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Putting Research Into "Action": The Impact of Brain Energizers on Off-task Behaviors and Academic Achievement

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Abstract

There are many factors influencing the learning environment in public school settings. As such, the recognition of developing a multidimensional approach incorporating a variety of "tools" for a teacher's toolbox can prove to be very effective. Research indicates that movement is one such tool that can increase the capacity for students to learn (Ratey, 2008). The purpose of this study was to explore the effects of brain energizers in a 1st grade classroom in rural Appalachia. Results of the study indicated that brain energizers had a positive effect on off-task behaviors as well as academic achievement. The incorporation of movement is also recommended as one strategy to mitigate the impact of childhood trauma.

Keywords: brain energizers, off-task behaviors, physical activity, childhood trauma

There are many factors which influence the learning environment for children. As such, the recognition of developing a multidimensional approach incorporating a variety of "tools" for a teacher's toolbox can prove to be very effective. Research indicates that movement is one such tool that can increase the capacity for students to learn (Pangrazi & Beighle, 2020; Ratey, 2008). According to Cook-Cottone (2017), measures of cognition improve with regular exercise. The importance of movement in relation to academic performance has also been noted by Michael et al. (2015) who found that "physical activity had a significant positive association with students' cognitive functioning" (p. 751). Movement is also encouraged as a strategy to mitigate the negative effects of students experiencing poverty and/or chronic stress and aligns with tenets of the Whole School, Whole Community, Whole Child Model (Jensen, 2009; Zacarian et al., 2017). Specifically, within the classroom, a reduction of concentration and attention can be offset by

providing movement in the form of brain energizers periodically throughout the school day (Barniff, 2011). One barrier to scheduling physical activity is concern that it may reduce valuable learning time. However, findings indicate that taking time for physical activity does not detract from academic progress (Ratey, 2008). Instead, research indicates that physical activity actually enhances children's learning (IOM, 2013; Martin, 2010; Ratey, 2008).

Given the benefits of physical activity, the purpose of this study was to explore the effects of "brain energizers" in a 1st grade classroom. The authors define brain energizers as brief classroom-based physical activities that 'wake up' the brain through movement to enhance the learning process. The research was conducted in rural Appalachia where child obesity rates are higher and rates of physical activity for children are lower than the U.S. average (Ickes & Slagle, 2013). The Appalachian Regional Commission also reported that only 23% of the Appalachian population is physically active as compared to 28% throughout the United States (Marshall et al., 2017). Along with challenges in Appalachia related to physical health, the ability for students to learn can also be negatively impacted due to mental health issues. In Appalachia, mental health discrepancies also exist at higher rates than in the United States overall (Elder & Robinson, 2018). Therefore, it is important to research opportunities which support student development and academic achievement from a holistic perspective. The goal of this study was to examine the effect of brain energizers on off task behaviors as well as academic performance on PALS (Phonological Awareness Literacy Screening) assessments. Results from this study indicate that providing opportunities for movement in the classroom has positive effects on the learning environment and does not detract from academic achievement.

Literature Review

The literature review provides an overview of research specific to topics explored throughout this study including information relevant to the findings and discussion. Included are areas which address the link between movement and learning, adverse childhood experiences, kinesthetic intelligence, school/administrative support, and classroom management strategies.

The Link Between Movement and Learning

Over the past several years, the amount of scholarly research and publications exploring the link between movement and learning has grown exponentially (Eliot, 2009; Hillman et al. 2014; Jensen, 2009; Katz et al., 2010; Lees & Hopkins, 2013; Ratey, 2008). According to the U.S. Department of Health and Human Services (2010), research indicates that brief, classroom-based physical activities can positively affect cognitive skills, attitudes, academic behaviors, and academic achievement. Another report entitled *Educating the Student Body*, released by the Institute of Medicine (IOM) (2013), stresses the importance of incorporating physical activity throughout the school day. This report includes a plethora of research supporting the cognitive benefits of physical activity and emphasizes the positive outcomes of incorporating movement as a break from academic learning.

Regardless of the daily schedule, according to neuroscientist Lisa Eliot (2010), "children, with their immature frontal lobes, can't sit still for long periods and desperately need physical breaks to recharge their mental batteries" (p. 151). From a human growth and development perspective, children have a basic need to move and research suggests that students are eager to do so when given the opportunity (Braniff, 2011; Pangrazi & Beighle, 2020). School environments which do not encourage movement can be especially challenging for children diagnosed with ADHD. Research by Pontifex et al. (2013) illustrates how moderate-intensity aerobic exercise positively impacts children diagnosed with ADHD. Braniff (2011) found that

brain energizers ranging from three to five minutes were an effective strategy for creating a positive classroom environment and reducing stress to facilitate the learning process. Recent research consisting of a meta-analysis examining the impact of physical activity in the classroom also indicated positive educational outcomes (Norris, Van Steen, Direito, & Stamatakis, 2019).

Adverse Childhood Experiences

The benefits of physical activity can also be beneficial for children who find it difficult to succeed academically when their experiences outside the classroom involve mental and physical health challenges interconnected with other issues such as socioeconomic status and/or traumatic childhood experiences such as abuse or neglect (Reardon & Leonard, 2020). Specific to socioeconomic status, living in poverty creates higher levels of chronic stress for children (Jensen, 2009). For some children, living in deep poverty creates an even greater challenge. "Deep poverty" refers to those who are 50% below those who are living in poverty, considered as an income of $12,125 for a family of 4 in 2015 (The Annie E. Casey Foundation, 2018).

Students with a high incidence (three or more) of adverse childhood experiences, or "ACEs," are 2.5 times more likely to fail a grade, score lower on standardized tests, experience more suspensions and expulsions, are more likely to be referred to special education, have poorer physical health, leading to poor attendance, and are 32.6 times more likely to be diagnosed with learning and behavioral problems (Burke-Harris, 2018). When a child is exposed to chronic stress and/or trauma, the body's sympathetic nervous system becomes dysregulated, causing students to live in a constant state of anxiety and heightened fear. As a result, the amygdala, the brain's fear center, becomes enlarged. Cortisol, a stress hormone, levels also increase; the higher the levels of cortisol in a child's body, the smaller the volume of the brain's hippocampus, which is critical for consolidating memories and internalizing learning. Further, this dysregulated

response causes prefrontal cortex function to diminish, which leads to the inability of a child to concentrate, problem solve, emotionally regulate, and control impulsivity (Burke-Harris, 2018).

Research has shown that physical activity and exercise increases the enzyme telomerase, which lengthens telomeres, a structure that protects one's DNA. When this occurs, telomerase lengthens telomeres, which in turn help rebuild DNA that has been damaged by chronic stress. Since household adversities and PTSD are strong predictors of telomere shortening, clinical research indicates that exercise can not only alleviate negative health impacts of chronic stress in children, but it can also serve to reduce cortisol levels. This will ultimately promote improved brain function and cognition in key areas of the brain devoted to the learning process (Law et al., 2016). Additionally, exercise is among one of the five key components to promote a "reset" of a dysregulated stress response in a child's sympathetic nervous system, which can be brought on by chronic, toxic stress (Burke-Harris, 2018). Further, physical activity promotes the release of a protein called the brain-derived neurotrophic factor; this protein is imperative for learning, cognition, and creation of memories in the hippocampus and prefrontal cortex. Therefore, exercise is paramount in the learning process for children in terms of the brain's physiological and sympathetic nervous system responses (Burke-Harris, 2018; Ratey, 2008).

Kinesthetic Intelligence

Gardner's (1993) theory of multiple intelligences includes eight different types. One type is defined as "bodily-kinesthetic intelligence" which refers to individuals who learn by doing and prefer a learning style involving opportunities to move (1993, p. 7). Kinesthetic learners are usually more creative problem solvers when they are able to move their bodies as part of the learning process (Reed, 2009). However, according to Reed (2009), "the Kinesthetic Learning Style is often the most neglected in the classroom" (p. 36). Additionally, brain energizers can

help with developing core strength, cross lateral movements, and overall developing a greater sense of physical literacy (Hannaford, 2005; Roetert & Jefferies, 2014). Therefore, brain energizers as well as other types of purposeful movement planning in the classroom, are important for students who may prefer a kinesthetic learning environment.

School/Administrative Support

In 2004, Congress passed the Child Nutrition and WIC (Women, Infants, and Children) Reauthorization Act (Pangrazi & Beighle, 2020). As part of this law, all schools receiving federal funding for school lunch programs were required to develop and implement wellness policies relating to nutrition and physical activity. As a result, many school districts adopted policies supportive of physical activity. For example, in the school district where the current study took place, the wellness policy states, "Students shall be given opportunities for physical activity during the school day through daily recess periods, physical education classes, walking programs, and the integration of physical activity into the academic curriculum" (WCPS, 2006, p. 10). Yet during professional development workshops conducted by the associate professor and co-author of this study, the majority of teachers indicated that they were unaware of the policy.

Classroom Management Strategies

According to Ma, Mare, & Gurd (2014), many teachers subscribe to an ideology that there is not enough time for implementation of brain energizers due to the academic rigor synonymous with standardized testing. However, when used as a classroom management strategy, brain energizers can serve as positive reinforcement which can be a very effective tool for classroom behavior management (Newcomer, 2009; Paciotti, 2010). According to Paciotti (2010), "rather than influencing classroom behavior through teacher desists and redirection,

teachers [can] use positive reinforcement to shape group and individual behavior" (p. 13). Providing opportunities for students to move can be a successful classroom management strategy to help students remain alert and attentive during instruction (Braniff, 2011).

Methods

The study was conducted through a collaborative effort between an elementary public-school teacher and an associate professor at a liberal arts college, both located in rural Virginia. The accredited school where the research took place was comprised of approximately 645 students. The percentage of students receiving free and reduced lunch at the school was over 60% (www.doe.virginia.gov). The ethnic composition of the student body was predominantly White. The study and subsequent implementation of brain energizers in the classroom were a result of discussions following a professional development workshop for teachers provided by the associate professor during the summer of 2014, entitled "The Link Between Movement and Learning," and included an overview of neuroscience in relation to the brain and movement as well as "tools" for increasing physical activity in the classroom. Subsequent conversations between the first-grade teacher, who has a bachelor's degree and ten years of teaching experience, and the assistant professor led to the development of this action research project as an opportunity for systematic inquiry into the teaching and learning process (Mertler, 2017). Given the prevalence of poverty and abuse in this area, researchers also explored the potential of brain energizers as a possible intervention to help mitigate the effects of traumatic experiences in hopes of bolstering academic achievement (Reardon & Leonard, 2020; Virginia Department of Social Services, 2017).

Context and Participants

To provide background context of the participants, school, and county involved in this study, pseudonyms are used to protect confidentiality. In the county where the research took place, 47.3% of children were identified as living in "deep poverty" during 2011-2015 (The Annie E. Casey Foundation, 2018). Additionally, external environmental factors impact these students as well. In terms of traumatic childhood experiences, there were 446 Child Protective Services referrals in 2014 and 463 in 2015, and of those referrals, there were 146 founded cases of abuse in the school district of this study during the two years (Virginia Department of Social Services, 2017).

Specific demographic information on the participants in this study involve the sample group consisting of 11 male and 9 female students in 1st grade. Some students received services from resource teachers as follows: three students received one-on-one instruction through Reading Recovery, two students attended group instruction in Reading Recovery Literacy, one student received day treatment counseling services, and two students received ESL instruction / services. Additionally, one student had been diagnosed with ADHD. Most students were from white, middle-class families while 32% received free/reduced lunch.

Study Design

Following IRB approval, brain energizers ranging in length from one to seven minutes were implemented in the 1st grade classroom on a daily basis. As noted earlier, the authors have defined brain energizers as brief classroom-based physical activities that 'wake up' the brain through movement to enhance the learning process. The results consist of data collected from October 2014 through May 2015. The length of each brain energizer was dependent upon the type of video or activity selected by the teacher. Prior to implementation, an observation protocol (Appendix A) was developed by the researchers to systematically collect data regarding off-task

behaviors in the classroom. The specific off-task behaviors included were based on the teacher's knowledge and experience of behaviors which most often interfered with or detracted from student learning goals. The behaviors were recorded based on student activity in "pods" or groups of five students as designated by the desk groupings in the classroom.

On a daily basis, the 1st grade teacher manually recorded data on the observation protocol form prior to and within 15-30 minutes following each brain energizer. The decision to implement a brain energizer was based on the teacher's determination that students were beginning to exhibit off-task behaviors. The majority of the energizers were conducted when off-task behaviors were observable in at least two of five children in one or more pods. When the teacher noticed that at least two of the five students in a minimum of two pods were exhibiting off task behaviors, she would manually fill out an observation protocol and indicate with a checkmark in the corresponding box. The off-task behaviors included not paying attention / focusing, not following directions, eyes roaming / staring into space, yawning, propping head up, putting head down on desk, and / or talking to one another without permission. Observable behaviors within 15-30 minutes following the brain energizers included paying attention, following directions, eyes focused either on teacher or work, alert, no propping, sitting up at desks, and / or talking to one another when permission granted.

In addition to data regarding observable behaviors prior to and following brain energizers, the observation protocol form was also designed to collect data regarding the length of sedentary time and type of activity (lecture, pencil and paper work, etc.) prior to each brain energizer as well as the length and type of brain energizer (teacher led, internet, original creation, etc.). Additionally, the teacher noted other applicable details such as academic performance on benchmark testing as well as affective student responses to various brain energizers.

The information from the manually recorded forms was entered into Survey Monkey to calculate overall percentages in each pod of off-task behaviors. Percentages were calculated in Survey Monkey based on the total number of checkmarks for all brain energizer sessions. Additional notes and comments documented by the teacher were also entered into Survey Monkey. In addition to the notes and comments documented by the teacher on specific days, she also shared her insight during discussions of the data as she reflected on the information collected.

Along with analyzing off-task behaviors, pre and post PALS assessment scores were also analyzed in May after testing for both had been completed. PALS (Phonological Awareness Literacy Screening) (n.d.) is a comprehensive assessment used throughout the state of Virginia to measure young children's knowledge of literacy fundamentals.

Findings / Results

A total of 177 brain energizers were recorded between September 2014 and May 2015. The observation protocol was utilized each day to collect data. As indicated in Table 1, the majority of brain energizers were implemented twice per day either in the morning only, afternoon only or one in the morning and one in the afternoon. The twice per day schedule comprised 55% of the total. This was followed by implementation once per day either in the morning or afternoon. The once per day schedule comprised 34% of the total. An implementation schedule of three times per day had the lowest overall percentage (10%). The most common implementation schedule overall was providing a brain energizer once per morning and once per afternoon (47%) for an average of two per day followed by one in the morning only (23%). In reviewing the data, the day of the week did not seem to impact effectiveness of the brain energizers. However, the time of day was important in that the morning

was predominantly when at least one brain energizer was implemented by the teacher due to her observation of off-task behaviors occurring. The off-task behaviors in the afternoon also warranted at least one brain energizer at a slightly lower rate than that of the morning. On each observation protocol form, the teacher noted that the rationale for two brain energizers (rather than one) either in the morning or afternoon was due to days in which students were struggling more so than usual to remain on task.

Table 1 *Time of Day and Number of Brain Energizers*

Time of Day	**# of Brain Energizers**	**Total # of Brain Energizers**	**Percentage**
Morning Only	1 x day	41	23%
Morning Only	2 x day	12	7%
Afternoon Only	1 x day	20	11%
Afternoon Only	2 x day	2	1%
One Morning / One Afternoon	2 x day	84	47%
Two Morning / One Afternoon	3 x day	18	10%

The popularity of the brain energizers was evident by teacher comments documented on several days where students asked to do one. On multiple occasions, the teacher noted that students had begun to recognize how the brain energizers helped to "wake up" their brains. For example, on one particular day the teacher noted that "one child was on allergy medication and was dragging….he asked me to do a brain energizer. We did two in a row and he was engaged until lunchtime!" The average length of each brain energizer was two to three minutes (50%) followed by three to four minutes (28%). The type of brain energizer was overwhelmingly internet-based (95%). GoNoodle (n.d.) was the most popular site utilized by the teacher, which is

a free website currently being used by four out of five U.S. public elementary schools. Students also requested the hamster dance, available on YouTube, as one of their favorite brain energizers. Another website used frequently by the teacher was Move to Learn (n.d.). According to this website, providing opportunities to be physically active at school can greatly enhance student engagement.

Off-Task Behaviors

As indicated earlier, the off-task behavior percentages were calculated based on each pod, not each child. The calculated percentages were based on the total number of checkmarks for all brain energizer sessions. The most observable off-task behavior in each pod, on average, that triggered the teacher to implement a brain energizer was talking to one another without permission (Table 2). This was followed by not paying attention and/or remaining focused and eyes roaming / staring into space. The average sedentary time prior to the occurrence of off-task behaviors was between forty-five minutes and one hour and the type of activity comprised a combination of lecture and pencil / paper work.

Student behaviors in each pod were recorded on the observation protocol form within 15-30 minutes following completion of each brain energizer. Overall results indicated that all off-task behaviors improved. The top three observable behaviors in each pod following completion of the brain energizers were alertness, not propping their head in their hands, and paying attention / focused (Table 3). Additional notes recorded by the teacher on the observation protocol forms indicated that students did well on Language Arts benchmark tests as well as Math quizzes taken directly after energizers.

Table 2 *Observable Off-Task Behaviors Prior To Brain Energizers*

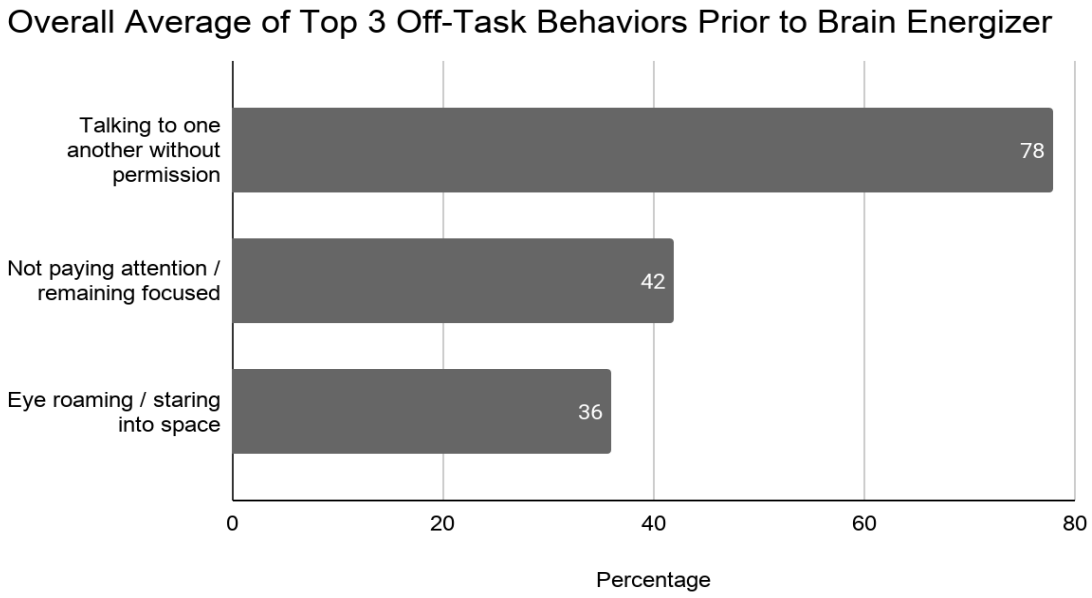
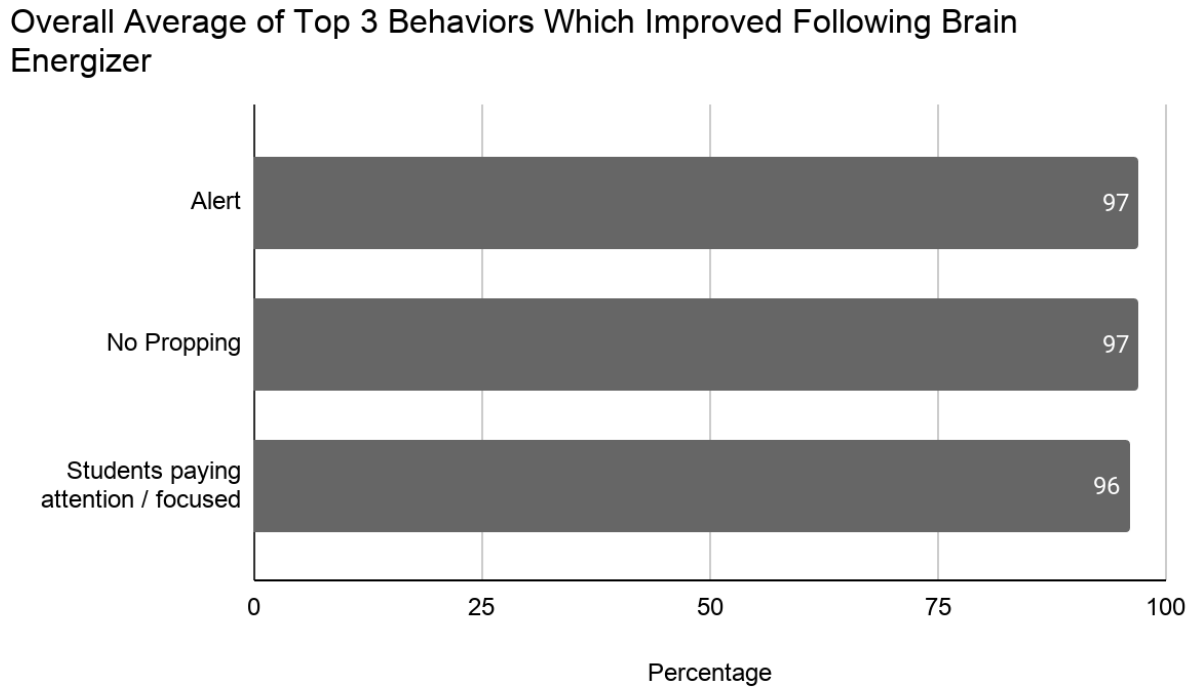


Table 3 *Observable Behaviors Following Completion of Brain Energizers*



On multiple occasions, there were also comments documented by the teacher indicating positive outcomes following the brain energizers. For example, she noted that one student had fallen asleep prior to the brain energizer. Afterwards, "student was fully awake and told me after taking weekly assessment 'I tried really hard.'" On another occasion, the teacher recorded "all good - especially one child who was having trouble staying engaged in the lesson - he was engaged for more than 30 minutes after the energizer!"

Phonological Awareness Literacy Screening (PALS) Results

In order to more fully examine the academic progress of a classroom incorporating brain energizers, results of the PALS screening were compared across all six 1st grade classrooms at the elementary school where the research took place. The analysis occurred in May 2015 after students in each class had completed all pre and post PALS assessments. Table 4 illustrates the mean scores from each classroom during August 2014 and May 2015. The pre-assessment mean scores for each classroom ranged from 19.6 to 23.5 and the brain energizer classroom was ranked fourth from highest to lowest. The post-assessment mean scores ranged from 32 to 44.8 and indicated that the brain energizer classroom was ranked first from highest to lowest.

The information in Table 5 illustrates the point increase and improvement percentages for each class from the beginning to the end of the academic year. The percentages of overall improvement among the five classrooms not utilizing brain energizers ranged from 58% to 88% for an average improvement of 71%. However, the improvement for the brain energizer classroom was 117%, which was 46% higher than the average of the five other classrooms.

Table 4 *PALS Scores (August 2014 and May 2015)*

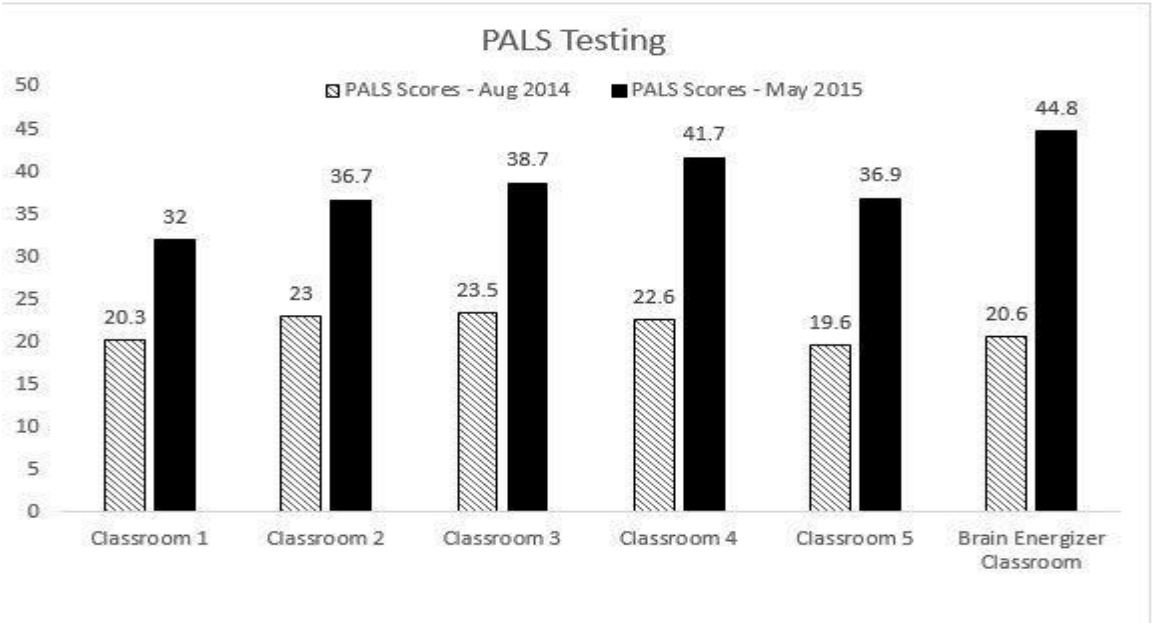


Table 5 *PALS Class Improvement (August 2014 and May 2015)*

Classroom	Points Increase	Overall % Improvement
Classroom 1	**11.7**	**58%**
Classroom 2	**14**	**60%**
Classroom 3	**15**	**65%**
Classroom 4	**19**	**85%**
Classroom 5	**17**	**88%**
Brain Energizer Classroom	**24**	**117%**

Interestingly, the teacher had purposefully planned and implemented a brain energizer immediately prior to the PALS testing. She also adopted this philosophy with other types of tests / screenings throughout the year when students were placed in more "high pressure" performance situations. Documented throughout the observation protocols were instances of students performing brain energizers prior to benchmark tests, etc. For example, one comment from the teacher stated students "took math quiz immediately after brain energizer, excellent grades!"

As noted earlier, several students were receiving services from resource teachers specific to reading and literacy as well as counseling and ESL instruction. Additionally, one student had been diagnosed with ADHD. The overall results from the pre/post PALS assessments indicated that these students also showed significant improvement in spite of their challenges and that brain energizers did not detract from their academic achievement. The teacher also documented ways that movement was used to support these students beyond brain energizers such as "I had the counselor take the sleepy student for a walk." This indicates another example of how movement was used to re-engage and wake up a student's brain and body for learning.

Discussion

Results from data collected indicate that brain energizers implemented in the 1st grade classroom of twenty students countervailed off-task behaviors. Per the observation protocol, the teacher would implement a brain energizer when a minimum of two students in each pod began to exhibit the off-task behaviors. Based on the implementation schedule included in the Findings section, the occurrences of off-task behaviors were more prevalent in the morning followed by several days where a brain energizer was needed both in the morning and afternoon.

Along with improvements in off-task behaviors, an analysis of PALS assessment scores also indicated positive academic outcomes. The results align with other research suggesting that physical activity can improve off-task behaviors as well as academic performance (IOM, 2013; Lees & Hopkins, 2013; Ratey, 2008). The next section discusses classroom management strategies and implementation suggestions.

Classroom Management Strategy

As noted earlier, many teachers may be concerned that taking time for brain energizers could detract from time that should be spent focusing on academic progress. However, data collected via notes on the observation interview protocol and personal communication with the teacher emphasized how vital the brain energizers have become as part of her overall classroom management strategy. For example, the teacher noted on one day that due to inclement weather conditions, the students did not have recess. As a result, they were having a difficult time settling down. She documented "I should have done 2 [brain energizers] in a row." Follow up conversations with the teacher indicate that this process has completely changed her teaching. Beginning with what she learned during the initial workshop which inspired this study as well as the research outcomes, her teaching strategies have evolved to include regular use of brain energizers as well as reflecting on and implementing other ways to incorporate movement throughout the school day. Classroom management strategies are discussed in more detail below in relation to positive reinforcement and classroom contract modifications. This section also includes implementation tips for educators who would like to incorporate brain energizers into their classroom.

Positive Reinforcement

One outcome noted by the teacher was not only did the brain energizers decrease off-task behaviors, they also became a useful tool for positive reinforcement. Throughout the year, the ability to shape group and individual behavior with positive reinforcement became apparent through the use of brain energizers. The teacher noted that during times when the students became restless or fidgety, she could often ask them for a specific number of minutes to focus. The positive reinforcement if they maintained focus for the specified timeframe was a brain energizer; the students almost always complied. She contrasted this with prior teaching experiences where she would find herself stating directives which were often repetitive and ineffective. In essence, time spent reprimanding students (negative reinforcement) for off-task behaviors were easily replaced with brain energizers (positive reinforcement). Another advantage to using the brain energizers as a positive reinforcement was that it minimized the necessity of depriving recess as a punishment.

Classroom Contract Modifications

Part of the classroom management strategy employed by the teacher for several years has been providing students and parents with a contract outlining student expectations and consequences for undesirable behaviors. This contract is always introduced and explained during the registration process at the beginning of the school year. Until the academic year during which the study took place, consequences for negative behaviors included deprivation of recess for incremental time periods. However, as a result of attending the professional development workshop on the link between movement and learning, the teacher decided to revise the contract. Following the basic rules and expectations, the new contract states:

Choosing not to follow the rules will result in these consequences:

- First Offense (after warnings are given): Loss of five minutes of playtime (student must walk the play-area track alone instead of playing with friends)* and straight face in planner
- Second Offense: Loss of 10 minutes of playtime (student must walk the play-area track alone instead of playing with friends) and sad face in planner

  *Students will walk the track instead of "sitting out" because it is important that all students get some exercise during recess. Exercise is beneficial to the learning process.

The updated contract was well received by both students and parents. The use of brain energizers as well as modifying the classroom contract became effective ways to increase rather than reduce levels of physical activity. The classroom environment created a culture in which movement was celebrated and valued for the positive effects on the learning process.

Physical Activity and ADHD

As noted earlier, school environments which do not encourage movement can be especially challenging for children diagnosed with ADHD. This topic is relevant to the current research in that one child involved in the study was ADHD. As part of the reflection process during data analysis, the teacher shared that brain energizers proved to be an invaluable resource for this particular student in relation to behavior regulation and academic achievement. She indicated that on a regular basis, she had observed a positive change in the student's ability to focus and engage with the academic content following the brain energizers.

Trauma-Informed Educational Approaches

As indicated in the literature review, students who are exposed to chronic stress and/or trauma often experience greater challenges in learning due to a dysregulated stress response (Burke-Harris, 2018). The dysregulated stress response can negatively impact the brain's

executive functioning and thus the ability to perform well academically (Craig, 2017). Students also exhibit behaviors that can interfere with the learning process. The relevance to this study is that chronic stress and trauma are often associated with high ACE (Adverse Childhood Experiences) scores which are more prevalent in rural areas due to higher rates of poverty (Reardon & Leonard, 2020). Physical activity is one way to help students manage aspects of the "fight, flight, or freeze" mechanisms occurring in their bodies as a result of the chronic stress or trauma they have experienced. According to Ratey (2008), "exercise controls the emotional and physical feelings of stress and it also works at the cellular level" (p. 60). Educational approaches using a trauma informed lens include consideration of student behaviors and challenges from a resiliency perspective to support student learning.

Implementation Tips

According to the teacher involved in this study, benefits of implementing brain energizers in the classroom include that they are free and do not require a substantial time commitment. However, there are a few points to consider to ensure a smoother implementation process.

Preview! Preview! Preview!

Prior to using a video of any brain energizer in class, it is important to preview the video from start to finish. During this time, teachers should take note of content, skill level required, and age-appropriateness. Teachers should also consider the movement level required. Based on age and grade level, some videos might be too boring or not active enough and some might require movement patterns which are too complex for a particular group of students.

Begin on the First Day

Most children thrive on regular routines in environments where they know what is expected. Therefore, it is important to incorporate brain energizers into the classroom beginning

with the first day of class. Students then learn that the routine becomes part of their regular school day. During the current study, the teacher would typically pull up the brain energizer on her computer / projector and have it ready to go when students returned from a bathroom break. At the beginning of the year, students would return to their seats and sit down following the break. The teacher would then ask them to stand up, push in their chairs, and stand by their desks. However, approximately two weeks into the school year, the teacher noticed that as the children became aware of the brain energizer pulled up on the screen, they would automatically stand by their desks ready to go.

Student Input / Involvement

The teacher recognized the involvement and engagement of students when she would request their input regarding the type of energizer. According to Hannaford (2005), the positive impact of physical activity on the brain is more effective when the movement is voluntary. Therefore, a key aspect of implementing brain energizers into the classroom is to allow student input and use those energizers which the students prefer.

Kinesthetic Intelligence

In relation to kinesthetic intelligence, the teacher emphasized the importance of and her focus on gauging individual student involvement in terms of upper and lower body. For example, some students involved in this study were able to coordinate the upper body movements but not the lower body movements and vice versa. The teacher noted that for some of the energizers, many of the students improved in their efforts to involve their total body when she provided gentle reminders. In terms of learning, involving the entire body stimulates frontal lobe processing in the brain (Hannaford, 2005).

Organization

Regardless of the grade level or subject being taught, organization is an important tool for any teacher's toolbox. Successfully implementing brain energizers into the classroom can be simplified by having an organized system. One helpful practice is to bookmark the sites once there are favorite ones identified by the children. From time to time, there can also be issues with internet accessibility due to the rurality of the location. Therefore, other options for keeping brain energizers accessible and ready to go include downloading those used regularly so that no internet is required. Free downloading software such as ClipGrab (http://clipgrab.org/) can be used to complete this task.

Another aspect related to the utilization of brain energizers includes the classroom layout. How is the physical space organized? It is important to evaluate how the desks and furniture are situated in order to provide the greatest opportunity for a variety of movement patterns. During the current study, the teacher mostly relied on videos which were conducive to students remaining at their desks. However, in some instances, the "pod" desk arrangement provided opportunities for the students to move and switch places during certain brain energizers. Student feedback indicated that they enjoyed this type of option.

Finally, organization also includes consideration of the classes surrounding the classroom where brain energizers were taking place. The architectural design of the school is an open classroom style. Early in the study, the teacher received a couple of complaints from her colleague in the adjoining classroom that music in the videos and the students were too loud. The teacher adjusted accordingly. If planning to implement brain energizers in an open classroom space, it might be helpful to discuss with the surrounding teacher(s) and test the sound ahead of time.

Teacher Involvement

There are many benefits when the teacher fully participates in the brain energizers. One benefit is that students are provided with an opportunity to witness the teacher struggling to learn the physical movement patterns in the same manner as themselves. If the teacher is relaxed and engaged in the process then the students will follow. As a result, they are afforded a chance to work on "getting it right" without taking themselves too seriously. Another benefit is that completing the brain energizers together offers an opportunity to build deeper connections with students. According to Buchanan (2011), a student-teacher connection can be developed when teachers are actively involved with students. Finally, due to the challenging nature of the teaching profession, the brain energizer can also provide a much-needed stress relief experience for the teacher.

Implications

Implications of this study suggest that there should be a deliberate effort to incorporate more physical activity into the school day. When reflecting on their own teaching, the authors in the study all found that they subscribe to the benefits of movement and physical activity in relation to creating a positive learning environment. According to the teacher, her overall summary regarding the use of brain energizers in the classroom is that they "should be a mandate." At the elementary level, the teacher continues to implement brain energizers on a regular basis similar to the protocol included in this study. Other teachers at her school and within the county have also adopted this practice to enhance the learning environment in their classrooms. At the college level, the associate professor has a sign-up sheet for students to select a day to provide a brain energizer during class. During the midway point of class, the students then share their selected brain energizer and everyone participates. In addition to their own practice, the teacher and assistant professor have offered additional workshops to educate and

encourage others regarding the link between movement and learning. Results from this study continue to serve as a catalyst for engaging educators in further dialogue and action regarding this topic.

Two of the three authors are also supporting movement and physical activity by involving teachers and students in research specific to trauma-informed yoga. The process includes offering trauma-informed yoga for both students and teachers to help mitigate the challenges associated with chronic, secondary, and vicarious trauma experienced by students and educators (Gross, 2020).

In addition to the reflections above, this study has potential implications for children living in situations of poverty and chronic stress, as is the case with many of the children enrolled in the study's public school system. As noted earlier, these children may often suffer from a dysregulated stress response. Since research indicates that movement can help to mitigate these effects and does not detract from the learning environment, all educators should consider additional ways to incorporate physical activity into the learning environment (Jensen, 2009; Zacarian et al., 2017).

Conclusions

The purpose of this study was to explore the effects of brain energizers in a 1st grade classroom in rural Appalachia. Findings indicated that off-task behaviors throughout the day were minimized with the implementation of brain energizers. Rather than being a distraction or overstimulating the students, the brain energizers served as a tool for creating an engaged and vitalized classroom. Intently focusing on brain energizers translated into focus and concentration on learning. Students were never too "hyped up" following an energizer to immediately settle down and begin working. As indicated by the PALS assessment scores, incorporating brain

energizers also does not detract from academic achievement. For children experiencing chronic stress, brain energizers also provide an opportunity to regulate their dysregulated biological systems. Results from this study supports the concept that taking time for physical activity does not detract from academic progress and instead can actually enhance children's learning (IOM, 2013; Martin, 2010; Ratey, 2008).

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Appendix A
Observation Protocol

Date:							
Time:							
Observer:							
***Observable behaviors prior to brain energizer**	Not paying attention / focusing	Not following directions	Eyes roaming / starring into space	Yawning	Propping heads up	Putting heads down on desk	Talking to one another without permission
Pod 1							
Pod 2							
Pod 3							
Pod 4							
Time sedentary prior to brain energizer							
Type of activity prior to brain energizer (lecture, pencil & paper work, etc.)							
Length of brain energizer							
Type of brain energizer (teacher led, internet, original creation, etc.)							
****Observable behaviors following brain energizer**	Pay attention / focused	Follow directions	Eyes focused either on teacher or work	Alert	No propping	Sitting up at desks	Talking to one another when permission granted
Pod 1							
Pod 2							
Pod 3							
Pod 4							
Notes:							

*Observable behaviors occurring with at least 2 of 5 children in each pod.

**Observable behaviors occurring within 15-30 minutes following completion of brain energizer.