



New Equation in Math Class: Movement=BRAIN BOOST

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Crestdale Middle School

This curriculum unit is recommended for:
sixth and seventh grade math classes.

Keywords: BDNF, resting heart rate, gray matter, white matter, pulse, mean, median, mode, range, mean absolute deviation, variation, measures of center, fraction, decimal, percent, percent of increase, percent of change, line plot, circle graph, cerebellum, cerebrum, corpus collosum

Teaching Standards: See [Appendix 1](#) for teaching standards addressed in this unit.

Synopsis: This unit is designed to be used over the course of the school year in the sixth or seventh grade math classroom. Students will learn basic information about the brain and how exercise benefits the brain. Students will participate in exercise for homework twice a week and will be asked to track their activities, pulse (resting and after exercise), and their pace of a mile run. Students will use the data collected by their classmates and themselves to generate line plots, box and whisker plots, circle graphs, mean absolute deviation, fractions, decimals, percents, percent of increase/decrease, mean, median, mode, range, and interquartile range.

I plan to teach this unit during the coming year in to 120 students in seventh grade math.

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New Equation in Math Class: Movement=BRAIN BOOST

Leslie Paytes

Introduction

As the title suggests children who are active experience a higher rate of success in math and other classes. This unit is designed to use physical activity to encourage math success by implementation over the entire school year through activities in and out of the math classroom. Standards addressed in this unit cover math standards from the fourth through seventh grades and physical education and health standards from the fifth through eighth grades.

My School

The unit is being implemented in the seventh grade math classes at Crestdale Middle School, a Charlotte Mecklenburg School, located in the town of Matthews, NC, a suburb of Charlotte. Crestdale is the home to 805 students of whom 7.1% identify as multi-racial, 10.4% are Pacific- Asian Islanders , 9.1%, are Hispanic, 16.5% are African-American, and 66.4% are White. Thirty-five percent of the students receive free or reduced price lunch. Crestdale has been designated three times as a “School to Watch” by the National Middle School Association and has teachers who are highly qualified having 30 with master’s degrees and 25 who are Nationally Board Certified in their disciplines. The students at this school have access to the Charlotte Mecklenburg 1:1 initiative which has provided middle school students in the district with Chromebooks for daily use. Chromebooks are browsers that allow the students to access the internet. The students use these devices at school in most classes. Students are learning to post work to Google Drive and to work collaboratively on Google Docs. Students are also learning to use Google Sheets – a spreadsheet application and Google Forms. Students have begun to have some of their classrooms “flipped” which means they listen to lectures/take notes at home and then explore the subject with the teacher in the classroom. Students at Crestdale have a 20 minute “activity” time after lunch daily. The classes are taken outside to either the basketball or four square courts. Students have the option of playing a game, jumping rope or just walking and talking. Students are not allowed to “stand around”, use their phones, or sit down. Students also have two elective times a day. The seventh grade schedule places the students in an elective for their first class of the day,

followed by two core (math, science, social studies, English) classes, lunch, activity, another elective, and finally two more core classes. The Crestdale principal, this year opted to shorten the class times to allow students access to science and social studies daily (- in previous years science and social studies classes have alternated days.) This change shortened other periods so students are in their core classes for 63 minutes a day and elective classes are 48 minutes long. Crestdale students report that they like the shorter class times (down from 82 minutes last year) because they do not get bored as easily. They are not pleased, however with the increased homework demands.

The math teachers at my school plan together twice a week in the grade level and once a month as a vertical team. We work collaboratively to create presentations, playlists, and videos of the content to share with the students. Teachers teach the North Carolina Standard Course of Study.

I have been a math teacher at Crestdale for the past 14 years in both the sixth and seventh grades. Previously, I taught math, science, social studies, English, and physical education at a middle school in Virginia. Having had a background in a variety of subjects is making it easier for me to integrate the standards beyond math into my curriculum unit. The entire seventh grade math department at Crestdale is implementing the “brain boost” portion of this unit, while the “brain breaks” and other activities are just being piloted in my room this year.

I purchased four exercise balls for my students to use this year through a PTA grant. The balls I bought have built in feet, which look like cows udders so the kids refer to them as “cow chairs”. The students with the exception of one or two in each class are all eager to have opportunities to sit on them. The “cow chairs” are currently located at a table where students sit for half the class period and then they switch with a counterpart and spend the remainder of the class period in a traditional desk. The students bounce on the chairs throughout the class period and they are smiling the entire time. I would like to add more “cow chairs” as the year progresses.

I also scavenged three standing desks, from the library, they are situated in the back of my classroom. I polled the students and asked them where they would prefer to have their place in the room be a standing desk, a cow chair, or a traditional desk and in each class over seventy-five percent of the students opted for the non-traditional seating arrangement. To allow as many students to use the standing desks as possible, the students have a partner with whom they switch seats, midway through the period.

Having alternative seating arrangements in the classroom has allowed me to get rid of several of the desks, thus freeing up floor space for students to work on projects on the floor if they desire. It has also made more room for the students to participate in brain breaks during the class period.

Rationale

Students who are physically active are more likely to do better in school, in Charlotte students demonstrate a trend toward increasing inactivity, in a 2013 study it was found that 18% of respondents had not participated in at least 60 minutes of physical activity on at least one day, 37% watched television three or more hours per day on an average school day, and 39% used computers three or more hours per day on an average school day.¹

To combat this trend and to gain real-world data, this curriculum unit will integrate physical activity with math class. Students will participate in “brain boost” homework two evenings a week and will have opportunities to do “brain breaks” in the math classroom. The rule of thumb for teachers in the classroom is that students usually can only attend to a task for as many minutes as they are old, plus or minus two minutes.² By redirecting with a brain break or shift in classroom activity students are redirected quickly and less class time is lost. In a professional development I took a few years ago I was introduced to the concept of 28/3. The trainer, Spence Rogers of PEAK (performance enhancement for all kids) said that in order for a person to remember and recall a new skill it took exposure and practice of that skill at least 28 times over a three week period with REM sleep in between the exposures to make the concept easy to recall.³ Some of the brain breaks my students will do will be linked to the math they are learning. The box and whisker dance has hand motions and a chant that introduces, reinforces, and reviews the five number summary of a box and whisker plot. The “dance” gets the students up out of their seats, it allows them to move, and it is a good way to review (quickly) vocabulary.

A study in the United Kingdom that looked at students born between 1991 and 1992 found that the more fit the students were had a direct correlation to their scores on standardized tests in schools. Boys who exercised for just 29 minutes a day had better scores than their peers who did not exercise. The more activity the students participated in yielded a better score on tests. The study also noted that girls who exercised only 18 minutes a day during study posted better science performance. The recommended time for adolescent exercise is 60 minutes a day, but the study found that even with a less than optimum participation yielded a positive correlation to improved performance in school.⁴

Regular physical activity is important not only for physical health resulting in lower body fat, stronger bones, greater muscle strength, and a stronger heart. Regular physical activity is also important for mental and cognitive health as well. Exercise has been shown to reduce anxiety and depression, as well as being linked to higher self-esteem.⁵

Researchers have found that students who are active can maintain greater focus, have faster processing speed, and perform better on standardized tests than their less fit peers.

The advantage of exercise at school and giving exercise as homework is that it improves overall health, and can improve academic performance. Students who are allowed to stand at desks rather than sit burn more calories which can lead to improved physical condition.⁶ Students who engage in active lessons are also burning calories and are moving more blood through the brain which “fires it up” for learning.

Students spend between six to seven hours a day at school. If, while at school they are encouraged to participate in vigorous physical activity in gym class and at recess: and if students are allowed to stand and move during their non-physical education class time they will have more opportunity to improve their overall fitness level. The added bonus of being given exercise as their homework will also improve students cognitive and mental health as well.⁷

The incorporation of brain breaks and the implementation of less orthodox homework in math class has led to the opportunity for cross-curricular connections. In math class, students are learning about the reasons for these activities. Students have a section in their notebooks dedicated to brain boost. In this section there are their math notes as well as some of the science behind the change in class. Students will be tracking their activity beyond the brain boost homework that is required. Students have diagrams of the brain, pictures of the brain breaks that they will be doing throughout the year, and the graphs and other math associated with the brain boost activity they have been doing for class.

Background Information

The brain is a three pound powerhouse that is responsible for keeping a person alive. It can be divided into three parts: the forebrain, the midbrain, and the hindbrain.

The forebrain is where the cerebrum is housed. This part of the brain is the most highly developed part of the brain and is responsible for intellectual activities. The cerebrum is made up two parts- hemispheres, which are separated by a fissure. The two halves of the cerebrum communicate via the corpus callosum- a thick band of nerve fibers that is located at the bottom of this fissure; because opposite sides of the brain control opposite sides of the body, the communication between the left and right hemispheres is crucial. The midbrain controls eye movement and other voluntary movements. The hindbrain is the upper part of the spinal column, the brain stem and the cerebellum. This part of the brain is responsible for movement and learned rote behaviors- when you perform a dance or a series of movements in tai chi you are activating the cerebellum.

Each cerebral hemisphere is made up of several parts: the two frontal lobes, which are responsible for short term storage. Broca’s area helps with speech. The parietal lobes allow us to enjoy food and are responsible for the sensory areas of the brain that give our bodies information about taste, touch, movement and temperature. Reading and math are

processing also take place here. The occipital lobe is linked to memory and vision. The temporal lobes allow us to enjoy music and are also responsible for memories and processing information about the four senses.

Covering the cerebral hemisphere is a thin layer of “gray matter”, which gets its gray color from the many neuronal cell bodies that pack this area. Neurons are made of three parts: a nucleus, dendrites, and axon(s). The dendrites are like the branches of a tree that extend out in all directions from the cell body. Dendrites receive messages from other neurons via synapses- which are at the end of the dendrites. Once a message is received it travels to the nucleus, where it is processed. Once the information has been processed it travels along an axon to its end called a terminal button. The terminal button then sends its information to muscles, glands or other neurons. Some axons are quite short, others are long, like those that run along the spinal column. The longer axons are covered with a strong coating of myelin which protects the axon and allows the axon to relay messages more quickly.⁸

Content Objectives

This curriculum unit will be used as a means to emphasize and review the statistics standards for sixth and seventh grade math. Students in the sixth grade learn to identify and write a statistical question. They also learn how to evaluate a set of data based on its variability by looking at a box and whisker plot, the mean absolute deviation of the data, and the measures of central tendency the mean, median, and mode. Students learned to determine based on the data when it is presented in a line plot or a stem and leaf plot which measure, mean, median, and/or mode could best be used to support an argument or explain a situation. Seventh graders take what they learned in sixth grade and expand upon it. Seventh graders create and compare double box plots and double stem and leaf plots. Students can then use these structures to create arguments for their mathematics. Students continue their study of mean absolute deviation of a set of data. Students will use the standards to create a project of their own design in the spring of the year.

This unit will also support the seventh grade physical education and science classes. Students in seventh grade physical education are expected to “understand the importance of achieving and maintaining a health-enhancing level of physical fitness and to use the gender- and age-related health-related physical fitness standards defined by an approved fitness assessment to self -evaluate fitness levels.”⁹ As the students work through the brain boost activities they will be expected to self-evaluate the impact the alternate math homework assignments are having on their general well-being. The seventh grade science curriculum includes a unit on the major systems of the human body and the way these systems interact with each other.¹⁰ As students work through the unit they will be given reasons based on the physical education and science standards for the need for more exercise and movement and the links between fitness and “smartness”.

Activities

Activities will be implemented bi-weekly. Brain breaks will be done daily in class. Students “study” statistics in the spring, but they will have had the math of the unit introduced over the course of the year, so by the time they get to the statistics unit they will not have to “learn” any more statistics, they will create a project demonstrating their mastery of the seventh grade math standards. Students will create a project using “brain boost” data, or they may choose another topic.

Activity One

Brain Boost- For homework bi-weekly, students will be asked to participate in aerobic activity for at least 30 minutes. Students may spend time at athletic practice, walking with their families, riding bicycles, playing outside, etc. The students record the duration and activity type in their agenda with a parent signature to acknowledge completion. The following day the students create a line plot of their activity with the activities of their classmates (Figure 1). If the classroom has a smartboard this can be one using technology, if not it can be created on the board using dry erase supplies or sticky notes. Students or the teacher may decide the exercise categories. Following the creation of the graph the students then review the skill of converting between fractions, decimals, and percents. A sample of the categories on the line plot could be athletic practice, bike riding, long/skateboarding, walking, running, other. The students found the percent for each category of exercise without the assistance of a calculator. Students were asked to practice finding the percent and to review percent to prepare the students for their study of proportions, and to maintain the skill of being able to perform basic math computation without the assistance of a calculator. Students will periodically create this data display again and practice the skills of converting between fractions, decimals, and percents.

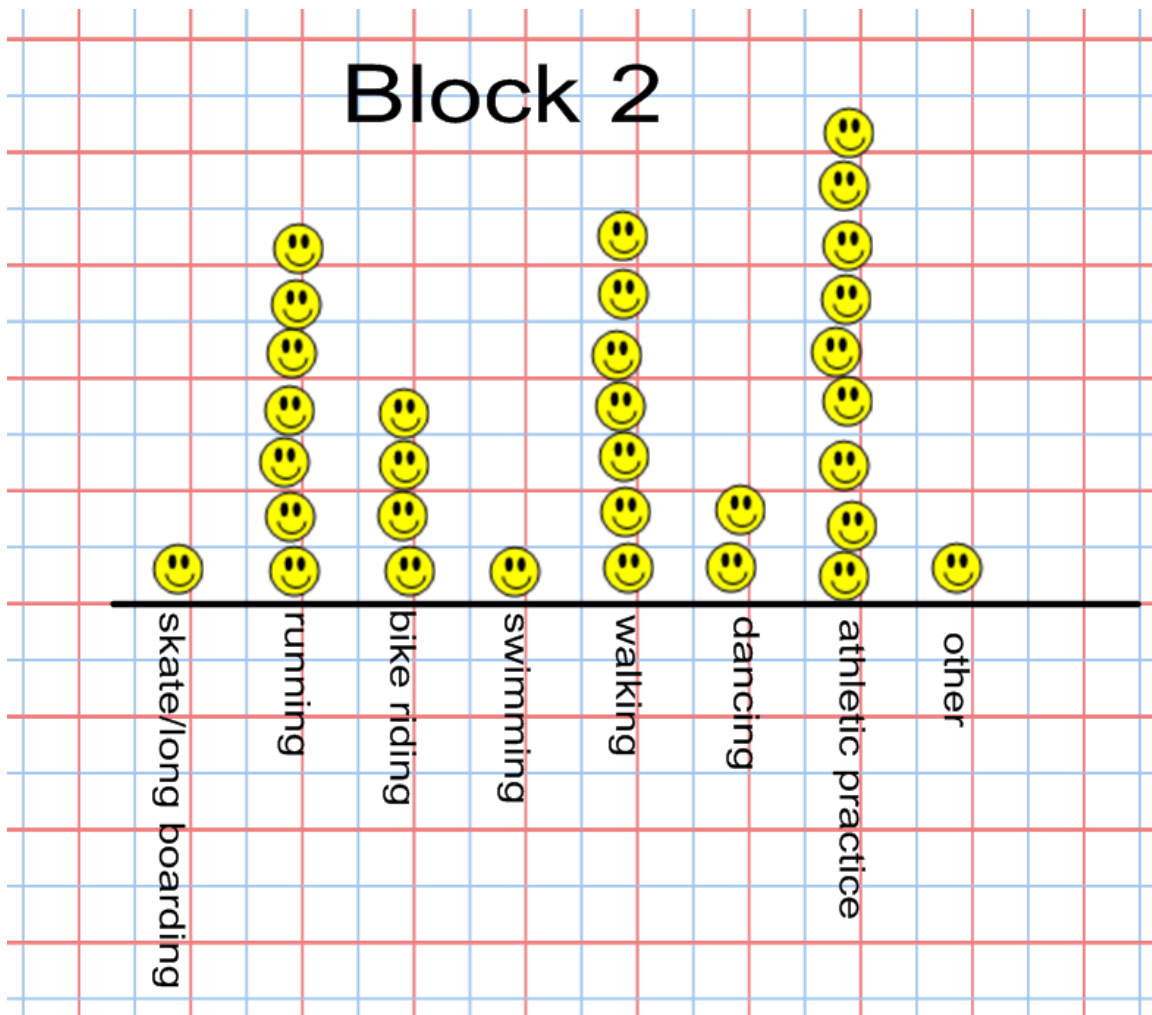


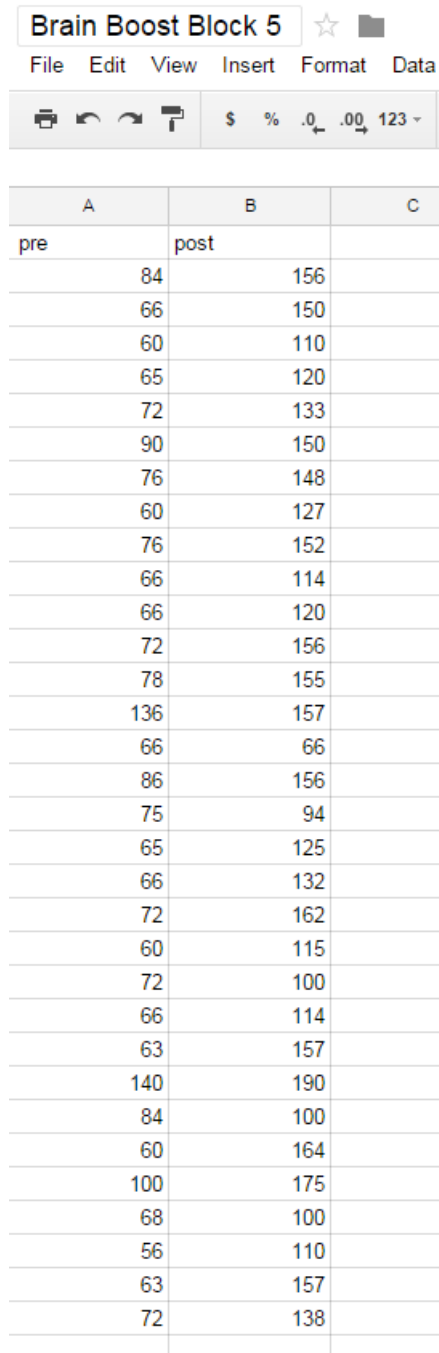
Figure 1. Example of line plot of brain boost data on a Smart board.

Activity Two

Brain Boost + Pulse Pre/Post

After the students are comfortable with completing brain boost homework, they learn how to find their pulse so they can gather additional data. The students place their ring and middle finger on their carotid artery and counted the number of beats they feel as they watch the second hand on a clock. Students watch the clock for ten seconds and record their heart rate. That evening students record their heart rate before and after they exercise. They wrote both of their times down in their agendas and again had their parents sign to acknowledge the completion of the homework. The next day in class

students changed their data from ten seconds to a minute, by multiplying each of their numbers by six. The students entered their data into a Google Sheet in class the next day. (Figure 2)



A	B	C
pre	post	
84	156	
66	150	
60	110	
65	120	
72	133	
90	150	
76	148	
60	127	
76	152	
66	114	
66	120	
72	156	
78	155	
136	157	
66	66	
86	156	
75	94	
65	125	
66	132	
72	162	
60	115	
72	100	
66	114	
63	157	
140	190	
84	100	
60	164	
100	175	
68	100	
56	110	
63	157	
72	138	

Figure 2. A list of pre/post pulse from brain boost homework in a graphing calculator.

To create a Google Sheet, from Google Drive choose New, then choose Google Sheet, name the sheet and set up the categories. To share this sheet with my students, I chose the share option at the top of the page and copied the shareable link onto my Google Classroom. The students were then able to complete the logging of their activity at their own pace and at their own desk by using their Chrome book.

To reinforce the skills learned in 6th grade statistics students were asked to find the mean, median, mode and range of each column of data. Student did these calculations using the TI-73 calculator. The students were instructed how to enter data into lists and then how to use the functions on the calculator to manipulate the data. The benefit of using the calculator is two-fold; first, the data are easier to adjust and work with, second, the TI-73 is very similar to the TI-84 that the students use in the 8th grade so the students are exposed the technology they will use in upper level math courses. Students can do this activity and practice this math over the course of the year to keep their skills sharp.

Activity Three

Brain Boost+ Graphing. The third type of brain boost homework is an extension of the first brain boost. Students again track the activities of their classmates, but they will now represent their classmates' activities using a circle graph. Students will find the percent that each group exercised and then multiply the percent by 360 to find the number of degrees needed to create a circle graph.(Figure 3) Students will then use a protractor to measure the angle needed for each type of activity. Students will create a key and label their graph. After they have made a graph by hand they will be taught to create a graph using the calculator's graphing function.



$$10/25 = 0.4 = 40\% \times 360 = 144 \text{ degrees}$$

$$5/25 = 0.2 = 20\% \times 360 = 72 \text{ degrees}$$

$$5/25 = 0.2 = 20\% \times 360 = 72 \text{ degrees}$$

$$3/25 = 0.12 = 12\% \times 360 = 43.2 \text{ degrees}$$

$$2/25 = 0.08 = 8\% \times 360 = 28.8 \text{ degrees}$$

Figure 3. Circle Graph- made from class brain boost data.

Activity Four

Brain Boost+ Mean Absolute Deviation. The mean absolute deviation (MAD) is used to find the variability of a data set. If the MAD is large, it tells the reader that the mean will not be a good measure to use to look at the variability of the data set. The MAD is found by averaging the data and then subtracting each of the original data points from the mean, and then the distances of those data points from the mean are averaged. A data set with a variability of close to one indicates that the data is all fairly close and that the mean would be a good way to describe the data.

Activity Five

Brain Boost + Box and Whisker Plot. The students will do their Brain Boost homework and record their pulses pre and post. These data will be entered into a Google form then made into a Google sheet. Students will then enter these data into the list function of their graphing calculator. The students will then create a double box plot of the data. Students will find the lower extremes, upper extremes, media, and quartiles of their data. They will plot the box plots and compare the two sets of data. Students will be asked to comment on the interquartile range and range of the data. Students will be asked to talk about the spread of the data. Students could also look at the MAD when talking about the spread of the data. Students would also calculate whether or not the data gathered pre/post or both had any outliers. An outlier is 1.5 times the interquartile range. This

value is subtracted from the lower quartile or added to the upper quartile. If a data point falls outside these numbers it is considered to be an outlier.

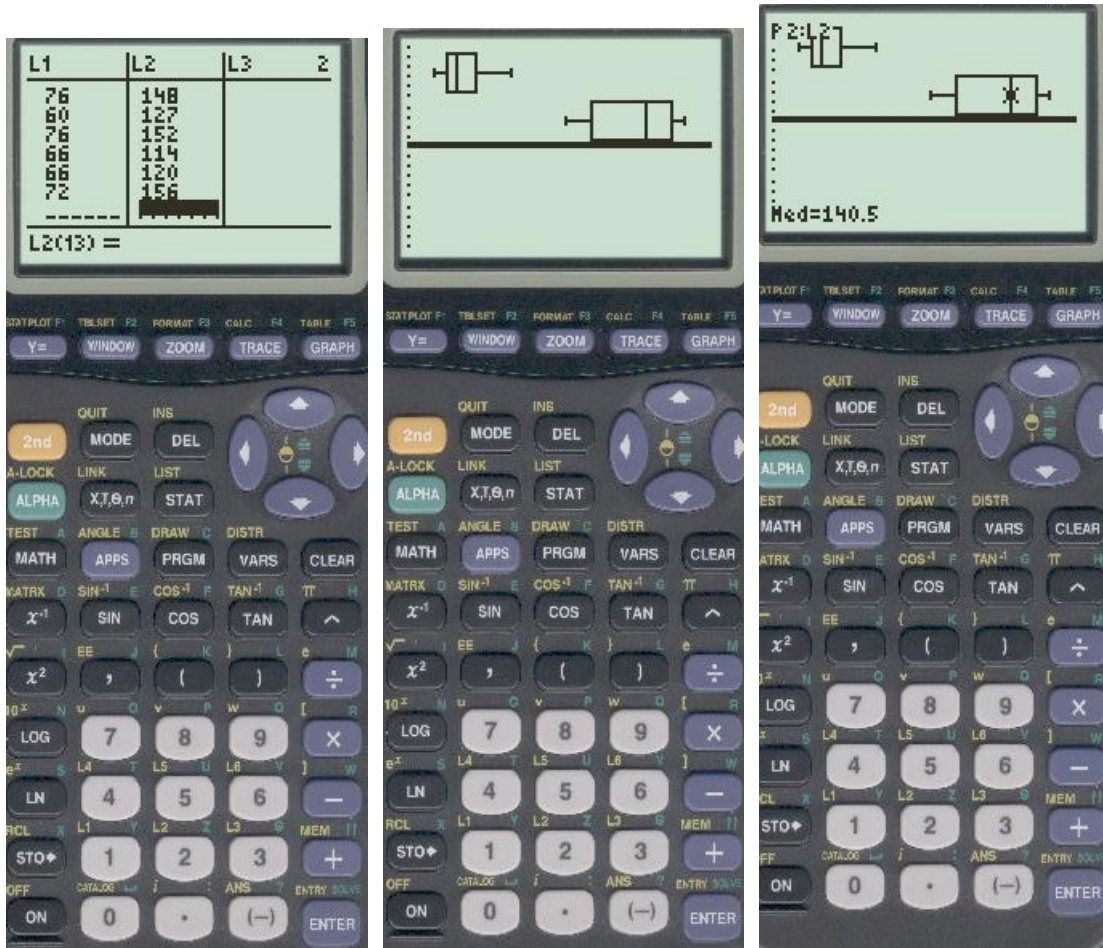


Figure 4. Example of screens from creating a box plot on a graphing calculator.

Activity Six

Brain Breaks.

Students will learn and participate in a series of activities which are designed to change or focus the physical and mental state. Not only do the breaks help to improve concentration they also help to stimulate the brain. Some of the brain breaks are done to clear the pathways between the hemispheres of the brain. Others are to get the students moving and breathing. And still others are to teach and reinforce content being learned in

math class. Brain breaks are usually quick – less than three minutes and “reset” the students to continue learning and working. Some of the brain break exercise are from the brain gym, referenced in a book by Carla Hannaford who says, “every time we move in an organized, graceful manner, full brain activation and integration occurs, and the door to learning opens naturally”. The exercised the students will learn and do in class will be brain buttons, the cross crawl, the hook up (which I have renamed the tangle), ear tugs, temple massage, and figure 8’s.

Box and Whisker Dance

Box and Whisker Dance steps.(figure 5) Students stand facing the front of the room. With hands fisted they bounce first their right hand up and down and say “lower extreme” then they bounce their left hand up and down and say “upper extreme”. Students then run their hands down the mid-line of their body and say “median”. Then they run their hands from each armpit down each side and say “lower median” (left) and “upper median” (right). Finally, they put their hands on their waists and wiggle from side to side saying “interquartile range”.

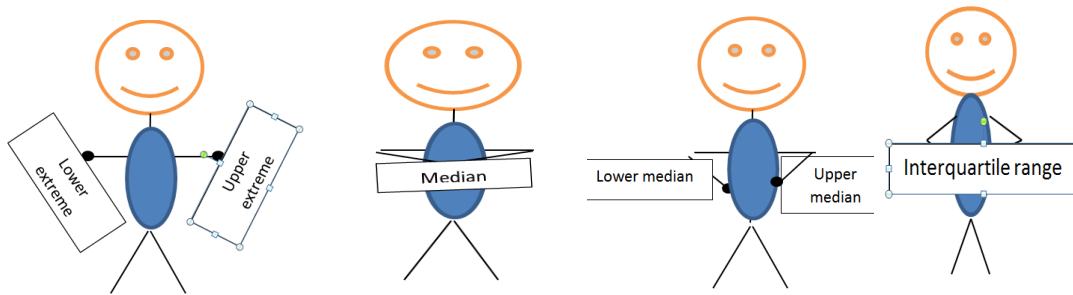


Figure 5. Box and Whisker “Dance Steps”.

Measures of Central Tendency Song

Sung to the tune of “Hey Diddle Diddle”. “Hey diddle, diddle, the median’s in the middle, add and divide for the mean, the mode is the number that happens the most and the range is the difference between.”

Brain buttons

Brain buttons are done by placing one hand above the navel and the other hand crosses over the body. While in this position the student gently rubs the space between the first and second ribs under the collar bone while patting the stomach. Students will then switch hands and activate the other side of the body.

Cross Crawl.

This activity is done by marching in place slowly while touching the opposite hand to the opposite knee as it is brought up. Students will do this over the period of a minute. It is thought that by crossing over center, this activity wakes up the brain and will cause the two halves of the brain to better communicate. I am incorporating math by having the students do chants after their rhythm is established. One day they will recite the prime numbers to 100, another they will do the cross crawl followed by a clap while they say “say it, write it, simplify” (how to change a decimal to a fraction), another day they will recite the first ten perfect squares and the first ten perfect cubes.

The Tangle

I have renamed, in Hannaford’s book it is referred to as the hook-up. Students extend their arms in front of them, and then cross their right hand over their left, the hands are then clasped and flipped underneath so they rest against the chest. The student then crosses his legs and finally applies his tongue to the roof of his mouth. Students are asked to remain in this position for one minute. This position is said to release stress.

Lazy Eight

Students will learn the lazy eight, where they draw an infinity symbol in the air in front of them with their dominant and then their non-dominant hand. Once again by crossing over center the hope is to speed up communication between the hemispheres of the brain.

Thinking Cap

The students will simply grab the outer portion of the ear and pull upward.

Energy Yawn

The energy yawn is done by massaging the jaw where the upper and lower jaw meet, it is said to relax the face and relieve stress. “Movement awakens and activates many of our mental capacities; it integrates and anchors new information to our mental capacities.”¹¹

Brain Yoga-

Students stand near their desks, extend one arm, bring it across the body, and grab hold of the earlobe on the opposite side of their body, then they extend the other arm and did the same thing. When they had hold of their earlobes they then did slow squats for two minutes, inhaling when going down, exhaling when coming up. The purpose of this activity is to energize, center, and focus the mind.

Appendix 1: Implementing the Teaching Standards

Students who complete this unit will have created line plots (4.MD.4.). They also will have worked through some of the sixth grade math standards to include reasoning about real-world math problems, finding the percent (6rp3 a and c). The focus on statistics is heavy from understanding that a set of data can answer a statistical question (6SP2), looking at the shape of data distribution which can be described by its center, spread, and overall shape. (6 SP2). Students will also display their data using a box plot(6SP3) Students will learn to analyze the data based on the shape and spread of the data, they will learn to look for patterns in their data and will be able to explain what those patterns mean. (6SP4 ,SP5)

Students will be able to change between fractions, decimals, and percents, and will be able to explain what a repeating decimal means. (7NS2d) Students will be able to understand a population based on a sample of the population and be able to make generalizations about a population (7.SP.1, 7SP2) Students will be able to assess overlap between sets of data and will be able to use data to gain information about a population (7.SP.3.,7.SP.4.) ¹

Students will apply information from a variety of sources to improve overall health. Students will track physical activity. (PE.6.MC.2.1 and PE.6.MC.2.4) Students will understand the importance of achieving and maintaining a health-enhancing level of physical fitness as well as track their pre and post fitness. Students will also monitor their social life to include the amount of sleep, exercise and calories they use each day. Students will also monitor the amount of aerobic exercise they engage in and will be conscious of keeping in the appropriate target heart rate zone/perceived exertion levels, including cool-down and appropriate post-activity stretching (PE6.HF.3.2)

Students will understand the importance of maintaining and achieving a health enhancing level of physical fitness, and will self evaluate their fitness levels. Students will also analyze data and examine the relationship between physical activity and caloric intake. (7.HF.3.3 PE.7.HF.3.2)

Teacher Resources

The Brain

Heffner, Christopher L., “Neurotransmitters”, All Psych.com.
<http://allpsych.com/psychology101/neurotransmitters/#.VjR-PberRMw>- a quick overview

of neurons and many of the neurotransmitters and what they do for the body. (accessed July, 2015)

National Institute of Neurological Disorders and Stroke. "Brain Basics, Know Your Brain. http://www.ninds.nih.gov/disorders/brain_basics/know_your_brain.htm. (accessed October, 2015)

Society for Neuroscience. "Brain Facts: A Primer on the Brain". http://www.ninds.nih.gov/disorders/brain_basics/know_your_brain.htm. (accessed October, 2015)

Brain Breaks

Colorado Education Initiative, *Take a Break: Teacher Toolbox for Physical Activity in the Secondary Classroom*, http://issuu.com/coloradolegacyfoundation/docs/cei_secondary_pa_breaks_-_tool_kit_?e=3141566/7615094- a pdf document out of Colorado which outlines different types of brain breaks. (accessed October, 2015)

Thrive Place, LP, "Day to Day Parenting", <http://day2dayparenting.com/qa-normal-attention-span> - blog outlining a "rule of thumb" for attention spans of children at various ages. (Accessed November, 2015)

Exercise and the Brain

CDC- Youth Risk Behavior Surveillance System, Charlotte Trial. http://www.cdc.gov/healthyyouth/yrbs/pdf/obesity/charlottemecklenburg_obesity_combo.pdf. (accessed, September 2015)

Hannaford, Carla. *Smart Moves: Why Learning Is Not All in Your Head*. Arlington, Va.: Great Ocean Publishers, 1995. An oldy, but a goody, an accessible read which also included information about brain breaks and brain gym. (accessed July, 2015)

Institute of Medicine, the National Academy of Sciences, *Educating the Student Body Taking Physical Activity and Physical Education to School* https://iom.nationalacademies.org/~media/Files/Report%20Files/2013/Educating-the-Student-Body/EducatingTheStudentBody_rb.pdf - article explaining the benefits of exercise and the brain, as well as the school's role in supporting student fitness. (accessed, October, 2015).

Ratey, John J., and Eric Hagerman. *Spark: The Revolutionary New Science of Exercise and the Brain*. New York: Little, Brown, 2008. Great book about all aspects of life and how it relates to exercise and a healthy brain from autism to alzheimers. (Accessed March 2015)

Sifferland, Alexandra. "Study: More Active Kids get Higher Test Scores", *Time*. <http://healthland.time.com/2013/10/22/study-more-active-teens-get-higher-test-scores/> (accessed October, 2015).

Stromberg, Joseph. "Five Health Benefits of Standing Desks", *Smithsonian.com*. <http://www.smithsonianmag.com/science-nature/five-health-benefits-standing-desks-180950259/?no-ist> . (accessed October, 2015).

Sui, Choa Kok. *Superbrain Yoga*. <http://www.pranichealingontario.ca/SUPERBRAIN.pdf> - several research studies on yoga practice and its influence on the brain. (accessed October, 2015).

Posters (all appropriate to hang in a school environment or to send home with students)

American Heart Association and Monkey Joes. "Is your child getting enough exercise?" <http://www.designinfographics.com/health-infographics/is-your-child-getting-enough-exercise> (accessed September, 2015)

CDC. "The more they burn, the better they learn". <http://physiodevelopment.com/exercise-affect-brain-chemistry/#more-2592> simple, powerful graphic. (accessed September, 2015)

Fpr.com. "Your brain loves the gym". <http://blogs.bmj.com/bjasm/files/2015/03/YourBrainLovesTheGym.png><http://blogs.bmj.com/bjasm/files/2015/03/YourBrainLovesTheGym.png>. (accessed September, 2015)

Goodwin and Cham. "Your brain by the numbers". <http://blogs.bmj.com/bjasm/files/2015/03/YourBrainLovesTheGym.png>. Terrific graphic about your brain with kid-friendly pictures and facts. (accessed March 2015).

Health Central. "Infographic, Know your Brain's Chemistry". <http://physiodevelopment.com/exercise-affect-brain-chemistry/#more-2592>. (accessed, October, 2015) .

McManus, Luke. “How does exercise affect our brain chemistry?”
<http://physiodevelopment.com/exercise-affect-brain-chemistry/#more-2592> . More suited to upper grades or adults. (accessed September, 2015)

Student Resources

Chudler, Eric H., “Neuroscience for Kids”.
<https://faculty.washington.edu/chudler/neurok.html> – Entire website, kid friendly. very good article describing the anatomy of a neuron with color pictures and a nice breakdown of the difference between a dendrite and an axon. (accessed October, 2015)

Easy Science for Kids. Human Body: Human Brain. <http://easyscienceforkids.com/all-about-your-amazing-brain/> - more facts about the brain with a very good picture of a neuron, dendrites and an axon. A quick video at the end explains what the brain is and how it works. (accessed November, 2015)

National Geographic Society. “Your Amazing Brain”,
<http://kids.nationalgeographic.com/explore/science/your-amazing-brain/#brain.jpg> – the last paragraph mentions the connection between exercise and the brain. (accessed October, 2015)

Science Kids. “Human Body Facts: Brain Facts”,
<http://www.sciencekids.co.nz/sciencefacts/humanbody/brain.html>. Bulleted list of brainfacts for kids. Website also has games, quizzes and activities about the body. (accessed October, 2015)

¹http://www.cdc.gov/healthyyouth/yrbs/pdf/obesity/charlottemecklenburg_obesity_combo.pdf

² <http://day2dayparenting.com/qa-normal-attention-span/>

³ <https://www.peaklearningsystems.com/>

⁴ <http://healthland.time.com/2013/10/22/study-more-active-teens-get-higher-test-scores/>

⁵ https://iom.nationalacademies.org/~media/Files/Report%20Files/2013/Educating-the-Student-Body/EducatingTheStudentBody_rb.pdf

⁶ <http://www.smithsonianmag.com/science-nature/five-health-benefits-standing-desks-180950259/?no-ist>

⁷ https://iom.nationalacademies.org/~media/Files/Report%20Files/2013/Educating-the-Student-Body/EducatingTheStudentBody_rb.pdf

⁸ http://www.ninds.nih.gov/disorders/brain_basics/know_your_brain.htm

⁹<http://www.dpi.state.nc.us/docs/acre/standards/new-standards/healthful-living/khs.pdf>

¹⁰ <http://www.dpi.state.nc.us/docs/acre/standards/new-standards/science/6-8.pdf>

¹¹Hannaford, Carla. Smart Moves: Why Learning Is Not All in Your Head. Arlington, Va.: Great Ocean Publishers, 1995.