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Learning Through Movement: Integrating Physical Education with the Classroom Curriculum

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An Action Research Report

By Nicolas Lepine

The Montessori method is a successful and popular alternative to the traditional school system used by the United States. There are thousands of Montessori schools across the country, both private and public. Montessori education is highly regarded for many reasons; one being that the Montessori curriculum is integrated so that one topic may be covered through various disciplines. Thousands of teachers throughout the country attend training centers to learn specific Montessori lessons as well as familiarize themselves with Montessori materials. However, there is not an established Montessori physical education (P.E) curriculum.

Without an established Montessori P.E. program, Montessori schools are left to independently decide what option they will take for a physical education program. Some schools will have the head teacher of each class be responsible for teaching P.E. because they do not hire outside "specialists." Some schools will hire a P.E. instructor for the school, but they are not Montessori trained. Other schools will hire outside consultants to teach P.E., but they will also not have any formal Montessori training. Either the classroom teacher has too little experience with P.E. programming, or the P.E. teacher does not have exposure to the Montessori method.

The P.E. teacher has to find a balance between ensuring full participation while keeping order during the class. When observing children in a typical P.E. class, most children seem to enjoy the class and have fun, yet some students opt out and do not participate with the group. The P.E. teacher may overlook children who do not participate in P.E. If the child perceives P.E. as recess, their attention and focus to instruction decreases, as they want to just play. This is compounded by the fact that

many P.E. classes have a student to teacher ratio that is larger than a typical classroom setting. These obstacles can make it difficult for P.E. instructors and teachers to give fulfilling, worthwhile instruction.

It is commonly understood that P.E. is an important component of the educational experience for students. The benefits of physical education are numerous, and go beyond the traditional notion that physical activity is good. Exercise is good for the body, and it is one way to prevent obesity. According to Yaussi (2005), the rates of obesity have more than doubled in the past two decades, with roughly fifteen percent of the children in the United States being considered overweight or obese.

Musselman (1914) argued that exercise and play are far more important than just movement. Exercise has been used in the past as just an outlet for extra energy, but Musselman (1914) argues this is just a small benefit of regular play and exercise, especially if the exercise resembles work. He states, "the measure of the value of play is the amount of work in it, the measure of the value of work is the amount of play in it" (Musselman, 1914, p. 27). The child learns practical life skills that may be applied to other areas of life through activities played in P.E.

With all of these benefits stemming from physical education, it is unfortunate that schools act as the primary, and sometimes only source of this activity. Chen and Ennis (2004) as well as Yaussi (2005) state that physical education in school may be the only opportunity for children to learn the skills required for proper health and nutrition. For a physical education program to be successful, the student must be motivated to participate and continue living an active lifestyle while making good food choices. According to Grasten, Jaakkola, Liukkonen, Watt, and Yli-Piipari (2012), "without enjoyment, kids

will not be motivated to exercise" (p. 260). When a child feels successful, they will become motivated (Grasten et al, 2012).

There are various reasons that students do not feel motivated during physical education. Chen and Ennis (2004) suggest one reason students are often hard to motivate to exercise is they had bad experiences with competition or they want to avoid the physical discomfort of exercise. When the child is not motivated or loses motivation, he or she becomes more likely to drop out of physical education with age. DeCorby, Halas, Dixon, Wintrup, and Janzen, (2005) state that parent support is paramount for a child to be motivated to be physically active, however, we also know many parents are not involved in a child's physical education. Another reason Yaussi (2005) suggested a lack of motivation from children might be some students do not prefer participating in group activities. This is when the adult or teacher needs to suggest other options for the child to consider so they can be physically active.

Once student motivation is addressed, physical education teachers need to consider curriculum programming and how it affects students' performance and motivation in the class. There are two ways that physical education focuses on creating a motivating atmosphere for students (Grasten et al, 2012). The first way is task-involving methods, and this method emphasizes cooperation, reflection, and critical thinking through completing goals or tasks. The second method is ego-involving, and this method emphasizes comparison, competition, and evaluation of competency. These methods cause different levels of motivation of the student. Wallhead and Ntoumanis (as cited in Grasten et al., 2012) stated in previous studies that task-involving methods in physical education increase enjoyment, make the kids work harder, and help the kids feel they are

successful. According to Chen and Ennis (2004) and Fraser-Thomas and Beaudoin (2002), one way educators have tried to motivate students is by emphasizing less team sports and emphasizing more a physically active lifestyle. They found it better to compare a student's performance to his or her previous performance instead of comparing students to one another. The child is most motivated when the child is trying to accomplish a goal or task while simultaneously working on mastery of a skill.

Finally, according to Yaussi (2005), physical education should integrate with the rest of the curriculum. This enables the student to get more exposure to topics in physical education without taking additional time away from the school day. Themes that were presented in the classroom can be physically practiced in physical education class, creating a kinesthetic awareness to the lesson in the classroom. This reinforces a concept that Chen and Ennis (2004) believe: without focus; the value of physical education is lost because there are no goals or objectives, teachers do not care if there is an improvement, and students do not learn much.

However, there are significant challenges to implementing a successful physical education program. A general idea that was generated DeCorby through an international survey was that non-specialty teachers are described as unmotivated to teach PE and often resort to activities that require minimal effort on their part and provide inadequate instruction (2005). Someone teaching physical education with an athletic background does not guarantee competence of the curriculum. However, according to DeCorby et al (2005), having a specialist does not guarantee a good program either.

Many teachers do not have the option of a specialist teacher, and Fraser-Thomas and Beaudoin (2002) said most classroom teachers who teach physical education feel

unprepared, do not have enough experience, or do not have enough time to review the literature of what they need to do. The classroom teacher may feel better suited to teach P.E. if they were able to draw ideas from lessons and themes in the classroom. The integration of P.E. and the main curriculum would save time and effort for the classroom teacher, as well as give them a scope and sequence. If the teacher feels more comfortable teaching P.E., it may increase participation of the students because of better overall programming as well as reinforce the classroom curriculum.

If the Montessori child is going to fully participate in P.E., then P.E. in the Montessori setting needs to integrate elements from other parts of the traditional Montessori curriculum. P.E. classes will still focus on physical activity and skill acquisition, but should include thematic elements from other lessons. The games in P.E. should include the thematic elements that encourage vocabulary retention as well as provide another model for concept understanding. This may help some students who are more kinesthetic learners.

Because PE is important to health and cognitive ability and it is best utilized when integrated with the curriculum, it is essential to involve all students as completely as possible. The purpose of the study is to get kids involved in PE by integrating curriculum in a fun, non-competitive way. The goal of the study is to see if more kids will participate in P.E. and be helped in their regular classroom work. This leads to the question posited in the research study: In what ways will anchoring the physical education curriculum to the classroom curriculum for the elementary one students change participation and behavior? Will there also be an effect on content retention from the culture curriculum? The hoped outcome for classroom integration with P.E. is two-fold

and symbiotic. Integrated elements of classroom work in P.E. will support and enhance classroom lessons, and integrated elements of classroom work in P.E. will help raise the status of P.E. to the child as a legitimate part of the curriculum and not just extra recess. All the while P.E. would continue to provide physical activity while improving motor function, teach physical skills, and help educate students for the prevention of obesity.

The research was conducted in a private Montessori school located in the Northeast side of Chicago. The school has a gymnasium on the second floor that measures ninety-four feet by fifty feet. Within the gym itself, there are two retractable basketball hoops, as well as four other portable basketball hoops. There is a climbing wall on the west wall that spans approximately forty feet. Behind the south wall is a storage area alcove, which houses most of the various sports equipment, which includes balls, jump ropes, etc. A removable volleyball net is kept in another storage space by the north wall. Finally, the heating and cooling system is controlled independently from the rest of the school.

The participants of the study are children aged six years to nine years. There are four classrooms in total, and each class has twenty-five children. Every class contains a mixture of first, second, and third grade students. Each classroom has one head teacher, as well as an assistant. Two classrooms come to P.E. together, and after twenty minutes, they leave and the other two classrooms come for another twenty minutes. The classroom assistant from each class comes to the lesson, so there are three teachers at P.E. at one time for fifty students.

Description of Research Process

The purpose of the research was to determine the effect of combining elements of the culture curriculum with the P.E. program. Would playing games in P.E. based on the planets and the Solar System help the students remember the names and the order of the planets, or would it not make a difference to overall learning? Would combining elements from their classroom work make the students feel that P.E. was more like a "legitimate" lesson, thereby increasing participation? To find the answers to these questions, I needed to establish baseline data.

Before we had students in the classroom, I consulted with the 6-9-faculty team to discuss what the culture curriculum consisted of during the beginning of the year. The 6-9 classes began their year with the first Great Lesson. Because the first Great Lesson dealt with the origin of the universe, the transition into the study of the solar system was a seamless one.

During the first week of school, a simple name game combined with a ball toss (see Appendix A) was played. During the first week, most of the first graders do not know the names of their classmates, so P.E. was a time when students could learn the names of their classmates and be active. It also helped me as the P.E. teacher to learn the names of the students as well. I initially demonstrated how the game was played with several volunteers from the student audience. Once the game was demonstrated, the classrooms separated and each made a large circle to fit all the members of their class. The assistant teacher then facilitated the game while I made my first observation notes and attendance. While every child participated due to the nature of the game, I was able to note varying degrees of participation among the groups observed. The students who were not participating adequately or inappropriately were marked on a tally sheet (see

Appendix B) to note the disturbance in behavior.

After the first week of playing the ball toss game, I administered the pre-assessment form (see Appendix C) to the classroom teachers. The assessment was to determine if the students knew the planets, and if so, in order starting from closest to the Sun. The assessment would give baseline data on how well the students knew the planets before the experiment. The pre-assessments would be compared to the post-assessments to see if there was a significant change in planet recall and order. The games played in P.E. would reinforce for the students the concepts and vocabulary that was being taught to them in their classroom culture curriculum.

Each teacher gave the assessment to their students with the simple instructions of filling out the form to the best of their ability. The students were told that spelling did not matter, and that all they had to do was try their best. Some of the first grade students' answers had to be transcribed because they were not writing proficiently yet. Afterwards, the pre-assessments were placed in my mailbox.

During the second week of school, the P.E. groups began to get different instruction. The first P.E. group became the experiment group, while the second group became the control group. The control group received lessons that had been created previously. The children practiced different movement patterns combined with running. The experiment group began the first of three games that they would play throughout the intervention.

The first game the experiment group played was called "The Planets Orbit around the Sun" (See Appendix D). The students grouped together to form "planets" which orbited around the Sun. While the instructions of the game were explained, I made an

emphasis to ask the students questions about the names and order of the planets. We played the game twice so every student had a chance to be planet and an asteroid. Afterwards we had a small discussion on asteroid collision. I mentioned craters on Jupiter as remnants of asteroid collision, as well as an asteroid collision on Earth as a possible explanation for the extinction of dinosaurs on Earth. The debriefing afterwards helped the children see the connection between the impressionistic simulations they played and concepts and vocabulary they learned in the classroom.

The first game played by the control group was called "Blob Tag." This game was a variation of the popular children's game of tag. During this game when the person who was "it" tagged someone, they joined with the original tagger to create a tandem. When this group tagged another person, they created a group of three. As more children got tagged, the group, or "blob," continued to grow. This made it easier for the blob to wrangle other children in like a net, but it made it difficult for the blob to change direction. This game emphasized communication within the blob, as well as evasive tactics by the children who were being pursued.

The second game played by the experiment group was called "Solar System Collection" (See Appendix E). During this game, groups made up of three students (one from each grade level) collected planet cards that were in the middle of the gym. Once the group collected one of every planet, they had to arrange their planets in order starting from closest to the Sun. The assistant teachers facilitated the game while I took observations on who was participating.

The second game played by the control group was a relay race game where the students decided what animal they were going to pretend to be. I asked several students

to demonstrate how an animal moved, which they did for the class. We then broke the two classes into seven groups and the teams "raced" each other using the movement that everyone agreed upon. The team that finished last chose the next animal so they would have an advantage being faster in the next race.

The last game played by the experiment group was called "Planet Scale" (see Appendix F). The students were broken up into groups by age. The younger age children where placed by the smaller basketball hoops, while the older students went to the larger basketball hoops. Each group had a basketball, which was explained as being equivalent to the size of Earth's moon. The objective of the game was to demonstrate how many moons it took to match the size of the planets of the Solar System. Half way through the game, we had to change the scale of the basketball to be the size of an Earth because the moon was too small an object to try and compare to the bigger gas giant planets. After all the planets were "scored," the students then had to match the size of the sun, but again the scale of the basketball had to be increased from the Earth to Jupiter. This lesson emphasized sizes of the planets and was impressionistic as well.

The last game played by the control group was similar to the animal relay race, except this time they used scooters. The children voted on how they positioned their bodies on the cart and what movement they used to propel themselves across the gym. The last group would choose the next movement so they had a better chance of not being last in the next race.

Once the games were finished, the next week all of the students re-took the pre-assessment form (see Appendix C). This new post assessment form would was exactly the same as before, and the teachers had the same instructions to give the children. Once

all of the assessments were completed, they were put in my mailbox. The following week in P.E., I gave the children a survey (see Appendix G), which asked them to rate their feelings about P.E. A different survey (see Appendix H) was given to the teachers to ascertain their thoughts about P.E. and whether they believed P.E. helped their children understand better in the classroom. Finally, the experiment group demonstrated one of the three games that they learned in P.E. to their classroom teacher.

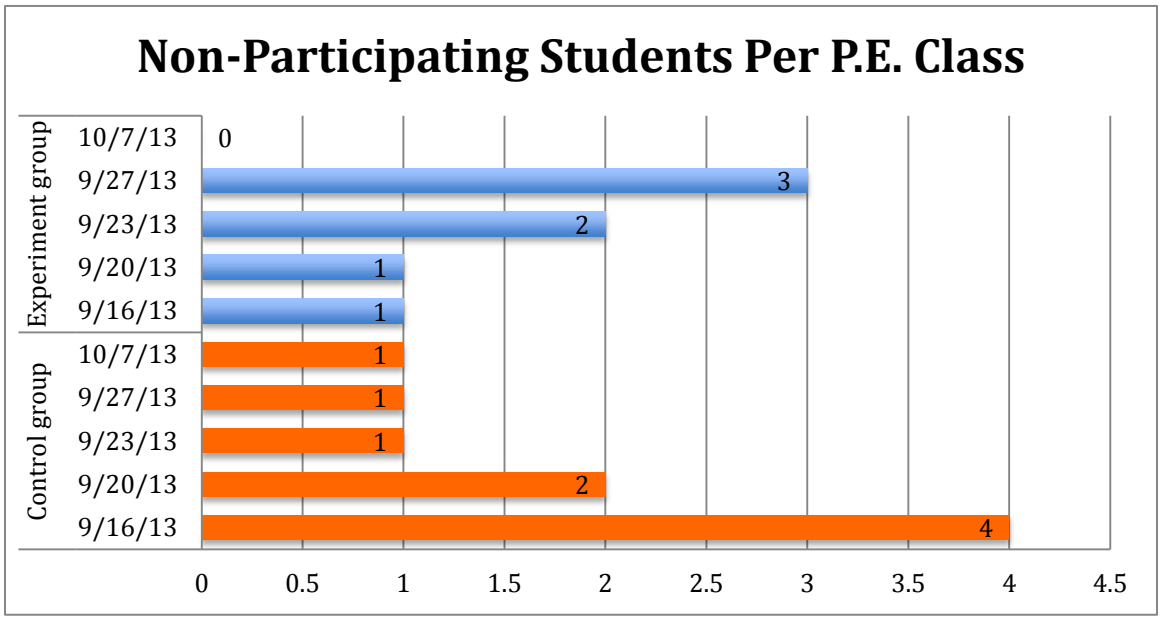
Analysis of Data

The purpose of this action research study was to determine the effects of combining P.E. lessons with the elementary culture curriculum. These integrated P.E. classes (experiment group) were compared to traditional (control group) P.E. lessons to determine if integration increased student participation and classroom concept retention. Observational records (observational data) in the form of a tally sheet were taken to note the students who were not participating in the P.E. class. The students were also given a pre-intervention assessment and a post-intervention assessment to determine if they learned the order of the planets. The assessments were collected to fulfill the requirement for artifacts for data collecting strategies. Finally, interviews were conducted with the elementary one assistant teachers and interns who provide organization and assistance to me in P.E. classes. They also work in the classroom, so they have a unique perspective on whether P.E. affected learning in the classroom. The interviews provided a means for collecting inquiry data. The collected data was then triangulated to create valid and credible conclusions.

Upon examination of the observational data, there was only slightly more participation in the experiment group versus the control group. According to Chart A, the

control group had several instances where multiple children did not participate adequately. There were three instances where there was a child who refused to participate, and two of those instances were from the same child. The experiment group had several classes with only one child not participating as well as two classes with several children not participating adequately. For the final class it was observed that everyone in the experiment group was participating. In total throughout the intervention, the control had nine instances where children did not participate adequately compared to seven times within the experiment group.

Chart A



Behavior during P.E was not significantly different between the experiment group and the control group. Both groups were relatively attentive, even though both groups required multiple reminders to listen to the instructor while directions were being given during a lesson. Generally, the children were engaged and enjoyed the activities that they

participated in. An interesting side-note was that the experiment group often had many more questions about how the game related to concepts they learned in class. Questions, comments, and observations were communicated much more frequently than the control group.

This led me to believe that the type of P.E. instruction, whether traditional or integrated, did not have a significant impact on participation *during* the activity. The students were engaged and the majority participated in both styles of P.E. instruction. However, there were more questions and comments from the integrated group *before and after* the class. In conclusion, integrated P.E. and culture classes did not enhance participation during the activity, but may have enhanced critical thinking and reflection skills.

When I compared the pre and post assessment scores (artifacts), both groups improved, which was to be expected. Both groups had worked for several weeks on the planets and the solar system in their classrooms. Students would naturally learn the concepts in the classroom through practice and exposure. In Charts B and C, the number of correct answers were tallied and displayed per grade level. For an answer to be correct, the planet must have been written in the correct space according to the order from its distance from the Sun. Spelling was not important as long as the planet written could be identified. There were some students that needed a teacher to act as a scribe for them because they were not able to write the planets yet. It is interesting to note that the experiment group had significantly lower pre-assessment scores, even though the distribution of students between the classrooms was generally the same.

Chart B

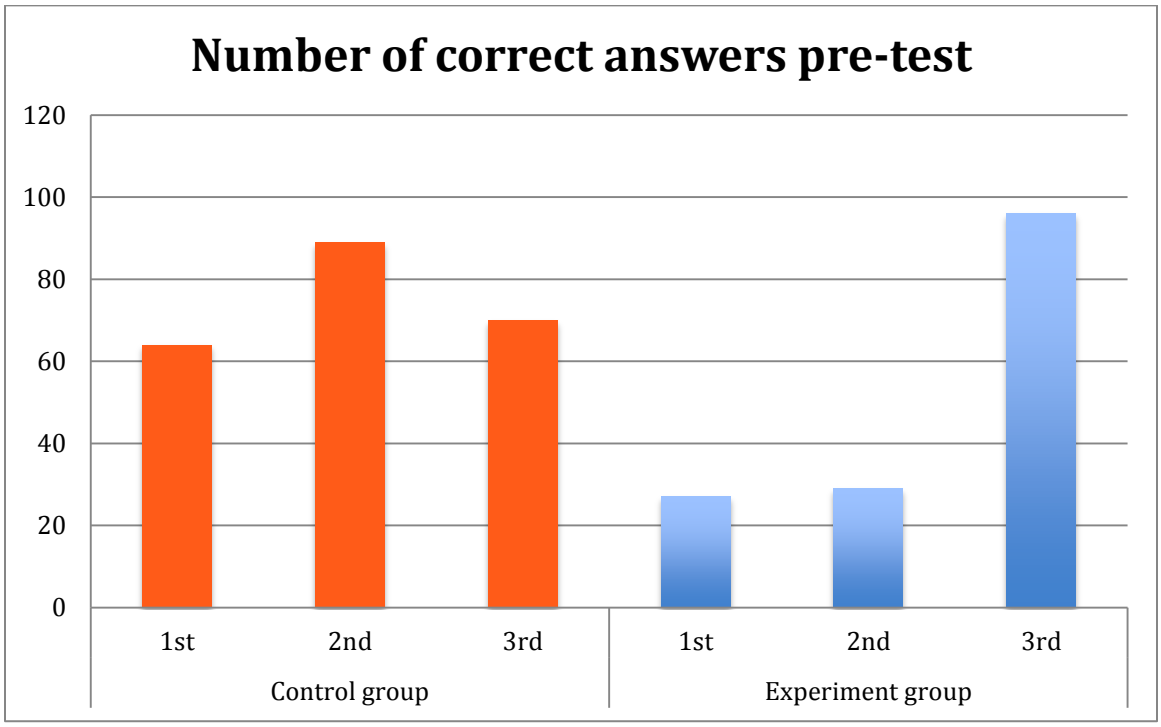
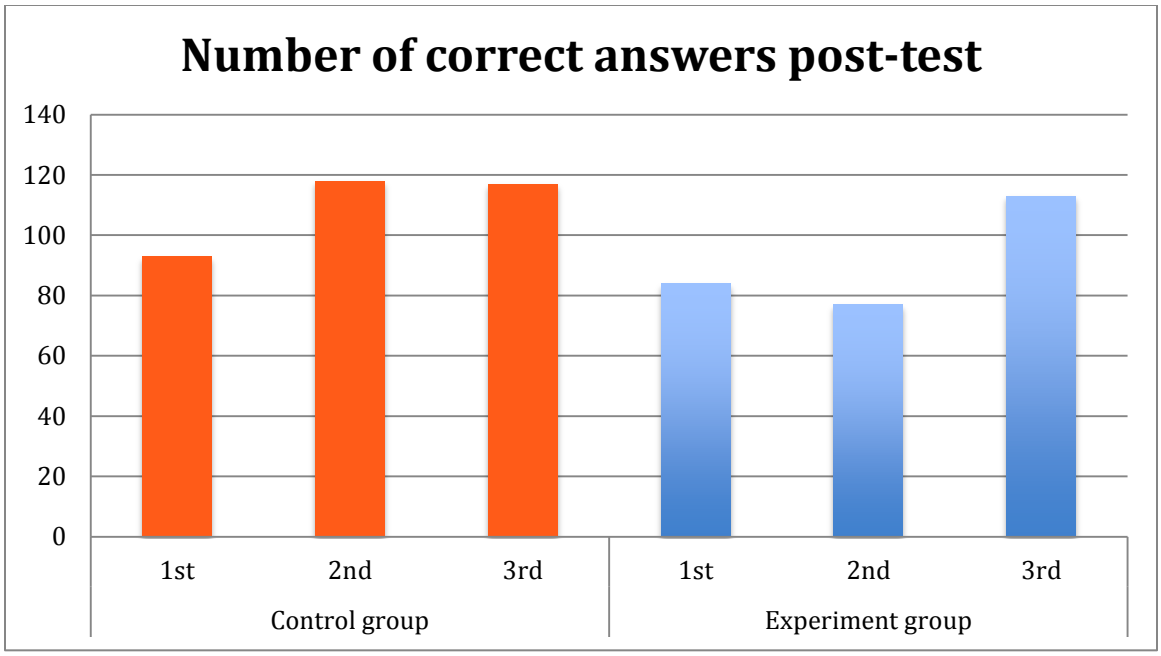


Chart C

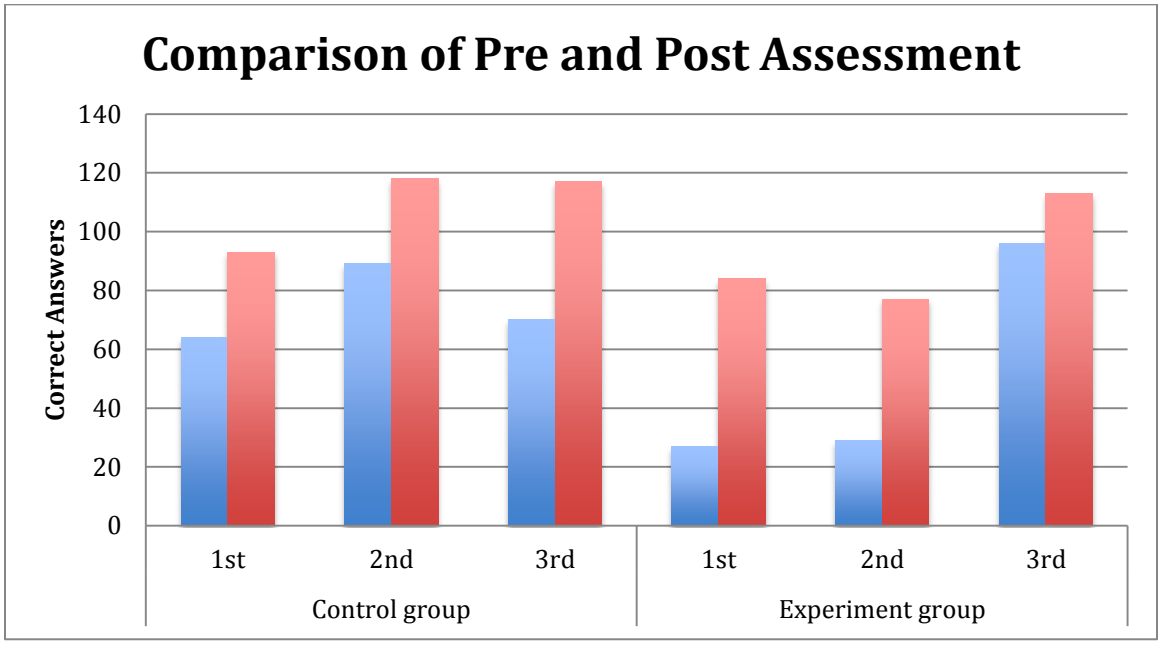


When the control and experiment group were compared (as in chart D), it became apparent that both groups showed improvement across the board at every grade level. Again, this was to be expected because the students would naturally learn the planet order in class. However, it can be seen in Chart E that there was significant improvement in the experiment group in grades one and two. The number of correct answers for the first grade in the experiment group more than tripled, while the correct answers for the second grade increased more than two and half times.

There could be several reasons why the integrated group's scores were higher. The experiment group had more practice with the concepts and vocabulary than the control group because of the extra exposure in their P.E. classes. Therefore, more practice resulted in better scores. Another possible explanation could be that some students were better suited to learn through physical movement, described as "kinesthetic learners" by Howard Gardner (2006). The students reinforced concepts they learned in

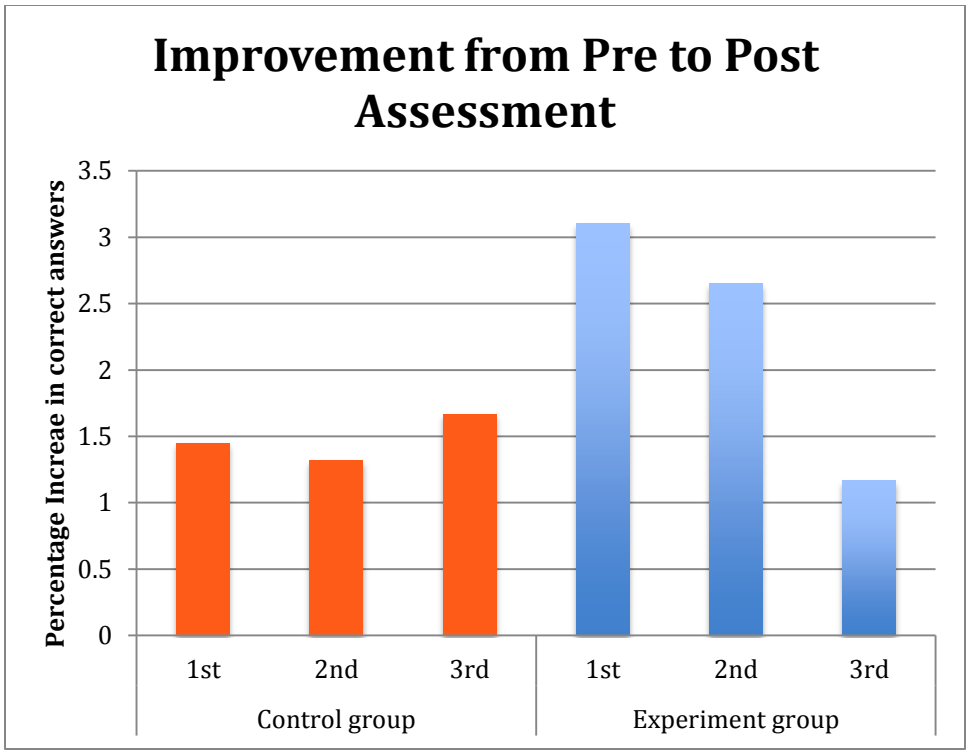
the classroom through movement and games in P.E. class. The kinesthetic learners retained concepts more completely, so they scored better on the post assessment, raising the overall average.

Chart D



The blue is the pre-assessment scores and the red is the post-assessment scores.

Chart E



The last data collected were interviews with the assistant and intern teachers from the classrooms. They were asked five questions:

- How does PE benefit your students in the classroom?
- How does PE benefit your students outside the classroom?
- Do you believe that PE should be integrated with the classroom curriculum?
- Does P.E. academically support the student?
- Has the interest or attitudes about PE changed since the beginning of the year?

The results of the interview were organized in Chart F. All the teachers believed that P.E. benefitted the students in the classroom. The majority said exercise and movement improved brain function and concentration. According to one teacher, "It's important to exercise the body as much as it is to exercise the mind. One really can't be healthy without the other." All the teachers believed that P.E. benefitted the child outside the classroom as well. The two most popular answers were P.E. provided exercise and helped the student learn skills that they would use later in life. One teacher said, "A lot

of the students play sports or do activities outside of the class, and P.E. gives them more practice at those skills."

Every teacher agreed that P.E. should be integrated with the classroom curriculum, but most were unsure how to do so. They understood that if P.E. classes were integrated with the classroom curriculum, it would provide more practice working with themes and vocabulary. When the teachers were asked if P.E. supported the student academically, the majority said yes, but for different reasons. The teachers who worked with the experiment group both agreed that the P.E. lessons supplemented the classroom lessons and aided learning. One teacher said, "I think some of the students probably know their planets better because of P.E," and the other described how students would talk about the games after P.E. class and make connections to a lesson learned in the classroom. Another teacher said P.E. was beneficial academically because it "helps them focus by getting energy out. Some of kids need that extra movement to get them settled."

The last question drew a split between the teachers. Two teachers agreed that P.E. was now viewed more positively than the beginning of the year. Part of the new found excitement came from the students knowing that they were not doing the same game as the other P.E. group. The element of mystery enticed some students, and "they are super excited to go to P.E. because they want to know what game is coming up next." The other two teachers that worked with the control group noted no difference in excitement between the beginning of the year to the end of the intervention. According to one teacher, "it (P.E.) has been consistently looked forward to the whole year."

Chart F

	P.E. benefits in the classroom?	P.E. benefits outside the classroom?	Should P.E. be integrated?	Does P.E. academically support the student?	Has interest changed about P.E.?
Teacher 1	Exercise is essential for body and mind	Skill acquisition	Yes	Yes, through description of games	Yes
Teacher 2	Friends	Exercise	Yes	Maybe, through description of games	Yes
Teacher 3	Movement and exercise	Skill acquisition	Yes	Yes, through energy dump	No
Teacher 4	Movement and concentration	Exercise	Yes,	No	No

In conclusion, integrating P.E. with the culture curriculum did not significantly help with participation and behavior. Integrating P.E. with the culture curriculum had a significant positive impact on the first and second grade students' ability to remember the names and order of the planets. Therefore, integration may be a successful method in improving learning in the classroom for some students. The teachers agreed that P.E. is worthwhile and should be integrated with the classroom curriculum, but had different opinions on how the integration would be beneficial.

Action Plan

When looking back at the research, it is interesting to note that there is not a significant change in behavior between the experiment group and the control group. The hypothesis was that the students would be more attentive and participate better in P.E. because P.E. class would be more similar to the regular Montessori classroom. The regular classroom is a place where students are generally attentive and peaceful, with

controlled movement. Students in gym usually have high amounts of energy because they are excited to move and play games. This leads to extra noise and fidgeting bodies, which in turn makes it harder for the teacher to get the students attention so instructions can be given for the game. The P.E. teacher has limited time with the students; so waiting for the students to calm themselves and become attentive uses precious class and activity time.

Even though the experiment group had lessons with themes from the classroom that was not enough for the kids to treat the gym as a classroom environment. They still were much louder than would be in the classroom. The students had more energy in the gym than they typically do in the classroom, which makes it harder to keep the body still and become attentive. Overall, lesson content is not enough to increase participation and improve behavior in the classroom.

If the P.E. teacher wants the class to be more attentive and participate more, he or she will need to specifically address that need. Integrating P.E. with the classroom was not enough. Specific lessons or guidelines should be presented to the students so they understand the behavior expectations while in the P.E. class. Modifications or alterations to the lessons may be a viable option for those students who do not want to participate. More research would be needed on implementing strategies for increasing participation in P.E. class.

Integrating P.E. with the classroom culture curriculum significantly improved the younger students ability to remember names and concepts from the class. The mechanism by which it improved is not fully known, but there was a larger improvement for the experiment group than the control group. This suggests that P.E. should be

integrated with the culture curriculum for the benefit of enhanced concept learning and retention. If one area of the classroom curriculum could be enhanced or augmented with physical activity, could all of them?

Either way, it is clear that there is a benefit to integrating P.E. with the classroom curriculum. Therefore, I will continue to collaborate with the elementary teachers and combine elements from the culture curriculum with the established P.E. curriculum. Both classes will have integrated lessons so they may both have the benefit of increased exposure to concepts and vocabulary from the classroom. If the trend of the previous research continues, then the younger students would reap the most benefit from the integration of P.E. and the classroom.

When I consider the success that integration had with the elementary students in P.E., a next logical step would be to see if integration also has a benefit with the upper elementary class as well. It was evident that P.E. integration did not have as much of an effect on the older third grade students in the experiment group, which could mean that upper elementary would not respond as favorably because of the closer similarity in age. However, that does not rule out the possibility that there could be benefits, and further investigation would be needed before making any conclusions. Once the experiment and its conclusions were analyzed, the same experiment would need to be repeated for the middle school students. I do not know the effect of age on the success of P.E. integration with the culture curriculum, so this must be investigated with further research. If the older students respond positively to integrated P.E. lessons as well as the younger students, major changes would have to be made to the P.E. curriculum to take full advantage of the benefits that integration offers.

The experiment showed that the culture curriculum and P.E. have opportunities for integration that benefit younger students. Similar experiments would need to be conducted with other areas of the classroom curriculum to see if there could be improvements in all areas. Could it be possible to have P.E. lessons that simultaneously teach and practice physical skills while also practicing math facts, or reading comprehension? There are areas of the elementary classroom curriculum that should be easier to integrate than others. Through experimentation it may be discovered that some areas of the classroom curriculum may not be suitable for P.E. integration. Only through continued action research would I be able to determine which lessons and modalities are most successful.

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Appendix A

Ball Toss Game

Introduction: This is a simple game that the children can play to help them remember names. Since this lesson is the first and done at the beginning of the year, many of the younger students will not know the names of their friends vey well. This also is a good introduction for the students to the PE teacher (if it is not the head teacher from their class), as well as a good introduction for the PE teacher to the students.

Materials: A large open space (such as a gym or field)

Prior Knowledge: None

Presentation

1. Arrange the children in a large circle so that all of the kids and the teacher can see each other.
2. Begin by saying you are going to play a game that involves names, and throwing and catching a ball. Explain that the children will say their name, say "good morning _____" to a friend, and throw the ball to that person.
3. The children will go one by one and present their name and throw the ball to another friend. Once everyone has been thrown to, the ball will be thrown to the teacher. The order of who was thrown to will be remembered for future attempts. For an extra challenge, there can be multiple balls in play during the game, making it more important for concentration and communication.

4. Depending on the size of the group, there might need to be multiple circles if possible. If the circle is thirty plus students, the game may last a long time and the children can easily become restless.

Aims:

Direct: For the children to learn each other's names

Indirect: Look at early motor movements of throwing and catching

Teamwork and team building

Control Of Error:

The teacher

Points of Interest: The silly movements they will do with their names.

Age: 6-9

Appendix B

Tally Sheet

Date Student	Participating	Not participating
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Appendix C

Pre and Post Assessment

Name_____

Date_____

Class_____

Grade_____

Please list the planets in order, starting from the planet closest to the Sun.

Sun

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

Appendix D

The Planets Orbit Around the Sun

Introduction: This is an impressionistic game that allows the students to see the movement of the planets around the Sun. The students have seen plenty of pictures and charts, but this lesson lets the children see the movement on a grander scale. Make sure to emphasize the vocabulary during the lesson. The asteroids component also makes the game more interesting for the students because many will notice that the larger sized planets will get much more than the smaller planets.

Materials: A large open space (such as a gym or field)

Many balls (soccer, dodge ball, easy catch etc.)

Prior Knowledge: None

Presentation

1. One of the teachers stands in the middle of the classroom and holds a yellow ball to represent the sun.
2. Begin by asking which planet was closest to the Sun. Once Mercury was identified, one child is asked to walk around the teacher (Sun) in close proximity to represent the orbit of Mercury.

Continue with the other planets. Next is Venus, but two children are chosen to represent Venus because it is a bigger planet. Next is Earth, which again is represented by two children because Earth and Venus are similar. One student is

1. Mars. Jupiter is created by ten students holding a hula-hoop because Jupiter is much more massive than the first four planets. Saturn is created using eight students because of its large size relative to the other planets. Both Uranus and Neptune used six students who hold onto an easy catch ball, which allows multiple students to hold onto the ball at one time.
2. The leftover students stand against the gym walls surrounding the children as they orbit the Sun. They have a soccer ball in hand which they use to roll at one of the planets when the teacher gives them a cue. Once the ball is rolled, whether a hit or miss, they chase the ball down and return to their original spot and try again.

Aims:

Direct: To reinforce the names of the planets

Indirect: Make an impressionistic lesson on asteroid collisions in the solar system

Control Of Error:

The teacher

Points of Interest: The number of times a planet got hit by an asteroid

Age: 6-9

Appendix E

Solar System Collection

Introduction: This game is similar to other card games like Memory and Go Fish. By combining the age levels, it insures that a group will not have all children who cannot read yet. It is important to enforce the rules on only taking one card at a time as well as not turning over cards prematurely, otherwise the game will be over too quickly.

Materials: A large open space (such as a gym or field)

Hundreds of Solar System cards with name and picture

Prior Knowledge: None

Presentation

1. The two classes are broken into teams of three (one child from each grade level). They arrange themselves around the gym against the wall.
2. In the middle of the gym are hundreds of cards that have the names of the planets on them. The cards are facing down so the kids cannot see the name of the planet on the card.
3. Each team can send one delegate into the middle of the gym to retrieve one card. They are not allowed to turn the card over and look at it until they bring the card back to their group.

Each child is only able to get one card at a time. If the team realizes that they have two of the same card, they are allowed to take one of the extras back to the

1. middle of the gym. That would be the end of the child's turn; the child would not be able to retrieve a new card.
2. To be successful, the team wants to have a card of each of the planets, as well as a Sun card. Once they have all the cards, they are to arrange it in order starting with the Sun first.

Aims:

Direct: To reinforce the names of the planets

Indirect: Teamwork, patience, and communication

Control Of Error:

The teacher

Points of Interest: The large number of cards in the middle of the gym

Age: 6-9

Appendix F

Planet Scale

Introduction: This game combines elements of basketball and geometry. At this level the students may be familiar with geometric terms such as similarity, equivalence, and congruence. Equivalence still should be explained to the children prior to the game beginning. This game requires good coordination between the teachers to be able to watch the whole gym to keep track of all the baskets.

Materials: A large open space (such as a gym or field)

At least six basketballs

Prior Knowledge: None

Presentation

1. The two classes are going to be split up into groups of four. Each group is going to be next to an adjustable basket. The basket will be at the lowest setting for the first second and second grade, and the middle setting for the third grade. Each group makes a line in front of the basket.

It will be explained to them how many Earth moons are equivalent to each of the planets in the solar system. Mercury is equivalent to about three Earth moons. Venus and Earth are each equivalent to about forty-nine moons. Mars would be equivalent to about eight moons. Jupiter is equivalent to about 64,729 moons.

1. Saturn is equivalent to about 37,387 moons. Uranus is equivalent to about 3,087 moons, and Neptune is equivalent to 2,827.
2. Because it would essentially be impossible for the children to complete 64,729 baskets in the time allotted to complete Jupiter, the scale would be changed from Earth moons to Earths. This would change Jupiter to 1,321 baskets, Saturn to 763 baskets, Uranus to 63 baskets, and finally Neptune to 57 baskets.
3. When the teacher says, "go," all the teams begin shooting their basketball. Once the basketball goes in, the child retrieves it and passes it to the next person in line. They then shoot the basketball until they score. The teachers are watching and counting out loud for the whole gym to hear the cumulative score of the group.
4. The children will most likely not succeed during the first lesson, so the game will be continued to the next P.E. session. Once all the baskets have been made, I will add an extra challenge of making the equivalent baskets of the Sun. That would take approximately 1.3 million baskets. The children would obviously not try to complete that challenge but appreciate the impressionistic lesson of planet size.

Aims:

Direct: To reinforce the names of the planets

Indirect: To learn the term equivalence

Control Of Error:

The teacher

Points of Interest: The number of baskets it takes to find equivalence

Age: 6-9