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THE EFFECT OF MANIPULATIVE MATERIALS ON STUDENT MOTIVATION

by
Deirdre Morrissey

A Thesis

Submitted in partial fulfillment of the requirements of the
Master of Science in Teaching Degree
of
The Graduate School
at
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Approved

Date Approved

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ABSTRACT

DEIRDRE MORRISSEY
THE EFFECT OF MANIPULATIVE MATERIALS ON STUDENT MOTIVATION
2002/03

Dr. Randall Robinson
Master of Science in Teaching

The purpose of this project was to determine the effect of manipulative materials on student motivation in the subject area of social studies. The students who participated in the project were divided into control and experimental groups. Each group was comprised of twenty-one third grade students living in rural southern New Jersey. Both groups completed pre and post surveys that focused on student motivation towards social studies. The experimental group students were instructed using manipulative materials after the completion of the initial survey and in conjunction with a unit on "Community Government". The control group students received no such intervention. The initial survey was re-administered to both groups upon their completion of the "Community Government" unit.

The data analysis used to report the findings were tests of significance. The results of the study were inconclusive and reflected no statistical significance between the two groups of children.

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Chapter One

SCOPE OF THE STUDY

Introduction

Motivation to learn has been a concern for educators for some time (Hancock, 1994). The disinterested student runs a greater risk of going off-task (Guthrie, Aloa, and Rinehart, 1997). Students who are not following the lesson as it progresses tend to exhibit a greater level of inappropriate behavior and this interferes with their ability to comprehend, process and recall the information covered in the lesson (Slywester, 1994). Students who maintain their inappropriate behavior or maintain their lack of interest put themselves at a greater risk for developing anti-social tendencies, up to, and including school abandonment (Amen & Reglin, 1992). Children's innate curiosity is reflected in their motivation to learn; this desire to explore new things regularly decreases as the child advances through his elementary school years (Raffini, 1993).

If students are allowed to participate in a class which incorporates a more hands-on approach to education, they will be less likely to go off-task, experience heightened interest in the subject matter, and exhibit greater levels of motivation towards the experience of school as a whole (Fogarty, 1997). Material needs to be presented in a variety of manners to deepen the level of comprehension on the part of the students (Wang, Haertel, and Walberg, 1994). Tactile learning strategies are an important tool to utilize when contending with unexciting material or if the class has

been participating in something of a repetitious routine, to allow a break in the monotony and to insure student interest and positive participation (Blair, 2000).

Something of an elusive variable, student motivation, is nonetheless, a key component in the education process as it represents a determiner of both perseverance and effort (Wang, Haertel, & Walberg, 1994); student participation (as a by-product of motivation) is, after all, an integral part of the education equation. According to Lumsden (1994), student motivation is related to the students' inclination, or lack thereof, to take part in the learning process. Moreover, Blake, Fairfield, and Paxon wrote that "learning was minimal when a student had inadequate motivation" (1999, p.17).

Students learn in a variety of ways (Emig, 1997). Students who out-performed their peers in math and science "were taught by educators who integrated hands-on learning, critical thinking, and frequent teacher developed assessments into their lessons" (2000, p. 24). Blair (2000) asserts that many students prefer to participate in hands-on activities and that students who have been taught with hands-on techniques fare extremely well when compared with their peers who have not had the benefit of instruction with manipulative materials.

Statement of the Problem

Most teachers instruct the way that they were taught; that is, most teachers lecture even in the primary grades (Emig, 1997, p.47). This approach to learning is dull, repetitive and turns even the most eager student into a disinterested by-stander (Strong, Silver, & Robinson, 1995). Research indicates that a significant percentage of individuals would be better served by instructional approaches other than the format of teacher

lecture (Schrimshire, 1997). Do students prefer hands-on activities or do students prefer the more common and standard teacher lecture format? Are manipulative materials a more viable instructional approach than the straightforward lecture? Since we know that students learn in a variety of ways (Emig, 1997), will manipulative materials serve to better increase the chances of students' grasping classroom material? Does active learning take place with the use of manipulative materials?

Statement of the Hypothesis

Students who are taught social studies with the inclusion of manipulative materials will exhibit a greater level of motivation and interest towards that subject than students who are not taught social studies with the inclusion of manipulative materials.

Limitations

The first limitation to the study was the size of the sample examined. The small size of the sample made the findings of the study impossible to extend to a population of greater dimension.

A small time allotment for the teaching of social studies was the second limitation of the study. More class time was spent on other subjects, which limited the time devoted to social studies. This limited time allotment proved to be a limitation in the long run. If the children had more opportunity to work with the manipulatives in the area of social studies, the results of the study may have been more statistically significant.

Finally, the time of year proved to be a limitation in the study. The experiment was conducted during a spring that followed an unseasonably long and harsh winter. The timing of the study with the advent of warmer weather and corresponding

outdoor activities turned out to be a limitation. Children had been indoors for so long that when baseball, soccer and various other extracurricular activities began, the children were extremely focused on their activity of choice, almost to the exclusion of all else. Had this study occurred during the long, harsh winter rather than after it, the students would have been more receptive the various activities which accompanied the lessons.

Definition of Terms

The following terms were used in the study:

Interest: a feeling of intentness, concern, or curiosity about something [an *interest* in politics].

Manipulative materials: objects with substance that can be touched and manipulated.

Magic Cover Manipulative: clear plastic report covers.

Question Cube Manipulative: large, paper “die” cube with the six question words, (Who, What, Where, Why, When, and How) printed one per face.

Question Machine Manipulative: paper, game-like device with four exterior surfaces covered with color words, and an inner layer containing written questions or problems.

Wikki Stix Manipulative: lengths of wax-coated yarn, possessed of a tacky texture.

Yes/No card Manipulative: stiff, smooth index paper cards glued to popsicle sticks with “No” written on one side of the card and “Yes” written on the other side of the card.

Motivation: the psychological feature that arouses an organism to action; the reason for the action; "we did not understand his motivation"; "he acted with the best of motives".

Chapter Two

REVIEW OF RELATED LITERATURE

Introduction

Student motivation to learn in school is paralleled with their success in school (Wang, Haertel, & Walberg, 1994). Students who are involved in class by actively participating in the lesson fare better, grade-wise, than their more reluctant or disinterested counterparts (Fogarty, 1997). Learning is limited when students lack motivation (Blake, Fairfield, and Paxon, 1999).

Educators need to vary their teaching techniques from the more traditional lecture format if they are sincere in their desire to reach their students (Schrimshire, 1997). Approaches to instruction which include manipulative materials assist students in learning material in a variety of ways (Emig, 1997). When students were instructed with hands-on techniques, which included the use of manipulative materials, they showed greater success in math and science when compared with their peers who were instructed without the use of manipulatives (Blair (2000).

Pupil Response to Instruction

Teachers have long been aware of the need for student attention and interest; if students are disconnected to the learning environment they will become disinterested and bored and less likely to be engaged in the task at hand (Lumsden, 1994). How is someone who is inattentive able to follow a lesson, let alone

contribute to it?

While it is not always the case, bored students are apt to participate in off-task behavior which can compromise their own learning and subsequent performance in school, not to mention the fact that they can become a distraction for other students in the class and for the teacher as well (Hoostein, 1994). Peek into any classroom where a student is being reprimanded for clowning around and you will readily note that he has disrupted the lesson. Edward Hoostein also tells us that this type of negative response to instruction “diminishes attention, lowers achievement, and is a likely reason for dropping out of school” (1994, p.475). According to Lumsden (1994), student motivation is related to the students’ inclination, or lack thereof, to take part in the learning process and she goes on to say that more than one student in four will abandon school prior to graduation. Moreover, Blake, Fairfield, and Paxon wrote that “learning was minimal when a student had inadequate motivation” (1999, p.17). If we expect our students to attempt to master the material covered in the course of their education, we must be certain to recognize the importance of motivation as a key player in the learning process (Burhorn, Harlow, & Van Norman, 1999).

Student Motivation

Two different, yet related, types of motivation are identified after a review of the literature: that of intrinsic and extrinsic. In layman’s terms, intrinsic motivation concerns itself with that which is present within the individual, what he or she brings with him to the education table, while extrinsic pertains to matters and influences which are outside of the individual or those influences which persuade the learner to engage in the learning process (Blake, Fairfield, & Paxson, 1999 “Intrinsically

motivated students will set their own goals and work to achieve these goals....
Extrinsically motivated students will perform a task to earn a reward or escape
punishment” (Blake et al., 1999, p.17).

These two different kinds of motivation are accepted as the norm, almost
across the board. However, this interpretation of the types of motivation is regarded
as a myth by Pardes when she writes that “motivation springs from the student’s
relationship to the specific task at hand, not from his or her personality type” (1994,
p.99). She feels that it is irrelevant whether the student is an intrinsically or
extrinsically motivated individual; either type is able to increase his motivation
provided sufficient teaching strategies are incorporated in the learning experience.

So long as we are able to access the potential catalysts to motivation, it is of
no great consequence what one’s take is concerning the impetus for student
motivation (internal vs. external); it seems prudent to recognize that both
interpretations can be deemed viable. It is fair to state that they could both be true in
certain cases. In any event, we can say with certainty that repetitive and dull material
which appears to have little or no relevance to the world in which we live, saps both
student and teacher motivation (Strong, Silver, & Robinson, 1995). Human nature
dictates that we are more likely to pay attention to matters which interest or concern
us and disregard or ignore those things existing outside of the realm of relevance
(Burhorn, Harlow, & Van Norman, 1999).

Motivational Influences

There are various factors that contribute to or distract from student motivation.

These influences can be narrowed into categories which include parental involvement (or lack thereof), unsafe or unhealthy home/neighborhood environment, social obstacles, and inadequate school curriculum and teaching techniques (Ellingson, Long, & McCullough, 1997). Granted the face of American society is changing; there is no longer a typical American family, but this is not necessarily a bad thing as long as reality remains a recognized part of the education scenario (Janes, Koutsopanagos, Mason, & Villaranda, 2000). Educational institutions are aware of the challenges that their students face and frequently reach out to the community to first establish, and then strengthen, ties in an attempt to create reciprocal commitments of responsibility between parents and students (Blake, Fairfield, & Paxson, 1999). This notwithstanding, the area in which the school can exert the greatest influence over the child is undeniably within the schoolhouse walls (Carroll, & Leander, 2001). As such, student motivation becomes more and more dependent on the teacher's style and teaching techniques (Hootstein, 1994).

Instructional Techniques

While student aptitude contributes to his ability to learn, Wang et al. (1994) found that the atmosphere of the classroom (supportive, safe, welcoming, etc.) and different kinds of instructional approaches had as much impact on learning as student abilities. Students learn in a variety of ways (Emig, 1997). Teachers need to vary their instructional techniques if they want to be certain of reaching all of their students. While research indicates that a significant percentage of individuals would be better served by instructional approaches other than the format of teacher lecture (Schrimshire, 1997), traditionally, this is the method that is most practiced, perhaps in

part because that is the way that we were taught (Emig, p. 47). Blair tells us that students will master more skills if differentiation of instruction occurs and while teaching materials are important, more essential to the positive classroom experience and successful student performance are the strategies that the teacher employs to teach the children . Students who out-performed their peers in math and science “were taught by educators who integrated hands-on learning, critical thinking, and frequent teacher developed assessments into their lessons” (2000, p. 24). “When a topic within the classroom is addressed in many different perspectives, the number of children reached increases dramatically. Students suddenly become more comfortable and more successful, which increases in the learning process” (Blake et al., 1999, p. 21).

We know also that inventive lessons and varied activities serve to actively motivate students (Hoerr, 1997). Students are apt to be more attentive and engaged learners when we are keeping their likes, interests and strengths in mind. It is necessary, then, that our educational system strive to create a learning environment in which variety and relevance drive teacher lessons and inspire their teaching techniques. It is unrealistic to expect students to be motivated or eager to learn whatever lesson is being taught if it is without meaning, either because they have already learned the material or the skills are superfluous or irrelevant (Brophy, 1987). That is not to say that all subject material needs to be adopted with the predilections of the student in mind. Rather, the need to account for individual styles of learning is as important to the success of the classroom and its learners as the subjects selected for instruction (Burhorn, Harlow, & Van Norman, 1999).

Learning Styles

Learning styles have been categorized by Howard Gardner into eight intelligences; verbal/linguistic, logical/mathematical, visual/spatial, musical/rhythmic, bodily/kinesthetic, naturalistic, interpersonal and intrapersonal (Brualdi, 1996). These categories determine, if you will, the way in which an individual best processes information. Some individuals remember things after having read them in a book, others need to have the information read to them and still others will be able to recollect the information if it is associated with a particular kind of rhythm. No matter what our disposition lends itself to, Mr. Gardner contends that we are all able to perform well in at least one category (Gardner, 1995) We are not limited to the one, and certain learning styles seem to travel together, but we each possess at least one strong suit, as it were (Gardner, 1995). The teacher who best capitalizes on the predominant learning styles of his or her students will motivate them and ensure their success (Burhorn, Harlow, & Van Norman, 1999).

Manipulative Materials in Instruction

Manipulatives, too, play an important function in developing motivation. Manipulative materials (or manipulatives) can be defined as anything which have substance and can be touched and accessed to further teaching instruction. Manipulative materials frequently are utilized in what we have come to know as tactile learning strategies. These strategies are those which incorporate manipulative materials into classroom lessons. If one were so inclined, pencils, crayons and pens could be deemed manipulative, as well as books. These tools are already commonplace in the learning environment and as such, are not those items which are being referred to

when discussing manipulative materials. Tactile learning strategies, while working especially well with Gardner's kinesthetic learners, were initially designed with the inclusive special needs student in mind. Ordinarily children with special needs benefit from hands-on engagement during the lesson; these manipulatives can serve to ground or focus the learner. Manipulatives also assist the special needs learner to increase and maintain his attention span (Bureau of Education and Research, 2000).

Techniques that incorporate objects to manipulate have been shown to benefit all students, not just those with special needs. According to Rutherford and Dahlgren (1990) "Young people learn most readily about things that are tangible and directly accessible to their senses..." (p. 186). Blair (2000) asserts that many students prefer to participate in hands-on activities and that students who have been taught with hands-on techniques fare extremely well when compared with their peers who have not had the benefit of instruction with manipulative materials. In the subject area of science, research indicates that the incorporation of manipulatives in science instruction has evidenced a major improvement in student attitudes toward science-oriented careers, in addition to science instruction in general (Frederick & Shaw, 1998). Bonwell and Eison (1991) tell us that students favor techniques which encourage engaged learning to the more traditional lecture. Children are naturally curious and manipulatives permit them the opportunity to explore material in the learning environment with a sense of adventure and fun (Janes, Koutsopanagos, Mason, & Villaranda, 2000).

Subject Area Selection

George, Mitofsky, and Peter tell us that often the least preferred subject in

school is that of social studies. "Students would do anything to avoid social studies if they could. Students do not care for the content of the subject because it is difficult and often not presented in an interesting way" (2001, p.16). This aversion students display toward social studies makes it a prime candidate for experimentation. Also the fact that math and science evidence the greatest use of manipulatives (Lumsden, 1994) encourages the exploration of their increased use in the area of social studies.

Summary

Learning need not be viewed as a chore though it is often associated with a kind of drudgery, particularly as the child matures (Lumsden, 1994). Students can master material almost without realizing it when they are actively involved in the learning process (Janes, Koutsopanagos, Mason, & Villaranda, 2000). It is this involvement which determines motivation for specific subjects and for the total school experience. When students are motivated to learn, something that hands-on materials facilitate, they are more confident and more responsive to the material being covered (Lumsden, 1994).

As the research indicates, student motivation is essential to the success of the learning process. Unmotivated students are less likely to participate fully in their own educational development and may, in turn, adversely affect the learning potential of their classmates. The unmotivated student is more likely to disrupt the lesson or to drop-out of school than the student who is involved in class. While sometimes an elusive variable to pinpoint, motivation is, nonetheless, a factor with which educators must concern themselves if they hope to engage their students in the learning process.

While individual aptitude determines student achievement to a degree, other

factors, such as motivation, home interest/support, and classroom environment are key components which contribute to student accomplishment. Educators must remain mindful of those influences that guide our students' behavior in the classroom. It is in our own best interest (and that of our students) to exert influence over those factors that are within the scope our expertise. Varying our teaching techniques to include manipulative materials can be a powerfully effective way to actively involve students.

Manipulative materials have been shown to increase student interest and performance. When an individual is engaged in his own learning, the task at hand no longer seems like work; the task at hand becomes enjoyable. Research has shown that hands-on materials encourage student motivation towards, and interest in, the learning process.

Chapter Three

PROCEDURE AND DESIGN OF THE STUDY

Introduction

Motivation is an essential factor in the education equation and a real concern of educators (Hancock, 1994). Blake, Fairfield, and Paxon (1999) determined that learning was limited when a student evidenced inadequate motivation. On the other hand, students who were instructed with a hands-on approach to learning demonstrated increased levels of interest toward the subject matter and towards their schooling as a whole (Fogarty, 1997).

While students benefit from different teaching techniques, most teachers instruct employing the lecture approach, almost exclusively (Emig, 1997). Tactile learning strategies, along with the inclusion of manipulative materials, are an important tool to utilize to facilitate learning during instruction (Blair, 2000).

In this study the researcher wanted to determine if social studies instruction which included the use of manipulative materials had a positive effect on student motivation. Does the incorporation of manipulative materials in classroom instruction increase student motivation toward the subject area in which the manipulatives are utilized?

Sample and Subjects

The students participating in this project attended a small, elementary school

located in a rural town in southern New Jersey. Grades kindergarten thru fifth made up the six grade levels in the school. Each grade level contained two classes.

The school offered students breakfast in the morning and lunch in the afternoon. Approximately one half of the students in the third grade classes were eligible for the free lunch program. The cafeteria functioned as a gymnasium, a chorus room, and an assembly hall.

There was a computer laboratory that contained twenty-four computers. Many of which were functional and not considered to be state of the art. The school library program encouraged the students to read various books. Students were also encouraged to take tests on their readings by utilizing the school's computerized Accelerated Reader program. Students participated in specials that included chorus, instrumental music, gym, art and Spanish.

The professional staff of the school averaged twelve years in the teaching profession. The atmosphere of the school was positive and everyone, staff and students alike, appeared to be happy to be a part of the school community.

In addition to the regular classroom teachers, there were eight support staff members who worked as paraprofessionals in the kindergarten, first second and third grade classrooms. There was an on-site social worker, and also a community liaison who maintained an office at the school. The district facilitator, responsible for coordinating and assisting in the implementation of district and school goals had an office at the school also.

As part of an Abbott District, the school received funding to subsidize tax dollars. As a result of this status, the school regularly participated in pilot programs which

targeted both teacher and learner improvement. An example of one of the initiated programs was the Lindamood Phoneme Sequencing Program (LIPS). In addition to their regular classroom phonics the students in grades kindergarten thru third were being instructed in this program.

The community had an average median household income of \$40,378 and a per capita income of \$ 18,632. Twenty per cent of the residents commuted outside of their town for employment. The racial majority was Caucasian. African American, Spanish, Latino, Asian and Indian families were represented in the remaining demographics of the community. Almost twenty-two per cent of children under the age of eighteen were living below poverty status, according to the 2000 census data.

Experimental Group

The number of students in the experimental group was twenty-one. Eight of the students in the experimental group were girls. The remaining thirteen children in the experimental group were boys. Of the girls, one was African American and the remaining seven were Caucasian. Of the boys in the experimental group, two were African American, one was Spanish and the remaining ten children were Caucasian.

Three of the boys in the class were in the process of becoming classified and/or eligible for support services; these three children were Caucasian.

The teacher assigned to the experimental group had over thirty-two years of experience in the teaching profession. All of her years in teaching had been spent at the school.

Control Group

The number of students in the control group was twenty-one. Eight of the children in the control group were boys. The remaining thirteen children in the control group were girls. Of the girls, two were African American and the remaining eleven were Caucasian. Of the boys in the control group, two were African American and six were Caucasian.

The teacher in the control group classroom had been in the teaching profession for thirty-two years. All of her teaching experience was in the third grade.

Procedure

This project was carried out during the spring of 2003. The spring arrived late and followed an unseasonable long and harsh winter.

The students in both the experimental and control groups were given a forced choice questionnaire, containing no open-ended questions (see appendix A). The survey was administered prior to the introduction of a particular unit in social studies. The unit was centered on the topic "Community Government".

The survey was distributed. The survey questions were read aloud to the students. The students were instructed to complete the survey as the questions were read aloud to them. The children were given ten minutes to complete the survey and were permitted to ask the researcher clarifying questions.

The students in the experimental group were taught "Community Government" with the inclusion of manipulative materials. Question Machines Manipulatives were used during two class sessions (see lesson plans in appendix B).

Magic Cover Manipulatives, along with dry erase markers were used by the experimental group students to help them grasp particular concepts in the unit (see lesson plans in appendix B). Wikki Stick Manipulatives were used by the experimental group to

assist with text comprehension. Both of these manipulative were used one class session during the course of the unit (see lesson plans in appendix B).

Students created a Question Cube Manipulative from their milk cartons. These cubes were used in small group work to further investigate the topic. The Question Cube manipulatives were utilized by the class for two class periods (see lesson plans in appendix B).

Yes/No Card manipulatives were made by the students and utilized in both large and small group discussion. During large group discussion, the students worked with the Yes/No Card manipulatives at least once a week during social studies class (see lesson plans in appendix B).

Upon completion of the “Community Government” unit, the use of manipulatives in social studies was ceased. The initial survey was re-administered to the students in both the experimental and control groups, in order to determine if the students in the experimental group evidenced a significant increase in interest and motivation toward the subject of social studies.

Description of the Instrument

The survey to be used in this study was created by the researcher by combining two instruments. The first instrument being that of Carroll and Leander (2001) who sought to capitalize on active learning strategies to motivate their students (see appendix C). The second instrument was that of Frederick and Shaw (1998) who looked at manipulatives and the effect they had on student attitudes, journal writing and achievement (see appendix D).

The survey was comprised of eleven questions. These questions were to

determine student interest and motivation toward the subject area of social studies (see appendix C).

Chapter Four

ANALYSIS OF FINDINGS

Introduction

Motivation is an important factor in student success in the classroom (Hancock, 1994). The motivated student fares better academically than his more disinterested counterpart (Guthrie, Aloa, and Rinehart, 1997). Teachers who add the use of manipulative materials to their repertoire of teaching techniques find that their students are more apt to remain on task and exhibit greater motivation towards school as a whole (Fogarty, 1997).

According to Blake, Fairfield, and Paxon (1999), the unmotivated student will evidence nominal learning, which is expressed in sub-par scholastic achievement. Most students prefer hands-on activities to the rote lecture format (Emig, 1997). Students who receive instruction with the use of hands-on activities demonstrate higher levels of success when compared with their peers who have been taught without the benefit of hands-on instruction (Blair, 2000).

This project hypothesized that children given social studies instruction with the inclusion of manipulative materials would evidence increased levels of motivation towards the subject area of social studies when compared with children who were given social studies instruction without the inclusion of manipulative materials. This hypothesis was tested using pre and post intervention surveys with the experimental

group. The same surveys were administered to the children in the control group but without the addition of manipulative materials in social studies instruction. The following analysis indicates relevant attitudinal changes on the part of the children.

Statistical Analysis

The following data reflects the comparison of the experimental groups pre and post survey results. The post survey results of the experimental group in comparison with the control groups post survey results are also examined.

In order to assess the effects of the intervention of manipulative materials on the experimental group, the eleven-question survey that was administered was analyzed using an independent samples t-test. Each question had a range (r) of three (yes, I don't know, no).

Table 1 reflects only the responses of the children in the experimental group. It compares the experimental groups pre and post survey responses and offers interesting, if limited, results. Of the eleven questions, only one reflected a change of any statistical significance. The second to last question, which had the students responding to the statement "My grades in social studies are good", evidenced a percentage (p) equal to that of .017. This tells us that the children in the experimental group felt better about their grades in social studies after the introduction of manipulative materials than before the introduction of manipulative materials. This researcher believes that the reason for this increased confidence was due to a greater understanding of the material covered during instruction which included manipulative materials. While this data is encouraging in light of the correlation between student motivation and academic performance, the findings and population size are too limited to extrapolate to any significant degree.

table 1

t-Test Experimental Group Only

| Survey questions | test | N | Mean | Std. Deviation | Std. Error Mean |
|---|----------|----|------|----------------|-----------------|
| I am happy learning about the world | pretest | 21 | 1.33 | .48 | .11 |
| | posttest | 21 | 1.43 | .75 | .16 |
| I like to cut with scissors | pretest | 21 | 1.62 | .80 | .18 |
| | posttest | 21 | 1.48 | .75 | .16 |
| Social studies is my favorite subject | pretest | 21 | 2.52 | .81 | .18 |
| | posttest | 21 | 2.19 | .93 | .20 |
| I like learning social studies by myself | pretest | 21 | 2.29 | .78 | .17 |
| | posttest | 21 | 2.19 | .93 | .20 |
| I like learning social studies with my class | pretest | 21 | 1.90 | .89 | .19 |
| | posttest | 21 | 1.81 | .98 | .21 |
| Reading about social studies is easy for me | pretest | 21 | 1.95 | .97 | .21 |
| | posttest | 21 | 1.48 | .81 | .18 |
| Social studies is fun because we get to do fun things | pretest | 21 | 2.00 | .77 | .17 |
| | posttest | 21 | 1.62 | .80 | .18 |
| I look forward to social studies class | pretest | 21 | 2.14 | .96 | .21 |
| | posttest | 21 | 1.90 | .94 | .21 |
| I think social studies is easy to learn | pretest | 21 | 1.86 | .79 | .17 |
| | posttest | 21 | 1.57 | .81 | .18 |
| My grades in social studies are good | pretest | 21 | 1.95 | .80 | .18 |
| | posttest | 21 | 1.38 | .67 | .15 |
| I like when we have projects to make | pretest | 21 | 1.86 | .91 | .20 |
| | posttest | 21 | 1.38 | .74 | .16 |

Question ten was also the only question to reflect statistical significance when the the posttests of both the experimental and control groups were compared (Table 2). This data was analyzed using a t-test. Table 2 shows us that p was equal to .033 indicating that there was a significant difference in the way that the two groups viewed their social studies grades. The children in the experimental group evidenced a statistical significance when compared with the children in the control group, showing that a greater degree of confidence about their grades in social studies as being good. That is to say that when the survey was initially distributed, both the experimental and the control groups felt equally leery about their good grades in social studies. However, upon the completion of the intervention which incorporated manipulative materials into social studies instruction during the course of a unit on “Community Government”, the children in the experimental group evidenced greater self-assurance towards their grades in social studies.

It is this researchers contention that the introduction of manipulative materials in instruction had a positive effect on the children who were taught using the hands-on techniques, especially when viewed in comparison with children who did not have the opportunity to experience instruction that incorporated manipulative materials/hands-on techniques. Though limited, the results support the premise that children who are instructed with the use of manipulative materials will evidence greater motivation to the subject area wherein manipulatives are employed, as evidenced by greater scholastic achievement. Students were more actively a part of their learning experiences which led to a better grasp of the material covered which produced a greater degree of academic accomplishment.

table 2
Experimental Group vs. Control Group, Posttest Only

| Survey questions | group | N | Mean | Std. Deviation | Std. Error Mean |
|---|--------------|----|------|----------------|-----------------|
| I am happy learning about the world | experimental | 21 | 1.43 | .75 | .16 |
| | control | 21 | 1.14 | .36 | 7.82E-02 |
| I like to cut with scissors | experimental | 21 | 1.48 | .75 | .16 |
| | control | 21 | 1.19 | .40 | 8.78E-02 |
| Social studies is my favorite subject | experimental | 21 | 2.19 | .93 | .20 |
| | control | 21 | 2.14 | .96 | .21 |
| I like learning social studies by myself | experimental | 21 | 2.19 | .93 | .20 |
| | control | 21 | 2.33 | .91 | .20 |
| I like learning social studies with my class | experimental | 21 | 1.81 | .98 | .21 |
| | control | 21 | 1.38 | .74 | .16 |
| Reading about social studies is easy for me | experimental | 21 | 1.48 | .81 | .18 |
| | control | 21 | 1.76 | .89 | .19 |
| Social studies is fun because we get to do fun things | experimental | 21 | 1.62 | .80 | .18 |
| | control | 21 | 1.38 | .74 | .16 |
| I look forward to social studies class | experimental | 21 | 1.90 | .94 | .21 |
| | control | 21 | 2.00 | .89 | .20 |
| I think social studies is easy to learn | experimental | 21 | 1.57 | .81 | .18 |
| | control | 21 | 1.81 | .93 | .20 |
| My grades in social studies are good | experimental | 21 | 1.38 | .67 | .15 |
| | control | 21 | 1.86 | .73 | .16 |
| I like when we have projects to make | experimental | 21 | 1.38 | .74 | .16 |
| | control | 21 | 1.33 | .73 | .16 |

Chapter Five

SUMMARY, CONCLUSIONS AND RECCOMENDATIONS

Introduction

Student motivation towards school is an important factor for teachers (Hancock, 1994). Children who are motivated in school are better students than children who have no interest in the learning process (Burhorn, G. E., Harlow, B.A. & Van Norman, J.F., 1999). Students who are disconnected to the learning environment will become disinterested and bored and less likely to be engaged in the task at hand (Lumsden, 1994). To develop and maintain motivation, teachers must vary their teaching techniques from the standard, lecture format, to an approach that incorporates hands-on techniques (Carroll, L., & Leander, S., 2001).

Educators who employ hands-on techniques as part of their instructional practices increase the degree of academic success their students achieve in comparison with those students who receive instruction which does not include manipulative materials (Blair, 2000).

Summary of Problem

Most teachers instruct in the way that they know best, the way that they were taught; the approach most teachers instinctually employ amounts to a standard lecture format, even in the primary grades (Emig, 1997). This teaching style, while not without some merit, often becomes repetitive and dull, causing the active learner to revert to the

role of a non-participant (Strong, Silver, & Robinson, 1995).

Schrimshire (1997) tells us that a significant percentage of students would be better served by instructional approaches other than the format of teacher lecture. Research tells us that children learn in a variety of ways (Emig, 1997). Children who were taught with hands-on instructional techniques that included the use of manipulative materials, out performed their peers who had not been taught with these techniques in both mathematics and science (Emig, 1997). Since children prefer to participate in hands-on activities (Blair, 2000), will manipulative materials serve to increase the likelihood of their understanding of classroom material? Does active learning take place with the use of manipulative materials?

Summary of Hypothesis

This researcher proposed that students who are taught social studies with the inclusion of manipulative materials will exhibit a greater level of motivation and interest towards that subject than students who are taught social studies without the inclusion of manipulative materials.

Summary of Procedures

This project involved the use of manipulative materials in conjunction with a social studies unit on "Community Government". The sample selected was made up of two groups of third graders. Each group contained twenty-one students. The groups were divided into the control group and the experimental group. The two groups were given pre and post surveys to complete before the commencement and after the completion of a unit on "Community Government". The survey was comprised of eleven questions

which were geared toward ascertaining student interest and motivation toward the subject area of social studies.

The experimental group received instruction that included the use of manipulative materials. These manipulative materials included Question Machine manipulatives, Magic Cover manipulatives, Wikki Stick manipulatives, a Question Cube manipulative and Yes/No Card manipulatives. The control group received standard instruction that did not include the use of manipulative materials.

Upon completion of the "Community Government" unit, the use of manipulative materials in social studies was ceased with the experimental group. The initial survey was re-administered to both the experimental and control groups, in order to determine if the students in the experimental group evidenced a significant increase in interest and motivation toward the subject of social studies.

Summary of Findings

The findings in this project were limited in their degree of statistical significance. There was one question on the survey of eleven that showed a marked difference of opinion among the students in the experimental group. The question pertained to the way the students viewed their grades in social studies. The children in the experimental group felt better about their good grades in social studies after the intervention with manipulative materials when their pre and post survey results were compared. The post survey results of the children in the experimental group was also significant when compared with the post survey results of the children in the control group. In that instance as well, the experimental group evidenced greater confidence in their academic performance.

Conclusion

The students in the experimental group felt better about their grades in social studies after the intervention than before. This positive response to the incorporation of manipulative materials could be attributed to the fact that the children felt they understood the material better. Hands-on exploration allowed for greater command of the material covered. Children who understand subject material regularly fare better academically than students who are struggling to master the information. Students know what their grades are and if they are doing poorly or not in a particular subject.

Recommendations and Implications

Based on the analysis of the data, this researcher believes that educators must remain mindful of the interest and motivation levels of their students during lesson planning and execution. When children were given the opportunity to participate in lessons with manipulative materials, they evidenced greater confidence in their academic performance. While limited, the data indicated that children who received hands-on instruction showed greater levels of understanding expressed through grade attainment than those children who were not exposed to instruction that included the use of manipulative materials.

This researcher recommends the incorporation of manipulative materials across the curriculum. While the use of manipulatives alone may not be the sole answer for maintaining student motivation in the classroom, it is certainly an important and viable aspect of any conscientious teachers approach to education. The use of manipulatives in the classroom would benefit from further research.

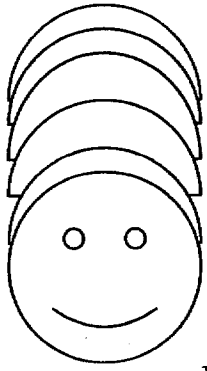
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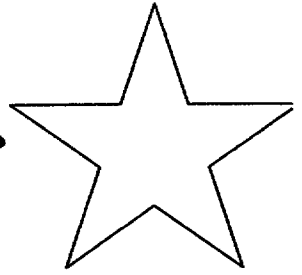
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APPENDIX A
STUDENT SURVEY



The subject is Social Studies



Please circle the face that best shows how you think or how you feel.



= yes



= I don't know



= no

1. I am happy learning about the world.



2. I like to cut with scissors.



3. Social studies is my favorite subject.



4. I like learning social studies by myself.



5. I like learning social studies with my class.



6. Reading about social studies is easy for me.



7. Social studies is fun because we get to do fun things.



8. I look forward to social studies class.



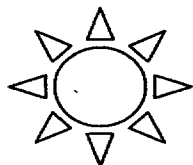
9. I think that social studies is easy to learn.



10. My grades in social studies are good.



11. I like when we have projects to make.



APPENDIX B
LESSON PLANS

LESSON PLAN NUMBER 1

Survey Distribution

Objective: At the end of the lesson the students will complete a survey, when given, with 100% participation.

Introduction:

- Advise students that there is an opinion survey they are going to be asked to complete.
- Tell students not to put their name the survey.
- Ask students to take out markers or crayons that they have in their desk to “jazz up” the boring questions.
- Tell the students that you will read the questions to them so that we can complete them all at the same time.
- Ask if there are any questions.

Development:

- Distribute questionnaire to the students.
- Read each question and possible response to the question to the class.
- Ask students if there are any questions they need repeated.

Summary and Evaluation:

- Collect the surveys.
- Compliment the students on their lovely artwork.
- Thank the students for their cooperation.
- Evaluation by observation.

LESSON PLAN NUMBER 2

Making Yes/No Cards

Objective: At the end of the lesson the students will make Yes/No Cards when given materials to do so with 100% accuracy.

Introduction:

- Have students recall how they vote with their thumbs in class on different occasions.
- Ask students to name those occasions.
- Ask students to identify other ways they could express their opinion or vote without speaking.
- Prompt with examples, if need be (raising hand, standing up, etc.).
- Explain that Yes/No Cards will be another way of showing how they feel about something or to respond to a question.

Development:

- Display completed Yes/No Card.
- Explain to students how to use a glue stick to glue the index card to the Popsicle stick, one side at a time.
- Remind the students that they need to apply pressure to make certain that the card will set correctly.
- Call on students to distribute index cards (two per student, one “Yes” and one “No”), Popsicle sticks (one per student) and glue sticks.
- Have students make their own Yes/No Card.

Summary and Evaluation:

- Once the students have their Yes/No Cards completed, ask the class various yes/no questions from different subject areas. Sample questions include:

- Are there three feet in a yard?
- Does the Moon get between the Sun and the Earth during a Solar Eclipse?
- Do members of a community vote members on to the City Council?
- Is sixteen a multiple of three?
- Was Bartholomew the wisest man in the village?
- Is the word “phases” spelled p-h-a-z-e-s?
- Evaluation of completed card and responses to the questions posed by observation.

LESSON PLAN NUMBER 3

Making a Question Cube

Objective: At the end of the lesson the students will create a question cube when given a milk carton, paper, scissors, glue stick and a marker with 100% accuracy.

Introduction:

- Display completed cube.
- Tell students that they will each be making a similar cube.
- Advise students that it is a simple and fun project that will help them with their social studies work.
- Instruct students that they are not to begin until told to do so.
- Call on students to distribute various materials.

Development:

- Show students how to fold their carton and glue the flaps in place with a milk carton.
- Make certain students are aware that they need to hold the carton upside down against the desk while exerting pressure from the top to make certain that the glue sets.
- Once set, have students trace the faces of the cube and cut out their six squares.
- Have student put their initials on one of the squares to identify ownership.
- Once the six squares are cut out, have the students write a question word, one on each piece (who, what, where, when, why, how) with their marker.
- Next, have the students glue each piece of paper to each side, one at a time.
- Remind students to apply pressure to the glued paper so that it will properly set.

- Circulate to assist and observe student progress.

Summary and Evaluation:

- Have students roll their cubes or “die”.
- Call on students to roll and share what word has ended up on top.
- Once the student has shared the question word on top, prompt the student to generate a question that begins with the question word.
- Tell student that they must take good care of their cubes, as we will be using them the rest of the week.
- Evaluation of participation and product through observation during and after circulation.

LESSON PLAN NUMBER 4

Using the Question Cube

Objective: At the end of the lesson the student will generate questions which are answered in the text of their social studies book when given question cubes and clip boards with 85% accuracy.

Introduction:

- Have students take out their social studies text.
- Call on a student to read the first paragraph in their text.
- Roll the question cube and show and tell the students the question word that is on the top of the cube.
- Create a question that can be answered by the information in the first paragraph using the question word that is on the top of the cube.
- Talk through your thinking so that the students can get a firm idea of how and why the question can be answered by the paragraph.
- Roll the dice again, and repeat the process with the next question word. If the initial word re-appears, roll again until a new word is found.
- Advise students that sometimes a question word may not apply to the paragraph that they are dealing with so that they recognize that there may be times when they will need to roll again.
- Call on student to read second paragraph in the text. Repeat procedure with second paragraph (rolling the die and generating 2 separate questions).
- Roll the die a third time and call on a volunteer to generate a question that can be answered by the information in the second paragraph.
- Assist students as needed.

Development:

- Call on a student to distribute question cubes to students. While that is going on, assign student into small groups (four groups of four, one group of five).
- Have students separate into their small groups, bringing with them their text, question cube and something to write with.
- Call on one member from each group to get a clipboard for the group.
- Tell students that they are to read the next four paragraphs in the text.
- Have students generate two questions per paragraph using their question cube.
- Tell students that they must come up with eight questions by the time they are finished.
- Tell student that they must work together to generate the questions as a group.
- Assign a secretary for each group who will write down the questions that the group comes up with, in addition to recording the group members names.

Summary and Evaluation:

- Once the activity is complete, call on groups to share their question with the class.
- Have students not in the group posing the question, answer the question.
- Have students in the group that posed the question vote if the question was answered correctly by using their Yes/No Cards. Students may use their textbook to answer the questions.
- Have each group turn in their questions.
- Evaluation by checking questions and answers for accuracy.

LESSON PLAN NUMBER 5

The Magic Cover

Objective: At the end of the lesson the students will use Magic Covers to help them identify and locate answers to questions distributed on a ditto with 85% accuracy.

Introduction:

- Discuss the idea of two sides to every issue with the class.
- Call on students to offer opinions about different activities (for example football, country music, reading). Do they like these activities? Why or why not?
- Call on other students who have an opinion different than the one volunteered and have the opposing student support his opinion.

Development:

- Call on a student to distribute question sheet.
- Call on students to read the questions to the class.
- Explain to student that they are going to read independently to find the answers to these questions.
- Introduce the Magic Covers.
- Tell student that these covers can be placed on top of their textbook page and written on with dry erase markers.
- Tell student that they are to circle the answers (to the questions on the handout) in their text using the Magic Cover and marker. The students should number what they have circled to correspond to the question the sentence or phrase answers.
- Repeat instructions.
- Call on a student to repeat the instructions.
- Call on a student to distribute markers.

- Call on a student to distribute covers (two per student, one for each page).
- Have students open their social studies text to pages 266 and 267.
- Have students begin their activity. Circulate to assist and monitor.

Summary and Evaluation:

- Call on students to answer the questions on the handout, using their textbook and in place Magic Covers.
- Ask students to vote with their Yes/No Cards about the answers to the questions and also way they feel about the issue discussed.
- Evaluation of participation and vote through observation.

LESSON PLAN NUMBER 6

Wikki Stix

Objective: At the end of the lesson the students will participate in a class discussion about volunteers, taxes and the role of city council and the mayor when called upon to do so with 85% accuracy. Students will identify information in their textbooks with the use of Wikki Stix, when given the material with which to work, with 85% accuracy.

Introduction:

- Tell students that they are going to be participating in a class discussion at the end of the period, based on their reading.
- Write *volunteer, taxes, mayor* and *city council* on the board.
- Tell student that the discussion will be about those three words and that they should pay special attention to those words as they complete their reading.
- Introduce Wikki Stix.
- Tell student that these pieces of wax-coated yarn can be used to circle, underline or point to information in their book.
- Tell students to use the Wikki Stix to highlight information in their book that will help them in the class discussion.
- Clarify any questions.

Development:

- Call on a student to pass out Wikki Stix, a bunch to a person.
- Allow students to explore/discover with the Wikki Stix.
- Assign pages in text to read.
- Circulate to monitor how students are managing with the manipulatives.

- After students have completed their reading, prompt class discussion. Use name cards to be certain that everyone present participates. Samples prompts include:
- What is a volunteer? Where does it say that?
- Ask students to name other examples of volunteers and list on chart.
- Ask students if they have ever volunteered or if they were going to, what would they do?
- Document discussion on tablet.
- What is a mayor? Can anyone be the mayor? How do they get to be mayor?
- Document discussion on tablet.
- What is a city council? How do you get to be on city council? What does the city council do? What do taxes have to do with anything?
- What are taxes? Where does tax money go? Who says where tax money goes?
- Document responses and discussion on chart.

Summary and Evaluation:

- Reiterate key words through documented discussion on chart.
- Evaluation based on observation.

Building Citizenship

Name _____

- 1) What is the issue discussed on pp. 266-267?
- 2) What stopped girls from playing Little League Baseball?
- 3) Who first opposed this rule?
- 4) When did she oppose this law?



- 5) Why did Martha Griffiths think girls should be allowed to play Little League?
- 6) What other reasons did people give for letting girls play?
- 7) What reason did Coach Platoni give for keeping girls off teams?
- 8) Why did some gym teachers feel that girls should not play?
- 9) What were some other reasons for keeping the girls out?

♥ Think about which side you agree with and why. ♥

LESSON PLAN NUMBER 7

Election Poster

Objective: At the end of the lesson the students will make and decorate an election poster, designed to get them elected Mayor of third grade, with 100% participation.

Introduction:

- Review chart generated in previous class depicting responsibilities of the city council.
- Call on students to read from the chart and discuss what they recall from that lesson.
- Tell students that there will be a position new to the school, that of mayor of third grade.
- Call on students to volunteer what some of the mayor's responsibilities might be and what qualities they would look for in a mayor.
- Prompt discussion on school and classroom rules, in class and at-home schoolwork responsibilities.
- Introduce the term "platform" and explain that when a politician runs for office he or she has strong opinions about certain issues.
- Prompt students to reiterate issues relevant to third grade.

Development:

- List issues on board generated from the discussion.
- Tell students that they are to create a campaign poster. This poster is what they will use to convince the other voters (members of the class) to vote for them. The poster must contain their name, how they stand on at least two school/class/home issues.
- Write criteria on board.
- Encourage the students to sketch their ideas/pictures first on scrap paper before they start to use the paper that is to be handed out.

- Clarify any questions.
- Call on a student to distribute paper.
- Call on a student to take out the markers and crayons and place them on the back table.
- Have students begin.
- Circulate to monitor progress.
- Collect posters as they are completed.

Summary and Evaluation:

- Once posters are completed, have students take out Yes/No Cards.
- Display completed posters, one at a time, to the class.
- Have students vote yes or no as to whether they think the poster fulfills the criteria and if that poster would make them want to vote for that student.
- Narrow the candidate selection down to three candidates.
- Have the three candidates leave the room.
- Have remaining students vote with Yes/No Cards to determine who is mayor of third grade.
- Call in candidates and advise winner of status.
- Summarize similarities between the activity and actual elections.
- Display all posters.
- Evaluation based on participation and the degree to which the criterion was met.

LESSON PLAN NUMBER 8

The Question Machine

Objective: At the end of the lesson the students will fill-in and use a Question Machine to study for their social studies test, when given time to do so, with 85% accuracy.

Introduction:

- Discuss key vocabulary from the unit by calling on students to answer prompted question. Who can tell me the definition of: taxes, citizen, city council, mayor, property, public property, laws, vote, election, volunteer, and government?
- Prompt for examples.
- Tell students that we are getting ready to have a test on the information we have been studying about Community Government.
- Introduce question machine. Ask by a show of Yes/No Cards who is familiar with this type of machine.
- Call on volunteers to share where they have seen these before and what kind of information was in them.

Development:

- Tell student that they will be working in pairs to study for the upcoming test.
- Tell students that they are each responsible for generating four questions based on the page numbers they will be given to work with. These questions must first be listed on lined paper, along with the answers to the questions, and then both questions and answered are to be transferred into the Question Machine. Before the questions are written in, the student must first have it checked and OK'd by the teacher.
- Write instructions on board.
- Repeat instructions.
- Show students where answers, questions, numbers and colors are written on the Question Machine.

- Clarify if there are questions or confusion.
- Reiterate instructions.
- Ask if there are questions.
- Call on a student to distribute the blank Question Machines.
- Divide the class in half by student number (even and odd).
- Assign text pages for even numbered students (pp.251-258) and for odd numbered students (pp.259 – 267).
- As students complete their questions and answers, their work is to be OK'd and then they may transfer their information into the machine.
- Pair up even and odd numbered students, with one group of three.
- Have students quiz each other on the material from the chapter in their machine.
- Circulate the classroom and ask the small groups to show how they feel about this activity, as a way of review, by using their Yes/No Card. (Yes they like it as a review activity, no if they do not).

Summary and Evaluation:

- Have students share with the class some of the questions on their machine.
- Evaluation based on observation.

LESSON PLAN NUMBER 9

Unit Test

Objective: At the end of the lesson the students will complete their social studies test, once distributed, with 85% accuracy.

Introduction:

- Have students clear off their desks and take out something to write with to prepare for the test.

Development:

- Distribute test.
- Have students complete.

Summary and Evaluation:

- Collect and grade tests.
- Use the following rubric to answer question numbers 14 and 15. *

| | |
|--|----------|
| Indent | 1 point |
| Capitals | 2 points |
| Spelling/punctuation | 2 points |
| Does the answer make sense? | 2 points |
| Does the response answer the question correctly? | 3 points |

*Equals a total of ten points per question

Name _____ date _____

Please circle the letter that answers the question.

- 1) Rules in a community are called _____.
a. property b. taxes c. laws d. vote

- 2) Parks and roads are examples of _____.
a. private property b. public property c. elections

- 3) In the United States we choose or _____ for the people who run our government.
a. volunteer b. law c. vote d. taxes

- 4) A member of a community or a country is called a _____.
a. city council b. leader c. citizen d. mayor

- 5) The voting that is held to choose government leaders is called a/an _____.
a. lottery b. taxes c. community d. election

- 6) A group of elected people who makes laws for a community is called the _____.
a. city council b. school board c. families d. volunteers

- 7) Money that people pay to support their government is called _____.
a. dues b. property c. taxes d. fees

- 8) A person who works without getting paid is called a _____.
a. teacher b. professional c. mayor d. volunteer

- 9) A leader elected by the community to make sure that laws are obeyed is called the _____.

- a. mayor b. fire chief c. principal d. city council
10) Libraries, school buses and new roads are examples of
how _____ are used.
a. votes b. taxes c. citizens d. volunteers

Please answer the following questions in the space provided.

11. Give an example of a *law* that protects people.

12. Name *two* jobs that a volunteer might do.

13. Name a *volunteer group* in your community.

14. How purpose do *laws* serve in a community?

15. How can people be good citizens?

LESSON PLAN NUMBER 10

Survey Distribution

Objective: At the end of the lesson the students will complete a survey, when given, with 100% participation.

Introduction:

- Advise students that there is an opinion survey they are going to be asked to complete.
- Tell students not to put their name the survey.
- Ask students to take out markers or crayons that they have in their desk to “jazz up” the boring questions.
- Tell the students that you will read the questions to them so that we can complete them all at the same time.
- Ask if there are any questions.

Development:

- Distribute questionnaire to the students.
- Read each question and possible response to the question to the class.
- Ask students if there are any questions they need repeated.

Summary and Evaluation:

- Collect the surveys.
- Compliment the students on their lovely artwork.
- Thank the students for their cooperation.
- Evaluation by observation.

APPENDIX C
CARROLL AND LEANDER SURVEY

APPENDIX D
FREDERICK AND SHAW SURVEY

Results in Percentages of the Science Attitude Survey

| Items | | Yes | | Don't Know | | No | |
|--|------|-----|-----|------------|----|----|----|
| | | Sp | F | Sp | F | Sp | F |
| 1. Science is my favorite subject. | Pre | 49 | 70 | 33 | 10 | 18 | 20 |
| | Post | 29 | 70 | 29 | 10 | 42 | 20 |
| 2. My grades in science are good. | Pre | 49 | 75 | 42 | 25 | 9 | 0 |
| | Post | 69 | 85 | 31 | 15 | 0 | 0 |
| 3. Reading about science is easy for me. | Pre | 58 | 85 | 18 | 5 | 24 | 10 |
| | Post | 27 | 95 | 29 | 5 | 44 | 0 |
| 4. Science is fun because we get to do fun things. | Pre | 96 | 95 | 2 | 0 | 2 | 5 |
| | Post | 91 | 100 | 9 | 0 | 0 | 0 |
| 5. I look forward to science class. | Pre | 78 | 70 | 11 | 25 | 11 | 5 |
| | Post | 67 | 80 | 22 | 15 | 11 | 0 |
| 6. I enjoy learning science by myself. | Pre | 18 | 30 | 9 | 35 | 73 | 35 |
| | Post | 22 | 70 | 18 | 5 | 60 | 25 |
| 7. I enjoy learning science with a group. | Pre | 84 | 85 | 7 | 15 | 9 | 0 |
| | Post | 80 | 65 | 7 | 25 | 13 | 10 |
| 8. I would like to have a career that uses science everyday. | Pre | 31 | 40 | 49 | 30 | 20 | 30 |
| | Post | 36 | 45 | 31 | 25 | 33 | 30 |
| 9. I believe electricity is important. | Pre | 96 | 95 | 4 | 5 | 0 | 0 |
| | Post | 91 | 100 | 2 | 0 | 7 | 0 |
| 10. I know safety rules when using electricity. | Pre | 89 | 90 | 9 | 5 | 2 | 5 |
| | Post | 98 | 100 | 2 | 0 | 0 | 0 |
| 11. I enjoy studying about electricity. | Pre | 44 | 80 | 36 | 15 | 20 | 5 |
| | Post | 62 | 95 | 27 | 5 | 11 | 0 |
| 12. I enjoy journal writing. | Pre | 51 | 50 | 16 | 0 | 33 | 50 |
| | Post | 22 | 60 | 31 | 5 | 47 | 35 |

VITA

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