Teaching Multiplication Facts: Using Kinesthetic Movement and Crossing the Midline

By

Ceirra Cristy

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Dr. Laura Adkins

Professor of Math Education

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Table of Contents

Abstract

The definition of crossing the midline is when the middle of the body is crossed with another part of the body such as an arm or a leg. This stimulates both sides of the brain. My unit plan includes real life examples that will help students understand the concept of multiplication, as well as teach them life long healthy exercise habits. The standards in 4th grade math require students to have an in depth knowledge of multiplication in order to apply explain it verbally and interpret it. This means that students must know all of their multiplication facts in order to use them and not only memorize them. My unit plan will be taught at the beginning of the year to insure that students know their multiplication facts and understand the concept. This will help them with the rest of the school year. The unit plan will help students achieve academically and will help them build a healthy life style. This will apply to all types of learners and allow them to excel in mathematics.

Oftentimes, students have trouble learning multiplication facts, and this can burden them throughout their education. Students are usually expected to memorize multiplication facts using flash cards. This can be hard for most students because they may not understand the concept of multiplication. In my research I found that using kinesthetic movement and crossing the midline can benefit students academically. This suggests that if my unit plan were used in a classroom it can be more effective than rote memorization.

I came up with the idea for my senior thesis during my Junior Internship at Harry S. Truman in Webb City, Missouri. I was in a 4th grade classroom and had the opportunity to help students while they were learning their multiplication facts. At one point I gave students, who were struggling to complete the timed multiplication test a chance to take it orally. They would read the answer to the problem as I followed along with them. I began to notice that students often knew the answer to the problem however, it took them a little longer to say it. This hindered them on the timed tests because their math facts had not yet become automatic. The method for them to learn their multiplication facts allowed them to make flashcards for the number they were on and then rehearse them when they had extra time. While I was observing I saw that this took about 5-10 minutes of their instructional time. At the end of the week they took a timed test and had to get all of the problems correct to move on. Their progress was monitored on the classroom wall. Each number set of multiplication facts was given an ice cream cone and then the students put their name under the set they were on. I observed that about half of the class did well, but the other half was struggling to move past their "6's" or "7's." I remember when I was in school my teacher used a similar method and from what I can remember, the class seemed to have similar results. In most of the classrooms I have observed the teachers have used similar techniques as well. I wanted to come up with a better way to teach students their multiplication facts, as well as, to incorporate physical activity to help keep the students healthy.

Multiplication facts are the basis for many problems in mathematics. They are the foundation for finding factors, figuring out division problems, and many other processes in math. Students are expected to memorize multiplication facts by using flash cards, memory games, and other types of rote memorization. Students can often get left behind if they cannot memorize

their facts by the time the teacher moves on to a new concept. This can cause problems for the students, teachers, school administration, and parents. When students fall behind, teachers have to use valuable instructional time to go over a concept that was supposed to be previously learned. Students can become frustrated and give up. This can cause schools' test scores to suffer. The goal of my project is to eliminate these problems.

I know that crossing the midline and incorporating kinesthetic movement helps stimulate the brain in a more effective way than having students sit in their seats and memorize flashcards. I came up with a unit plan that incorporated both of these practices to create a solution to allow all students to be successful in learning their multiplication facts. The unit plan I created does not take away from crucial instructional time, but helps give students the opportunity to get up and move around in order to prepare them for lessons that are about to be taught.

I have observed many classrooms that use brain breaks in order to prepare students to learn. These brain breaks usually take about 3-5 minutes on average. In my unit plan I use brain breaks to continue the instruction of multiplication facts. This helps serve the purpose of preparing the students for learning new information as well as rehearsing their multiplication facts. I will also send home workout routines for students to do with their family. These workout routines will include multiplication facts. The students will do the workout and then fill in how many of each exercise they did.

This quotation is what my unit plan and research is based on. A Chinese Proverb states, "Tell me, I'll forget, Show me, I'll remember, Involve me, I'll understand." Telling a student the answers to multiplication facts will lead her to forgetting. Showing her on flash cards may allow her to remember. But, involving her in kinesthetic movement that helps her learn her multiplication facts will allow her to understand the concept. This makes learning multiplication

facts significant to many people.

Students require more brain stimulation to learn concepts. Learning has become more active and involved. Teachers are catering to all learners and their learning styles. The Missouri Southern Lesson Plan includes eight learning styles: Naturalistic, Visual-Spatial, Musical, Verbal-Linguistic, Logical-Mathematical, Bodily Kinesthetic, Intrapersonal, and Interpersonal. It is difficult for a teacher to cater to all of these learning styles; however, it is necessary to reach all students. This means that teachers must take new approaches to teaching old concepts. If you observe a classroom today you will often see students moving around and being active. Research has shown that an active body means an active brain. After completing a study on the effects of physical activity on the brain, Dr. Chuck Hillman stated, "Physical activity is related to better cognitive health and effective functioning across the lifespan"(2006.) Teachers can incorporate movement into lessons so students can learn more effectively. When movement is used in the classroom students can focus better, as well as get out excess energy. This is beneficial to both the teacher and the students. Imagine a 4th grade classroom where students don't wander around the room and, thus cause distractions because they have too much built up energy. Most teachers would agree this would be an ideal classroom. With my research I have found a way to reduce this by including everyday lessons on multiplication that include movement.

Multiplication facts are typically taught using memorization. Students are given flash cards or other methods to memorize their multiplication facts. This means that students are memorizing without actually understanding the concept. To truly learn something, students must first understand the concept. You can tell a student that four times four is sixteen a hundred times and she may not remember it. However, if a student participates in an activity that incorporates this concept she is more likely to remember it. Crossing the midline during an activity

incorporates both sides of the brain. If a student participates in exercises that include crossing the midline, her brain will be more active. This means that she will be more likely to learn a concept while participating in this type of activity. My project is important because it will help find a way to use movement to help students learn all of their multiplication facts.

Right now there is not a standard way to teach multiplication facts. Teachers are required to teach them, but each classroom may have a different method. Some methods may work better than others. If a student is put in a classroom with a teacher whose method does not work she may suffer throughout her education. This can also be the case for a student whose parent has no idea how to help his child learn her multiplication facts. By creating a unit plan that students can use both at school and home I hope to close the gaps between student's memorization of multiplication facts.

My thesis is important because it can prevent students from falling behind, and thus suffering throughout their education. Imagine a student that cannot learn his math facts, but is extremely good at math up until this point. This student may be put in remedial classes for the rest of her education only because he cannot memorize a somewhat simple concept. But, if a unit plan was created that helped this student learn her multiplication facts she could continue to advance and succeed in math. This is a problem for many American students. They fall behind because we are focused on reading and language arts more than we are focused on mathematics. For a first world country we have significantly low scores in math. Among 34 developed countries the United States rated 21st in mathematics. My project will help improve test scores and students' success in math.

Obesity and inactively is also a big issue in the United States. Childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years ("Childhood

Obesity Facts"). In 2012 more than one third of children were obese or overweight. Children participate in less physical activity everyday than in years past. My project will create a unit plan that will help improve this problem. Students are expected to sit in their seats at school everyday with very few breaks. My unit plan will include exercises and activities that allow students to get up and move around. By participating in learning activities that include movement everyday, students will increase muscle mass, reduce fact, and increase energy levels. This will contribute to the fight to end childhood obesity in our country.

Overall, my thesis will benefit many people. Teachers will benefit because they will not have to constantly go back over multiplication facts when they have moved on to new concepts. It will also be helpful that every student will have the same level of understanding. Therefore, teachers may be able to incorporate higher-level concepts and activities. These activities could include topics that would be taught in the next grade. This would allow students to have a jump start on what they will be learning in 5^{th} grade and feel more comfortable when it is taught. Students will benefit because they will not be frustrated and feel like giving up on math because they do not know their multiplication facts. Parents can benefit because the lesson plan can be used at home. Parents can help their children understand their multiplication facts and also participate in the activities with their children. Parents and students can bond while participating in physical activities together. This can benefit both students and parents because they will become more active. School administration will benefit from higher tests scores. In the education system test scores can mean more funding, which can allow the school to have better resources and highly qualified teachers.

To complete my research I first collected information about how multiplication is taught and how successful it has been. The information I collected information from research articles

and previous experiences in the classroom. With this information I have formed an approach to teach multiplication that does not solely include approaches already being used. I also collected information on the benefits of kinesthetic movement in the classroom, specifically crossing the midline. I have collected information on how obesity affects learning and the benefits of daily exercise. I have found that most teachers use rote memorization to teach multiplication facts. I have collected information on how successful memorization methods are for learners. This has helped me understand why students are not successful at learning their multiplication facts.

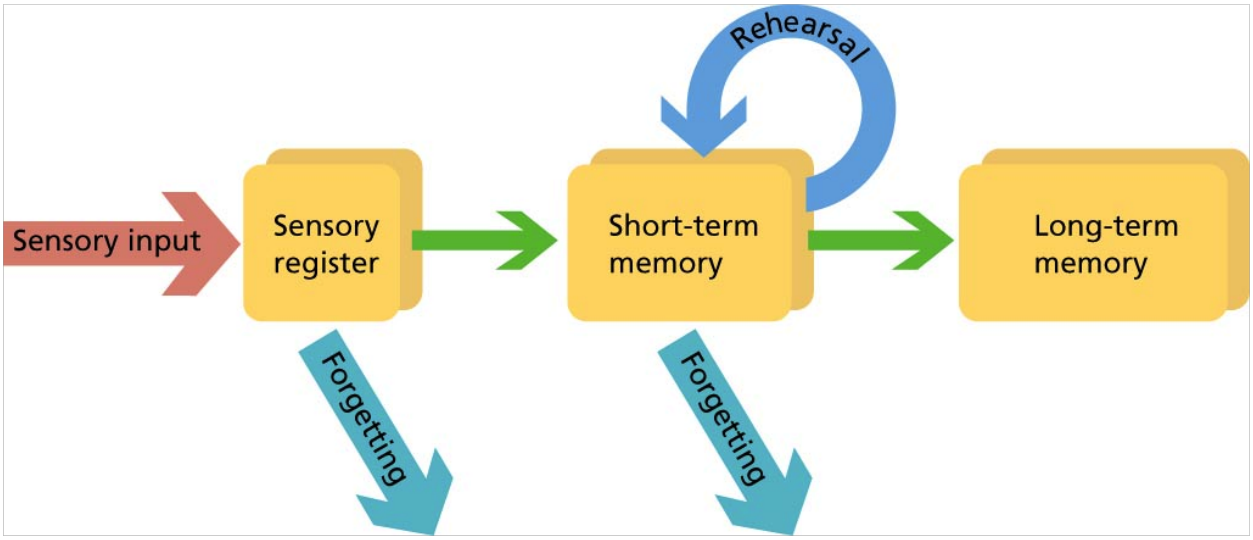
I used the information I collected to create a detailed lesson plan. I used the Missouri Southern lesson plan as a template. My lesson plan includes learning goals and objectives, student engagement, formative assessment, summative assessment, instructional input, learning activities, student accommodations, and enrichment/extension. The learning goals help both students and the teacher know what is expected in the lesson. Without this information the learning goals can be unclear and make students feel insecure. These are also important to make sure the teacher knows her final goal and does not get off track.

Student engagement is important so that students know that what they are learning relates to real life. The opportunity for success can be enhanced when the teacher uses active learning. Engagement should grab the students' attention and interest them in the subject being taught. Formative assessment should be included to check students' understanding of the concept being taught. This can be used multiple times throughout the lesson plan and the information gained from it should be used to either reteach or continue with the lesson. Summative assessment allows the teacher to make sure all of her students have grasped the concept and can now apply it. Instructional input is essential to the lesson plan because it includes all of the information the teacher and students must know to teach/learn the concept. Student accommodations and

enrichment/extension go hand in hand. These elements of the lesson plan allow the teacher to gear the lesson toward every student. Without these important elements the lesson plan will not be effective. It is important to incorporate these so both the teacher and students are successful.

Finally, I used the information I have found to explain why my lesson plan will help students be successful. I used the research on kinesthetic movement and daily activity to help reinforce my method of teaching multiplication facts.

To create my lesson plan I used the research I found on the best way for the brain to process information and store it into the memory. Ben Orlin, a high school math teacher in California, argued that memorizing does not always mean learning. Students may know that 1x1 equals 1, however they have no understanding of why that is. In order for students to memorize and be able to use their multiplication facts they must rehearse them frequently, as well as make connections to their everyday life. By making connections to their everyday life students will have a deeper understanding of multiplication facts. If a student is told four times four equals sixteen without any further connection, then it will be hard for her to remember the answer. However, if the student is told if you do four jumping jacks four times you have done sixteen jumping jacks she can imagine this and even participate in the activity, which will help her understand the concept. The stages of memory are essential to the storage and processing of new information.



There are three stages of memory processing. Encoding is the first stage and it involves elaboration and organization. Repeating something over and over to try to memorize it is not the most effective way to encode information into our long-term memory. This method is known as maintenance rehearsal. Maintenance rehearsal is effective for maintaining information in short-term memory. For example, if a student goes through a set of flashcards to memorize her "7's" multiplication facts she may be able to score well on a test soon afterwards; however, later on it is unlikely that she will be able to explain why seven times seven equals forty-nine or even answer the question correctly. Allowing students to make connections to something they can participate in will help them to remember the concept more accurately. My lesson plan allows students to participate in activities that help them have an in-depth understanding of multiplication facts. It also allows them to participate in activities that stimulate their brain and allow them to encode information more effectively.

A more effective way to memorize is elaborative rehearsal. This connects what students are trying to learn with what they already know. If the information is processed and rehearsed it can then be stored, which is the second stage of memory. Storing the memory is the most

important part because if it is not stored correctly it cannot be retrieved and then used later on during tests or other practices. The final stage is retrieval. This is when we retrieve memory that has been rehearsed and stored. It is common for multiplication facts to be taught by rehearsing them over and over until they are memorized, or not memorized in some cases. Using this method of teaching can be ineffective because the students don't have anything to connect the information to; therefore, it is not encoded into the brain as effectively for long term memory. This can make it more difficult for students to recall the answer of a multiplication fact on a test. If the test is timed, then students could be even less successful because they are under pressure.

When a concept is encoded into our long-term memory effectively we can retrieve it when prompted by cues. For multiplication facts they will be retrieved with direct retrieval. Direct retrieval is when an item is linked directly to a question or a cue. For the lesson plan, students will complete timed tests on their multiplication facts. In order for them to be successful on these tests they need to participate in learning activities that help them store their multiplication facts correctly. Participating in kinesthetic movement stimulates the brain and helps the students to memorize information more effectively.

Automaticity is important for students to be successful with their multiplication facts. Automaticity is the ability to do things without occupying the mind with the low-level details required, allowing it to become an automatic response pattern or habit. It is usually the result of learning, repetition, and practice. John Woodward, a mathematics expert, has conducted research that shows many students have trouble with automaticity in their math facts. This can hinder them throughout their education. They cannot preform tasks such as finding common denominators or figuring out factors. Teaching facts through strategies is one example of a teaching method that has been researched for teaching facts. It is shown in John Woodward's

research that students may develop strategies for multiplication on their own. Teachers may also teach strategies in lessons everyday. It can be argued that strategies help students organize their facts into knowledge that can lead to long-term retention. Other research suggests that students should then be given timed tests, which are an example of retrieval. If the information is not encoded or stored properly, then students cannot retrieve the information. Kinesthetic movement is a useful way to help students remember information so they can retrieve it later.

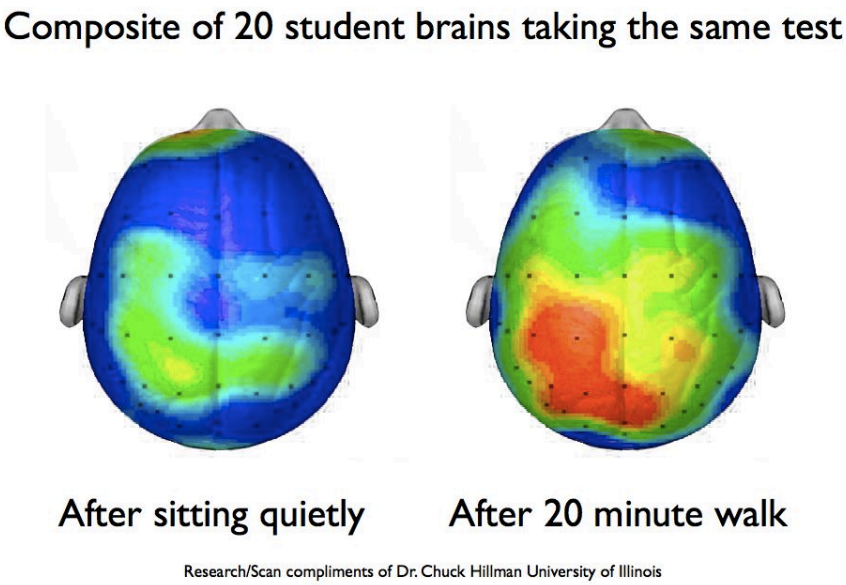
In my unit plan the strategy for remembering multiplication facts is using physical movement that is done in repetitions. While students are taking their timed tests if they have a movement that relates to the multiplication facts they will be able to remember them easier. And, if they understand how multiplication works they will be able to figure out the answer by using problem solving and activities they have participated in.

Kinesthetic movement or physical activity allows the brain to be stimulated differently than if a student were just sitting and listening to a lecture. Students learn best when they combine mind and body while learning new information. Oftentimes, students feel like they "can't" achieve in math. If a teacher uses a teaching strategy students are comfortable with they are likely to be more successful in learning the information. Students are already familiar with kinesthetic movement; they move everyday at recess, after school, at the park, and in may other areas of their life. They can use this to help them achieve in math. Because students are comfortable with kinesthetic movement they are more likely to remember and learn a subject when using it. Not only are students familiar with physical activity, but it also helps stimulate the brain more than sitting in their seats.

Research has proven that when time in physical education is reduced to give more time to a certain subject, (for example, math) a student's performance in that subject does not improve.

When researchers studied students' field test scores they found they were positively associated with their academic achievement and their Body Mass Index's were inversely related. The State of Kansas released that students who are physically fit score above standard on Kansas state assessments in reading and math (Prina). "On average, students who are physically fit score above standard on Kansas state assessments in reading and math. For students who met fitness standards for zero to one fitness test, 50.4 percent scored above standard on reading assessments and 41.8 percent scored above standard on math assessments" (*New study shows positive relationship between physical fitness and academic test scores among Kansas students*.) This helps show that incorporating movement in lessons can help students retain the information. It also shows that physically fit students preform better academically. The results were shown in both reading and math. It is important that students participate in physical activity because they perform higher in problem solving, organizing, planning, concentration, resisting impulses and using strategies to achieve goals. Students can perform better in many areas by participating in physical activity. The increase in blood flow to the brain can help with memorization by stimulating the dentate gyrus. The dentate gyrus is part of the hippocampus and is essential to memory. This is essential to students being able to remember their facts from 4th grade on.

The brain can benefit greatly from exercise. When a person participates in physical activity the brain goes through a process called neurogenesis (Mercola.) This process allows the brain to adapt and grow new brain cells. The benefit of new brain cells is that they can help improve memory. When students exercise, their brain produces more gray matter in the hippocampal region and this helps with memory. Multiplication facts have to be memorized in order to be automatic. Exercise helps the brain with memory. When exercise and multiplication facts are taught together it will help students remember.



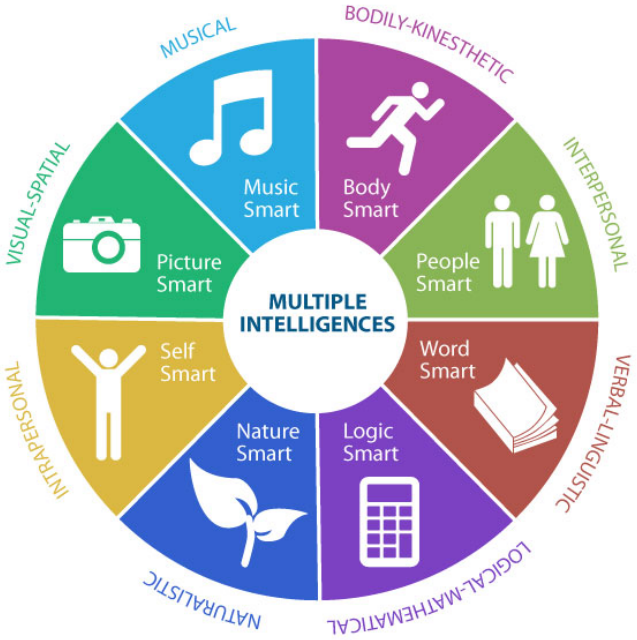
This diagram of the brain suggests that allowing students to get up and move stimulates their brain much more than just sitting quietly. The results of the brain scan would be similar for students participating in memorization techniques for multiplication facts. However, if students were participating in a physical activity while learning their multiplication facts their brain would be far more stimulated. This would allow them to learn their multiplication facts

"To improve mental performance, many individuals, resort to hard work and repetition. In turns out, they might be missing out on one of the most powerful brain boosters in the world – exercise." (Duvall)

Researchers in Finland completed a study using boys in their first three years of school. "High Levels of Physical Activity Linked to Early Academic Achievements" research article has shown that boys who participate in physical activity have better math and reading skills than boys that don't participate in physical activity. In a Chicago-area school, students that

participated in an exercise program at the beginning of the day nearly doubled their reading scores (Mercola). Research also showed that students used the treadmill for 30 minutes solved problems 10 percent more effectively (Mercola). To write my unit plan that can apply to all students, gender must be taken into consideration as well as many other factors.

Young boys have a lot of energy, however, they are expected to sit through a seven-hour school day with minimal breaks. Young girls also have a lot of energy and need to use it so they can concentrate on what is being taught. Crossing the midline of the body can stimulate both sides of the brain. A student participating in this type of activity is using more of his brain. Regardless of the type of learner he is using more of his brain than if he were sitting in a chair memorizing information. Crossing the midline is important for many skills in a child's life. If a child does not develop the skill of crossing the midline it can affect his behavior, writing skills, and coordination. Without this skill students can fall behind in both academic and physical achievement.



On the Missouri Southern Lesson plan there are seven different types of intelligences that are addressed: Musical, Mathematical-Logical, Visual-Spatial, Bodily Kinesthetic, Naturalistic, Intrapersonal, Interpersonal and Linguistic. Each student learns differently because they each possess different types of intelligences. In the classroom it can be hard to address all seven in one lesson. This can hinder students that do not learn the way the lesson is being taught. My unit plan helps address all seven multiple intelligences and can allow all students to be successful at learning their multiplication facts.

In order for a musically intelligent student to learn effectively, sound and rhythm needs to be involved in the lesson. While doing exercises in repetitions students will be using rhythm, especially students that are musical learners. For example a musical learner may do three windmills seven times in a rhythm. She will then have completed 21 windmills and is able to connect that three times seven is 21. Students may also include music with their at-home workout routines (See Appendix A.)

Logical-Mathematical learners think abstractly about patterns and relationships. Using the method of crossing the midline to teach multiplication is an abstract method that will benefit logical-mathematical learners. Students that have a Mathematical-Logical intelligence will benefit because they are learning multiplication facts. Students with this type of intelligence learn by solving problems and working with numbers. It is safe to assume that these types of students will learn their multiplication facts faster than other students. They may not need accommodations or any extension to help them learn their facts.

A visual-spatial learner uses pictures, diagrams, and visual aids to learn new information. Crossing the midline allows this type of learner to see why four times four equals 16 in a physical activity. Visual-Spatial learners would be allowed to draw out the exercises they are

completing in order for them to visually see what is being done. They will also be able to see their classmates participating in the activity and understand how many exercises they have completed.

Bodily-Kinesthetic learners will be able to move and participate in kinesthetic activities that will help them learn their multiplication facts. They will use their bodies to workout the multiplication facts and to make a connection with the facts and physical movement.

If a student is a naturalistic learner he prefers learning about natural events and living things. Crossing the midline can be beneficial for this learner because he is learning about how his body and mind work. In order to accommodate these types of learners the students will be told that they may complete the at home workout routines outside in order to be in a natural space. This will allow them to be in nature while completing their exercises and learning their multiplication facts.

Intrapersonal learners enjoy working alone. An intrapersonal leaner can benefit because crossing the midline does not require a partner or group. Intrapersonal intelligent students can figure out their own personal motivations and goals. This lesson will allow them to make goals for learning their multiplication facts and staying physically fit. For example, they could set a goal saying that by the end of the year they will be able to do 20 push-ups in a row. They may incorporate more push-ups into their Send Home Activities in order to meet this goal. An interpersonal learner is a learner that learns from cooperating and relating to others. Crossing the midline can be incorporated into groups and a student can share what he did to cross the midline. She will also be able to complete the send home activity with her family. This will benefit an interpersonal learner.

Verbal-Linguistic learners enjoy learning through reading and writing. Crossing the midline can benefit a verbal-linguistic learner by allowing him to stimulate his brain. This can help improve his reading skills. Students that are Verbal-Linguistic learners will be able to verbalize their answers, as well as, say the problems out loud. They may also write the problems one times one equals one if that helps them to understand the answer better.

The unit I created is designed to cover 11 weeks depending on how well students grasp the concept. It can be adapted to take longer or shorter depending on how quickly the students learn their multiplication facts. The first week of the lesson will cover two sets of multiplication facts, "1's" and "2's." Two days will be dedicated to the practice of the multiplication facts and on the third day the students will take their time tests. These facts are easier for students to grasp because they are not as complex. The following weeks will only cover one set of multiplication facts for four days. The fifth day will be dedicated to taking their timed tests. When I implement this unit plan in my own classroom I expect to see a 100% success rate with the timed test. Because the curriculum also requires many other concepts to be learned in fourth grade I plan for the instruction to only take 15 minutes maximum. This instruction will take place at the beginning of the math instruction time. Not only will it serve a purpose of teaching the students multiplication facts, but it will also help prepare the students' brains for the content that is being taught during math instruction.

The beginning lesson plans for each week with follow this guideline. Objectives will be based off of the state standards and follow the three-part design in the Missouri Southern Lesson Plan. The standards I will use for my lesson plan are:

- CCSS.MATH.CONTENT.4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as

many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

- CCSS.MATH.CONTENT.4.OA.A.2 Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
- CCSS.MATH.CONTENT.4.OA.B.4 Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.

The objectives will be as follows:

- Following instruction using kinesthetic movement, students will learn their multiplication facts in order to complete a timed test with 100% accuracy.
- Following instruction using kinesthetic movement, students will complete workout routines in order to answer multiplication fact problems.
- Following teacher led physical activity, students will be able to complete various kinesthetic movements in order to maintain physical fitness.

These objectives and standards will guide the remaining parts of my lesson. In order to meet these objectives I will have to know the instructional input that is required to teach each lesson. Students must understand that the first number represents how many times they will complete the set of exercises. The second number represents how many exercises they will complete in that set. So, for example, if the students are give the problem1x1 and told to do jumping jacks they

will understand that one time they will do one jumping jack. This means they have done one jumping jack total. For this lesson the students will learn the following multiplication facts using this method:

1x1

1x2

1x3

1x4

1x5

1x6

I will teach them the benefits of physical activity. These include maintaining a healthy weight, having a better attention span, and being able to learn concepts successfully.

This information will be taught using instructional strategies. The students will participate in class workout activities in order to learn their multiplication facts. I will model the workouts and how to determine the answer to the multiplication problem that goes along with the workout. Then we will all participate in the remaining activities together. Students will also have send home activities that will reinforce the new concepts. These will include similar exercises that we have completed in class and the students will participate in them with their family.

In every classroom there is a need for accommodations to the instructional strategies and learning activities. Depending on the class there may be students that have physical limitations. When I have my classroom context I will pick exercises that all students can complete. If students have IEPs that require test accommodations I will address that with either a longer time to take the test or completing the test with a paraprofessional. Depending on their Individualized Education Program (IEP) the paraprofessional may prompt them in order to help them answer

the questions. There may also be students that need enrichment and extension. Students that grasp the concept quickly may be asked to lead the class in the workout routines. They will also be asked to make up their own workout routines for the send home activities.

The lesson will begin with student engagement. I will ask students if they have ever participated in a workout routine, for example lifting weights or participating in a repetition type workout. After I have asked this question and the students have answered as a class we will do 1 set of 2 jumping jacks. I will ask them how this could help them learn their multiplication facts. Hopefully, students will respond with something like this: 1 set times 2 jumping jacks equals 2 jumping jacks. So this would help explain our multiplication facts.

Throughout the lesson I will use formative assessment to check if students are learning the concept. As a class we will participate in the physical activities. After we have completed each set I will ask the students how many total exercises they have done. They will either hold up their answer on their fingers or on whiteboards. This answer will then be written on the board next to the exercise. For example: Do 1x1 jump to the ceiling= 1.

For the summative assessment, students will complete timed multiplication tests at the end of the week. These tests will have to be completed with 100% accuracy for students to pass them. These tests will include multiplication facts from the set the students have been learning during the week. If the students all complete the test with 100% accuracy the class will move on to the next set of multiplication facts. If this does not happen I will determine whether the whole class should continue with instruction of that set of multiplication facts, or if I should take time to work individually with the students who are struggling. I believe it is important to keep all of the students together in instruction because a student may get discouraged if she is the only one working on a certain set of multiplication facts.

According to Lengel and Kuczala's (2010), *The Kinesthetic Classroom,* there are six purposes of movement: Preparing the Brain, Exercise and Fitness, Providing Brain Breaks, Class Cohesion Activities, Teaching New Content and, Reviewing Content. My unit plan incorporates all six purposes. The brain is being prepared to learn new concepts in math because I will teach multiplication facts using movement at the beginning of math everyday the students' brains will be prepared to learn the new math concepts. We will use exercise and fitness because the students will be involved in exercise routines while learning their multiplication facts. Throughout the day my unit plan provides brain breaks for the students. Brain breaks are a time to get up and move around and take a break from learning the content for example language arts. We will also all participate in the class activities using movement this will help the class work together. The movement we participate in will serve the purpose of teaching new content when we begin the lesson at the beginning of the week. We will review the content throughout the day and the rest of the week. This meets all purposes of movement.

Throughout the day when students need a brain break, or to get out of their seats, I will use this time to rehearse multiplication facts using movement. There will be a deck of cards with the multiplication facts that students have had instruction on that I will draw from in order to figure out the repetitions of the exercise (See Appendix A.) There will also be a deck of cards with various exercises on them (See Appendix A.) I will draw from this deck in order to determine the type of exercise the students will be participating in. I may also give students the chance to draw the cards in order to include them or reward them for good behavior. Students could also be asked to lead the class in the exercises. This can be used for students that are not participating or for students that have had good behavior.

In the classroom it is important to involve students parents and family. When parents are involved in their child's education it can benefit both the child and the parents. Research proves that involving parents can help student's self-esteem, improve academic performance, and help parents develop positive attitudes toward their child's school (Brown.) It can be hard to coordinate with parents and get them involved in their child's schoolwork. In my unit plan I have created send home activities that can be fun and beneficial at home. These activities can take on average 10-15 minutes of the parent and child's time. These activities also serve as workout routines that can help the student's family stay active and healthy. The activities will be similar to the activities we do in class. An example of the activity would be, do one times seven crunches. The student and their family would participate in the workout. Almost 70 percent of adults American are considered to be overweight or obese (Overweight and Obesity Statistics.) Not only will these help students and parents remain healthy, they will also help families be involved in their children's work. Each day after the introduction of the new multiplication facts the routine will be sent home with the students. The students have until the day of the timed test to complete the routine and answer the multiplication fact problems. The workout routine will also serve as a review for the students while they are at home. The student can complete the routine as many times as she chooses in order to help her remember her multiplication facts.

The send home activities can also help students with different intelligences. Musical learners may not have enough music or rhythm incorporated into the instruction of math facts so they may choose to include music while they are participating in their workout routine. Naturalistic learners may choose to do their workout routines outside in order to help them learn. These at home activities help to enhance the lesson for different types of learners, as well as to

provide accommodations for learners that are not getting everything they need from the lessons at school.

Grade Level: 4th Grade

Content Area: Mathematics

Time to Teach Unit: Approximately 11 Weeks (55 days)

In Week 1 students will learn their "1's" and "2's." On the first day I will introduce "1's" multiplication facts see Appendix A for my sample lesson plan. Students will begin participating in physical activities routines that will incorporate "1's" multiplication facts. This will take 10-15 minutes of instruction time. We will take brain breaks throughout the day. For example, 1 jumping jacks 3 times (1x3) equals 3 jumping jacks. The brain breaks can take anywhere from 1-5 minutes as needed during the day. We will complete the following facts:

- 1x1
- 1x2
- 1x3
- 1x4
- 1x5
- 1x6

I will give the students their send home workout routine so they can begin practicing their multiplication facts at home. The example of the send home workout is in Appendix A. Students will complete the send home activity and bring it back for me to check that they have completed it. They will then take the activity home in order to practice their facts for the rest of the week. The activity will be turned in to me on the day of the test.

Day two will be similar to day one. Students will continue to participate in routines to learn their multiplication facts. The instruction time will remain the same at about 10 to 15 minutes. Brain breaks will also be taken throughout the day. I will include the facts we have previously learned into these brain breaks, as well as, the new multiplication facts. On day two we will complete the following facts:

- 1x7
- 1x8
- 1x9
- 1x10
- 1x11
- 1x12

On day three we will **c**omplete the timed test for "1's" multiplication facts. If my lesson works, as I believe that it will all students will pass with one hundred percent accuracy. I will give the test at the beginning of the day in so that I can have time to grade the tests before we move on to the next set of multiplication facts. During students math instruction they will be introduced to "2's" multiplication facts. I will follow the same lesson plan as I did previously I will just switch the facts from "1's" to "2's." The instruction time should remain the same at about 10 to 15 minutes. Brain breaks will also be incorporated throughout the day when students need to get up and move around or take a break from what they are learning in another subject. The facts that will be completed on day three are:

- 2x1
- 2x2
- 2x3

- 2x4
- 2x5
- 2x6

The students will receive a new send home activity that incorporates “2’s” multiplication facts. This will also be checked the following day and turned in the day of the test.

On day four the instruction will be similar to day three. Students will continue to participate in routines to learn their multiplication facts.

Instruction time during math (10-15 minutes.) Similar to previous days brain breaks will be taken throughout the day. The completed facts for this day will be:

- 2x7
- 2x8
- 2x9
- 2x10
- 2x11
- 2x12

On the fifth and final day of the week students will complete their timed test. I will grade them over the weekend so I can determine if I need to meet with certain students or completely reteach the set of multiplication facts.

All other weeks will follow the same guideline as week two. During week two students will learn their “3’s” multiplication facts. I will split the twelve multiplication facts in each set over the first four days of the week. This means that each day we will work on three sets. This will shorten the instruction time to 5 to 10 minutes each day. Brain breaks will also be utilized during this week and the following weeks. On the first day we will complete the following facts:

- 3x1
- 3x2
- 3x3

The send home activity will be give to the students at the beginning of the week. They will bring their completed assignment back the following day. As we progress through the week they can check their answers as we learn and complete the remaining multiplication facts. Days two, three, and four will follow the same plan as day one. On day five students will complete their timed test. I will grade these over the weekend and once again determine how the unit will process according to students progress and understanding.

This unit plan allows for adjustments to allow all students to learn their multiplication facts with 100 percent accuracy. If a set of multiplication facts is taking longer for students to learn, more than a week's time can be used for instruction. More brain breaks can also be incorporated into the classroom depending on the students needs. Formative and summative assessments will help me to decide if extra time is needed or if the students are ready to move on.

While completing my thesis I learned a lot about how students minds work. Students of all ages require movement in the classroom. Completing my thesis reinforced what I already knew about movement in the classroom. However, I did not know how valuable it could actually be to our brains. Physical activity can actually help regenerate brain cells and allow our brains to grow. Students who are learning new concepts need their brain to regenerate and grow along with their instruction. I had never thought of physical activity this way until I completed my research and created my unit plan. At first I struggled to find research that applied directly to math and physical activity. I had to adjust and be broader to understand how physical activity benefited learning in general. I would have liked to be more specific towards math, however the

information available did not allow for that. This raised my awareness to research that needs to be done in math and that my thesis could benefit many students. I look forward to implementing this unit plan into my classroom and hope to share it with other teachers as well. I hope to find that when I implement my unit plan that all students will be successful in learning their multiplication facts. I also hope it will help involve parents in their students education and help them to understand that every child can be successful in math.

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Missouri Southern State University
Lesson Plan

<table>
<tr><td>Candidate Name: Ceirra Cristy</td><td>Date:</td></tr>
<tr><td>Subject: Math</td><td>Grade: 4th</td></tr>
<tr><td>Lesson Title: Workout Your Multiplication Facts</td><td>Length of Time: 10-15 minutes</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Classroom Context (Describe two student demographics and two classroom contextual factors addressed in the lesson plan):</td></tr>
<tr><td>Objectives/Learning Goals (at least three, written in three-part behavioral format):

Following instruction using kinesthetic movement students will learn their multiplication facts in order to complete a timed test with 100% accuracy.

Following instruction using kinesthetic movement students will complete workout routines in order to answer multiplication fact problems.

Following teacher led physical activity students will be able to complete various kinesthetic movements in order to maintain physical fitness.</td><td>Standards/Quality Indicators/Skills (Missouri Learning Standards and national standards addressed by the lesson. Write each out fully.):
CCSS.MATH.CONTENT.4.OA.A.1
Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
CCSS.MATH.CONTENT.4.OA.A.2
Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.
CCSS.MATH.CONTENT.4.OA.B.4
Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1-100 is prime or composite.</td></tr>
<tr><td>Student Engagement (Describe how you will prepare students to learn the material and why the material has real-world application):</td><td>Materials Used in the Lesson:
Resources found in Appendix A
-Workout Your Multiplication Facts</td></tr>
</table>

To introduce the lesson I will ask students if they have ever participated in a work out routine. For example lifting weights or participating in repetition type work out. After I have asked this question and the students have answered as a class we will do 1 set of 2 jumping jacks. I will ask them how this could help them learn their multiplication facts. Hopefully students will respond with something like this. 1 set times 2 jumping jacks equals 2 jumping jacks. So this would help explain our multiplication facts.	-student whiteboards
Technologies Used by the Teacher (Specifically describe how each tool enhances learning and engagement.): No technology is needed for this lesson because the students will be participating in physical activities.	
Level of Expectations (Circle all that apply & **label examples in your lesson plan**.): *Depth of Knowledge (DOK)* Students will be able to recall their multiplication facts on a timed test. Recall Skill/Concept Strategic Thinking Extended Thinking	
Multiple Intelligences (Circle all that apply and link to instructional strategies and/or learning activities.): Bodily-Kinesthetic learners will be able to move and participate in kinesthetic activities that will help them learn their multiplication facts. Students that have a Mathematical-Logical intelligence will benefit because they are learning multiplication facts that require them to solve problems and use numbers. Naturalistic Visual-Spatial Musical Verbal-Linguistic Logical-Mathematical Bodily-Kinesthetic Intrapersonal Interpersonal	
Formative Assessment (Describe how you will assess student knowledge/performance before the lesson.): As a class we will participate in the physical activities. After we have completed each set I will ask the students how many total exercises they have done. They will either hold up their answer on their fingers or on whiteboards. This answer will then be written on the board next to the exercise. For example: Do 1x1 jump to the ceiling= 1 *Knowledge Base Corners KWL Chart Ponder and Pass Take a Stand Pre-Test Signal/Action Responses Content Survey Bias/Misconception Identification Personal Inventory Scavenger Hunt Investigation/Observation/Interview Review Standardized Assessment Data*	
Summative Assessment (Describe how you will formally assess student knowledge/performance after the lesson. This assessment IS reflected in each	

objective.):
Students will complete timed multiplication tests at the end of the week. These tests will have to be completed with 100% accuracy for students to pass them. These tests will include multiplication facts from the set the students have been learning during the week.

Instructional Input (Identify the content, concepts, ideas, and vocabulary necessary for students to achieve the objectives/learning goals.):
Students must understand that the first number represents how many times they will complete the set of exercises. The second number represents how many exercises they will complete in that set. So for example if the students are give 1x1 jumping jacks they will understand that one time they will do one jumping jack. This means they have done one jumping jack total. For this lesson the students will learn the following multiplication facts using this method:
1x1
1x2
1x3
1x4
1x5
1x6
Benefits of physical activity:
-Help maintain a healthy weight
-Help students learn better and pay attention better

Instructional Strategies (Identify the strategies you will use to deliver the instructional input. Identify all that apply and label in instructional input.):
The students will participate in class workout activities in order to learn their multiplication facts. I will model the workouts and how to determine the answer to the multiplication problem that goes along with the workout. Then we will all participate in the remaining activities together.
Cooperative Learning *Read Aloud* *Scaffolding* *Independent Learning*
Classroom Discussion *Learning Centers* *Lecture* *Flexible Grouping*
Nonlinguistic Representations *Similarities/Differences* *Summarizing/Note Taking*
Modeling *Hands-On Learning* *Peer Evaluation* *Inquiry*
Socratic Circle *Project Based Learning* *Experimental Labs* *Questioning*
Other (Identify.):

Learning Activities (Identify and describe the specific activities your students will do to apply the information in the instructional input.):
The students will participate in workout routines including jumping jacks, pushups, hopping, jumping, windmills, and other exercises that can be completed in the classroom.

Formative Assessment (Describe how you will assess student knowledge/performance during the instructional strategies and learning activities.):
The send home activity will allow me to check how students are doing individually learning their multiplication facts. Each day will I will check the progress of their send home activity. They will bring home the Workout Out Your Multiplication Facts

sheet and complete it with their family. Their parents will then sign it and send it back to school. If the students struggled to answer the problems correctly I will ask them to repeat the activity. Students that got all of them correct will be asked to come up with their own exercises to go with the multiplication facts and complete the workout with their family. *Checking for Understanding Numbered Heads KWL Chart Observation Anecdotal Assessment Know it Show it Response Cards High 5 Student notes/Nonlinguistic organizer Quiz Homework Project Draft of Summative*
Student Accommodations (*Mandated by IEPs/504 Plans*): Depending on the class their may be students that have physical limitations. When I have my classroom context I will pick exercises that all students can complete. If students have IEPs that require test accommodations I will address that with either a longer time to take the test or completing the test with a paraprofessional. Extended Time Assignments/Homework/Tests Text in Alternate Format Student Response Cueing System Reduced Distraction Learning/Testing Environment On Task Learning/Behavioral Checklist Strategic Seating Choices Adaptive/Assistive Technology (Describe) Break Down Task into Smaller Parts Reduced Vocabulary Content Advanced Detailed Organizer Other (Identify):
Enrichment/Extension (Identify additional instructional strategies and learning activities you will use for accelerated learners. Describe technology used by the student.): Students that grasp the concept quickly may be asked to lead the class in the workout routines. They will also be asked to make up their own workout routines for the send home activities.
Review and Bridge (***Describe*** how students will review key concepts and bridge to real-world application and upcoming lessons.): At the end of the lesson we will look over the answers we have put on the board and say out loud that 1x1=1, 1x2=2 and so on. I will also remind the students that it is important to stay physically fit so they can prevent health problems.

Name: Date Due:

Workout Your Multiplication Facts

Instructions: Complete this workout with your family. Do each exercise and then record the number of times you did each exercise. You may complete the routine as many times as you need to in order to learn your multiplication facts.

The first number represents how many repetitions of the exercise you complete. For example if the first number is 2 you will repeat the set of exercises that many times. The second number represents how many times you complete the exercise in the repetitions. For example if he second number is 3 and you are doing jumping jacks you will complete 3 jumping jacks. For this whole problem you will do 3 jumping jacks 2 times.

1x1 push-ups How many push-ups have you done?	1x7 crunches How many crunches have you done?
1x2 squats How many squats have you done?	1x8 windmills How many windmills have you done?
1x3 toe touches How many toe touches have you done?	1x9 donkey kicks How many donkey kicks have you done?
1x4 lunges How many toe touches have you done?	1x10 knee raises How many knee raises have you done?
1x5 forward arm circles How may forward arm circles have you done?	1x11 bridges How many bridges have you done?
1x6 backward arm circles How many backward arm circles have you done?	1x12 leg swings (6 each leg) How many leg swings have you done?

Front

1 x 1
1 x 2
1 x 3
1 x 4

Front

1 x 5
1 x 6
1 x 7
1 x 8

squat	windmill
push up	lunge
leg swing	knee raise
forward arm circle	backward arm circle

Name _____ Date _____

Multiplication of 1s

Set 1

1	4	8	1	1
x 2	x 1	x 1	x 7	x 1
4	1	10	1	1
x 1	x 9	x 1	x 3	x 2
1	5	1	1	1
x 1	x 1	x 1	x 4	x 5
1	2	3	6	7
x 6	x 1	x 1	x 1	x 1
1	1	9	1	10
x 8	x 10	x 1	x 3	x 1