THE EFFECTS OF THE LIINK INTERVENTION ON SPATIAL MEMORY

by

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ABSTRACT

The Effects of the LiiNK Intervention on Spatial Memory

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The purpose of this study was to compare spatial memory abilities between the LiiNK intervention and control schools. This study compared children by grade level, school, and school district for significant differences. Participants in first (N=100), second (N= 88), and third (N=24) grades from three Dallas- Fort Worth school districts participated in the study. Spatial memory was assessed using a spatial reconstruction task by studying a novel object array for 20 seconds then recreating the spatial layout of the characters on a blank screen. An individual t-test ($p = 0.552$) showed no significant difference between the LiiNK intervention and control groups. ANOVAs were used to compare the other independent variables which showed no difference between districts ($p>0.6$) but did show a significant difference ($p<0.01$) for mean misplacement error by grade. First graders showed more misplacement than second and third grade students over the 20 trials. This finding suggests a child's maturational level may play a bigger part in spatial memory than unstructured play at the pre-test time. Another possibility is there is a large enough gap without multiple play periods during the summer months when children are not in school that the positive changes of the LiiNK intervention will be seen more at the end of the year during the post-test than the beginning of the year with the pre-test.

BACKGROUND

Physical activity of all types affects cognitive abilities positively throughout an individual's entire life. Early intervention to develop regular play and exercise patterns is imperative for life-long practice and maintenance that benefit the whole person. By allowing children the right to play in an unstructured, outdoor environment and instilling the importance and benefits associated with physical activity the chances of those children becoming healthy, productive citizens with enhanced brain health rises dramatically. The emphasis of unstructured play allows for spontaneity of activity and movement. Without the limitations of equipment task constraints, unstructured play lends itself to larger amounts of physical activity in younger children (Burdette 2005). These opportunities let children explore movement and their environment which allow for development of problem solving and executive function (Ramstetter & Murray, 2017).

Executive Function and Learning

Executive function is the overarching term for brain functions that allow humans to rationalize, plan, and maintain mental control which is housed in the hippocampus and frontal cortex of the brain (Eslinger 1996). This is composed of skills like cognitive flexibility, inhibition, and working memory. Cognitive flexibility is defined as the ability to switch between thinking about different topics or think about multiple subjects simultaneously. Inhibition is the voluntary restraint on a direct expression of an activity (Biederman 2001). Working memory is short-term memory that is associated with immediate, conscious processing. Hillman examined the effects of an aerobic exercise after school program and on the student's (8-9 years old) cognitive flexibility and attentional inhibition. The students who participated in the aerobic fitness protocol were shown to have greater improvement in both areas in a pre- and post-test

comparison. Even more importantly, this improvement was shown to be quantity dependent- meaning that higher attendance in the fitness regimen, was correlated with larger differences seen in pre and post-test measurements (Hillman 2014).

According to the current research, spatial memory, a specific type of working memory and the aspect of memory responsible for orientation and details about one's environment, is one of the leading indicators of academic success. Baddeley (2004) examined patients with auditory memory impairments and demonstrated that they were still able to retain visual memories based on working memory tasks. This represents the idea that visual memory ability is highly indicative of actual understanding through present cognitive tasks, and therefore representative of academic ability and preceding success. Visual memory has been found to be a more permanent ability than that of auditory memory (Kane, 2004). This is based on the specificity of cognitive skills. The brain uses domain specific abilities in order to process certain tasks, and these bouts of specific tasks in working memory increase the retention with an increase in bouts. The hippocampus uses relational memory in order to improve task performance (Monti, 2015). Relational memory is similar to spatial memory in that it assists in binding arbitrary pieces of existing information together. These domain specific tasks that are processed separately are organized through the concept of relational memory (Konkel, 2009).

Children and Brain Development

During childhood and young adulthood (ages 5 - 25), aerobic activity can help improve neuron plasticity and therefore increase neuron connections and learning (Cotman, 2007). These neuron connections allow for information to be processed and retained at an improved rate. Not only does physical activity help to increase learning and memory, but also helps to maintain brain function for later in life. It has been shown that aerobic activities can decrease symptoms of

dementia and Alzheimer's. A study conducted in Denmark held a 16-week intervention with elderly patients diagnosed with these neurodegenerative diseases. The study concluded that there was a statistically significant increase in mental speed and attention, as well as an increase in feelings of self-efficacy by the participants after participating in an aerobic intervention (Wortmann & Hasselbalch, 2015).

As important as physical activity is to brain development, learning, memory, and attentional focus in children, one would hope the research shows active levels of children across America. Sadly, this is not true. The obesity rate and activity levels of children have a highly negative correlation across the United States The physical activity levels have decreased while obesity levels have exponentially increased (CDC, 2018). Texas is currently one of the leaders in the United States' adolescent obesity epidemic. In the state of Texas, one in every three children is considered overweight or obese (CDC, 2016). The recommended amount of physical activity for children in the United States is 60 minutes per day. In Texas, 30% of children have been reported to participate in this amount of activity (CDC, 2016). This 60 minutes of prescribed physical activity daily is shown to help control a child's weight, builds muscle, increase joint mobility and health, and increase bone health. Despite all of these benefits and more, less than half of the elementary-aged children in the United States currently achieve this level of physical activity due to minimizing recess during the school day (Mahar, 2011). When children are in school, recess is one of their few opportunities to participate in outdoor physical activity. It has been shown that along with increased physical health, physical activity can also positively affect a child's academic success.

School Policies and Whole Child Development

Current school policy in many schools across the country is that more time needs to be spent on reading, writing, math, and science to aid in improving academic outcomes. This has not proven to be an effective strategy at this time, although most schools still use this ideal as the gold standard in improving student learning (CDC, 2015). Interestingly, Finland is one of the few countries that has taken note of the value of unstructured play in schools and has made it a priority to maintain this play environment in schools. As a result, they are ranked much higher than the United States in math, science, and reading and have sustained this change over the last decade (Rhea, 2016). Following this positive trend, many Asian countries are embracing the Finland mindset and including at least 10 minutes of unstructured play every hour of the school day (Rhea et al., 2018). More pertinent from an educator's perspective, an increased amount of time devoted to aerobic play can positively affect academic performance or at least "is not accompanied by a decline in academic performance" (Hillman, 2008, p.60). Spending more time during the day participating in these activities is improving the academic success of a child- while also positively impacting emotional stability, socialization skills, and physical health of the child (Clark & Rhea, 2018). The time spent on physical activity and outdoor play assists in increased appropriate, focused classroom behaviors, social growth among peer relationships, and a decrease in academic and social anxiety (Ramstetter et al., 2010).

The LiiNK Project Intervention and Whole Child Effects

Due to the accolades Finland has received over the past decade for their academic achievement successes, the LiiNK (Let's Inspire Innovation 'N Kids) project was created to meet similar needs for children in the U.S. related to the whole child. The LiiNK project is implementing policy and procedural changes throughout the school day to shift the classroom

environment to a more successful model (Rhea, 2016). The initial years of the LiiNK project reinforced previous studies and validated that unstructured outdoor play decreases the amount of off-task behaviors in the classroom and increases student's listening comprehension skills. Math and reading scores over a two-year period have improved at least 2% in children participating in the LiiNK intervention compared to children in schools that do not engage in multiple unstructured play breaks each day (Rhea, 2016). Along with the increased academic scores, in the first two years of this intervention, students in grades 1 and 2 have shown character development improvements with honesty, empathy, and respect for adults (Clark & Rhea, 2017; Rhea et al., 2018). The increase in these areas are accredited to the combination of unstructured, outdoor play and Positive Action character lessons that are taught daily for 15 minutes as part of the LiiNK intervention, as well as the children's opportunity to implement these qualities into their day during unstructured outdoor play.

Jarrett (1998), demonstrated a significant difference on on-task behaviors in children who participated in as little as one bout of recess (30 minutes) during a school day. The LiiNK project has also shown similar results in a decrease of off-task behaviors as more physical activity is incorporated into the school day (Rhea et al., 2018). Even more appealing, these behaviors have persisted in students of multiple grade levels even after semester breaks and in different classroom settings (Lund 2017). The most recent data from LiiNK shows decreased attentional fatigue, measured through listening effort, in children who participate in the LiiNK protocol compared to control students (Lund et al., 2017). Attentional fatigue is a neuro-psychological concept that results from overuse of the brain's inhibitory attention mechanisms and therefore regulating on-task behaviors (Kaplan 2010). We know that auditory memory is a part of working memory that has been defined above. Working memory has a definitive time to be processed and

become a part of ingrained and permanent memory. Lund and colleagues (2017) demonstrated the important brain activity that occurs during this time of unstructured play. Children participating in the LiiNK intervention have more frequent breaks for physical activity and for their brains to store and use this working memory more effectively. This formless time allows the individual's brain to abstract the learning information in working memory and therefore be more effective at retaining information throughout the day

Physical Activity and Brain Function

Aerobic activity is shown to have many effects on brain function, such as release of neurotransmitters that increase neuron communication, decreased reaction time, and increased reading capacity, among others (Madigan, 2004). Unstructured play has been shown to mark activity in the prefrontal cortex (Kane, 2004). This area of the brain is the control center and is active in making plans and problem-solving (Rhea et al., 2016). Physical activity and play allows increased blood flow in the brain to replenish oxygen and glucose more rapidly, therefore giving the brain more "fuel" to learn new concepts and make connections with older material. Unstructured physical activity has been shown to have positive effects on learning new material; habitual physical activity has shown similar results for memory because of its effects on long-term brain health. This shows continuing with a policy intervention, like the LiiNK project, will not only increase how children are learning but also their ability to make connections within the concepts and retain the information on a more permanent basis.

Luciana & Nelson (1998) tested children with a visual spatial memory sequence while using an fMRI in order to track brain activity. During this working spatial memory task, the dorsal portion of the frontal cortex was active. An interesting connection in this study is that this is the same aspect of the brain that is active when adults are doing the same task, indicating that

use and improvement is longitudinal. This area of the of the brain is also active when learning to read and solve math problems – creating a sound foundation that spatial memory is a basis of academic success. While working memory is housed in the frontal cortex, long-term memory and explicit patterns are housed in the hippocampus (Monti, 2014). Long-term physical activity has also been shown to enhance the activity in these areas and functions of the brain, indicating that unstructured play could have a positive impact on these neural functions and the transfer of information from the frontal cortex to the hippocampus representing lasting changes in memory.

Purpose

The purpose of this study was to compare spatial memory abilities between the LiiNK intervention and control school children in grades 1, 2, and 3. This is a topic that has not been considered or measured in children of this age with this amount of daily unstructured play breaks compared to children who have minimal daily recess.

Research Question

Are there spatial memory differences by group, school district, and age as a result of differing amounts of unstructured play offered daily?

Hypotheses

Hypothesis 1: Children participating in the LiiNK intervention will show higher spatial memory scores than those of the children in the comparison population.

Hypothesis 2: Older children will show higher spatial memory scores than younger children.

Hypothesis 3: There will be spatial memory differences across school districts.

METHODS

Participants

Participants in first (N=100), second (N= 88), and third (N=24) grades from three Dallas-Fort Worth school districts participated in the study. Male (N=106) female (N= 98) students encompassed all schools in the study. The total sample of 204 can be split by school and school district as well. See table 1 for totals by group. Participants were excluded from this intervention if they were absent from school on the day of the assessment or if they are not part of the intervention process. Children who were not a part of the intervention process were those who did not attend the scheduled recesses each day or were dismissed from taking the annual standardized tests for whatever reason.

Table 1.

Number of Participants by Group, District, Grade Level, and Gender

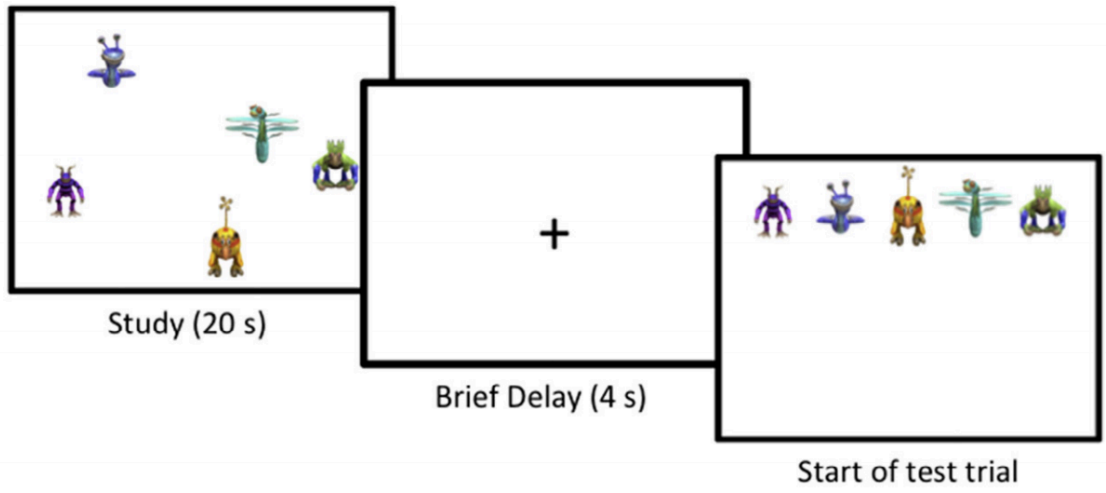
		1st grade		2nd grade		3rd grade		TOTAL
		Male	Female	Male	Female	Male	Female	
District 1	LiiNK	6	6	7	5			24
	Control	5	7	4	8			24
District 2	LiiNK	13	15	11	9	6	6	48
	Control	17	7	8	12	6	6	44
District 3	LiiNK	5	7	5	7			24
	Control	6	6	8	8			28
TOTAL		52	48	43	49	12	12	

Measures

Demographics The demographics form was used to collect data on the district, school, grade level and gender of each participant. Refer to Appendix A for the survey items.

Computerized Cognitive Task (Spatial memory task) Hippocampal Memory Function: Spatial memory was assessed using a spatial reconstruction task. The participant was asked to study an object array (containing 5 novel objects) placed at different locations on a computer

display with a white background for a period of 10 seconds. Following a 4 second interval, the objects appear at the top of the computer display and the participant is then asked to recreate the spatial layout of the objects as viewed in the study phase.



Procedures

The LiiNK Project was approved by the Institutional Review Board at Texas Christian University which can be found in Appendix B. Informed consent was received from each of the parents/guardians of the children before data collection began. A sample consent letter can also be found in Appendix B.

All participants in this study were also active participants in the LiiNK intervention. The LiiNK intervention includes 4 15-minute unstructured, outdoor play breaks throughout the school day and 15 minutes of daily character lessons.

In order to measure spatial memory, the participant was asked to study an object array, 5 novel monster characters, placed at different locations on a computer display with a white background for a period of 18 seconds (object 1). Following a 4 second interval, the objects appear at the top of the computer display (object 2) and participants are then asked to recreate the

spatial layout of the objects as viewed in the study phase. This occurs five times, each participant moved through the 5 screen process in a four phase order, allowing each participant up to 20 trials over a single 20-minute time period. This task was developed, and used in coordination, with Dr. Khan from the University of Illinois (Hillman & Khan, 2014).

As mentioned above, children were pulled from their classroom in groups of four-six at a time and taken to the assigned testing room. Once at the room, they sat down at a desk that has a trained test administrator and a computer. The task was already pulled up on the screen and explained by the administrator. The subject completed the task prompted by the actions on the screen. If the participant got stuck, the task administrator prompted them to move on after roughly 20 seconds.

The computerized assessment (spatial memory) is a random sample design and only requires four students (two males and two females) to be pulled from each grade level classroom for a total of 24-30 per grade level at each school. This task takes no more than 20 minutes to complete and only four students are disrupted from any particular class to do this task at a time. Dates and times were approved by teachers and administrators before completing the assessment in both intervention and comparison school settings.

Statistical Analysis

This is a quantitative cross-sectional design. An independent t-test was used to examine differences between the intervention and control schools on spatial memory. A one-way ANOVA was used to examine differences by grade and school district for spatial memory.

RESULTS

The research question asked: Are there spatial memory differences by group, school district, and age as a result of differing amounts of unstructured play offered daily? The data was analyzed using a variety of error metrics. If a subject 'swapped' two of the novel characters, their error misplacement drastically increased and was unrepresentative of their spatial memory ability. The data shown in Figures 1-3 has taken this swap misplacement into account. An independent t-test showed no significant intervention effects at the time of data collection

($p = 0.552$). Figure 2 shows the mean misplacement scores for the intervention and control groups. A one-way ANOVA was calculated for spatial memory differences by age (shown by grade level) and school district. Through the ANOVA, Figure 1 showed 2nd and 3rd graders had significantly lower misplacement scores than 1st graders after adjusting for swap errors ($p < 0.01$). There were no significant differences between 2nd and 3rd grade misplacement scores ($p > 0.16$). Figure 3 shows no significant differences between school districts based on the ANOVA's misplacement factor score ($p \geq 0.6$).

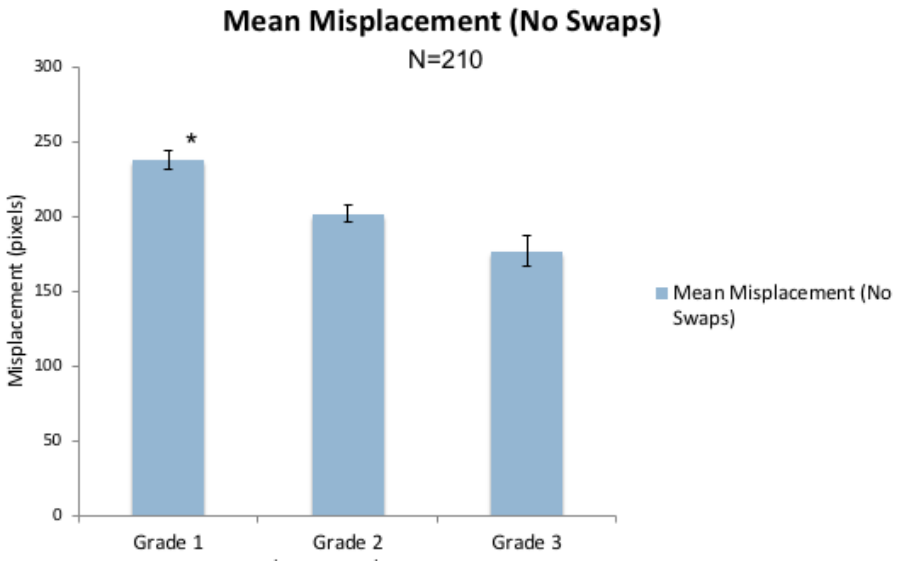


Figure 1

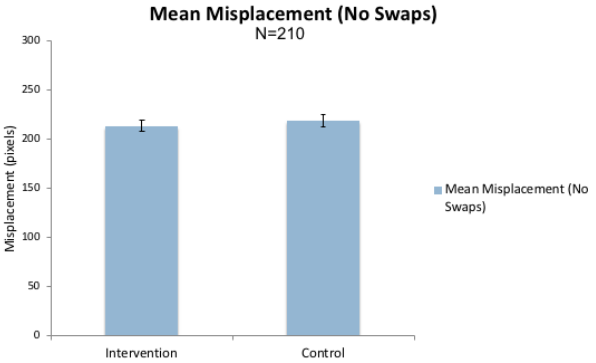
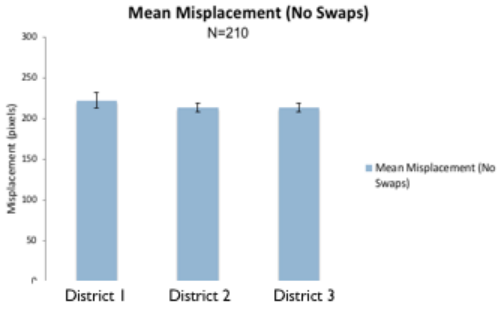


Figure 3>

< Figure 2



DISCUSSION

The purpose of this research study was to investigate the effects of unstructured play on spatial memory abilities in elementary-aged children. The results of this study showed that the only significant difference within all differences tested was higher spatial memory abilities by grade level. Second and third-grade children were significantly higher in spatial memory than the first-grade children. This finding suggests a child's maturational level may play a bigger part in spatial memory than the intervention at this point.

Anecdotally, when completing data collection for this study younger children most certainly required more prompting when completing the task. This shows the possibility that the task used during this study might be more difficult for first graders and therefore did not accurately depict their abilities.

The lack of significance between intervention and control programs offer a multitude of insights into reasoning. Unstructured play leads to a host of positive changes in children including: a decrease in attentional fatigue, an increase in classroom focus and emotional stability, and a slight improvement in academic achievement (2-4%). These outcomes are a result of a full school year with a pre and post-test. This study examined the beginning of the year two-month segment to see if the intervention impacts children from the beginning of the year or if it

is just an end of the year change. This study showed that the changes are not as a result of introducing the intervention to the children. It will be interesting to see if changes happen at the end of the year for the accumulation type effect instead.

While all of these outcomes can be attributed to unstructured play over a year period of time, it is possible that spatial memory needs a one-year pre and post-test as well. Khan and colleagues showed that pre and post testing of spatial memory with an aerobic intervention did bring about significant differences (2014). With this set of data being considered the first data point in a longitudinal study, the early time point (two months into the intervention) has been shown to have no significance between intervention and control children. One other consideration with these findings is that there is a large enough gap in intervention procedures during the summer months when children are not in school that the positive changes of the LiiNK intervention are then negated by a lack of unstructured play during the summer break.

Future Considerations

This study focused on a cross-sectional sample from a larger longitudinal study. Based on the findings of this study, more research is needed in order to understand the larger overall effects of the intervention over time. A post-test in late spring needs to be included in order to understand accumulation effects better. It might also be beneficial to test the participants in the morning and then again in the same afternoon for play effects with spatial memory over a full day.

Works Cited

Baddeley, A. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences,4*(11), 417-423. doi:10.1016/s1364-6613(00)01538-2

Barr-Anderson, D. J., Auyoung, M., Whitt-Glover, M. C., Glenn, B. A., & Yancey, A. K. (2011).

Integration of Short Bouts of Physical Activity Into Organizational Routine. *American Journal of Preventive Medicine*, 40(1), 76 93.doi:10.1016/j.amepre.2010.09.033

Biderman, J., Hirshfeld-Becker, D.R., Rosenhaum, J.F., Hérot, C., Friedman, D., Snidman, N., Faraone, S. V. (2001). Further Evidence of Association Between Behavioral Inhibition and Social Anxiety in Children. *American Journal of Psychiatry*, 158 (10), 1673-1679. doi:10.1176/appi/aip 158.10.1673

Burdette HL, Whitaker RC. Resurrecting Free Play in Young ChildrenLooking Beyond Fitness and Fatness to Attention, Affiliation, and Affect. *Arch Pediatr Adolesc Med.* 2005;159(1):46–50. doi:10.1001/archpedi.159.1.46

Center for Disease Control and Prevention. (2018, January 29). Retrieved from https://www.cdc.gov/healthyschools/obesity/facts.htm

Cotman, C. W., Berchtold, N. C., & Christie, L. (2007). Exercise builds brain health: Key roles of growth factor cascades and inflammation. Trends in Neurosciences, 30(9), 464-472. doi:10.1016/j.tins.2007.06.011

Eslinger, P. J. (1996). Conceptualizing, describing, and measuring components of executive function: A summary. In G. R. Lyon & N. A. Krasnegor (Eds.), *Attention, memory, and executive function* (pp. 367-395). Baltimore, MD, US: Paul H Brookes Publishing.

Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: Exercise effects on brain and cognition. *Nature Reviews Neuroscience, 9*(1), 58-65. doi:10.1038/nrn2298

Hillman, C. H., Pontifex, M. B., Castelli, D. M., & Khan, N. A. (2014). Effects of the FITKids Randomized Controlled Trial on Executive Control and Brain Function. *Pediatrics,134*(4). doi:10.1542/peds.2013-3219d

How much physical activity do children need? (2015, June 04). Retrieved March 2 , 2018, from https://www.cdc.gov/physicalactivity/basics/children/index.htm

Kane, M. J., Hambrick, D. Z., Tuholski, S. W., Wilhelm, O., Payne, T. W., & Engle, R. W. (2004). The Generality of Working Memory Capacity: A Latent-Variable Approach to Verbal and Visuospatial Memory Span and Reasoning. *Journal of Experimental Psychology: General,133*(2), 189-217. doi:10.1037/0096-3445.133.2.189

Kaplan, S., & Berman, M. G. (2010). Directed Attention as a Common Resource for Executive Functioning and Self-Regulation. *Perspectives on Psychological Science,5*(1), 43-57. doi:10.1177/1745691609356784

Konkel, A., & Cohen, N.J. (2009). Relational memory and the hippocampus: Representations and methods. *Frontiers in Neuroscience, 3*(2), 166-174. doi: 10.3389/neuro.01.023.2009

Luciana, M., & Nelson, C. A. (1998). The functional emergence of prefrontally-guided working memory systems in four- to eight-year-old children. *Neuropsychologia,36*(3), 273-293. doi:10.1016/s0028-3932(97)00109-7

Lund, E., Brimo, D., Rhea, D., & Rivchun, A. (2017). The Effect of Multiple Recesses on Listening Effort: A Preliminary Study.

Madigan, J. B. (2004, September). The New Recess Model. *Texas Elementary Principal and Supervisors Association Journal.*

Mahar, M. T. (2011, January 31). Impact of short bouts of physical activity on attention to-task in elementary school children. *Preventive Medicine*, 52, 60-64. doi:10.1016/j.ypmed.2011.01.026

Monti, J. M., Cooke, G. E., Watson, P. D., Voss, M. W., Kramer, A. F., & Cohen, N. J. (2015). Relating Hippocampus to Relational Memory Processing across Domains and Delays. *Journal of Cognitive Neuroscience,27*(2), 234-245. doi:10.1162/jocn_a_00717

Ramstetter, C. L., Murray, R., & Garner, A. S. (2010). The Crucial Role of Recess in Schools. *Journal of School Health,80*(11), 517-526. doi:10.1111/j.1746-1561.2010.00537.x

Ramstetter, C., & Murray, R., Dr. (2017). Recognizing the Benefits of Recess. *American Educator,*17-23.

Rhea, D.J. (2016). Recess: The forgotten classroom. *Instructional Leader Journal*, 29 (1), 2-6.

Rhea, D., & Clark, L. (2017). The LiiNK Project®: Comparisons of Recess, Physical Activity, and Positive Emotional States in Grades K-2 Children. *International Journal of Child Health and Nutrition,6*(2), 54-61. doi:10.6000/1929-4247.2017.06.02.1

Rhea, D.J., Rivchun, A.P., & Pennings, J. (2016). The Liink Project: Implementation of a Recess and Character Development Pilot Study with Grades K & 1 Children. *Texas Association of Health, Physical Education, Recreation, & Dance Journal* (TAHPERD), 84 (2).

Rhea, D. J., & Rivchun, A. P. (2018). The LiiNK Project®: Effects of Multiple Recesses and Character Curriculum on Classroom Behaviors and Listening Skills in Grades K–2 Children. *Frontiers in Education,3*. doi:10.3389/feduc.2018.00009

Texas State Nutrition, Physical Activity, and Obesity Profile. (2016, September 07). Retrieved March 19, 2018, from https://www.cdc.gov/nccdphp/dnpao/state-local-programs/profiles/texas.html

Wortmann, M. (2015, July 23). World Alzheimer report 2014: Dementia and risk reduction. Alzheimer's & Dementia, 11(7). doi:10.1016/j.jalz.2015.06.1858

Appendices

a. Example demographics form

Date:		10/5/17					
School District:		2			School:	Intervention	
Station Number:		1					
Grade Level	Teacher	Participant Name	Participant #	Counterbalance	Sex	Ethnicity	Blocks complete
(K,1,2,3)				(A/B)	(M/F)	(W,H,AA,O)	
1	A		3713	A			
1	B		313	A			
2	C		8013	A			
2	D		8513	A			
1	E		2413	A			
2	F		10613	A			
1	G		5513	A			
					School:	Comparison	
1	H		8816	A			
1	I		12216	A			
2	J		4816	A			
2	K		6116	A			
2	L		12616	A			
1	M		2816	A			

b. Sample Consent Letters

PARENT'S PERMISSION TO PARTICIPATE IN RESEARCH

Title of Research: Liink Project (Let's inspire innovation 'N kids)

Funding Agency/Sponsor: TCU, Walsh Foundation, Andrews Foundation, Fox Foundation

Study Investigators: Dr. Debbie Rhea, Alex Rivchun, Dr. Stephanie Jevas, Dr. Jackie Pennings, Dr. Danielle Brimo, Dr. Emily Lund, Katie Trolinder, Diana Schwene, Laura Clark, David Farbo, April Long, Dr. Kathy Cammarata, Carol Bollinger, Kim Jones, Dr. Nicole Stroud, Cathy Wells & Aubrey Goodwin.

What is the purpose of the research? To examine the effectiveness of a combined recess and social/character development intervention to produce a more inclusive, equitable and effective learning environment for K-8 level children longitudinally

How many children will take part in this study? This study includes all grade level participants from each participating school (approximately 250 students from each school).

What is me and my child's involvement for taking part in this study? Because this is a school-initiated change to structuring, the only necessary involvement will be for your children to follow standard school protocol for the character development curriculum and the three to four – 15 minute unstructured outdoor recesses daily. The other involvement is participating in the character development questions related to school connectedness, prosocial behaviors, respect for adults, honesty, children's empathy, bullying, and engagement and disaffection with learning. Each child will answer the questions with either a yes, no, or sometimes. An example of a question is "I enjoy coming to school." We may also videotape occasionally the recess area or the classroom for educational purposes only. This means we will use the footage to validate behaviors that we observe in the classroom or on the playground.

For how long is my child expected to be in this study, and how much of my child's time is required? Because the project is school initiated, no extra time will be required of your child. There is no designated termination time for the intervention changes as they will be daily procedure. The survey questions will be asked verbally at the beginning and the end of the school year and will only take five minutes per session with 7 sessions taking place during a week at the beginning of the year and a week at the end of the year.

What are the risks of taking part in this study and how will they be minimized? There is minimal risk associated with this study. Because this falls under an institutional pilot, school counselors will be aware of the fitness testing protocols, character development curriculum, and recess observations, and will be made available for any students seeking assistance. Recess in numerous research articles has been a main concern with teachers and administrators because this is one of the heightened areas for bullying to occur. We are all mindful of this going into the intervention. These articles have commented that having recess without an understanding of how to behave is the key issue. We feel as a result of incorporating the character development curriculum into the school day each week throughout the year and each of the following years, the students will be much more responsible and less bullying will occur. Teachers will be trained on watching for this during recess as well as counselors will be trained on how to work with the students once the students have been identified who are bullying. We realize there can also be some risk with anonymity and that it could be violated. We are taking every precaution through removing names on all data entered into the SPSS file, keeping data locked up in a secure location, using qualtrics to collect survey data in order to keep it more secure.

What are the benefits for taking part in the study? Implementation of this curriculum can possibly improve classroom focus (the ability to follow through or complete tasks), improve attention to process rather than focus strictly on outcome, decrease discipline issues, improve attendance, decrease the number of students diagnosed with ADHD and other related learning disabilities, and improve academic performance in math, science, and language arts. Results of this project could contribute to the advancement of educational systems and reform to better serve the needs of enrolled children.

Will I be compensated for taking part in the study? There is no compensation except for the possible benefits listed above.

What is an alternate procedure(s) that I can choose instead of having my child take part in this study? There are no alternate procedures that will occur. Your child will follow all of the protocol because it is a school requirement for character development responses, but if you decline your child's participation in the data being reported to TCU for evaluation, then there will be no alternate procedures for that either.

How will my child's confidentiality be protected? Names will be protected and only researchers will have access to reports on specific measures provided by schools listed above. For data accumulation and analysis purposes all names will be removed. After data is collected, analysis will be run and paper forms will be stored in safe cabinet to protect the participant's information until all data analysis have been run. Then answers will be shredded. Any data on Qualtrics or other recording sites will be virtually locked because of password protection. The only individuals who will have access to qualtrics data are the statistician, Dr. Jackie Pennings, Dr. Debbie Rhea, the project director, and Alex Rivchun, the project manager.

Is my child's participation voluntary? Yes, completely voluntary.
Can my child stop taking part in this research? You can tell us that you don't want your child's responses on surveys included in the data analysis. Your child will be included in

character development curriculum and extra unstructured recesses daily. Teachers will be monitoring the playground while the students are outside at recess.

What are the procedures for withdrawal? Tell the teacher that you no longer want your child's responses included in the data analysis.

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

Who should I contact if I have questions regarding the study? Dr. Debbie Rhea, Principal Investigator, TCU, 817-257-6861, d.rhea@tcu.edu

Who should I contact if I have concerns regarding my child's rights as a study participant?
Dr. Dennis Cheek, Chair, TCU Institutional Review Board, Phone 817 257-6749.
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 allowed your child to participate in this research, and you understand that you are not giving up any of your legal rights.

Child's Name (please print): _____ Date of birth:_____

Parent's Name (please print): _____

Parent's Signature: _____ Date:_____

Investigator's Signature: _____ Date:_____

CONSENT TO PARTICIPATE IN RESEARCH

Title of Research: Liink Project (Let's inspire innovation 'N kids)

Funding Agency/Sponsor: TCU, Walsh Foundation, Andrews Foundation, Fox Foundation

Study Investigators: Dr. Debbie Rhea, Alex Rivchun, Dr. Stephanie Jevas, Dr. Jackie Pennings, Dr. Danielle Brimo, Dr. Emily Lund, Katie Trolinder, Diana Schwene, Laura Clark, David Farbo, April Long, Dr. Kathy Cammarata, Carol Bollinger, Kim Jones, Dr. Nicole Stroud, Cathy Wells & Aubrey Goodwin.

What is the purpose of the research? To examine if the implementation of character development curriculum and extra recesses daily will decrease teacher burnout as children become more in touch with appropriate behaviors through character development and unstructured recess breaks.

How many people will participate in this study? This study includes all grade level teachers from each participating school (approximately 15 teachers per school)

What is my involvement for participating in this study? You will be submitting responses to a teacher burnout scale. There are 20 questions that you will submit responses to at the end of each of the next five years.

How long am I expected to be in this study for and how much of my time is required? The time required is all part of the school day that is required of your employment. No extra time is required. You will respond on an itouch provided to you through the qualtrics online survey system. Your responses are blinded.

What are the risks of participating in this study and how will they be minimized? If you find that you are becoming more burned out as a result of answering the questions, it could make you doubt your teaching ability or at the worst, make you want to quit teaching. We are hoping if we identify that burnout is occurring, we can step in with some interventions to help you cope and better equip yourself with adjusting your teaching to the students or extra expectations that might be burning you out. We realize there can also be some risk with anonymity and that it could be violated. We are taking every precaution through removing names on all data entered into the SPSS file, keeping data locked up in a secure location, using qualtrics to collect survey data in order to keep it more secure.

What are the benefits for participating in this study? Implementation of this curriculum can possibly improve classroom focus (the ability to follow through or complete tasks), improve attention to process rather than focus strictly on outcome, decrease discipline issues, improve attendance, decrease the number of students diagnosed with ADHD and other related learning disabilities, and improve academic performance in math, science, and language arts. Results of this project could contribute to the

advancement of educational systems and reform to better serve the needs of enrolled children, and ultimately lead to more satisfied teachers.

Will I be compensated for participating in this study? There is no compensation except for the possible benefits listed above.

What is an alternate procedure(s) that I can choose instead of participating in this study? There are no alternative procedures for this study since the changes are school based changes.

How will my confidentiality be protected? We are using qualtrics which is a survey online system. Your responses will be completely confidential. No individual responses will be reported to anyone. Only results from the groups will be reported.

Is my participation voluntary? Your participation is completely voluntary.

Can I stop taking part in this research? You may stop answering the burnout survey at any time without any concern for punishment or negative backlash.

What are the procedures for withdrawal? If you don't want to participate in the survey response at the end of the year, you just don't submit your responses through qualtrics. No one will hound you to submit responses.

Will I be given a copy of the consent document to keep? Yes, you will receive a copy of this document.

Who should I contact if I have questions regarding the study? Dr. Debbie Rhea, lead researcher, TCU, d.rhea@tcu.edu or 817-257-6861.

Who should I contact if I have concerns regarding my rights as a study participant?
Dr. Dennis Cheek, Chair, TCU Institutional Review Board, Phone 817 257-6749.
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:_____