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Culminating Experience Action Research Projects,

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Edited by

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Abstract

As a part of the teacher licensure program at the graduate level at The University of Tennessee at Chattanooga (UTC), the M.Ed. licensure candidate is required to complete an action research project during a 3-semester-hour course that coincides with the 9-semester-hour student teaching experience or with school employment. This course, Education 5900 Culminating Experience, requires the student to implement an action research plan designed through (a) the Education 5010 Methods of Educational Research course, (b) a required learning assessment required during student teaching, or (c) a newly-designed project. The course is, also, taken by elementary and secondary teachers who are, already, licensed to teach. The action research projects, from spring semester 2017, are presented. This Action Research Project includes: (1) Student Transition into Ninth Grade (Jennifer Clemmer); (2) Effect of Short-Term Integration of Scientific and Mathematical Investigations (Robert Hall); (3) Effects of Physical Education on Math Performance (Whitney Shea Layne); and (4) A Study of the Integration of Physical Activity and Movement and its Effect on Academic Behavior (Emily Parsons). (Individual papers contain references and figures.)

Deborah A. McAllister

March 2, 2020

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Student Transition into Ninth Grade

Jennifer Clemmer

EDUC 5900, Spring 2017

The University of Tennessee Chattanooga

The Institutional Review Board of the University of Tennessee at Chattanooga (FWA00004149) has approved this research project #17-085.

Introduction to the Problem

The study examines the transition of ninth-grade students, with regard to making friends and feeling supported on campus. This topic is important on a school level as close to half of the students matriculate from the middle school, and the other half enter from other schools around the city, state, country, and world. Boarding students and day students join the student body in the ninth grade. Boarding students, especially, need to be supported on campus because they are leaving home and a family full of support to live more independently in a dorm for the first time. The school has a network of avenues in place to provide academic, emotional, and physical support to the students. It is important to school personnel that students know and discover these avenues of support during the ninth-grade year.

Review of Literature

Ninth-grade students are transitioning in many ways. These students are entering new schools, meeting new classmates and teachers, and participating in new activities. This study focuses on the peer and adult relationships during a transitional year and the student's feeling of academic success. Previous research shows that supportive peers and teachers are associated with higher academic success (Cook, Herman, Phillips, & Settersten, 2002; Powers, Bowen, & Rose 2005). The students' perceived level of support has been found to be influential on the success of the student, meaning the support is not necessarily observed by a third party but still reported by the individual student (Stroet, Opdenakker, &Minnaert 2013). Teacher support has been linked to influencing student motivation, engagement in class, and sense of belonging in the school (Virtue 2015). Adult support is crucial for adolescent development and creating the sense of independence (Stroet et al., 2013; Virtue 2015).

Peer relations are important as adolescents develop. Good peer support has also been linked to lower occurrences of high-risk behaviors (Bowen, Rose, Powers, & Glennie, 2008). A sense of belonging has also been associated with a more positive self-image (Osterman, 2000). Fostering good relationships is important, especially during the transitional times. This study focuses on how students view their peer and teacher relationships, as well as how they view their ability to succeed in school. The study will also investigate the student's sense of belonging and if "free time" allows for time with friends. Examining these factors will give a deeper understanding of how students view these relationships and their academic success.

Data Collection and Results

Data Collection

Subjects. Parental consent forms were sent to parents of 170, ninth-grade students. Seventy-five parents consented to their child's participation. Of these 75 students, 39 students consented and completed the survey.

Methodology. Students completed the survey on their own time. *Google Forms* was used to collect the survey results. Data was organized and scored on a 4-point scale for positively worded questions (1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Neither, 4 = Somewhat Agree, 5 = Strongly Agree). Negatively worded questions received negative scores (-1 = Strongly Disagree, -2 =Somewhat Disagree, -3 = Neither, -4 = Somewhat Agree, -5 = Strongly Agree). Survey scores were generated by adding scores for each question. Data was analyzed for descriptive statistics, as well as using one-way ANOVAs.

Results

Thirty-nine students completed the survey (21 male, 18 female). Twenty-seven of those students entered the school in sixth, seventh, or eighth grade. Twelve entered in ninth grade.

The majority of students reported making friends in class (44%) or in an afterschool activity (31%). An analysis of variance showed that the effect of gender on the Making Friends is Difficult Score was not significant (p=.0594). In general, female students reported having a greater difficulty making friends than did male students.

An analysis of variance showed that the effect of gender on the Friend Support Score was significant (p<.05). Male students reported a greater feeling of support from their friends.

An analysis of variance showed that the effect of gender on the 8 Hours of Sleep Every Night question varied greatly, but was not statistically significant. Female students reported not getting 8 hours of sleep every night, while male students neither agreed nor disagreed with getting 8 hours of sleep every night.

The effect of grade entry on the Difficulty Making Friends Score was significant (p<.05). Students entering the school in middle school reported having a more difficult time making friends than students entering in the ninth grade.

The effect of grade entry on the Survey Score Sum was significant (p<.05). Students entering the school during the middle school years scored higher on the survey, as compared to students entering the school in ninth grade.

Conclusions and Recommendations

Conclusions

Generalizations to the school population cannot be made for this study based on the sample size. To have more conclusive data, more students need to take the survey. Poor participation in this study can be attributed to the timing of the study and the perceived importance of participation. There was no incentive to participate in the study. School personnel understand that these results cannot be generalized to the entire freshmen class but appreciates what the results do indicate.

Based on the results received results, girls and students entering in middle school have more difficulty making friends than boys of the same age. Girls feel less supported by their friends than do male students. It is interesting to find that students entering in middle school reported having a more difficult time making friends. These students have attended the school for a longer period of time, and, therefore, have had longer to make friends and should know more of their peers than do incoming students. Entering ninth-grade students scored lower on the survey, overall, indicating that the transition and the level of support felt by these students is lower than the students matriculating from the school's eighth grade. These students have not had the time to make friends and establish relationships with peers and adults on campus, so this result is to be expected.

Recommendations

Based on the results of this survey, special attention needs to be given to ensure the smooth transition of all rising ninth-grade students with extra support provided to female students and new students. A larger sample size would be needed for statistical validity, so it is recommended that the school find better ways to reach students and receive responses. The school administration has avenues to survey students with greater success than the methodology in this study, so the sample size should be greater if the survey were administered again.

Further research on this topic does not require additional funding. Technology helps to keep costs low, as well as to provide confidentiality of responses. The school plans to implement a version of this survey to the ninth-grade class at the end of the school year, in an attempt to acquire more responses.

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Effect of Short-Term Integration of Scientific and Mathematical Investigations

Robert Hall

Education 5900, Spring 2017

The University of Tennessee at Chattanooga

The Institutional Review Board of the University of Tennessee at Chattanooga (FWA00004149) has approved this research project #17-091.

Introduction to the Problem

Mathematics and science are related in many ways. Mathematics is often referred to as the language of science due to its ability to describe nearly everything exactly, so long as the correct equation is used. Often times, the public education system neglects to ensure that students are taught the proper mathematical operations before taking a particular science course. For example, many theories in early science courses are based on logarithmic calculations. However, these calculations are not taught in mathematics class until Algebra II. This forces teachers to find less reliable methods of explanation, as the students are not familiar with logarithmic growth.

As many mathematical operations are not introduced in mathematics classes before they are needed in science classes, scientific and mathematics instruction time are often integrated into one science lesson. The efficacy of such integration has been disputed regularly, and this debate is ongoing. This study will investigate the efficacy of short-term integration of mathematical concepts into a scientific investigation. The topic of the lesson will be Hooke's Law, or the spring constant equation, and its relationship to the slope-intercept form of writing equations.

Integration has been argued to be an effective technique, as science and mathematics are closely related. This integration comes at the cost of instructional time, however. The effect of scientific and mathematical integration during direct instruction will be investigated using a pre-test and a post-test, given before and after two alternative lectures. One group of participants will receive an integrated lesson to include direct mathematics and science instruction, and the other group will receive mainly science instruction with minimal mathematics instruction.

Review of Literature

In the past century, the education system worldwide has made increasingly concerted efforts to reform and revitalize how instructors approach education in all aspects of academia. Whether in the elementary classrooms setting, where teachers set out to build a lasting foundation, or in the collegiate realm, in which adults are utilizing new strategies to enter the workforce, a much-needed change has emerged in integrative approaches to teaching. More recently, a specific eye has been turned towards the assimilation of mathematics and science in a clear, cohesive manner that would allow for both students and instructors, alike, to understand the innate connection between the two. On a larger scale, this STEM (science, technology, engineering, mathematics) integration would allow for the establishment of a stronger education system that promotes a society heading ever faster into one of the greatest technologically-advanced times the world has ever experienced. This paper seeks to establish the history of STEM integration, as well as the benefits and potential obstacles that face high school students in maintaining long-term recollection of lessons learned.

To better understand the concept of subject integration within the classroom, one must explore the history of STEM, and how it has gained so much popularity in the recent times. While mathematics has been largely based in concrete, linear formulas and answers, the subject of science has seen a great deal of reformation in, not only, its importance, but the manner in which is presented. In the past 350 years, science has gone from the basic subjects of chemistry, biology, and physics into more than 400 specified sub-categories as research areas have increased interest (Hurd, 2002). Indeed, as these separate factions have expanded, so, too, have their trans-discipline tactics in addressing new research questions. Within biology, alone, scientists have divided and combined to form subjects that have the ability to tackle specific questions such as biochemistry, ecology, and human anatomy. Additionally, changes in the social and cultural context have led to further research in how we must now approach the sciences and their application, as seen in consistent updates to the ethics of experimental research. Though mathematics maintains its solid form, it is the application of mathematics in the real world and in research that, in combination with the sciences, presents a promising potential.

However, the concept of subject integration into schools is far from new. As early as the 1800s, France had begun establishing new concepts into schools that would begin combining mathematics and science in one of the most impressive educational reforms of its time. At this point in history, many trades were controlled under trade guilds, “an association of craftsmen or merchants formed for mutual aid and protection and for the furtherance of their professional interests” (*Encyclopedia Britannica*, 2009, ¶ 1), which used their power to control prices and fees throughout Europe. These guilds would fall, however, due to strict policies in educating others in their trade and steep fees, as well as hostility towards any technology that would threaten their work. As such, these guilds would be abolished and France needed a new way to approach education to compensate for the loss of specialty training organizations that the guilds provided. In this educational reform, Napoleon's government would establish trade schools within the curriculum, utilizing the teachers of the various mathematics and sciences that would serve as the foundation for the newly-formed classrooms. Such trade courses included blacksmithing, carpentry, and woodworking (Pannabecker, 2002), which were supported by the rest of the teaching faculty as a means of integrating both subjects in a way that served the students, as well as the country, in its new direction. Such an undertaking was not met without conflict, however, as many teachers were only well-versed in their specific disciplines and were not prepared for the combination of subjects within the classroom. Today's collegiate students and current instructors are found to be in a similar predicament.

In order for subject integration to become a viable instructional method for teaching, the focus must begin from the instructors, themselves. While the benefits of STEM and integrated teaching have been studied, one of the greatest obstacles lies in the comfort level and capabilities of the teachers already in place. Some colleges, such as Tufts University, have been in the forefront of collegiate reform, establishing engineering courses in K-12 classes that allow for the amalgamation of mathematics and science in a hands-on environment more suited for child development (Stohlmann, Moore, & Roehrig, 2012). Tufts University offered support to the schools and teachers by holding classes for the faculty and meetings with the teachers, as well as holding classes for the students to help solidify their efforts in promoting STEM. As the importance of sciences and mathematics increases in the technological workforce, so, too, does need for increased cross-discipline courses and majors in colleges and universities. While many colleges are beginning to offer these types of courses for the new cadre of academic instructors, the next challenge lies in supporting the existing teacher workforce.

For vast majority of schools in recent history, courses have been taught in segregated courses, with each instructor specializing in his or her subject. Therefore, in order to facilitate this integration of subjects, there must be a reform of teaching support within the classrooms. In their research, Stohlmann, Moore, and Roehrig (2012) found that a number of systems would need to be in place to assist educators, including increased time for planning and establishing groups for cross-discipline teaching, as well as support for lesson materials, teacher efficacy, and state and federal funding, in order to better streamline the overall process. The study noted the need for improving practices within the teaching community, which included more hands-on approaches, discussion and inquiry, problem-solving techniques, and utilizing the instructor as the facilitator. In a study by Parish (2013), research indicated a notable increase in curriculum-based assessments when instructors participated in professional development courses in technology integration, with science students being eight times more likely to score above the school district mean, as opposed to those students whose instructors did not participate. While implementing an integrative approach in the classroom may be difficult, a properly-developed support system can be the key in allowing a smoother transition. As schools begin to establish more STEM courses and supports, it is paramount that we focus on the goal of the program: student learning.

The integration of STEM and cross-discipline teaching of mathematics and science has been the focus of many researchers in the academic field, with many of the results showing promise across many K-12 classes. One such study, conducted by Satchwell and Loepp (2002), used a newly-developed program called the Integrated Mathematics, Science, and Technology (IMaST) curriculum which set out to build a standards-based curriculum for seventh-grade courses. In their study, they measured differences in mean scores for mathematics procedures, problem solving, knowing science, and science process. In all four categories, students in the IMaST classrooms scored 1 point higher than the standard students, with IMaST students scoring 3 points higher in the science process portion of the testing. While conducted on a smaller, specific group, the results of the study are promising, and should be researched further across multiple grade levels and school districts.

An additional longitudinal study, by Goldschmidt and Jung (2010), utilized integrated teaching to improve science content, vocabulary, reading, and writing for fourth-grade students with 100 teachers participating. They noted that students in the treatment group scored 1.5

points higher than their counterparts in science areas, and accounting for prior students achievement. Moreover, when tested in seven areas of science-based writing and reading, student scores in the treatment group indicated an effect size ranging from 0.33 to 0.80 compared to the control group. These types of experiments, which are designed to factor in all aspects of learning, including student performance, teacher qualification and efficacy, and outlying obstacles, are crucial in identifying the benefits of integrated learning, and provide significant, qualitative support for funding further research and implementation in other schools. As studies further indicate the needs for teacher support and increased test scores, another approach must be implemented to form a complete program in the form of the qualitative aspect of STEM and integrated designs.

While most research focuses around the measurable effects of a curriculum, a great deal can be said about how the students receive the lessons and how lessons affect the way they engage and learn. In 1981, a committee was formed to create a program that would increase integrative teaching methods in schools (Berlin & Hillen, 1994). The Activities Integrating Math and Science program (AIMS) began with 6 states, 45 teachers, and over 2,000 students between grades 4 and 6. The primary goal of AIMS was to "investigate the effects of participation in a hands-on integrated math/science program on students' expressions of their thinking and learning, and attitudes and perceptions towards the beliefs about math and science" (p. 284). The teachers/researchers gathered statements from students and their own observations within the classrooms to measure how effective the program had been. Many teachers reported a significant increase in their students' self-efficacy and confidence, positive interactions with peers and staff, and a greater involvement of students in classrooms activities. Equally as notable was the increased school attendance at schools with at-risk youth, with a significant increase in interest, both in school and at home. In their experiment, Goldschmidt and Jung (2010) also noted an increase in involvement with lessons, stating that 77 percent of treatment teachers believed their students were engaged/very engaged, compared to 66 percent of the control teachers. Although qualitative results are harder to measure, the indication is clear. Students that enjoy learning will try harder, and students that try harder tend to score better. This lesson should not be lost on researchers when designing future experiments.

Teaching and learning in the next century is going to be distinguished by faster and more efficient individuals, and that will grow at an exponential rate for the rest of time. In order for our teachers, and especially our students to be prepared, we must turn our focus from the traditional manner of segregated academics toward a combined effort among the different subjects and thought processes so that we may face the challenges in the future. As it pertains to the current high school demographic, it is important that we make these changes quickly and efficiently so that students may be better prepared for the growing demands of colleges and universities that are already in the process of reforming their programs. The nation must unite on the education front for solidarity for the children, as they are being shaped today for our future and benefit. Through new and innovative integrated approaches and STEM integration into all classrooms, we seek to establish this future as a cohesive unit and population.

Data Collection and Results

Data Collection

Subjects. Data was collected from 57 voluntary participants from a high school in Hamilton County, Tennessee. Subjects were recruited from two, freshman-level Physical World Concepts classes.

Methodology. Subjects were divided into two groups based on which class they attended. Both groups were taught about Hooke's Law and its relationship to the slope-intercept form of writing equations. The experimental group received an integrated lesson with direct instruction for both the mathematics and science topics included in the lesson, while the control group received strictly scientific instruction pertaining to Hooke's Law. The control group would be asked to rely on their own prior knowledge from previous mathematics classes, with minimal intervention from the science instructor. Both groups were given a pre-test to determine their background knowledge in both subjects. After the pre-test, direct instruction for Hooke's Law was given. The control group received strictly scientific instruction, while the experimental group received scientific and mathematical instruction. After the instructional period was completed, students were given a post-test to evaluate their improvement.

Results

The mean score on the pre-test for the experimental group was 59%, with a standard deviation of 17%, while the mean score for the control group was 60%, with a standard deviation of 17%. The *z*-score for the pre-test was -0.06, indicating that the experimental group scored an average of 0.06 standard deviation below the control group. The mean score on the post-test for the experimental group was 57%, with a standard deviation of 19%, and the mean score on the post-test for the control group was 60%, with a standard deviation of 19%. The *z*-score of the post test was -0.167, indicating that the experimental group scored an average of 0.167 standard deviation below the control group.

Conclusions and Recommendations

Conclusions

In this short-term integration study, participants were given a pre-test and a post-test. Scores on the pre-test were incredibly close, with a *z*-score of 0.06. This indicates that both groups had similar background knowledge of the material. If the absolute value of the *z*-score on the post-test was large, that would mean the groups had much different background knowledge of the material, making comparisons much more difficult. This assertion is further validated by the average scores on the pre-test for both groups being only 1 percentage point apart from each other, with the control group scoring a mean of 60% and the experimental group scoring a mean of 59%.

The *z*-score on the post-test was surprising. The experimental group scored an average of 3 percentage points lower on the post-test than the group that received strictly science instruction. Although half of the post-test was mathematics-based, the group that received integrated mathematics and science instruction scored more poorly on the post-test than did the control group, as indicated by the *z*-score of -0.167. The reason for this could be that, by integrating the mathematics lesson and science lesson in one instructional period, valuable instructional time was spent reviewing a mathematics concept that could have been spent on direct instruction for the science concepts that are based on the mathematical concept. Possible sources of error are many in this study. A short-term study lends itself to error, as outlying data is difficult to predict. High school students are another source of error, in their own right. It is difficult to evaluate testing results from high school students without a large sample size.

Recommendations

There is no general consensus on this topic. In general, it seems to be considered a good idea to scaffold mathematical concepts in conjunction with science concepts. The agreement breaks down with the logistics of such integration. Science teachers are often charged with the task of teaching a concept that is based heavily in mathematical theory to students who are many grade levels behind in their mathematical knowledge. This leads to incomplete mathematical lessons, as science teachers attempt to integrate small mathematics lessons into the flow of their scientific instruction.

For future studies on the integration of mathematics and science, it would be wise to choose a more challenging mathematical concept. The slope-intercept form seemed to be widely known prior to the pre-test, which may have eliminated the need for the integrated mathematical instruction and rendered instructional time spent on the slope-intercept form unnecessary and redundant. A good topic for investigation into integration would be radioactive decay and its relationship to logarithmic growth and decay. Many fewer freshmen students are familiar with logarithmic calculations, so the effects of discrete and integrated instruction could be noticed. Future studies should also consider a more longitudinal approach. A full semester could be utilized with two separate classes who consistently receive different types of direct instruction. It would be wise to include a mathematics teacher in future studies to collaborate on lessons. This would be difficult to coordinate in a high school, as scheduling conflicts are nearly impossible to avoid when trying to find randomized participants who would be in the correct mathematics and science classes.

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Effects of Physical Education on Math Performance

Whitney Shea Layne

Education 5900, Spring 2017

University of Tennessee at Chattanooga

The Institutional Review Board of the University of Tennessee at Chattanooga (FWA00004149) has approved this research project #17-083.

Introduction to the Problem

While the physical, social, and emotional benefits gained from physical education are well established in education, there are many theories and questions concerning physical education and its effects on academic performance. These questions are not just national, but worldwide. Studies are being conducted, with varying age groups, all over the world. Some research shows that there is no correlation, and other research shows that physical activity and physical education only improve academic performance in certain subjects. There are many mixed results from research, with regard to this subject area. The results from this study could, not only, influence my career as a physical education teacher, but, also, provide implications for future research.

Review of Literature

Much of today's society understands the importance of being consistently physically active, and the benefits that can be obtained (Keeley & Fox, 2009). "Young children need specific and systematic opportunities to learn fundamental physical skills that will contribute to a lifetime of physical activity" (Stork & Sanders, 2008, "Abstract"). However, especially for children, there are many benefits that extend beyond the physical aspect, including mental and social well-being. It has been found that increased physical education could positively improve physical status among both normal and overweight children (Sollerhed & Ejlertsson, 2008). There is a very wide range of research conducted on how physical education and physical activity impact cognitive and academic performance. There have been various academic subjects used to measure academic performance. Among each subject area, there are many different tests or instruments used to determine academic performance.

Researchers have indicated that low intensity physical activity facilitates cognitive processes immediately after exercise, yet high intensity facilitates fatigue and consequent cognitive degrade, but improves cognitive performance after a physiological recovery (Phillips, Hannon, & Castelli, 2015). Some research has shown that physical activity can also be detrimental to academic performance (Phillips et al., 2015). In recent results, researchers found that vigorous physical activity may be the cause of increased mathematics performance up to at least 30 minutes after the exercise (Phillips et al., 2015). Another study compared two schools' scores of language arts and mathematics with one school receiving more time in quality physical education (Graham, Robinson, & Tremarche 2007). Ardoy et al. (2014) found that increasing the number and time of physical education classes can have positive effects on academic performance. However, it is noted throughout several studies that having physical education and reducing classroom instruction time has not decreased academic performance, either (Ardoy et al., 2014).

Coe, Pivarnik, Womack, Reeves, & Malina (2006), researched previous studies that have shown there is a positive relationship between academic achievement and physical activity and sports participation, and other studies have shown no correlation or an inverse relationship. Some research has shown that physical activity can also be detrimental to academic performance (Phillips et al., 2015). However, the possible reasons for increased academic performance are for various reasons including increased self-esteem, increased attention span, and reduced boredom (Coe et al., 2006). Many studies showed a positive correlation between increased physical activity and academic performance, despite small differences in how each study was conducted (Fedewa & Ahn, 2011). "Physically active academic lessons of moderate intensity improved overall performance on a standardized test of academic achievement by 6% compared to a decrease of 1% for control group" (Donnelly & Lambourne, 2011, "Abstract"). The review of much research showed that there was a weak relationship between physical activity and academic achievement (Keeley & Fox, 2009). This led the researchers to believe that cognitive function and academic performance should not be assessed at the same time, but separately (Keeley & Fox, 2009).

One of the major limitations in this field of research has been trying to take into consideration so many different factors (Phillips et al., 2015). Another common limitation was that most sample sizes were relatively small (Ardoy et al., 2014). Due to the wide range of research in this area, another limitation is there is not enough research that specifically pinpoints a specific subject, if it is just one subject, or if physical education can improve academic performance. In one particular study, researchers were not able to have a true control group that did not receive any physical education (Telford et al., 2012). Another limitation of their study was having to rely seriously on teacher's reports and the inability of the pedometer to distinguish small changes in energy output.

As can be seen from previous research, there is a need for much more research in this area. There are many different studies in this field that all focus on very different aspects. Most studies have the need for a larger sample size and evaluating each aspect that can influence academic performance. Also, precisely what subject area, if any, are affected by physical education is another limitation. In this study, participants will attend their physical education and computer lab enrichment classes in accordance with their normal schedule. Participants will take a mathematics speed test each week after physical education and computer lab class. Their scores will be compared to determine if there is any correlation between physical education and improved academic performance in mathematics.

Data Collection and Results

Data Collection

The participating students were still a part of their normal routine and schedule. Participants stayed with their class and went to their regularly scheduled physical education and computer lab classes. Two different classes participated. The main difference between these two classes were that they had physical education and computer lab on different days. Both classes were taught by the same physical education teacher.

Subjects. The participants were fourth-grade students in a rural elementary school in Tennessee. These students were of similar socioeconomic and ethnic backgrounds, proven from previous studies to be factors can influence academic performance (Coe et al., 2006). The total number of participants was 38 students, and included 15 girls and 23 boys.

Methodology. Each class, in their homeroom, took a mathematics speed test immediately following physical education and computer lab. The test was given each week, two times per week, once after physical education, and once after computer lab. Each test was timed for 5 minutes. Tests were given and graded by their teachers. The study lasted for 4 weeks.

Results

The mean, median, and mode of student scores after computer lab and physical education are presented in Figures 1 and 2, respectively. The lowest weekly mean calculated was during week one, after computer lab. The highest weekly mean calculated was during week two after physical education. Every weekly mean after physical education was higher, except in week four, in which the after computer lab mean was higher. The median was never lower than a score of 98. A score of 100 was the median at five different times. The mode was always 100. At the end of data collection, four, type 2 one-tailed *t* tests were run to compare week-to-week scores after physical education and computer lab. These results are presented in Figure 3. There were no significant differences.

After Computer Lab	**Mean**	**Median**	**Mode**
Week 1	86.4473684	98	100
Week 2	91.89189	99	100
Week 3	93.525	100	100
Week 4	93.97297	100	100

Figure 1. Mean, median, and mode of student scores after computer lab are presented.

After PE	**Mean**	**Median**	**Mode**
Week 1	92.23529	100	100
Week 2	95.31429	100	100
Week 3	93.67647	100	100
Week 4	92.67568	99	100

Figure 2. Mean, median, and mode of student scores after physical education are presented.

	T Test Results
Week 1	0.101871
Week 2	0.151477
Week 3	0.480385
Week 4	0.320158

Figure 3. Weekly *t* test results are presented.

Conclusions and Recommendations

Conclusions

Based on the data and statistical analysis from this study, there were no significant differences in mathematics scores after physical education and computer lab. Therefore, from this study, the generalization can be made that physical education does not improve academic performance in mathematics, either positively or negatively. There are other factors to consider that could affect these conclusions. The mathematics speed test could have been too easy for students, or the students could have been given too much time to complete the speed test. Therefore, it does not accurately reflect the impact of physical activity on academic performance. Students could have been challenged more. Another factor to consider is the intensity of physical activity. This was not recorded in this study, but could impact the study. Technology could be incorporated into this study to improve reliability of this study. The intensity of physical activity has been mentioned as a key factor in whether physical activity influences academic performance. Students could wear heart rate monitors to determine the intensity of physical activity. Tests and quizzes could be administered on the computer to leave out any potential bias in grading.

Recommendations

With regard to the effects of physical activity on academic performance, most educators agree that physical activity in physical education does not hinder a student's academic performance. It may not, necessarily, directly improve academic performance, but it does not hurt academic performance, either. However, there are qualities and characteristics that can be obtained from physical education that can transfer over into success in the classroom.

For physical education teachers, one recommendation to consider is to be in constant collaboration with classroom teachers. There are ways that physical education can help the overall well-being of students, which in turn can improve academic performance. There are also ways to incorporate mathematics, science, and various subjects into physical education. This is where the need for collaboration is evident. Find out what the teachers are teaching and develop lessons that incorporate these concepts, if possible. For example, there are many games that can be played with money that require students to count and add their money while being physically active.

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A Study of the Integration of Physical Activity and Movement and its Effect on Academic Behavior

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Introduction to the Problem

Physical activity is very important for children, especially with the rates of childhood obesity in the United States. Unfortunately, for many students across the country, physical education (PE) time has been vastly reduced due to the high demands of academic testing. Physical activity is not only important for health, it is also very important to help self-concept, increase academic achievement, and promote positive academic behaviors.

Review of Literature

The there is ample literature available on the relationship between physical activity and academic achievement and academic behavior. Throughout the literature, there is no evidence that physical activity or PE is harmful to academic achievement. In fact, Blom, Alvarez, Zhang, and Kolbo (2011) have found that the students with the highest level of physical health zones (the most fit/healthy students) were three to four times more likely to have high levels of academic achievement (test scores) compared to the students with no healthy zones. They also found that students with very low healthy zones were over four times more likely to have eight or more absences in an academic year. As a result of the No Child Left Behind Act, many schools across the United States reduced the PE time sharply, so that only 4% of elementary schools offer PE or its equivalent on a daily basis (Simms, Bock, & Hackett, 2014). This lack of physical activity could be a contributing factor to the high rates of obesity in children today. Statistics show that students in the United States are significantly less active when compared to their Swedish or Australian peers, and have significantly higher body mass index values (Reed, Einstein, Hooker, Gross, & Kravitz, 2010). One of the main contributors of being overweight, or obese, is sedentary behavior. Reed et al. also found that PE and poor diet were significantly negatively correlated; hence an increase in participation in PE was associated with lower consumption of sugar-sweetened beverages, fast food, and potatoes.

The literature also suggests that physical activity and PE can have a positive impact on self-concept. Reed et al. found a significant relationship between PE and low self-concept, implying that, as participation increased, the student tended to have a higher self-concept. According to Simms et al. (2014), teachers have also reported that PE may enhance children's social skills. "Physical activity stimulates immediate chemical changes in the brain that increases attention and may enhance cognitive performance" (Mullender-Wijnsma et al., 2015, p. 365). According to Dills, Morgan, and Rotthoff (2011, p. 4), "recess increases the amount of work completed and improves classroom behavior by reducing fidgeting and listlessness." They also state that breaks are essential for alertness and achievement in children. Young children comprehend material more thoroughly and quickly when the material is presented with short breaks (p. 4).

Fedewa, Ahn, Erwin, and Davis (2015) conducted a study of 431, third- through fifth-grade students from urban schools, in which the students were split into groups, one being the experimental group and the other being the control group. They had the experimental group integrate physical activity into their core curriculum for 20 minutes per day, 5 days per week, for 8 months. The students wore pedometers and they used standardized test scores to compare the academic achievement of the students. They found that the mathematics scores were significantly higher for the experimental group. The scores were also higher on the reading assessment, but they did not find any significant differences in the reading scores. What they did find was very interesting. For example physical activity breaks were found to increase fluid intelligence (the general ability to think abstractly, reason, identify patterns, and solve problems) scores. They believe that the experimental groups scored higher on their mathematics and reading assessments because they benefitted from the physical activity breaks that the control group did not have. A limitation of their study was with the teacher logs, which were not completed consistently by the teachers participating in the study.

Data Collection and Results

Data Collection

Subjects. The subjects consisted of one class of kindergarten students. There were 17 students in the study. The class consisted of 7 girls and 10 boys. Most of the participants were from a low socioeconomic background and varied in ethnicity. The majority of participants were Caucasian, with three African American, two Asian American, and 2 Hispanic participants.

Methodology. The researcher used a checklist to note the frequency of on- and off-task academic behaviors exhibited by students during an 80-minute literacy block that immediately followed the intervention. The researcher documented which center the students were at when they were on- or off-task during the literacy block. The time increments for movement varied day to day and were recorded by the researcher. The time range for the length of movement intervention time was broken down into the following increments, 0-5 minutes, 6-10 minutes, 11-15 minutes, and 16-20 minutes.

Results

The results indicate that the students exhibited the most on-task academic behaviors when they received between 6 and 10 minutes of the movement intervention. The students also exhibited more on-task academic behaviors when they received an intervention between 16 and 20 minutes. The students were considered to be the most off-task after receiving an intervention that lasted between 0 and 5 minutes. The students were exhibiting the most off-task academic behavior at the writing center. There were 3 students, of the 17 students, that exhibited the highest off-task academic behaviors. Of those three students, one of them had a developmental delay and receives some special education services.

Conclusions and Recommendations

Conclusions

The results of the data indicate that the students exhibited the most on-task academic behaviors when they received time for movement over 5 minutes in length, prior to their literacy centers. The most on-task academic behaviors were exhibited after a movement intervention lasting between 6 and 10 minutes in length. The next most frequently-exhibited on-task behaviors were observed after interventions of movement that lasted between 16 and 20 minutes. After the movement interventions, the students were expected to work independently at three of the four literacy centers. At one of the four literacy centers, the students worked with the teacher in a small group. The students were the most off-task at the writing center, in which they were expected to work independently. This result was not surprising because the students were redirected and quieted while working at the writing center the most often during observations. Often, the students were not given a specific task to be completed at the writing center, and this lack of accountability in completing a required task greatly contributed to the off-task academic behavior. It was surprising to see the results indicate that the second most frequently off-task center was the iPad center. The students in this study came from a high poverty school, and many do not have access to this type of technology at home. The iPad center is the most popular center and free choice option, but the students often wanted to see what other students were doing or talked during the center. The students are only allowed to use one literacy-based application on the iPad, but sometimes the students would be off-task and using the iPad for other purposes, such as taking pictures. The school has a way to monitor the student iPads from the teacher iPad, but this classroom had not yet set up the monitoring system. This study indicates the need for that monitoring program to be in place and used during literacy centers. Three students were the most off-task during the course of the study. One of those students was off-task every day but 1 day. He had a developmental delay and received special education services form the school. His inability to stay on task while working independently was definitely a limitation of the study because he was not yet developmentally ready for that type or length of independence in learning. The other two students most habitually off-task required redirection often, but frequently completed required tasks during literacy centers.

The limitations of this study are that the study could not have a control or experimental group. Another limitation of this study is that the students were in kindergarten and there was no standardizing testing for literacy to track their academic achievement, as well as their academic behavior.

Recommendations

The study indicates that the additional movement time is beneficial to student academic behaviors and even more beneficial when it is over 5 minutes in length. I would recommend that students in kindergarten receive daily movement and brain breaks that incorporate physical activity to better promote academic behaviors. The amount of physical activity time allowed in schools has been slowly decreasing over the years. It can be offset in the classroom with adding movement time to help the students get physical activity time, and to help them exhibit more on-task academic behaviors during a long block of learning. This idea of adding movement time in the classroom has been growing over the past few years and more research is needed to determine the potential effects on academic behavior and academic achievement. The entire grade level at the school uses the additional movement time because of the benefits that have been seen in educators' classrooms. If these educators could share their success with other educators, it could lead to more professional development opportunities. The use of a monitoring system, by the teacher, to monitor the students while using their iPads could be very beneficial to document the individual student's academic behavior. I believe that the students would be more productive in the writing center if they were given a specific task, or tasks, to be completed and held accountable for completing.

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