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The Impact of Vigorous Physical Activity on Preschool and Kindergarten Children's On-Task
Behavior and Focus

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in fulfillment of final requirements for the MAED degree

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I am filled with gratitude for the teachers I work with, the school that has provided a great educational experience for me, and most of all, the children I have shared the Montessori classroom with for over a decade. I am very grateful to St. Catherine University and my family for helping me fulfill a long-held dream.

Abstract

This study aims to investigate the impact of daily moderate to vigorous physical activity on preschool and kindergarten-aged children's on-task behavior and focus. The research took place over four weeks in a Montessori early childhood classroom with 15 children aged three to six. Each day, children participated in 12-15 minutes of physical activity, including running, jumping and marching, vigorous enough for them breathe hard. The researcher used both quantitative and qualitative data tools to examine effects on ability to focus and to be on-task during the following two hours. The increased movement had a positive impact on the children's transition to the next activity and on the rate of children being on task for up to two hours. Continued research is needed to determine effectiveness on focus.

Keywords: on-task, focus, Montessori, preschool, kindergarten, early childhood, movement, physical activity

Children come into the world ready to move their bodies, and while their specific movements will grow and become more refined, their drive to be physically active remains an important force throughout childhood. Preschools typically present many opportunities for children to develop gross motor skills, including walking, sweeping or carrying a bucket, and fine motor skills such as drawing, painting or molding clay. However, an indoor environment is not always conducive to allowing children to run vigorously or engage in enough movement to breathe hard.

In the Montessori school where the researcher has taught for over a decade, she and her fellow teachers have endeavored to create opportunities for children to be active. Over the last 14 years, they noticed that more children seemed to need to move more often and more vigorously than in the past, which could be reflective of the national trend towards children having less time or opportunities for physical activity (Savina et al., 2016). Their school implemented longer recesses at both midday and in the afternoon, and created a culture that allowed children to take the opportunity to carefully run around the elliptical outline of the circle-time rug if there were no other children using the space.

When the school reopened after the months-long closure for the coronavirus pandemic, it seemed that their students not only needed to move more, they had a more difficult time settling into focused, engaged activities and staying on-task during the morning. Several children developed a habit of seeking to run about 10 minutes after they arrived; they would ask the researcher if they could run, and with approval, would silently and carefully run until she could hear them breathing hard. The children would then stop, smile, and walk off to calmly find an activity.

The Action Research Project the researcher developed grew out of observations of children's increased need to move vigorously in combination with her school's concern at what appeared to be an increased difficulty in engagement with classroom activities. The preschool and kindergarten program is based in Montessori philosophy, which places children in three-year age grouping. Because of the age range, the types of activities or "lessons" chosen could vary widely, as some children might have built a wooden tower out of pink cubes while another created a map of Europe and a third child solved multiplication problems with sets of beads.

The research was conducted in a classroom of 15 children aged three-to-six during the winter months, when children have even less opportunity for physical activity due to the cold and snowy Montana environment. The project examined the effect of increased physical activity in a Montessori early childhood classroom on focus and on-task behavior. Each day of the research, children were invited to join in a group activity of 12-15 minutes of moderately vigorous physical activity. The intervention was followed by the classes' usual circle time and the morning work time, when the researcher surveyed the children's focus and engagement in the activities they chose to do that day.

Theoretical Framework

Children need to move and be active, and many child development, medical and educational perspectives support the need for young children to engage their bodies and move (Muth, 2020; NAEYC, 2020; Savina et al. 2016). The researcher's desire to study the effects of increased activity on her students' ability to concentrate and engage in on-task behavior was seen through a theoretical framework of neurobiology. A neurobiological framework regards movement and physical activity as vital to the growth, development and maintenance of a

healthy human body. The brain, as a critical component of a vertebrate's body, is likewise affected by movement.

Children's developing brains are positively impacted by the release of neurotransmitters which is triggered by physical activity (Wegner & Ohlberger, 2015). Neurotransmitters are chemicals within a body that have near-term effects on brain function and include dopamine, norepinephrine and serotonin (Hoza, 2014). Wegner and Ohlberger (2015) also stated that physical activity increased blood flow to the brain and the effect was most dramatic when there was change from resting to motion, such as when children who had been sedentary got up and vigorously moved in a classroom. Neurotransmitters also influence memory and learning, and assist in the consolidation and connection of memories (Thompson, 1986).

Movement activates various parts of the brain, which has been shown to increase concentration, memory and overall cognition (Wegner & Ohlberger, 2015). The activation, from increased oxygen and nutrients circulating in the brain from increased blood flow, improves the awakened or alert state needed for concentration and cognition. One study specifically emphasized how moderate-to-vigorous physical activity, which resulted in hard breathing and indicated increased blood circulation and oxygenation, played an important role in the improvement of concentration, cognition and memory formation (Hoza, 2014).

The research project was developed with consideration of the need for young children to experience increased physical activity and exertion to improve their ability to engage in and focus on their learning opportunities. The Literature Review below indicates there is compelling data to indicate the relevance and validity of the project.

Review of Literature

To spend time in a Montessori preschool is to see children in motion. In the primary classroom, a visitor might see two children working on a puzzle together while another is counting small beads; meanwhile, two could be purposefully walking between two spots as they transfer blocks or other materials to their work space. Yet another could be walking around, and maybe even jumping up and down, as she talks to a few friends. Maria Montessori emphasized the need for children in an early childhood classroom to have the opportunity to learn through movement. She created specific lessons to help children develop both gross motor skills and fine motor skills; the opportunity to utilize these skills are a central tenet of Montessori preschools (Lillard, 2005). In fact, daily opportunities for gross motor activity and skill development are considered a core component of all quality early childhood education programs, according to the National Association for the Education of Young Children (NAEYC, 2020).

Professional childcares and preschools consider physical activity and gross motor movement to be especially important because the physical activity level for children in the United States has decreased. As many as half of all preschool-aged children are not achieving the recommended amount of moderate to vigorous physical exertion on a daily basis (Savina et al., 2016). The 2018 U.S. Department of Health and Human Services' Physical Activity Guidelines for Americans recommended 180 minutes per day of physical activity for preschool aged children, and called on caregivers, including preschool teachers, to promote daily activity, from light to vigorous levels (U.S. Department of Health and Human Services, 2018). The American Academy of Pediatrics noted that many children had not achieved this level of activity, and recommended pediatricians encourage parents and caregivers to facilitate young children obtaining an average of 15 minutes of physical activity per hour (Muth, 2020).

As a result, educators have explored approaches to increase physical activity and researchers have examined the effects of increased movement and activity in schools and classrooms (e.g. Goerg, 2016, Hill, 2010, Mahar et al., 2006, Shoval et al., 2018). Researchers have tried to determine if presenting options for increased movement could have implications for children's attention, focus and concentration, memory, and overall cognitive functions. A review of literature shows that studies document possible benefits to children's learning experiences from higher levels of activity.

Increased large motor activity in classrooms has been investigated in three main ways: individual activities that children chose at different times to increase gross motor movement (Fuchs, 2015; Goerg, 2016; Shoval et al., 2018); intentionally increasing recess with accompanying strategies for promoting greater levels of movement during recess (Savina et al., 2016; Shoval et al., 2018); or all-group movement breaks conducted during classroom time (Hill et al., 2010, Mahar et al., 2006; Savina et al., 2016). While mindfulness lessons such as yoga or meditation have also been studied for the impacts on children's engagement and learning, this review is focused on intentional increases in moderate to vigorous activity during the school day.

Purposeful Large Motor Activity

When given an opportunity to engage in gross motor activities in Montessori schools, young children may choose these throughout their classroom time (Fuchs, 2015). Montessori classrooms intentionally foster the opportunities for preschool-aged children to develop and refine their gross motor skills. Fuchs (2015) emphasized the importance of movement to implementation of Montessori philosophy in an early childhood classroom. She described the benefits children ages three to six experienced, including a developed sense of order, improved coordination, concentration, and growth in cognition, when movement activities were part of the

curriculum. The curriculum included specific lessons that a child could choose when he or she felt compelled to move their bodies. She highlighted that movement is tied to cognition; developmentally, children need the skills of controlled movements of their bodies as well as the enhanced cognitive skills that accompany movement (Lillard, 2005).

A study that examined the impact of increased access to gross motor lessons and activities preschool-aged children in a Montessori classroom did not document significant increased levels of concentration (Goerg, 2016). However, Goerg found the opportunity to seek out and use jumping or controlled walking activities did reduce the variability or range of concentration levels for some children during each day. The movement may have moderated the swings in levels of concentration.

In contrast to Goerg's study in a Montessori early childhood classroom (2016), Shoval et al. (2018) documented improved academic performance in kindergarten children when they had access to a specialized area of the classroom which offered opportunities to move. Children could choose different activities inside the classroom such as an obstacle course or pairing large motor movements with cognitive instruction, such as writing large numbers on the rungs of a ladder of the climbing structure. The impact of the increased movement activities was measured by utilizing mathematical assessments and reading comprehension tests. Researchers concluded that one of the factors leading to the documented academic gains was that more opportunities for controlled movements in the day increased "physiological arousal" (p. 364) which improved attention and concentration.

Recess: Increased Unstructured Activity

Researchers have studied recess to consider if the relatively unstructured opportunity to run, jump, climb and be active, without the direction of a specific mandate, influenced children's

ability to successfully engage in learning upon returning inside to the classroom (Savina et al., 2016; Shoval et al., 2018; Stapp, 2018). While Shoval et al. (2018) found positive benefits of structured activities, they were not able to document improved concentration or academic performance from increased unstructured activities. They found that kindergarten classes that had the opportunity for up to 90 minutes per day of what they called “movement for its own sake” (p. 363), rather than structured and teacher-directed movement, did not demonstrate the same academic gains. However, on-task behavior was shown to improve when children had recess time and were physically active during that time (Barros et al., 2009).

Targeted Intervention to Increase Movement

Another manner of increasing children’s movement during their time at a school, including preschool, is to have short breaks from regular classroom work to offer or even encourage children to partake in a vigorous group exercise activity. Short exercise breaks of 10-15 minutes for the group can significantly improve on-task behavior, according to Savina et al. (2016).

A study of over 200 elementary-aged children found that a classroom-based intervention to increase activity, which researchers called “Energizers,” improved participating children’s on-task behavior in the period of time afterward (Mahar et al., 2006). The energizing activities were drawn from a prescribed set of physical activity options that included jumping jacks, marching in circles around each student’s desk, or flapping arms like a flying bird. After the physical activity intervention, students’ behavior was observed to note whether they were on-task or talking, interrupting the teacher or other students, making noises, or passively reacting by not doing the lesson or classroom activity. Students in each grade from kindergarten through fourth grade

demonstrated improved on-task behaviors following the interventions when compared to the baseline data collected prior to the use of the physical activity breaks.

Mahar et al. (2006) also documented more improvement in on-task behavior with the children who were considered the most disruptive. As they note, children who struggle to stay focused and on-task are frequently those who “may cause the most disruption in learning” throughout the classroom (p. 2093). Thus, a decrease in their off-task activities can have a positive effect on the learning environment for all the students.

A German investigation of the impact of increased physical movement in the classroom utilized an intervention of 5-8 minutes of exercises (Wegner & Ohlberger, 2015). The participants were 11- to 13- year-old students whose self-assessments and surveys indicated increased focus and willingness to learn. When longer exercise breaks of 15 minutes during the school day were investigated in a United Kingdom study, the 1,200 participating elementary school students demonstrated an increase in cognitive performance (Hill et al., 2010). The researchers attributed the gains in cognitive and academic function to increased arousal and attention (Hill et al., 2010).

In summary, a variety of approaches to increase children’s movement and exertion may positively impact children’s ability to stay on-task and increase their concentration, i.e., to participate effectively in a school setting. While not every study demonstrated significant changes, several contain compelling evidence of the benefit to children’s daily school experience, especially from short breaks from normal classroom routine that increase physical activity, thereby potentially increasing children’s alertness.

Methodology

The researcher conducted a classroom action research project that included observation, student self-assessment, a classroom wide on-task behavior tally, and daily teacher field notes. The population for the study was a group of 15 children enrolled in an early childhood class at a Montessori school in a mid-sized Montana university town. The class was composed of eight girls and seven boys whose ages ranged from three to six years. Eleven children were enrolled for five full-days, one child was enrolled for four full days, and three children were enrolled for three full days per week. Parents of students were given passive consent forms in advance of the start of the research. All parents chose to allow their children's data to be included.

Each day for four weeks, the researcher implemented the intervention during the morning session with her students. When all students that were expected to attend that day had arrived, at approximately 9:10 am to 9:20 am, she played the music box to indicate that it was time for children to go to their cubbies, put on a face mask, and proceed to the circle area. Children came into the adjoining room which held an elliptical-shaped rug that covered most of the floor space. The children each sat down around the outer edge. When everyone had arrived, the researcher asked them all to stand.

Using the bongo drum, the researcher drummed a slow beat and the children began walking around the ellipse. She increased the pace a little and asked them to march, with knees high. After a minute, she said it was time to tiptoe, and drummed a light beat. Then she increased the beat until all the children were able to move fast enough to have a slow gentle run. The researcher beat at this pace for about two minutes, and then stopped. Next, she asked them to face the middle and get ready to jump: first 5 times to the drum; then 10, 15, and finally 20. Then she drummed a random, fast beat which they called "popcorn": the children jumped happily until

the researcher stopped drumming, which was usually when she could hear heavy breathing through their masks and she observed them slowing down.

In the next phase, the researcher turned on a CD with a series of 12 short tunes which the children had learned to associate with different paces or ways of moving. The children were familiar with the songs on the CD and the accompanying movements because the series of songs were used regularly throughout the year, although not consistently at the same time of the day nor every day as in the intervention. The movements were to: walk slowly heel-to-toe, tip toe like a kitty, march, run like a deer, gallop like a horse, skip, walk slowly like an elephant while swinging a trunk, stand in one place and move back and forth as if skating, hold hands up high then float hands down in synch with the music like leaves in the wind, dance like a fairy, and finally, to rest in child's pose. At the conclusion, the researcher turned off the CD and asked the children to slowly and silently sit up with their legs crossed, ready to begin circle. The intervention took 12-15 minutes each day, varying slightly because of the need to pause for a shoe that came off or a mask that came down.

When the normal morning circle activities adjourned, children were dismissed to go back to lessons they had started, some to eat morning snack, and others to begin new work. The researcher waited 10 minutes for the children to transition to their lessons, then she began data collection.

Data Collection

During the first week, the researcher collected baseline data, using all four of the data tools used during the intervention weeks. The only exception was that during the baseline data collection week, she did not ask children the last question on the self-assessment form, which

probed their opinions on the intervention itself. During the second, third and fourth week, she conducted the intervention each day and utilized the data tools as described below.

The first data tool used was the On-Task Behavior Tally Sheet, Appendix A, which the researcher used every 20 minutes during the morning, from approximately 9:45 to 11:20 am, for a total of four or five data points per day. She waited 10 minutes after children were dismissed from the circle and had been able to choose their activity or work. Then she visually surveyed the two connected rooms that comprised our classroom and counted how many children were not on-task. Children were considered “on-task” if they were in front of lessons or activities. They were considered to not be on-task if they were wandering, interrupting other students or misusing materials. Transitioning students, for example, those just returning from the bathroom or completing snack, were considered on-task if they were moving intentionally and were not actively disrupting other children.

The researcher set a timer on her cell phone to ring every 20 minutes so that she would be able to do the count of on-task versus off-task children and then go to her notebook to write down the tally. The phone was always out of sight of the children in a large pocket and set on a very low-ringer volume so that children did not actually hear it.

Every morning the researcher utilized an On-Task Behavior Log, Appendix B, to assess the degree of focus and on-task behavior demonstrated by individual children. She observed up to five children per day and all children at least once per week, to the extent possible given children’s absences throughout the four weeks, which were intensified over previous years because of Covid-19 protocols. The Behavior Log provided an opportunity to observe individual children during the morning work period following the intervention. The researcher noted qualities of children’s focus and on-task behavior, including if they were: at lesson, physically

engaged, eyes on the materials, moving the materials or doing the activity; at lessons with eyes moving around the room, fiddling with materials or not touching; at lesson and talking to other children nearby; misusing the materials; wandering away from the lesson; or wandering for more than five minutes without choosing or participating in an activity.

The third data tool was a Daily Field Log, Appendix C, designed to provide insight into the intervention and the daily classroom activity. This was completed daily, as soon as possible and no later than before the researcher left school. The field notes were intended to provide qualitative information about children's focus, engagement, and any information that could be relevant regarding the implementation of the intervention.

Once a week, all children were provided the opportunity to give a self-assessment via oral question/discussion with the researcher utilizing the fourth data tool, Student Self-Assessment on Focus and On-Task Behavior, Appendix D. Children were asked to respond individually, although sometimes other children stood nearby to listen and observe. Children were able to reflect and comment on whether they thought they chose and finished their lessons, rather than leave before done; whether they focused on their own work without bothering or interrupting other children; and whether they were able to choose "challenging work."

Challenging work is the phrase used in the researcher's school to help children identify activities that are new, engaging, or in the zone of proximal development, to appropriately challenge themselves. Children were asked to respond by pointing to a sheet with a green thumbs-up for yes, yellow sideways thumb to indicate so-so or maybe, and red thumbs-down for no or not at all (Appendix E). The final question probed their thoughts on the intervention, asking how they felt after they did the increased movement intervention each morning. The exact words or actions they responded with were noted on the assessment form.

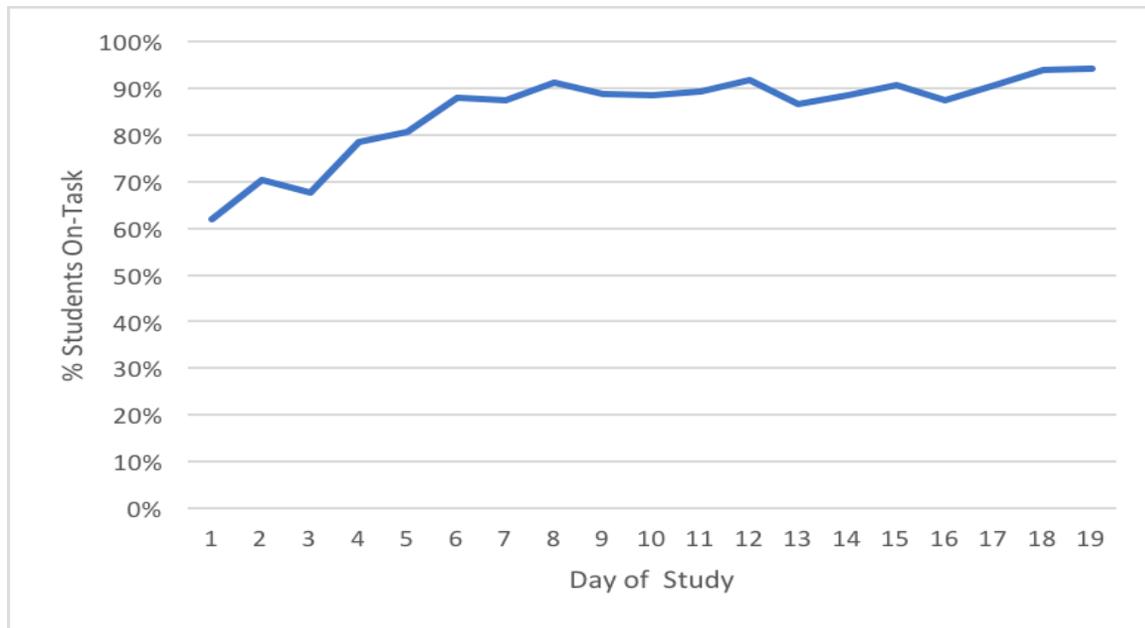
Analysis of Data

The researcher conducted the project to observe effects on focus and on-task behavior in the work period that followed the intervention of increased moderate to vigorous physical activity in the classroom. Data was collected using observation, student self-assessment, a classroom wide on-task behavior tally, and daily teacher field notes. The population for the study was a group of 15 children enrolled in an early childhood class at a Montessori school in a mid-sized Montana university town. The class was composed of eight girls and seven boys whose ages ranged from three to six years.

On-Task Behavior

Children in the classroom were observed every 20 minutes to assess how many were on-task. They were considered on-task if they appeared to be engaged in an activity as evidenced by being in front of their lesson versus not wandering, or talking with a friend or partner about the activity versus talking across the room or interrupting another student. During the baseline week, prior to introducing the intervention, an average of 72% of children were found to be on-task during the morning work period. The daily average ranged from a low of 62% to a high of 81%.

On the days that the movement intervention was used, the daily average was higher. The daily average during the weeks of the increased movement ranged from 87% to a high of 94%. Figure 1 below depicts the daily averages during the duration of the project, from the baseline week, Days 1 – 5, through the three weeks of the intervention, Days 6 – 19.

Figure 1*Daily Average Children On-Task*

Note: Baseline Data Collection Days 1-5; Intervention Data Collection Days 6-19

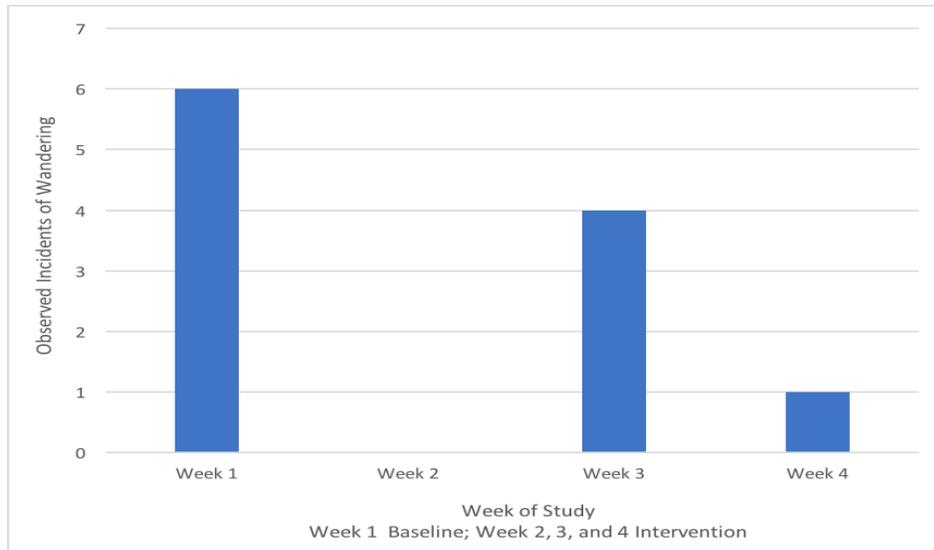
When the daily on-task averages were consolidated into weekly averages, the data indicated that the baseline week had an on-task average of 72%. During Week 2, which was the first week of the movement intervention, children were considered to be on-task for average of 89% of the time of the morning work period. In Week 3, children were also on-task an average of 89% of the time. The final week of the intervention, children demonstrated an increased on-task average of 91%.

Wandering, which is an off-task behavior, was noted to decrease according to data collected in both the Behavior Log and the Field Notes. The researcher commented twice in the field notes during the baseline week that there was a lot of wandering away from work, and only commented on wandering once during the 14 days during the movement intervention, as depicted below. Weekly tallies of individual student behavior, as observed and detailed in the

Behavior Log, also indicated a decrease in wandering. The number of noted incidents of wandering away from a work or activity that was already started decreased from the baseline week to the weeks the movement intervention was implemented, as seen below in Figure 2.

Figure 2

Incidents of Wandering Away From Lesson



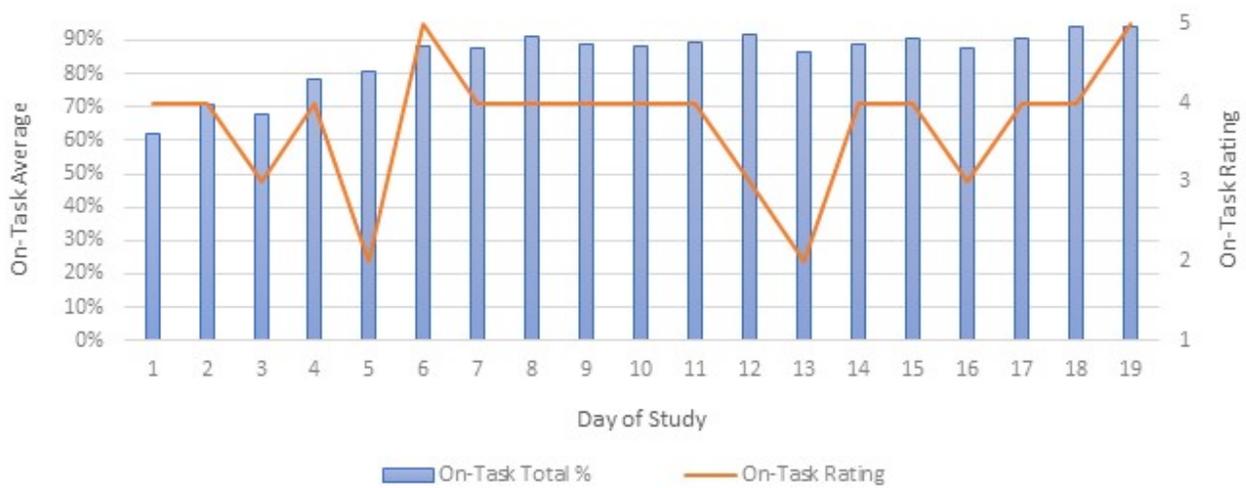
Each day the researcher rated her perception of the morning work period's overall productivity, how on-task and focused the children seemed to be. The daily ratings of the work period productivity were consistent with the percentage of children observed to be on-task 73% of the research days. Days that were rated a high rating of 4 or 5 indicated the researcher thought the work period was productive and had on-task and focused student behavior. These days coincided with on-task tallies that were average or above. Days that were rated as 3 corresponded to on-task averages of 75-87% which is lower than average. Two days were assigned low ratings of 2. One of those days also had a low classroom on-task average demonstrated in the On-Task Behavior tallies. The other day with a low rating of 2 was out of synch with the observed On-Task Behavior tallies' percentage for the morning. This day was notable because the researcher

arrived late due to a medical appointment, just in time for the movement intervention and work period. The relationship between the field notes researcher rating of each day and the observed on-task tally percentage is shown below in Figure 3.

Figure 3

Daily Researcher Rating of On-Task and Focus Versus On-Task Tally Daily

Average



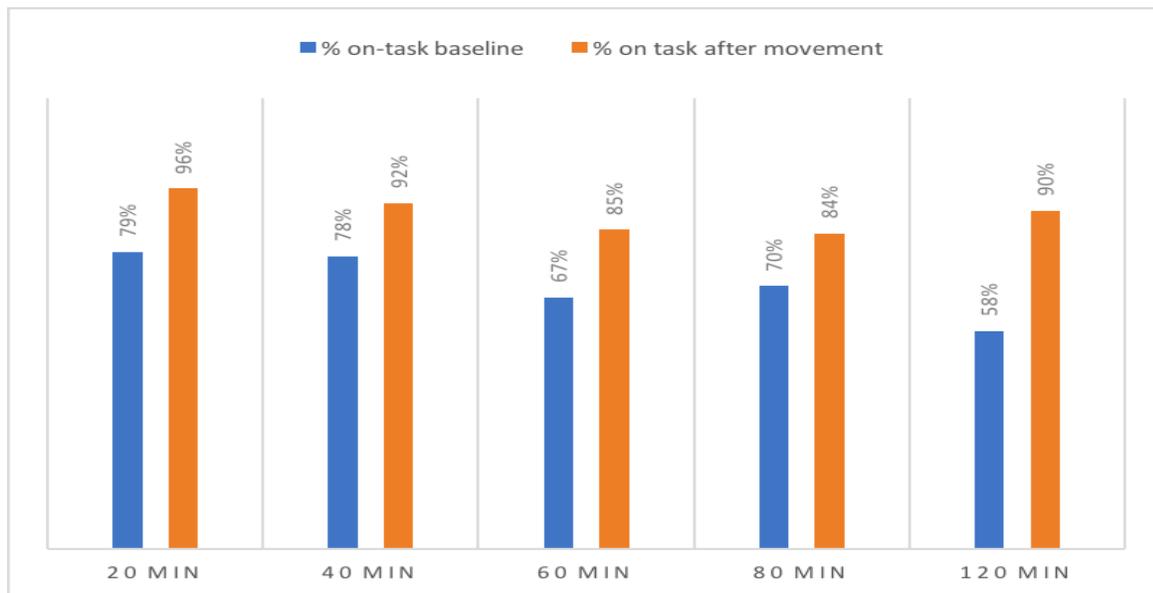
The researcher examined the on-task rates in the classroom for each time interval measured, from after the intervention and circle until adjournment for lunch. The on-task rate decreased with each interval until lunch. The children were the most on-task in the 20 minutes after the movement and the subsequent circle time.

When comparing the on-task rates for the 20 minute increments during the mornings of the baseline week to the weeks with the increased movement, the rates declined in a similar pattern. However, the movement intervention increased the number of children on-task immediately after circle and that boost remained consistent throughout the morning. The On-

Task % Through the Morning, Figure 4, depicts the overall higher rate during the intervention as well as showing the decline over the morning work period.

Figure 4

On-Task % Through the Morning



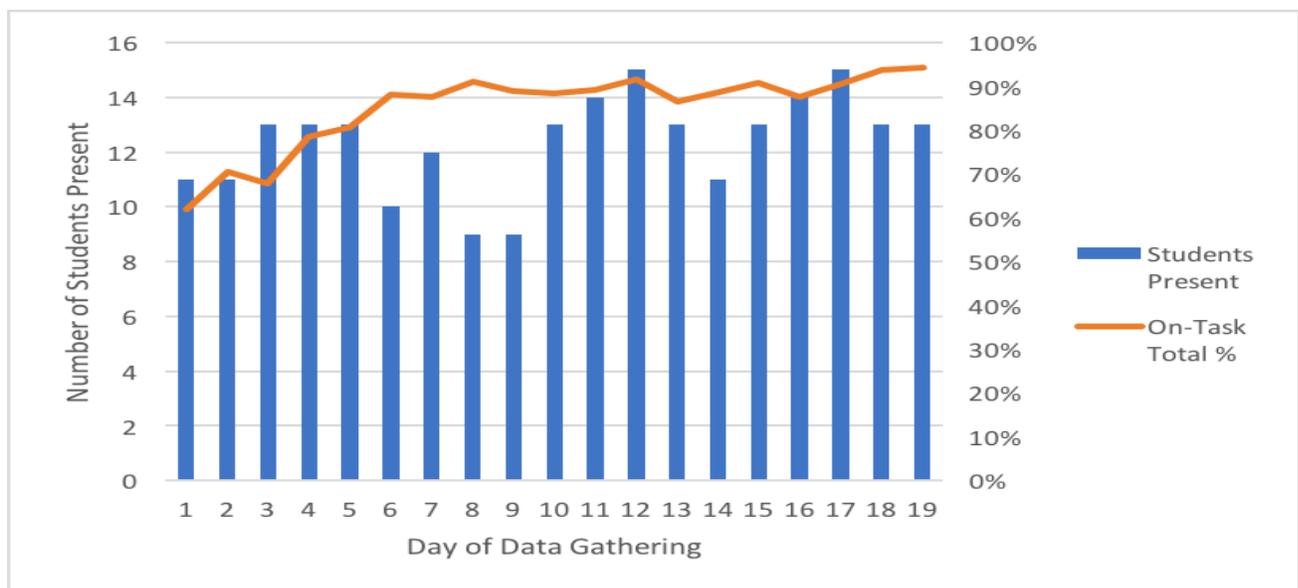
It is important to note there was not as much data collected at 120 minutes, so the statistics included are based on three data points during the baseline week and five during the intervention period. Because the movement intervention took approximately 15 minutes, there was not always a full two hours of work period before breaking for lunch.

Anecdotal comments by the researcher in her Field Notes corroborated the increased on-task behavior. During the first week implementing the movement, numerous children were absent with potential Covid symptoms. One teacher in another classroom had just recovered from a Covid diagnosis, and another was absent and awaiting test results. These absences required a shifting around of teachers and assistants. At the end of this week, the researcher noted: “This week has been better work period-wise. Especially considering staff absences and overall teacher stress level. Maybe the movement really helps??”

While analyzing the data, the researcher considered if attendance variations impacted on-task rates. The data was examined to consider if there was a correlation between the number of students present and the on-task average for that morning. There did not appear to be a relationship between the number of children and the classroom's on-task average. As seen in Figure 5 below, the two days with full attendance of 15 children, days 12 and 17, also had two of the three highest daily on-task averages. Day 12 had an on-task average of 92% and Day 17 had an on-task average of 92%. The two days with the highest on-task average of 94% had 13 children in attendance, an 86% attendance rate.

Figure 5

Daily Attendance and Daily On-Task Average



A modification for one student, based on information that was shared during his self-assessment, may have improved his ability to be on-task. The student had been observed to not participate as enthusiastically as many others. During self-assessment in the second week of the intervention, he indicated that he did not like doing the increased movement and added that “sometimes my shoes fall off. For real.” He and the researcher both talked to his parents about

the situation that afternoon and he arrived the next day with new shoes that did not fall off easily while jumping. During the next week's self-assessment, he responded with a thumbs-up, indicating a positive reaction, when asked how he felt about the movement.

Observations of the student's ability to focus and engage in on-task behavior, as noted during the Behavior Log, indicated an improvement at approximately the same time as the change in shoes and ability to participate in the intervention. During the baseline week, he was observed three times and each time he was off-task: wandering, interrupting other children, or even misusing materials. In fact, throughout the four-week research period, he was the only child noted as misusing materials as the primary aspect of the observation. During observations made in the subsequent weeks, he was observed as on-task and focused at least once each week. This could be ascribed to the intervention itself, or it could be attributed to the new shoes reducing anxiety and the distraction caused by clothing that did not fit.

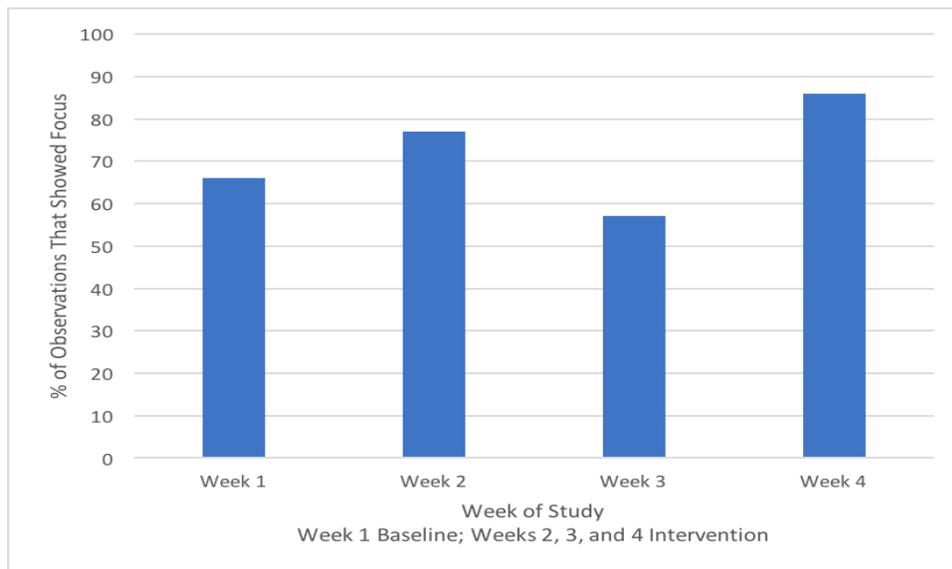
Student Focus During the Work Period

Each week, the researcher spent time during the morning work period observing individual students and noting their degree of focus or lack thereof. She attempted to observe each child each week; however, due to individual children's schedules and numerous absences from Covid-like symptoms, not all children were officially observed nor their behaviors noted during each of the weeks. It is also important to note that the observations of the children happened on different days of the week or at different times from one week to the next. If the researcher happened to observe a particular child during their most focused time of the morning, it would affect how consistent or reliable the observations were and impact the validity of the comparisons.

When the researcher combined each week's observations of how many student observations indicated focus versus observations that indicated lack of focus, a pattern was not observed. As indicated in Figure 6 below, observations of focused behavior ranged from 57% in the third week to 86% in the fourth week.

Figure 6

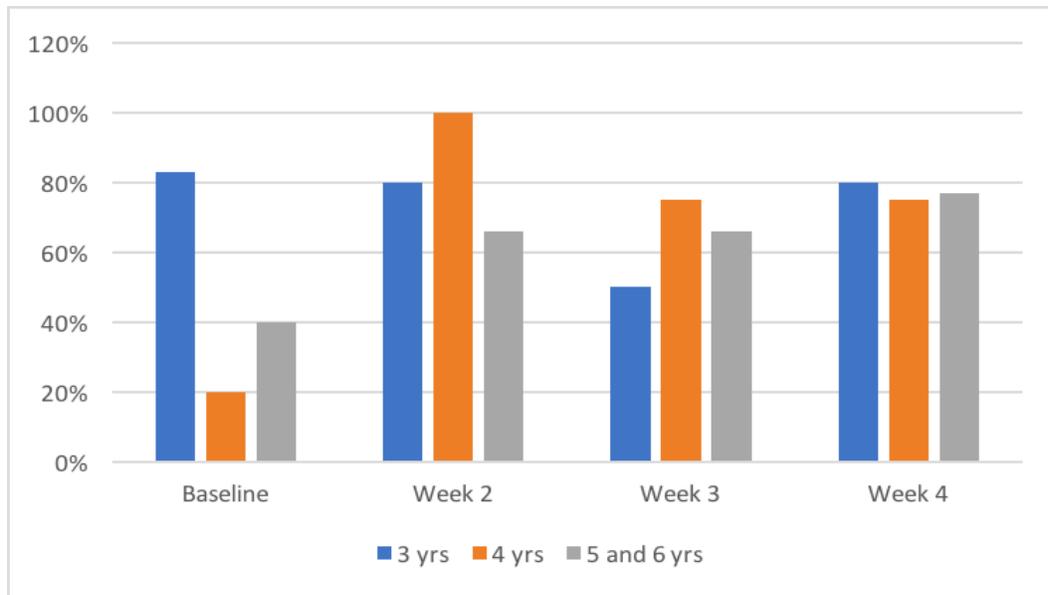
% of Observations That Showed Focus



The researcher investigated if there were patterns demonstrated in observed focused behavior by analyzing children by age. The observed degree of focus exhibited by the younger children, aged three and aged four, did not indicate a pattern, as noted in Figure 6 above. The rate at which the researcher's individual observations of students aged five and six were noted to be focused with a strong rating of 1, i.e., at lesson, physically engaged, eyes towards material, moving materials or doing activity, increased over the study period, ranging from 40% of the observations during the baseline week to 77% during the final week, as shown in Figure 7. Since there was only one child aged 6, he was included in the grouping with the five-year-olds.

Figure 7

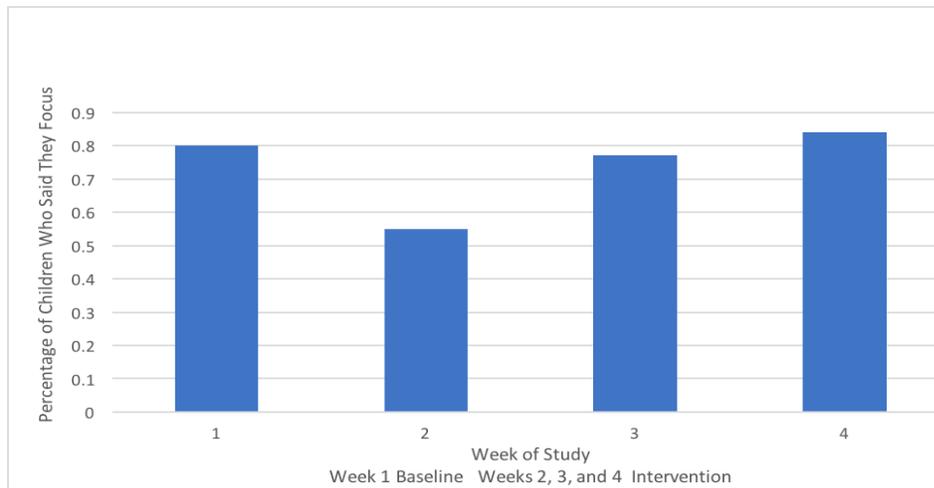
Rate of Observations of Focused Work by Three, Four and Five- and Six-Year-Old Students



The students indicated an increase in their focus on their own work during each week of the increased movement, Weeks 2, 3 and 4 during their self-assessments. However, the data from the baseline week, Week 1, which only included five responses, had a higher self-assessment of degree of focus. The researcher notes that there is less data for the first week because several children were absent and four children declined to answer the self-assessment at all. Percentages of children's self-assessment of their focus for each of the four weeks is shown below in Figure 8 below.

Figure 8

Weekly Percentage of Children Who Said They Focus on Own Activities



Transitions

Field Notes included a rating by the researcher to assess the perception of each day's transition from the intervention to the next activity, which was group circle time. Of the 14 days of data collection while implementing the intervention, 12 days had comments noting the transition was good, smooth, or went really well. Two days were considered not so good or so-so. During the first week of the intervention, the researcher noted: "feels like circles are much calmer and focused and the transition to work is smoother." During morning circle, children sit near each other around a circular or elliptical shaped rug while quietly listening and attending to teacher-led information that can include singing, finger play, listening to a story, and short informational presentations, such as an explanation of the craters on Mercury.

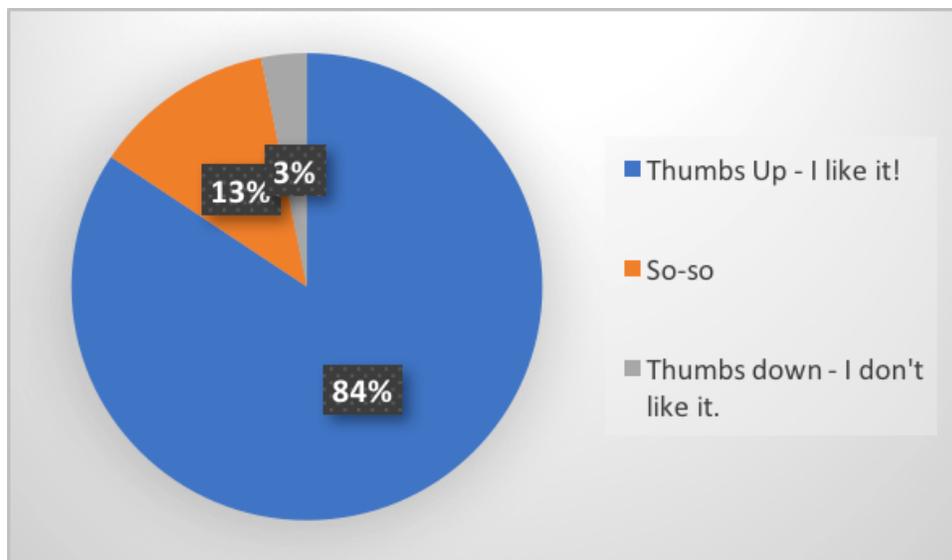
Positive Reactions from Children

The majority of students, 84%, enjoyed the intervention of increased daily movement, according to their responses in the self-assessment. Children were asked how they felt about the daily increased movement of running, jumping and marching as part of the weekly self-

assessment. Some responded enthusiastically to Self-Assessment Question 4: How do you feel after you do the morning movement of running, marching and tip-toeing? Of all the responses received during the three weeks of the intervention, 84% indicated “thumbs up” approval. Some responded with big smiles and one reported “I feel good!”. Children’s Responses to Increased Daily Movement is shown below in Figure 9.

Figure 9

Children’s Responses to Increased Daily Movement



Discussion

The purpose of this action research project was to observe the impact of moderate to vigorous physical movement prior to the morning activity time in a Montessori classroom on the focus and on-task behavior of the students aged three to six. The researcher conducted a tally of on-task behavior at 20-minute increments, observed the focus of the students with a behavior log, kept daily field notes, and asked students to complete a self-assessment each week. The data collection tools and the process were the same during the baseline data week and the three weeks

of the increased movement intervention, except that the self-assessment did not ask children their opinion regarding the movement during the baseline week.

After the week of baseline data collection, the researcher implemented a daily activity of moderate to vigorous physical activity for 12-15 minutes prior to the transition to morning circle and then the activity time, called the morning work period in a Montessori classroom. The movement activity started with marching, tiptoeing, running gently or jumping in rhythm to the teacher's drumming for four to five minutes until the teacher could hear increased breathing through the children's Covid-regulation masks. The children then moved around the elliptical line on the rug in synch to a series of short instrumental songs on a CD that was the same every day.

Based on the data gathered, increased vigorous physical activity for 12-15 minutes for Montessori students aged three to six had a positive effect on their rate of on-task behavior for the rest of the morning. Observed on-task behavior was more frequent an hour and a half to two hours following the increased movement during the study period, indicating that children who participated in a period of moderately vigorous physical movement were more likely to choose an activity and remain engaged in that activity. The improvement in the ability to remain on-task in the classroom was consistent with the findings of Mahar et al. (2006) in their study of elementary aged children who participated in vigorous group exercise breaks.

The students exhibited a corresponding reduction in wandering and off-task behavior during the study period. The researcher's anecdotal data and the specific observations of individual children indicated the incidence of children wandering in the classroom without engaging in an activity decreased after the introduction of daily vigorous physical activity.

The positive effect on the classroom's on-task behaviors was observed for up to two hours. The increased rate over the baseline of on-task behavior did not diminish as the morning progressed. While the rate of on-task behavior decreased each day as it got later and closer to lunch time, in the baseline period as well during the intervention, the boost experienced from the movement held over the two hours.

The study was not designed to specifically address the impact of the increased movement on circle time; however, an improvement was observed. The researcher noted a significant improvement in the transition to circle time. She also anecdotally observed increased focus from the students at circle time during the study period. She would encourage further study of the impact of increased vigorous movement directly on students' ability to sit and focus during a group activity such as morning circle.

The study also observed impacts on students' ability to focus on specific activities. While children were observed to be actively involved in their chosen lessons, i.e., on-task, the researcher did not have sufficient data to confirm or deny an impact on the degree to which children focused on their chosen activities. Observations of older students, those aged five and six, encouraged the researcher that there was an improvement in their individual focus during the study period. This was supported by the children's self-assessments, which showed the children reported an increase in their ability to focus. The researcher noted that the increased positive response to the self-assessment questions, however, could also be attributed to the children becoming more familiar with the question and the self-assessment process. Discussing the questions each week could have increased their attention to their own approach to work, regardless of the intervention.

Regardless of documented impacts on focus and on-task behavior, the children enthusiastically enjoyed the increased movement. The researcher has integrated the increased movement into her daily routine for the children, and the children remain very positive about participation.

Based on the data gathered in this action research, the researcher would recommend that teachers provide an opportunity for children aged three to six to move vigorously enough to breathe hard for approximately 10-15 minutes before the morning classroom time, commonly referred to as the work period in a Montessori school. This could be an important addition to the daily efforts of schools to meet the needs of young children, especially during times when children may have reduced or restricted physical activity, whether that is from community wide pandemic restrictions, inclement weather such as a Montana winter or a hot southern summer, or communities with restricted access to outdoor spaces for increased physical activity.

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Appendix A

On Task Behavior Tally Sheet

Date:

Day of Week:

Time [every 20 min]	# students present	# students on task	Percentage

Students are considered “on-task” when in front of lessons or activity, vs. not on-task students who are wandering, interrupting other students, or misusing materials. Transitioning students, for example, those just returning from bathroom or snack, are considered on-task if they are moving intentionally and not actively disrupting others.

Appendix B

On-Task Behavior Log

Name :

Date :

Day of Week:

Student ID number	Time	Behavior Code	Comments

1. At lesson, physically engaged, eyes towards materials, moving materials or doing activity
2. At lesson, eyes moving around room, fiddling with materials or not touching
3. At lesson, talking to others nearby
4. Misusing the materials
5. Wandering away from lesson
6. Has not set up lesson or chosen an activity for more than 5 minutes and is wandering

Appendix C

Daily Observational Field Notes

Date :

Time filled out :

Number of students present in morning :

Questions to reflect upon	Reflections and Observations
Rate the mood and feel of the day from 1-5: 1 "this was a tough day" 5 "wow what a fabulous day"	
Was the weather normal? Were we able to have outside recess?	
Were there disruptions to the morning work period?	
High levels of illness or absences? How many children absent and why?	
Describe how engaged the children were in the intervention: Did they seem happy to participate? Were they especially energetic and eager or more tired and slow, ready to stop early?	
How did they transition from the intervention to work period?	
On a scale of 1 – 5, was the morning work period very unsettled (1) or productive with focused and on-task students (5).	
Other observations or thoughts	

Appendix D

Student self-assessment on focus and on-task behavior

Conversation with all students to ask them to reflect on their ability to be on-task and focused during morning work period: a simple thumbs up for yes, thumb sideways for so-so and thumbs down for no. I will have a laminated sign with thumbs up, thumbs sideways and thumbs down for them to point to when I verbally ask each question except the last. The last question is open-ended. To be conducted on Thursday mornings during the study. The first week, for baseline, will not include Question 4.

Date and Time:

Student ID number:

This week:

1. I can choose interesting and “challenging work” most of the time
[*Challenging work* is the phrase used in our school to help children identify activities that are new, engaging or in the zone of proximal development by appropriately challenging themselves]:



2. I complete my lessons most of the time, rather than put it away before I finish.



3. I can focus on my own work and not bother other children most of the time:



4. How do you feel after you do the morning movement of running, marching and tip-toeing?

Appendix E

Laminated response chart to use with self-assessment data tool

