Intervention		Comparison				
	Mean	SD	Mean	SD	*df*	*f*	*p*
%Negative Emotions	6.52	10.84	14.13	15.91	1,54	4.58	.03

CHAPTER 5. DISCUSSION

This study investigated the differences in physical activity patterns and the effects of physical activity on emotional states of elementary school children during school hours who were involved in the LiiNK Project intervention and comparison school students who followed a typical school schedule. The LiiNK Project intervention requires four 15-minute recesses (unstructured, outdoor play breaks) and one 15-minute character development lesson to be implemented daily. The comparison school students in this study followed their typical schedule of two 15-minute recess periods daily, one before and one after lunch, and had no character development program. As a result of sedentary and mental health behaviors becoming increasingly concerning in elementary school aged children, measuring the number of steps and the amount of physical activity in students in the intervention school and the comparison school accumulate daily and how the activity levels impact their emotions could provide answers for successful interventions in the field to deter these behaviors in the future (Rhea et al., 2016).

Descriptive statistics will be discussed, which includes the average age, weight, and number of students in each grade and school that participated. Next, results from accelerometer data will be discussed and interpreted. Emotional states that were observed during recess will then be discussed. Finally, the limitations of this study will be evaluated and insight to future directions of research will be explored.

Descriptive statistics

The participants in this study were 1st and 2nd grade students from two LiiNK elementary schools in north Texas. First grade students ranged in age from 6-7 years old and 2nd grade students ranged in age from 7-8 years old. The average weight of the 1st and 2nd grade students

was 52 pounds and 59 pounds respectively. The weight of the individual was not a factor when calculating physical activity intensity. The design at the start of the study was to have an equal number of participants in the two schools. However, due to lack of participation from the comparison school, problems with accelerometers, and attrition, the final representation was 98 intervention students and 67 comparison students. For the total population, there were 79 males and 86 females.

Question 1: Physical activity

The first research question examined physical activity differences between 1st and 2nd grade students who received the LiiNK intervention versus students attended a school with 30 minutes or less of recess and no character development lessons. Clark and colleagues (2017) discovered children in private schools who participated in the LiiNK intervention experienced higher step counts than their matching comparison students accumulated throughout the school day. They measured steps with pedometers instead of accelerometers which are more accurate. Telford and colleagues (2016) found male students tend to be more active and achieve higher levels of physical activity than females in elementary school children (Telford, Telford, Olive, Cochrane, & Davey, 2016). Edwards and colleagues (2013) also found students are likely to be more active until they reach adolescence and then their physical activity patterns seem to plateau and begin to decrease. Based on these past findings, it was hypothesized that intervention males and all 2nd grade students would demonstrate higher physical activity levels than the comparison school females and 1st grade students respectively.

The results of this study showed that there were significant differences in time achieved in various physical activity intensities between intervention and comparison schools throughout the week. Intervention students demonstrated significantly higher time in moderate and vigorous

physical activity. Types of moderate to vigorous activities on a playground would include swinging, jumping, and sprinting. In addition, intervention students spent significantly less time in sedentary and light physical activity versus the comparison school. On average, intervention school children achieved almost 60 minutes more of moderate to vigorous activity during the week in relation to the comparison school. According to the CDC, it is recommended that children get at least 60 minutes of physical activity a day (CDC, 2016a). Over the course of the week, intervention school students were achieving almost one full day more of physical activity than the comparison students. These results can be attributed to the fact that intervention school children received double the amount of recess time during the week. High levels of physical activity among children are shown to decrease their chances of becoming obese and developing negative health problems (Burgi et al., 2011). This research suggests intervention school students could be at a lower risk of developing these health problems and a better chance to lead a long and healthy lifestyle.

No significant differences were found between males and females with regards to sedentary, light, and moderate physical activity. Males actually had higher times in which they were sedentary and lower time spent in moderate physical activity when compared to females. Vigorous physical activity is the only category in which males had higher times than females that was significant. More time spent in vigorous physical activity does support previous research that states that males would engage in higher intensity activities than females (Telford et al., 2016). This means that males were spending more time during the day engaging in vigorous activities such as sprinting. More time spent in vigorous activity will increase cardiovascular endurance and may lead to higher weight loss and fitness levels than females of the same age (Burgi et al., 2011). Although not reaching the same intensity level as males, females were still

reaching high levels of light and moderate physical activity. This means that females took part in activities such as walking, swinging, climbing, or skipping.

The final part of the first research question examined the differences in physical activity by grade level at both schools. The only significant differences in physical activity between the grades was in the light category, with 1st grade students spending more time in physical activity than 2nd grade. Sedentary, moderate, and vigorous physical activity was similar between the grades. These results indicate that 1st and 2nd grade students had similar physical activity patterns throughout the week, which rejects the hypothesis that 2nd grade children would be more active than 1st grade children. Although not significant, it is interesting to note that 2nd grade children did have the highest totals in moderate and vigorous physical activity. These results support previous research studies that have tracked the physical activity levels of children as they get older (Edwards et al., 2013). This may support that notion that children need more opportunities to be active as they age.

Physical activity during recess breaks

Further analysis on the data was conducted to determine the differences of physical activity intensities during each recess period. This analysis was needed to determine which group was more active during recess when an equal number of periods were given to each group. The results revealed that intervention and comparison school students displayed similar amounts of sedentary, light, and moderate physical activity. However, comparison school students displayed significantly higher levels of vigorous physical activity during one recess period than the intervention students. These results could be due to the fact that comparison school children are seated for longer periods of time. Since they are sitting longer, they are building up more energy and becoming more restless. In some instances, comparison school children would be in

class for almost two hours before they were able to go to recess for the first time. Results from previous LiiNK project studies have shown that comparison school students display more off-task behaviors in the classroom than intervention school children (Rhea et al., 2016). This indicates that comparison school children are fidgeting more in the classroom, requiring more movement time, and use their recess time to get as much movement as they can before they have to go back and sit for another long period of time (Rhea et al., 2016).

It is interesting to note that among all students involved in the study, the average time spent in sedentary activities during recess averaged less than two minutes. This means that 86% of recess time was spent moving around in some kind of way at either light, moderate, or vigorous intensities. These results show that all children are taking advantage of their recess time to become active. Regardless of how many recess periods are provided, all students are using this opportunity to burn off the body's excess energy due to sitting in the classroom for so long each day. This supports other research studies that have discovered that recess during the school day can provide children with 5-40% of their daily recommended physical activity (Ridgers et al., 2010). The participants in this study were actually meeting the daily recommendations for physical activity during recess alone. Previous research studies have shown that children can be sedentary for almost seven hours of the school day (Howie & Pate, 2012). The results of this study showed that children prefer to exchange that seat time for active time, as long as they are given a choice of how to be active.

Accelerometer steps

In addition to physical activity intensity levels, the first research question also explored differences in total step counts between schools, genders, and grades throughout the week. Intervention school students demonstrated almost 4000 more steps throughout the week when

compared to the comparison school students. When calculating a distance for these steps, intervention school students were traveling about two miles further than the comparison students weekly. The results from this study confirm the findings from previous studies that also found intervention school students would take significantly more steps than control students (Clark & Rhea, 2017). The difference though was Clark's study used pedometers which were less reliable than accelerometers so the findings from this study clearly demonstrated the intervention has an impact on physical activity patterns in schools.

Although intervention students were taking more steps than comparison students, other factors could play a part. The first is that intervention school students received double the amount of recess than the matching comparison school, so they were given more opportunity to move during the day. School structure, classroom location, and class schedule could also play a significant role in the differences. The intervention school students in 2nd grade had a longer walk to the playground than the 2nd grade students in the comparison school. This could cause the intervention school students' step counts to be higher without even engaging in recess throughout the week. The type of classroom activities might also attribute to the differences in step counts. For example, the intervention school students may have a classroom activity which requires them to go outside and walk around the school, which would dramatically increase their step counts. In regard to gender, males took significantly more steps than females during the week. On average, males were taking up to 1700 more steps a week than females, which accounts for almost an extra mile of traveling. When examining steps by grade level, 2nd grade students took almost 3000 more steps than 1st grade students. These are the same results that were found with Clark and colleagues when examining similar students in private schools (Clark & Rhea, 2017).

Question 2: Positive and not positive emotional states

The second research question examined emotional state differences between the intervention and comparison school children. Studies have shown that exercise has an inverse relationship in anxiety and depression among children (Biddle & Asare, 2011). As exercise patterns increase, anxiety and depression decrease and renewed energy increases (Dunton et al., 2014). The hypothesis was supported that intervention school children would display significantly more positive emotional states and significantly less not positive emotional states than the children in the comparison school. The most common positive emotional states displayed in the intervention students were smiling, laughing, and cheering. There could have been many reasons for the differences in emotional states observed between the two schools. The intervention school students received a character development curriculum as part of the treatment. Therefore, children in the intervention school may interact through play differently than in the comparison school as a result of the program. Intervention schoolchildren know how to respect one another and play fairly so that everyone can have fun. Because of this, there are less negative emotions observed in LiiNK school recess periods. In addition, the difference in playground set up and equipment may have attributed to the differences in positive and not positive emotions displayed. As part of the LiiNK program, intervention schools are not allowed to bring balls out to the playground during outdoor unstructured play breaks which resulted in more cooperative game play. As a result, every child who wanted to play was involved and there was no winner or loser. The comparison school did allow balls on the playground which resulted in competitive games of basketball and football. As a result, the researcher observed students who did not support each other and would often get into arguments about the game. They would

waste the majority of their recess time arguing over the game rather than setting aside their differences and continuing to play, resulting in more negative displays of emotion.

Question 3: Physical activity and emotional states

The third research question examined the relationship between positive emotional states and multiple outdoor, unstructured play periods daily. In the intervention school, students engaged in a higher amount of physical activity and steps during the week than the comparison school. In addition, the intervention school also displayed a higher amount of positive emotions and a lower amount of negative emotions. These findings support other research studies which state that children will experience more positive emotional states following a moderate intensity physical activity period (Dunton et al., 2014). As the number of outdoor, unstructured play periods increased, so did the happiness of the students. Opposite of that, as the number of outdoor, unstructured play periods decreased in the comparison school, increased unhappiness of students was exhibited during recess. Previous research supports these findings that higher levels of physical activity during play breaks results in positive emotional states such as happiness in the students (Biddle & Asare, 2011; Clark & Rhea, 2017).

Limitations

When analyzing the recess data, inconsistency of recess periods may have been a limitation of this study. The data for recess were analyzed using a set time provided by the teachers in which students would go out to recess. If these schedules were not exactly the same for every day of the study, the recess data may reflect higher sedentary behaviors in the students than what actually occurred. Another limitation in this study is the blinding of the researchers when they were observing recess periods for emotional states. There was no way to blind the researchers as to which school they were observing. As a result, this may have caused a bias in

the observations which resulted in intervention schools having more positive and less negative emotional descriptors. The researcher worked on bias before the study began, but there was no way to truly know whether bias crept in or not.

Future Directions

Future research should continue to monitor physical activity levels between the intervention and comparison schools of varying sizes and diversity of groups for differences. In order to have a more reliable data set, consideration should be taken to make sure all accelerometers to be used have been fully tested and monitored on a pilot group for at least a week before moving forward with the actual study. Testing all accelerometers and eliminating the defective devices will eliminate the chances of getting blank data at the end of the week. In addition, the straps used for the accelerometers should be piloted for discomfort and irritation so that attrition rates might decrease.

Another future direction would be to increase the number of days the devices were worn and the times of the year (diversity of outdoor weather). At the beginning of this study, the aim was to collect 10 days of data for each participant. However, due to attrition and device malfunction, only 5 days of data were collected. Having more days to examine within the research period could present a better representation of the physical activity patterns of children. In addition, this study did not collect data over weekend days of physical activity patterns. Future studies should include at least one weekend day to compare to the physical activity patterns during the school week.

The observation tool used to gather emotional states during this study has been validated and used in other research studies. However, it was used due to the young age of the children and their inability to accurately complete surveys and questionnaires. The next study in this line

of research should aim to observe children that are older for two reasons. First, it will allow the researcher to determine the emotional states of participants through objective emotional reports from the participants instead of trying to interpret body language and non-verbal cues which can be much more subjective. Second, the physical activity data obtained from these older children can be used to compare to the participants from the current study. Since this study observed 1st and 2nd grade students, future directions should aim to examine children in 3rd and 4th grade that are affiliated with the LiiNK intervention.

Summary

These results are especially important for schools and teachers that shorten or even eliminate recess from their curriculum. It is fairly clear that children use recess as a time to engage in high levels of physical activity. They burn off extra energy that has been built up in the classroom through the results that they are active for 86% of recess. In addition, the increase in physical activity has resulted in more positive emotional states displayed by children on the playground. Physical activity and positive emotional states will result in children decreasing their chances of becoming obese and developing negative mental health problems (Kremer et al., 2014). This study supports the claim that outdoor, unstructured play is a vital piece to the physical and mental development of children.

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Appendix A

PARENT CONSENT FORM

Texas Christian University
Fort Worth, Texas

PARENT'S PERMISSION TO PARTICIPATE IN RESEARCH

Title of Research: Creating healthier kids one step at a time: An exploratory study through LiiNK

Funding Agency/Sponsor: The LiiNK Project

Study Investigators: David Farbo, April Long**,** Laura Clark, Aubrey Goodwin, Diana Schwene, Dr. Rhea

What is the purpose of the research? The purpose of this research is to explore how physically active children are throughout the day (during school and after school), and to observe positive emotional states of children.

How many children will participate in this study? Approximately 240 children will participate in this study

What is my and my child's involvement for participating in this study? Your child may be wearing a accelerometer for the duration of the school week. They will wear the device for two weeks of school (Mon-Fri) at school and when they go home. In additions, your child may be observed at recess for positive emotional states (e.g., smiling, laughing). Finally, parents may be required to complete questionnaires and surveys about their child's physical activity and positive emotional states while at home.

For how long is my child expected to be in this study, and how much of my child's time is required?
Your child will participate in this study during school hours as well as after school hours, over the course of two weeks (Mon-Fri). Your child will not devote any time to this study during non-school hours.

What are the risks of participating in this study and how will they be minimized?
There are minimal risks associated with this study. School administrators, teachers, and counselors will be made aware of the protocols and will be available for assistance. No deception will be used at all. There will be no incentives to participate in this study, and your child will not be pressured to participate in any way. Teachers will be monitoring behaviors during class time and recess per usual. This study will maintain confidentiality so that all students' names remain anonymous.

Pedometers can potentially radiate electromagnetic energy, which could possibly affect any individual who wears a pacemaker. If your child has a pacemaker or wears any electrical devices

(e.g., hearing aids), please consider the potential risks of pedometer wear.

What are the benefits for participating in this study?
A potential benefit of this research for the students participating is that they may become more aware of how active they are on a daily basis. If physical activity levels are shown to improve psychological and emotional states among children, then this study could add to the knowledge base of why play physical activity are essential components of childhood.

Will I be compensated for participating in this study?
No students or parents will be compensated for taking part in this study.

What is an alternate procedure(s) that I can choose instead of participating in this study?
If you choose for your child to not participate in this study, your child will not be included in data collection. There is no alternate procedure. There is no punishment or ridicule for non-participation

How will my child's confidentiality be protected?
Only the listed study investigators will have access to the names of students. This data will be kept anonymous by removing all student names from data files entered into SPSS and by keeping the data password protected and locked in a secure location.

Is my child's participation voluntary?
Yes.

Can my child stop taking part in this research?
Yes. Your child can choose to withdraw from the study at any time.

What are the procedures for withdrawal?
Children or parents can withdraw from the study at any time by directly informing the primary researchers (David Farbo or April Long) or the student's teacher.

Will I be given a copy of the consent document to keep?
Yes.

Who should I contact if I have questions regarding the study?
David Farbo, 978-413-8311, d.farbo@tcu.edu
April Long, 214-755-5563, a.j.long@tcu.edu

Who should I contact if I have concerns regarding my rights as a study participant?
Dr. Tim Barth, Co-Chair, TCU Institutional Review Board, Phone 817-257-6427.
Dr. Anna Petursdottir, Chair, TCU Institutional Review Board, Phone 817 257-6436
Dr. Bonnie Melhart, TCU Research Integrity Office, Telephone 817-257-7104

Your signature below indicates that you have read or been read the information provided above, you have received answers to all of your questions and have been told who to call if you have any more questions, you have freely decided to participate in this research, and you understand that you are not giving up any of your legal rights.

Participant Name (please print): _____

Participant Signature: _____
Date:_____

Investigator Name (please print):_____Date:_____

Investigator Signature: _____
Date:_____

Appendix B

Operational Definitions

EXEMPLARS OF LOW, MODERATE, AND HIGH INTENSITY AFFECT CODES

(Durbin et al., 2010)

Positive affect

Facial:

LOW = slight raising of corners of mouth – no teeth visible – no contraction of outer eye corner; or, smile is fleeting
MODERATE = corners of mouth definitely raised – teeth visible – no contraction of outer eye corner
HIGH = full smile – corners of mouth definitely raised – teeth visible – contraction of outer eye

Vocal:

LOW = somewhat lilting tone of voice; brief giggle or hiss; singing or humming
MODERATE = giggle or extended laugh; clearly exuberant tone of voice; statement with overtly positive content (e.g., "I like this!", "neat", "cool")
HIGH = full, extended laugh; screech, shriek, or whoop; statement with *both* overtly positive content and positive tone

Bodily:

LOW = perky/snappy movement; floating motion of arms or hands; ambiguous hop or skip
MODERATE = brief hop or skip with clearly positive tone; slight wiggle or contortion
HIGH = clearly jubilant motions, "dance of joy", clapping, arm shaking/quivering, knee slapping

Surprise

Facial:

LOW = slight gape to mouth or eyebrow slightly raised & curved; or, expression is fleeting
MODERATE = definite gape to mouth or eyebrows definitely raised & curved
HIGH = definite gape to mouth *AND* eyebrows definitely raised & curved

Vocal:

LOW = slight or possible gasp
MODERATE = apparent gasp, statement with surprised tone ("wow", "ooh", "huh?")
HIGH = outright gasp, statement with overt surprised content ("I'm surprised")

Bodily:

LOW = slight freezing motion or backward bodily motion
MODERATE = definite freezing motion, definite backward bodily motion, slight startle
HIGH = definite startle motion, hands raised to cheeks

Sadness

Facial:

LOW = droopy cheeks; slightly downturned mouth; slight raising of inner corners of eyebrows; or, expression is fleeting; or, expression is apparent only on one side of the mouth
MODERATE = definitely downturned mouth or definite raising of inner corners of eyebrow

HIGH = both definitely downturned mouth *and* definite raising of inner corners of eyebrows

Vocal:

LOW = slightly whiny or dejected tone; slight sigh
MODERATE = definite sigh; definite whiny or dejected tone; statement with possible/probable sad content
HIGH = deep sigh; crying sound; statement with obvious sad content

Bodily:

LOW = somewhat slumped posture; lifeless motion with arms, dejected gait/walk
MODERATE = definitely slumped posture; shoulders slumped; dejected kick of feet or dropping of arM
HIGH = head in hands; head slump; clearly dragging feet

Anger

Facial:

LOW = eyebrows drawn slightly down & together, mouth slightly tense or squarish; or, expression is fleeting
MODERATE = eyebrows definitely drawn down & together; mouth definitely tense or squarish
HIGH = *both* eyebrows definitely drawn down & together *and* mouth definitely tense or squarish

Vocal:

LOW = irritable or cranky tone; slight grunt
MODERATE = definite grunt, groan, or sharp exclamation; statement with possible/probable angry content
HIGH = statement with definite angry content; definite angry/irritable tone; yelling

Bodily:

LOW = slight tension in neck or shoulders; irritable foot tapping or shaking
MODERATE = definite tension in neck or shoulders; forceful movements; arm shaking
HIGH = kicking, punching or other aggressive motion; fists balled; stomping

Fear

Facial:

LOW = eyebrows slightly raised & tightened; mouth corners drawn slightly down & back
MODERATE = eyebrows definitely raised & tightened; mouth corners definitely drawn down & back
HIGH = *both* eyebrows definitely raised & tightened *and* mouth corners definitely drawn down & back

Vocal:

LOW =slightly quavering tone of voice; whispering or cautious tone
MODERATE = statement with possible fearful/wary content; frightened "ooh", "yikes", stuttering "uhhh"s"
HIGH = "eek", yelp; statement with definite fearful/wary content

Bodily:

LOW = cautious or wary gait; slight tension; nervous twitching, hand tapping, foot swinging, etc.; diminished activity level or stilling; nervous facial movements (other than prototypical fear facial expressions)
MODERATE = slight defensive body posture; fearful tension; slight withdrawal/move backward
HIGH = definite defensive body posture, jumping back in fear; definite retreat; definite freezi

Appendix C

Finalized Operational Definitions

Emotional States
(Clark, 2016)

Category	Emotions	Behaviors
Positive	Happiness/joy, content, excitement, surprise, celebration	Smiling, laughing, giggling, positive statement, jumping, clapping, hopping, skipping, cheering
Not positive	Sad/upset, angry, aggressive, annoyed/irritated, frustrated	Frowning, scowling, pouting, negative statements, kicking, hitting, angry or frustrated expressions
Other	Concentrated, perplexed	Determined expression, hit in the face with object and surprise