# TEACHING METHOD AS A DETERMINANT OF STUDENT ATTITUDE

THESIS

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by

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ABSTRACT

The purpose of this study is to assess the effect on student attitude with respect to using a hands-on teaching method in the elementary school, but limiting hands-on experience in the middle school. The primary question addressed is this: do students' attitudes towards science decline in middle school when hands-on science methods are used less frequently?

Student attitudes of grades three, five, seven, and eight are compared. Male and female students from two districts with presently two different approaches to teaching science are subjects of this study. An attitudinal survey comparing student attitude as it develops from grades three to eight was used.

This study finds that student attitude of students consistently exposed to a hands-on teaching methods in grades three through eight do not decrease in seventh and eighth grade as students whose middle school teachers limit hands-on teaching and learning experience. This study concludes that once hands-on teaching methods are employed in a district at the elementary school, it is imperative to continue usage of hands-on teaching methods at all grade levels.

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# Chapter I

## Statement of the Problem

The influences on student attitude towards school has been the subject of considerable study for many years. To date, three categories of variables seem to influence student attitudes primarily. Student self-concept and perceived ability to learn and perform well is one such attitudinal influence (Haladyna, Olsen, & Shaughnessy, '82). Parental influence on student attitude can be significant, both positively and negatively significant (Schibeci & Riley, '83). The dominant force in student attitude development is, however, the teacher influence and classroom environment (Talton & Simpson, '86). With regard to science class, student enjoyment and enthusiasm is known to be high during the elementary years and then plummets to a low point generally in ninth grade (Simpson & Oliver, '85).

The purpose of this study is to assess the effect on student attitude with respect to using a hands-on teaching method in the elementary school, as compared

to a teaching method with limited hands-on experience in the middle school. Two research questions were developed to examine student attitude as it relates to teaching method in the middle school. First, do students who have been exposed to a teaching method using less hands-on activity in middle school science classes like science any less than students who have been exposed to a teaching method using more hands-on activities in science class? Second, do students' attitudes towards science decline when hands-on science methods are used less frequently?

During the 1960's and 1970's a great deal of attention was given to affective education. If we can change how people feel, then we can change how people think and act, was a premise of the affective education movement. Social ills and problems in our country, such as the Vietnam War and the Civil Rights movement, seemed to be failures of the human enterprise. In the 1980's the political tide turned and consequently affective education became a secondary concern. Concerns raised by industrial leaders that graduating students were incompetent and ill-prepared to meet the needs of our technological society gave rise to demands

for back-to-basics in education. Yet advocates of affective education assert that concern for student feelings, attitudes, and emotions ultimately effects how students learn and therefore is necessarily the concern of teachers who are determined to teach their students how to learn and not merely acquire information (Combs, '82).

As a result of these societal changes many educators are concerned with student attitudes. Science educators ask questions such as: What is the impact of science education on student attitude? Do students enjoy science classes? Why? Why not? Do students believe what they learn in science class is important to their lives and to the world's future?

The reasons for assessing student attitude are significant. It is generally hoped by teachers that what is taught, and how that subject matter positively affects student attitude will be a guide for the development and improvement of future teaching methods.

As family influence and classroom environment are significant factors in creating a positive (or negative) student attitude towards school, so is self-perception a determinant of attitude. If a teacher can

identify students with poor self-concept, then that same teacher can adapt the teaching methods and classroom environment to create a stimulating and supportive classroom in which those students with poor self-concept may learn to raise questions and develop their own interests. In doing such, the teacher can help provide an environment where students learn to like school and learning (Talton, '86). On a larger scale, the objective to creating any new science curriculum always includes fostering positive attitudes towards science as well as helping students to acquire knowledge and understanding ( McMillan & May, '79 ).

The Association for Supervision and Curriculum Development ( ASCD ) in 1994 recommended that teachers regularly assess student attitude in order to "stimulate and motivate students' natural curiosity" ( ASCD, '94 ). Educational consultant, Grant Wiggins, connects self-concept and the classroom experience by urging: "Only by apprenticing in the hands-on work of knowledge production can students learn to turn inchoate feeling and received opinions into unforgettable, vibrant, and systematized knowledge" ( Wiggins, '89 ).

Nearly twenty years ago, Benjamin Bloom's research concluded that school achievement is influenced in great measure by positive attitude ( Bloom, '76 ). As a result of those findings, and subsequent research which affirms the same ( Canon & Simpson, '85; Gardner, Simmons & Simpson, '92; Haladyna, Olsen, & Shaughnessy, '82 ), the ASCD urges teachers to instill in students "confidence that they can learn science and complete projects that will lead to the belief that there is some intrinsic motivation ( joy, excitement, and satisfaction ) in being independent, responsible, and persistent learners" ( ASCD, '94 ).

Looking beyond what happens in the classroom, attitudes are as important as cognitive variables in influencing not only learning outcomes, but career choices, and the use of leisure time ( Koballa, '88 ). "Manpower demands in [ our present ] technological development are such that science teaching should stimulate student interests' so that students will join the forces of working people to face the challenges of our world ( Hasan, '75 ).

Science education, in particular the work of the classroom teacher, cannot be overestimated, because

science education is a basic component in the general education of all students so that they can learn to work and live in tomorrow's world where "science plays a major role in influencing present societies and shaping new ones ( Hasan, '75 ).

The purpose of this study is to assess one teaching method ( hands-on teaching ) as a determinant of student attitude. New curricula generally use a hands-on approach to engaging students in the learning. This is particularly true in the elementary grades. Concern has been raised at the decline in student attitude at the middle school ( junior high ) level ( Simpson & Oliver, '85 ). This study serves to discern if utilizing the hands-on science to a lesser extent is one factor in the decline in student attitude toward science. If this is so, then the thoughtful classroom teacher can adapt his or her teaching method to include hands-on activities to a greater extent to accommodate those students who learn better by hands-on activity and those whose attitude is positively affected by the use of it as they became accustomed to it in earlier grades.

There is concern that the research on student

attitudes about science lacks "integrative findings" ( Peterson & Carlson, '79 ) while others are concerned that "science attitudes are not clearly defined and perhaps misleading" ( Haladyna & Shaughnessy, '82 ). The method of measuring student attitude towards science in this study was a twelve-question survey. The instrument was tested for reliability in a test - retest sequence involving a time interval of one week. Analysis of the data may help teachers determine what teaching methods are particularly appealing at certain ages and by gender.

# Chapter II

## Review of the Literature

The purpose of this study is to assess the effect on student attitude with respect to using a hands-on teaching method in the elementary school, as compared to a teaching method with limited hands-on experience in the middle school. Two research questions were developed to examine student attitude as it relates to teaching method in the middle school. First, do students who have been exposed to a teaching method using less hands-on activity in middle school science classes like science any less than students who have been exposed to a teaching method using more hands-on activities in science class? Second, do students' attitudes towards science decline when hands-on science methods are used less frequently?

What students think of their classes is important to educators. For the past thirty years extensive studies have researched the attitudes of students towards science classes. The findings of these studies are revealing. In 1983, a random sample of 3,000 students across the United States discovered that fifth

graders ( in public and private schools ) "find the science taught in school enjoyable and interesting, not too difficult, and not based on learning too many facts" ( Doran & Jacobson, '84 ). In 1989, nearly three-fourths of the students in randomly selected schools were "very positive in their perception of the usefulness of science study for daily living, further science study, and for future living" ( Yaeger, Simmons, Penick, '89 ). What is more, that perception does not decline as students proceed through high school.

When researchers have asked students what they believe makes for enjoyable, useful classes that are conducive to learning, students are quite specific. An overwhelming number of students indicate that ( in completing the sentence ) "If I were the teacher. . ." they would make science entertaining; they would not use writing activities as much; they would use language and terms which students can easily understand; they would have students discuss their ideas with each other more often; and they would ask students in the class what they would like to learn and study ( Piburn & Baker, '93 ).

Why study student attitude and what is "attitude"? "Attitudes," says Koballa, "register preferences -- likes or dislikes. Attitudes are learned. Attitude toward science is defined as a learned response evaluating our feelings within the environment related to science learning" (Koballa, Crawley, Shrigley, '90 ). Koballa concluded, "Much of that attention [ of previous years ] to attitude towards science stems from belief that affective variables are as important as cognitive variables because they influence learning outcomes and career [ choices ] ( Koballa, '88 ).

Attitude theorists give at least three primary reasons for studying attitudes: attitudes are generally stable over time; attitudes are learned by experience; and attitudes are related to behavior ( Koballa, '88 ). That is to say, an individual's actions reflect one's feelings toward objects and issues. If educators can employ those teaching methods which appeal to a variety of students, then they will thereby, encourage the development of positive attitudes towards science.

It is helpful for our perspective here to recall the course of science education in America in the past several decades. Teacher in-service programs for

science abounded in the 1960's and 1970's as a result of public awareness of the technology boom in other countries ( particularly in the Soviet Union and the race into outer space ). New science curricula were produced at the same time which encouraged student interaction and hands-on experience. However, the enthusiasm of the 1970's turned to public skepticism when student performance of American students was compared to student performance of other countries and when public education costs skyrocketed. As a result, new science curricula production was traded for textbook and teacher-centered classrooms in the late 1970's and 1980's. In an effort to learn of the impact of the science programs of the 1960's and 1970's, research was conducted with those students in 1981. It was found that the innovative science programs of the 1960's and 1970's did not fail the students in process skills, content knowledge, nor attitude toward science. The hands-on science programs did not trade content knowledge for process skill development. Rather, across curricula, student attitudes were more positive with the use of those science programs ( Shymansky, Kyle, Alport, '82 ). Substantiating those findings was

a 1984 country-wide research project which discovered that "the test results for fifth- and ninth-graders in the U.S. is the pervasive improvement in scores for 1983 over 1970. . ." ( Jacobson & Doran, '85 ). More than twenty studies dealing with science program differences and effectiveness revealed that "By virtue of their design, most programs will positively change cognitive and affective components which they were designed to affect" ( Haladyna & Shaughnessy, '82 ).

Then what is the goal of attitudinal research and teaching methodology? Says Grant Wiggins, "Our aim should be to develop in students a thirst for inquiry and a disgust for thoughtless, superficial, and shoddy academic work" ( Wiggins, '89 ).

What is the prevailing student attitude of students towards science? After tracing the meaning and history, and defining the term "attitude" as an affective variable in student regard for science and science classes, Koballa concluded that there are only a handful of tentative conclusions which can be made from over two hundred studies about student attitude which were conducted between 1976 and 1983. Two of those conclusion are these: the effect of science

programs on attitudes varies considerably; and, attitudes toward science decline as students move to higher grades ( Koballa, '88 ). These same findings were substantiated in other studies -- particularly that science attitude declines between junior high and senior high school ( Hofstein & Welch, '84 ). Canon and Simpson discovered that the attitude of students is significantly more positive at the beginning of the year than it is at the end of the school year. This is true for all students "regardless of ability group or gender" ( Canon & Simpson, '85 ). And, compared to students from Korea, Britain, Canada, Spain, and Ireland, students of the United States are *least* likely to say that what is learned in science class is useful, and they are *least* likely to say they like science "a lot" or "a little" ( Lapointe & Mead, '89 ).

What are the factors that create these student attitudes? What do our students experience in their classrooms? In the Second International Science Study, it was discovered that students study science "in essentially traditional ways -- being lectured to, copying notes off the board, reading the textbook, and taking written tests" ( Jacobson & Doran, '86 ). Also

found in that same study was that fifth graders "often use textbooks, but not library books; seldom help teachers plan lessons and topics; and frequently copy teacher notes and watch the teacher do experiments. And while fifth graders sometimes do experiments by themselves, they seldom do experiments in small groups Doran & Jacobson, '84 ). Robert James found that the suburban students he studied had the greatest decline in attitude towards science in grades six and seven -- not coincidentally the same grades in which students are lectured to more often, in which they copy notes more often, and in which they read from textbooks more often ( James, '85 ). In a random sample of junior and senior high students to determine what pupils believe about how the school influences their likes or dislikes of science, 35% of the students indicated writing assignments, including writing up reports and experiments, were the least liked aspects of science classes -- while only 25% indicated tests as the least liked aspect ( McMillan & May, '79 ).

Classroom variables are the strongest influences on attitude toward science ( Simpson, '90 ). Talton and Simpson examined the variable of self-perception,

family influence, and classroom environment to discover if any of these generally most influential variables was dominant. They discovered that "of the three sets of variables, the classroom environment variable predicted the greatest amount of variance in attitude toward science in all grades" ( Talton & Simpson, '86 ). The implications for the teacher are significant: "stimulating, supportive classrooms in which students may question and develop their interest in science help produce students who like science" ( Talton & Simpson, '86 ). Although other researchers have not always found such a strong correlation between the classroom environment and student attitude, they have found that students must sense satisfaction with the work they do; the class environment must be positive; and instruction needs to be organized ( Haladyna, Olsen, & Shaughnessy, '82 ). These and similar findings have led the Association for Supervision and Curriculum Development to recommend that children interact with things, other children, and adults; that there be less dependence on drill and practice and greater emphasis on construction of ideas; that students be allowed to invent and discover in

their science classes; and that teachers act not as fact-givers, but as facilitators ( ASCD, '94 ).

Teachers control the classroom environment. Teacher attitudes, teaching methods, and a teacher's decorum are all crucial in determining student attitudes. Research reveals a consistently high relationship of "teacher quality variables to attitude (i.e., teacher enthusiasm, respect for teacher knowledge, teacher support of students, teacher praise, teacher commitment to learning, and fairness towards students)" ( Haladyna, Olsen, & Shaughnessy, '82 ). The principle role of the teacher in determining student attitudes can be threatening to teachers. Yet there are just a few considerations which need to be kept in mind. Pupil-centered classrooms are most likely to produce positive changes in student attitude for science students who are finding out scientific information by conducting experiments ( Fraser, '80 ). Contrastly, teachers with a "more positive attitude toward structure" are less likely to produce students with a favorable attitude towards science. What teaching strategies enhance student attitudes, interests, and other affective variables?

Fraser has identified four sources of information on science for students which ultimately influence student attitude: experimentation, experts, books, and the teacher ( Fraser, '80 ). Students like to be engaged in discovery. Research has shown "that one of the reasons given for students' enrollment in science is their involvement in laboratory work" ( Hofstein, Moaz, & Rishpan, '90 ). These researchers discovered this connection as they studied students involved with extracurricular sports. Proportionately, students enrolled in athletics were more likely to enroll in science classes which employed hands-on activity. Byrne and Johnstone found that "simulation, gaming and related techniques can be as effective as traditional methods with regard to knowledge acquisition, and more effective in terms of promoting positive attitude development" ( Byrne & Johnstone, '88 ). Substantiating this finding, Shymansky states that "across curricula, students exposed to new science programs showed the greatest gains in the areas of process skills development, attitude toward science, and achievement" ( Shymansky, '83 ). Despite these findings, the overwhelming majority of data on instructional

practices suggest "while innovative instructional approaches appear to be related to science proficiency, and many science educators encourage the use of hands-on activities, responses from students indicate that science instruction continues to be dominated by teacher lectures and textbooks" ( Mullis & Jenkins, '88 ).

McCollum discovered something unique when he compared lectures and dissections of frogs in biology classes and found that students who were taught by lecture acquired significantly more knowledge about frogs, but they had no difference in attitude about the class experience. ( Koballa, Crawley, & Shrigley, '90 ). At first this seems a contradiction with the previous research reported and with student response to what makes for engaging classroom experiences. There are several variables that are difficult to measure in this finding: What would be the effect over the long haul for students of a lecture format in biology class? Was the lecturer engaging or boring? How were the dissections carried out? Was the purpose of the dissection made clear before the procedure was done by the students? Perhaps the students in this country

are more accustomed to lectures and teacher demonstrations than to experimentation ( Lapointe & Mead, '89; Jacobson & Doran, '86; James, '85 ).

Teaching methodology is undoubtedly a very significant determinant of student attitude. There are other significant variables in attitude development. In a study to explore the relationships of students, teachers, and learning environment variables to science attitudes ( in grades 4, 7, and 9 ) it was found that "student perceptions of the importance of science was consistently the most significant of the student variables ( Haladyna, Olsen, Shaughnessy, '83 ). This is particularly important in view of Lapointe and Mead's findings [ U.S.A. students -- compared to their counterparts in other countries -- are least likely to say that what is learned in science class is useful ] ( Lapointe & Mead, '89 ). A secondary factor in student attitude towards science class was "fatalism" ( the feeling that students have little or no control over their success in the class ).

Three recent studies concerned with student attitude as it relates to feelings of success underscore "fatalism" as a factor in determining

student attitude. Canon and Simpson discovered that statistically, achievement motivation did not play a role in predicting science achievement. However, science attitude was a significant predictor of achievement ( Canon & Simpson, '85 ). In a more recent study, Simpson found that generally students enter junior high school with positive feelings towards science -- and if students experience success in their initial courses in science, it is likely they will continue to elect and be successful in subsequent science classes. The opposite is true also ( Simpson, '90 ). In a "Qualitative Study of Attitude Toward Science," it was found that student attitudes grew more positive when science was fun, when the students knew exactly what teachers expected of their performance, and when activities ( including tests ) helped them learn ( Piburn & Baker, '93 ).

Students need to be active learners. Students need to know that what they are learning is applicable to life outside the science class. The classroom atmosphere must encourage discovery; and the teaching methods employed must support all these student needs. These are some of the findings learned from the

research. Are these student concerns effective to the same extent in all students? No. Are there gender differences? Yes. Hasan, concerned that science is a basic component of general education and that industry demands scientific and technological development, researched what instructional procedures and classroom activities are the most effective in fostering an interest in science. His conclusions are revealing: the motivation of science teachers, and student participation in science activities "seem to operate only in male students." Social concerns are of greater influence in female students, generally ( Hasan, '75 ).

The American Association for the Advancement of Science ( Project 2061 ) and other organizations have generated not only a lot of interest in science education, but have impacted the educational system on a number of levels: primarily, curriculum, teaching methodology, and assessment. One study recently found that despite the use of one new science program ( Science-Technology-Society, or STS ) featuring the integration of science, technology, and societal concerns ) at the junior high school level, there was no change in student attitude toward science in the

positive direction ( Ebeneezer & Zoller, '93 ). By contrast, research shows that some new science curricula raise both student interest and attitudes as well as raising student achievement scores. These new science courses stress learning how to learn science ( learning science process versus facts, laws, and theories ) increase student attitudes towards science not only at the junior high level, but in urban areas as well as suburban areas, and in classes with a mix of male and female students ( Shymansky, Kyle, & Alport, '82 ). Measuring the effects of new science curricula on student performance reveals that at the elementary level ( K-3 ) the greatest impact is on process skill development, but at the intermediate grade level attitude increase the most; and at the senior high school level, the impact was extended to include achievement ( Shymansky, Hedges, & Woodworth, '90 ). Since teacher attitude is a significant determinant of student attitude, it is an important finding that the attitude of teachers was positively changed as a result of teaching teachers with hands-on involvement ( Pedersen & McCurdy, '92 ).

Having considered the factors which influence

student attitude towards science, attention can be focused on trends in science education. There are three trends in science education today which are changing the way teachers teach science, the way in which students learn about science, and if successful, changing student attitudes about science in a more positive direction. These trends are inquiry-based science ( that students research areas of interest to them ), cooperative learning ( doing science projects and experiments in small groups ), and problem-solving ( students experimenting and researching in order to solve scientific questions ).

Researchers found in a nationwide random sample study of 2,000 students, that 81% indicate they do laboratory work as a part of their science classes on a regular basis ( Jacobson & Doran, '86 ). In another random sample study of junior high students conducted to determine what pupils believe about how the school influences their likes or dislikes of science, 70% indicated they liked experiments, investigations, dissecting, and other hands-on activities best ( McMillan & May, '79 ). While critics are concerned that newly developed hands-on curricula compromise

content knowledge in order to gain process skills and improved attitudes, Shymansky and his colleagues discovered that "students developed their process skills and interest in science at the elementary grade level and then increased their achievement and continued their process skill development in later grades ( Shymansky, Hedges, & Woodworth, '90 ). In a study comparing text-based learning, hands-on learning, and computer-aided instruction, Gardner found that hands-on activities increased both content knowledge and attitude toward science; hands-on activities together with computer-aided instruction increased the knowledge and attitude even more; and text-based learning had the lowest knowledge and attitude scores ( Gardner, Simmons, and Simpson, '92 ). In 1988 the National Science Foundation, hoping to "develop a more disciplined approach to inquiry and experimentation -- improving [ student ] ability to organize and articulate knowledge and to approach problems systematically" recommended the integration of science with other subject areas, more hands-on experiences, appeal to what students are interested in learning, and the use of recent research on teaching and learning

( Bybee, Buchwald, Crissman, and Heil, '89 ).

It is safe to say that if students like best to learn by experimentation, they learn best when they experiment and dialogue with other students about what they are observing. Sachse recommends that to improve on student acquisition of scientific information, "science teachers must emphasize depth of learning rather than breadth of factual information . . . and engage students through direct experiences and cooperative learning" ( Sachse, '89 ). Byrne and Johnstone concluded after their research of student attitude: "desired attitude changes are unlikely to be achieved without the use of what have become known as interactive approaches ( eg. simulations, games, case studies, role-playing )" ( Byrne & Johnstone, '88 ).

Problem-solving is now seen as an essential ingredient of teaching method for many science teachers. Problem-solving capability of students became an issue when it was discovered as late as 1988 that "more than one-half of 7th grade students never were asked to suggest a hypothesis or to interpret data," that teaching methods continue to be "primarily fact-oriented textbooks," and that "only 42% of

[ America's junior high students ] can use scientific procedures and analyze scientific data" ( Mullis & Jenkins, '88; Bybee, Buchwald, Crissman et al. '89 ); ( Lapointe, Mead, & Phillips, '89 ).

What students think of science is important to educators. Attitude determines in some measure how students learn and how much students enjoy learning. What teachers do to engage students, how the teacher interacts with the students, the teacher's role in the classroom, the general atmosphere in the classroom, and how much the science learning is grounded in the real world all serve to determine student attitudes about school, and specifically about science.

# Chapter III

The purpose of this study is to assess the effect on student attitude with respect to using a hands-on teaching method in the elementary school, as compared to a teaching method with limited hands-on experience in the middle school. Two research questions were developed to examine student attitude as it relates to teaching method in the middle school. First, do students who have been exposed to a teaching method using less hands-on activity in middle school science classes like science any less than students who have been exposed to a teaching method using more hands-on activities in science class? Second, do students' attitudes towards science decline when hands-on science methods are used less frequently?

The site selected for this study was a large metropolitan, socially-diverse population in Up-State New York. The population of the county is approximately one million people. This population is distributed in urban, suburban, and rural areas. The economy is diverse; the largest employers are Eastman Kodak Company, Xerox, and a number of high-

technological industries.

Third-, fifth-, seventh-, and eighth-graders were selected from two suburban school districts. The two districts are at opposite sides of the city from each other. While all school districts in the area have made the attempt to employ hands-on learning experiences for the study of science, these two districts were chosen for this study because they presently have two distinctly different approaches to elementary school science. Both districts have embraced a hands-on, experiential, science philosophy. The first district hired elementary education teachers in recent years to teach exclusively science at the elementary school level. The district incorporates hands-on learning experiences at all levels (K-12) of science education in the district. The second district, while philosophically supporting the use of hands-on experiences at all levels of science education, does not uniformly use hands-on experience in science classes in the middle school years. That is to say, some 7th and 8th grade teachers admittedly do not utilize hands-on experience in their science classes as a primary teaching methodology, rather

opting for a lecture and note-taking method.

The attitude survey instrument used in this project was a twelve-question survey containing statements relating to science, the science class, and teaching methodology. After each statement, four possible choices ("almost all the time," "most of the time," "some of the time," and "almost never") are listed to determine the student's agreement with the statement. The final question asked to what extent the student likes science class and students could reply by indicating: "very much," "a lot," "some," "a little," or "not at all." The survey asked questions which relate to the development of student attitude towards science. The validity of the content of these questions was established by previous research cited in Chapter Two. A copy of the survey is attached in Appendix A.

In order to establish if the survey questions could be understood and easily read by all the students in the study, the questionnaire was evaluated by a reading specialist and determined to be at a third-grade level. The survey was initially distributed to third graders of varied reading ability. It was found

that all the students given the survey were able to read, understand the questions, and answer the questions using the several response choices given for each statement.

In order to get a response from the widest possible spectrum of students in each district, the survey was distributed in the following manner: In the first district, surveys were given to one third- and one fifth-grade class in each of four district schools, additionally, it was given to two seventh- and two eighth-grade classes in the middle school. This was done in order to allow for diversity in teaching method from various teachers. In the same way, in the second district, copies of the survey were distributed to one third- and one fifth-grade class at each of the district's two schools, additionally, it was given to two seventh- and two eighth-grade classes in the middle school. Those students who returned with the required parent-permission form by the assigned date were given the questionnaire to complete. In this way, the survey is a sample of student attitude and not a survey of each student in every class in the districts. It also accounts for the difference in numbers of respondents

per class and grade level.

The survey was distributed the weeks of April 6-April 14, 1995. The total number of respondents in this survey was 52 third-grade boys; 57 third-grade girls; 38 fifth-grade boys; 44 fifth-grade girls; 37 seventh-grade boys; 50 seventh-grade girls; 31 eighth-grade boys; and 41 eighth-grade girls. The total number of respondents was 350. Permission to conduct the survey was obtained from the Assistant Superintendent of each district. The survey was administered by each classroom teacher. The teachers were informed of the purpose and method of the survey. Students were also informed of the purpose of the study. An analysis of the data retrieved from the survey is recorded in Chapter Four.

# Chapter IV

## Analysis of Data

The purpose of this study is to assess the effect on student attitude with respect to using a hands-on teaching method in the elementary school, as compared to a teaching method with limited hands-on experience in the middle school. Two research questions were developed to examine student attitude as it relates to teaching method in the middle school. First, do students who have been exposed to a teaching method using less hands-on activity in middle school science classes like science any less than students who have been exposed to a teaching method using more hands-on activities in science class? Second, do students' attitudes towards science decline when hands-on science methods are used less frequently?

The data summarizing the responses to the attitudinal survey of this research project is recorded in this chapter. Appendix A contains a copy of the survey administered to all the subjects of the study. The tables in this chapter indicate the question which was asked in the survey, the percentage of responses to

the question for males compared to females, the percentage of responses of males in the first district compared to the percentage of responses of males in the second district, and the comparison of percentage of responses of females in the first district compared to the females of the second district. District 1 ( D,1 ) refers to the school district in which all teachers in all grades employ hands-on science teaching methods as a primary teaching method; District 2 ( D,2 ) refers to the school district in which elementary teachers employ hands-on science teaching methods as a primary teaching method, but seventh and eighth grades teachers utilize hands-on teaching methods less often than their counterparts in the first district.

The total number of respondents in this survey was 52 third-grade boys; 57 third-grade girls; 38 fifth-grade boys; 44 fifth-grade girls; 37 seventh-grade boys; 50 seventh-grade girls; 31 eighth-grade boys; and 41 eighth-grade girls. The total number of respondents was 350. Only one response was allowed for each question. However, some students failed to answer each of the twelve questions. In such cases the percentage of response reflects the omitted answers.

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

Treatment A
Grade 3, Female
District 1

| ID# | Group | Score |
|---|---|---|
| 1 | 0 | 38 |
| 2 | 0 | 32 |
| 3 | 0 | 39 |
| 4 | 0 | 42 |
| 5 | 0 | 48 |
| 6 | 0 | 39 |
| 7 | 0 | 40 |
| 8 | 0 | 46 |
| 9 | 0 | 30 |
| 10 | 0 | 34 |
| 11 | 0 | 48 |
| 12 | 0 | 43 |
| 13 | 0 | 36 |
| 14 | 0 | 37 |
| 15 | 0 | 42 |
| 16 | 0 | 45 |
| 17 | 0 | 37 |
| 18 | 0 | 32 |
| 19 | 0 | 47 |
| 20 | 0 | 40 |
| 21 | 0 | 34 |
| 22 | 0 | 42 |
| 23 | 0 | 41 |
| 24 | 0 | 38 |
| 25 | 0 | 25 |
| 26 | 0 | 28 |
| 27 | 0 | 22 |
| 28 | 0 | 25 |
| 29 | 0 | 25 |
| 30 | 0 | 15 |
| 31 | 0 | 29 |
| 32 | 0 | 36 |
| 33 | 0 | 36 |
| 34 | 0 | 40 |
| 35 | 0 | 21 |
| 36 | 0 | 38 |
| 37 | 0 | 43 |
| 38 | 0 | 32 |

Treatment B
Grade 3, Females
District 2

| ID# | Group | Score |
|---|---|---|
| 39 | 1 | 37 |
| 40 | 1 | 31 |
| 41 | 1 | 32 |
| 42 | 1 | 39 |
| 43 | 1 | 39 |
| 44 | 1 | 39 |
| 45 | 1 | 36 |
| 46 | 1 | 44 |
| 47 | 1 | 40 |
| 48 | 1 | 33 |
| 49 | 1 | 35 |
| 50 | 1 | 38 |
| 51 | 1 | 32 |
| 52 | 1 | 30 |
| 53 | 1 | 33 |
| 54 | 1 | 37 |
| 55 | 1 | 26 |
| 56 | 1 | 33 |
| 57 | 1 | 32 |
| 58 | 1 | 25 |

Group 0= Hands-on K-12
Group 1= Hands-on till 7th gr.
48= Highest possible score
0= Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 | | Treatment 2 |
|---|---|---|
| Grade 3 | | Grade 3 |
| District 1, Females | | District 2, Females |
| 38 | = n = | 20 |
| 4 | = mdn = | 3 |
| 3.26 | = $\bar{x}$ = | 3.15 |
| 1.03 | = $s_{\bar{x}}$ = | .81 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was .25, we must retain the null hypothesis and conclude that the two groups were equivalent.

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

| Treatment A<br>Grade 3, Males<br>District 1<br>ID# | Group | Score | Treatment B<br>Grade 3, Males<br>District 2<br>ID# | Group | Score |
|---|---|---|---|---|---|
| 1 | 0 | 32 | 34 | 1 | 40 |
| 2 | 0 | 43 | 35 | 1 | 39 |
| 3 | 0 | 35 | 36 | 1 | 37 |
| 4 | 0 | 43 | 37 | 1 | 41 |
| 5 | 0 | 35 | 38 | 1 | 39 |
| 6 | 0 | 41 | 39 | 1 | 34 |
| 7 | 0 | 45 | 40 | 1 | 39 |
| 8 | 0 | 36 | 41 | 1 | 32 |
| 9 | 0 | 47 | 42 | 1 | 33 |
| 10 | 0 | 48 | 43 | 1 | 44 |
| 11 | 0 | 38 | 44 | 1 | 40 |
| 12 | 0 | 43 | 45 | 1 | 23 |
| 13 | 0 | 42 | 46 | 1 | 20 |
| 14 | 0 | 38 | 47 | 1 | 29 |
| 15 | 0 | 35 | 48 | 1 | 41 |
| 16 | 0 | 36 | 49 | 1 | 34 |
| 17 | 0 | 44 | 50 | 1 | 31 |
| 18 | 0 | 33 | 51 | 1 | 29 |
| 19 | 0 | 40 | 52 | 1 | 31 |
| 20 | 0 | 35 | 53 | 1 | 25 |
| 21 | 0 | 46 | | | |
| 22 | 0 | 35 | | | |
| 23 | 0 | 34 | | | |
| 24 | 0 | 42 | | | |
| 25 | 0 | 30 | | | |
| 26 | 0 | 28 | | | |
| 27 | 0 | 34 | | | |
| 28 | 0 | 30 | | | |
| 29 | 0 | 30 | | | |
| 30 | 0 | 31 | | | |
| 31 | 0 | 36 | | | |
| 32 | 0 | 37 | | | |
| 33 | 0 | 33 | | | |

Group 0 = Hands-on K-12
Group 1 = Hands-on until 7th grade
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 | | Treatment 2 |
|---|---|---|
| Grade 3 | | Grade 3 |
| District 1, Males | | District 2, Male |
| 33 | = n = | 20 |
| 4 | = mdn = | 4 |
| 3.54 | = $\bar{x}$ = | 3.30 |
| .75 | = $s_{\bar{x}}$ = | .98 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was -.85, we must retain the null hypothesis and conclude that the two groups were equivalent.

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

Treatment A
Grade 5, Females
District 1

| ID# | Group | Score |
|---|---|---|
| 1 | 0 | 40 |
| 2 | 0 | 35 |
| 3 | 0 | 35 |
| 4 | 0 | 31 |
| 5 | 0 | 21 |
| 6 | 0 | 24 |
| 7 | 0 | 27 |
| 8 | 0 | 27 |
| 9 | 0 | 32 |
| 10 | 0 | 24 |
| 11 | 0 | 34 |
| 12 | 0 | 25 |
| 13 | 0 | 28 |
| 14 | 0 | 25 |
| 15 | 0 | 37 |
| 16 | 0 | 28 |
| 17 | 0 | 31 |
| 18 | 0 | 36 |
| 19 | 0 | 31 |
| 20 | 0 | 35 |
| 21 | 0 | 30 |
| 22 | 0 | 32 |
| 23 | 0 | 37 |
| 24 | 0 | 29 |
| 25 | 0 | 35 |
| 26 | 0 | 25 |
| 27 | 0 | 29 |

Treatment B
Grade 5, Females
District 2

| ID# | Group | Score |
|---|---|---|
| 28 | 1 | 40 |
| 29 | 1 | 39 |
| 30 | 1 | 31 |
| 31 | 1 | 27 |
| 32 | 1 | 35 |
| 33 | 1 | 35 |
| 34 | 1 | 35 |
| 35 | 1 | 29 |
| 36 | 1 | 33 |
| 37 | 1 | 42 |
| 38 | 1 | 32 |
| 39 | 1 | 44 |
| 40 | 1 | 29 |
| 41 | 1 | 34 |
| 42 | 1 | 31 |
| 43 | 1 | 37 |
| 44 | 1 | 30 |
| 45 | 1 | 37 |

Group 0 = Hands-on Teaching
Group 1 = Hands-on Teaching
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 | | Treatment 2 |
|---|---|---|
| Grade 5 | | Grade 5 |
| District 1, Females | | District 2, Females |
| 26 | = n = | 18 |
| 2 | = mdn = | 3 |
| 2.38 | = $\bar{x}$ = | 2.77 |
| .85 | = $s_x$ = | .94 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was .77, we must retain the null hypothesis and conclude that the two groups were equivalent.

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

| Treatment A<br>Grade 5, Males<br>District 1<br>ID# | Group | Score | Treatment B<br>Grade 5, Males<br>District 2<br>ID# | Group | Score |
|---|---|---|---|---|---|
| 1 | 0 | 24 | 20 | 1 | 47 |
| 2 | 0 | 40 | 21 | 1 | 40 |
| 3 | 0 | 44 | 22 | 1 | 34 |
| 4 | 0 | 40 | 23 | 1 | 36 |
| 5 | 0 | 31 | 24 | 1 | 31 |
| 6 | 0 | 30 | 25 | 1 | 38 |
| 7 | 0 | 48 | 26 | 1 | 45 |
| 8 | 0 | 35 | 27 | 1 | 36 |
| 9 | 0 | 38 | 28 | 1 | 46 |
| 10 | 0 | 35 | 29 | 1 | 39 |
| 11 | 0 | 28 | 30 | 1 | 42 |
| 12 | 0 | 29 | 31 | 1 | 40 |
| 13 | 0 | 31 | 32 | 1 | 42 |
| 14 | 0 | 33 | 33 | 1 | 35 |
| 15 | 0 | 36 | 34 | 1 | 31 |
| 16 | 0 | 35 | 35 | 1 | 36 |
| 17 | 0 | 38 | 36 | 1 | 36 |
| 18 | 0 | 31 | 37 | 1 | 34 |
| 19 | 0 | 32 | 38 | 1 | 29 |

Group 0 = Hands-on until K-12
Group 1 = Hands-on until 7th grade
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 Grade 5 District 1, Males | | Treatment 2 Grade 5 District 2, Males |
|---|---|---|
| 19 | = n = | 19 |
| 3 | = mdn = | 4 |
| 3.11 | = x = | 3.53 |
| .99 | = $s_x$ = | .77 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was -.84, we must retain the null hypothesis and conclude that the two groups were equivalent.

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

Treatment A
Grade 7, Females
District 1

| ID# | Group | Score |
|---|---|---|
| 1 | 0 | 36 |
| 2 | 0 | 35 |
| 3 | 0 | 44 |
| 4 | 0 | 39 |
| 5 | 0 | 17 |
| 6 | 0 | 24 |
| 7 | 0 | 29 |
| 8 | 0 | 35 |
| 9 | 0 | 34 |
| 10 | 0 | 34 |
| 11 | 0 | 25 |
| 12 | 0 | 26 |
| 13 | 0 | 28 |
| 14 | 0 | 31 |
| 15 | 0 | 37 |
| 16 | 0 | 26 |
| 17 | 0 | 29 |
| 18 | 0 | 29 |
| 19 | 0 | 34 |
| 20 | 0 | 35 |
| 21 | 0 | 25 |
| 22 | 0 | 31 |
| 23 | 0 | 38 |

Treatment B
Grade 7, Females
District 2

| ID# | Group | Score |
|---|---|---|
| 24 | 1 | 26 |
| 25 | 1 | 32 |
| 26 | 1 | 32 |
| 27 | 1 | 37 |
| 28 | 1 | 26 |
| 29 | 1 | 25 |
| 30 | 1 | 18 |
| 31 | 1 | 18 |
| 32 | 1 | 28 |
| 33 | 1 | 18 |
| 34 | 1 | 13 |
| 35 | 1 | 25 |
| 36 | 1 | 16 |
| 37 | 1 | 22 |
| 38 | 1 | 22 |
| 39 | 1 | 22 |
| 40 | 1 | 18 |
| 41 | 1 | 11 |
| 42 | 1 | 18 |
| 43 | 1 | 21 |
| 44 | 1 | 25 |
| 45 | 1 | 17 |
| 46 | 1 | 23 |
| 47 | 1 | 21 |
| 48 | 1 | 26 |

Group 0 = Hands-on K-12
Group 1 = Hands-on K-6
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 | | Treatment 2 |
|---|---|---|
| Grade 7 | | Grade 7 |
| District 1, Females | | District 2, Females |
| 23 | = n = | 25 |
| 3 | = mdn = | 1 |
| 2.61 | = x = | 1.00 |
| .92 | = $s_x$ = | .82 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was -2.90, we must reject the null hypothesis and conclude that the two groups were not equivalent in favor of the District 1 treatment ( hands-on experience ).

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

| Treatment A<br>Grade 7, Males<br>District 1<br>ID# | Group | Score | Treatment B<br>Grade 7, Males<br>District 2<br>ID# | Group | Score |
|---|---|---|---|---|---|
| 1 | 0 | 36 | 20 | 1 | 13 |
| 2 | 0 | 42 | 21 | 1 | 13 |
| 3 | 0 | 38 | 22 | 1 | 20 |
| 4 | 0 | 35 | 23 | 1 | 21 |
| 5 | 0 | 34 | 24 | 1 | 22 |
| 6 | 0 | 41 | 25 | 1 | 24 |
| 7 | 0 | 29 | 26 | 1 | 18 |
| 8 | 0 | 24 | 27 | 1 | 24 |
| 9 | 0 | 26 | 28 | 1 | 18 |
| 10 | 0 | 40 | 29 | 1 | 31 |
| 11 | 0 | 37 | 30 | 1 | 38 |
| 12 | 0 | 33 | 31 | 1 | 31 |
| 13 | 0 | 25 | 32 | 1 | 33 |
| 14 | 0 | 25 | 33 | 1 | 24 |
| 15 | 0 | 34 | 34 | 1 | 21 |
| 16 | 0 | 22 | 35 | 1 | 27 |
| 17 | 0 | 36 | 36 | 1 | 28 |
| 18 | 0 | 29 | 37 | 1 | 35 |
| 19 | 0 | 26 | 38 | 1 | 26 |

Group 0 = Hands-on K-12
Group 1 = Hands-on K-6
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 | | Treatment 2 |
|---|---|---|
| Grade 7 | | Grade 7 |
| District 1, Males | | District 2, Males |
| 19 | = n = | 19 |
| 3 | = mdn = | 1 |
| 2.79 | = x = | 1.47 |
| 1.03 | = $s_x$ = | .90 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was -2.03, we must reject the null hypothesis and conclude that the two groups were not equivalent in favor of the District 1 treatment ( hands-on experience ).

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

Treatment A
Grade 8, Females
District 1

| ID# | Group | Score |
|---|---|---|
| 1 | 0 | 35 |
| 2 | 0 | 35 |
| 3 | 0 | 13 |
| 4 | 0 | 25 |
| 5 | 0 | 25 |
| 6 | 0 | 28 |
| 7 | 0 | 22 |
| 8 | 0 | 34 |
| 9 | 0 | 26 |
| 10 | 0 | 29 |
| 11 | 0 | 23 |
| 12 | 0 | 28 |
| 13 | 0 | 30 |

Treatment B
Grade 8, Females
District 2

| ID# | Group | Score |
|---|---|---|
| 14 | 1 | 29 |
| 15 | 1 | 34 |
| 16 | 1 | 18 |
| 17 | 1 | 22 |
| 18 | 1 | 21 |
| 19 | 1 | 17 |
| 20 | 1 | 20 |
| 21 | 1 | 21 |
| 22 | 1 | 31 |
| 23 | 1 | 35 |
| 24 | 1 | 20 |
| 25 | 1 | 22 |
| 26 | 1 | 29 |
| 27 | 1 | 34 |
| 28 | 1 | 26 |
| 29 | 1 | 23 |
| 30 | 1 | 39 |
| 31 | 1 | 27 |
| 32 | 1 | 26 |
| 33 | 1 | 31 |
| 34 | 1 | 33 |
| 35 | 1 | 36 |
| 36 | 1 | 26 |
| 37 | 1 | 27 |
| 38 | 1 | 23 |
| 39 | 1 | 33 |
| 40 | 1 | 28 |

Group 0 = Hands-on K-12
Group 1 = Hands-on K-6
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 Grade 8 District 1, Females | | Treatment 2 Grade 8 District 2, Females |
|---|---|---|
| 13 | = n = | 27 |
| 2 | = mdn = | 2 |
| 2.15 | = x = | 1.96 |
| .99 | = $s_x$ = | .98 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was 1.79, we must retain the null hypothesis and conclude that the two groups were equivalent.

RAW SCORES
ATTITUDINAL SCIENCE SURVEY

Treatment A
Grade 8, Males
District 1

| ID# | Group | Score |
|---|---|---|
| 1 | 0 | 39 |
| 2 | 0 | 26 |
| 3 | 0 | 23 |
| 4 | 0 | 23 |
| 5 | 0 | 33 |
| 6 | 0 | 31 |
| 7 | 0 | 29 |
| 8 | 0 | 31 |
| 9 | 0 | 28 |
| 10 | 0 | 24 |
| 11 | 0 | 30 |
| 12 | 0 | 34 |
| 13 | 0 | 32 |

Treatment B
Grade 8, Males
District 2

| ID# | Group | Score |
|---|---|---|
| 14 | 1 | 29 |
| 15 | 1 | 38 |
| 16 | 1 | 44 |
| 17 | 1 | 38 |
| 18 | 1 | 15 |
| 19 | 1 | 22 |
| 20 | 1 | 32 |
| 21 | 1 | 32 |
| 22 | 1 | 29 |
| 23 | 1 | 31 |
| 24 | 1 | 39 |
| 25 | 1 | 36 |
| 26 | 1 | 32 |
| 27 | 1 | 22 |
| 28 | 1 | 35 |
| 29 | 1 | 26 |

Group 0 = Hands-on K-12
Group 1 = Hands-on K-6
48 = Highest possible score
0 = Lowest possible score

NULL HYPOTHESIS

There will be no statistically significant difference between the means of Treatment 1 and Treatment 2 when tested at the Alpha .05 confidence level.

STATISTICAL SUMMARY

| Treatment 1 Grade 8 District 1, Males | | Treatment 2 Grade 8 District 2, Males |
|---|---|---|
| 13 | = n = | 16 |
| 2 | = mdn = | 3 |
| 2.46 | = $\bar{x}$ = | 2.63 |
| .77 | = $s_x$ = | 1.20 |

FINDINGS

Since the ( t ) required at the Alpha .05 is + 1.99, and since the ( t ) obtained was .94, we must retain the null hypothesis and conclude that the two groups were equivalent.

# Chapter V

## Summary, Conclusions, Implications

The purpose of this study is to assess the effect on student attitude with respect to using a hands-on teaching method in the elementary school, as compared to a teaching method with limited hands-on experience in the middle school. Two research questions were developed to examine student attitude as it relates to teaching method in the middle school. First, do students who have been exposed to a teaching method using less hands-on activity in middle school science classes like science any less than students who have been exposed to a teaching method using more hands-on activities in science class? Second, do students' attitudes towards science decline when hands-on science methods are used less frequently?

Research has determined that there are a number of factors which influence student attitude. The personality and behavior of the teacher are two of the most important factors in determining student attitude. Classroom activities, parental involvement and expectations, the curriculum, peer relationships, and

the work involved in the class are all contributing factors to student attitude.

In order to answer the two questions of this research project, third-, fifth-, seventh-, and eighth-graders were selected from two suburban school districts. The two districts are at opposite sides of the city from each other. While all school districts in the area have made the attempt to employ hands-on learning experiences for the study of science, these two districts were chosen for this study because they presently have two distinctly different approaches to elementary school science. Both districts have embraced a hands-on, experiential, science philosophy. The first district hired elementary education teachers in recent years to teach exclusively science at the elementary school level. The district incorporates hands-on learning experiences at all levels (K-12) of science education in the district. The second district, while philosophically supporting the use of hands-on experiences at all levels of science education, does not uniformly use hands-on experience in science classes in the middle school years. That is to say, some 7th and 8th grade teachers admittedly

do not utilize hands-on experience in their science classes as a primary teaching methodology, rather opting for a lecture and note-taking method.

The attitude survey instrument used in this project was a twelve-question survey containing statements relating to science, the science class, and teaching methodology. After each statement, four possible choices ("almost all the time," "most of the time," "some of the time," and "almost never") are listed to determine the student's agreement with the statement. The final question asked to what extent the student likes science class and students could reply by indicating: "very much," "a lot," "some," "a little," or "not at all." The survey asked questions which relate to the development of student attitude towards science. The questions this study was designed to answer are: do students who have been exposed to a teaching method using less hands-on activity in middle school science classes like science any less than students who have been exposed to a teaching method using more hands-on activities in science class? Second, do students' attitudes towards science decline when hands-on science methods are used less frequently?

"Attitudes," says Koballa, "register preferences -- likes or dislikes. Attitudes are learned. Attitude toward science is defined as a learned response evaluating our feelings within the environment related to science learning" (Koballa, Crawley, Shrigley, '90 ). Koballa concluded, "Much of that attention [ of previous years ] to attitude towards science stems from belief that affective variables are as important as cognitive variables because they influence learning outcomes and career [ choices ] ( Koballa, '88 ).

Attitude theorists give at least three primary reasons for studying attitudes: attitudes are generally stable over time; attitudes are learned by experience; and attitudes are related to behavior ( Koballa, '88 ). That is to say, an individual's actions reflect one's feelings toward objects and issues. If educators can employ those teaching methods which appeal to a variety of students, then they will thereby, encourage the development of positive attitudes towards science. Students like to be engaged in discovery. Research has shown "that one of the reasons given for students' enrollment in science is their involvement in laboratory work" ( Hofstein, Moaz, & Rishpan, '90 ).

Byrne and Johnstone found that "simulation, gaming and related techniques can be as effective as traditional methods with regard to knowledge acquisition, and more effective in terms of promoting positive attitude development" ( Byrne & Johnstone, '88 ). Substantiating this finding, Shymansky states that "across curricula, students exposed to new science programs showed the greatest gains in the areas of process skills development, attitude toward science, and achievement" ( Shymansky, '83 ). Attitudes toward science decline as students move to higher grades ( Koballa, '88 ). These same findings were substantiated in other studies -- particularly that science attitude declines between junior high and senior high school ( Hofstein & Welch, '84 ). Canon and Simpson discovered that the attitude of students is significantly more positive at the beginning of the year than it is at the end of the school year. This is true for all students "regardless of ability group or gender" ( Canon & Simpson, '85 ).

These findings are substantiated again in this study. The findings of this survey demonstrate that the similar hands-on teaching methods employed by both districts at the elementary level produce essentially

equivalent attitudes in students in both districts. However, in seventh grade, when District 2 teachers ceased to utilize hands-on teaching methods to the same extent as the teachers in District 1, there was a significant negative impact on student attitude. Those students who were exposed to little hands-on teaching methods in the seventh grade did not like science and science class as well as the students who were taught using more hands-on teaching.

The eighth grade student attitude in District 2, both females and males, did rebound to some extent. District 2 student attitude did not rise enough to be exactly the same as District 1 in eighth grade. It did rise significantly from seventh grade. No conclusions can be made from the survey to explain why the District 2 student attitude rose dramatically in eighth grade. Teachers in both districts may have explained to some extent the general poor student attitude towards science in eighth grade when they expressed their concern that the eighth grade classes ( Earth Science ) were difficult to present as hands-on experience.

Consistent with previous research, student attitude declined as students progressed from third

grade through eighth grade. Seventh graders showed the least positive attitude towards science compared to other grades. Consistent hands-on teaching method in every grade by District 1 teachers seems to have diminished the negative trend in student attitude. While District 2 eighth grade student attitude had rebounded to nearly the same attitudinal level as the District 1 students, the measurable attitudinal score was not significantly different beyond the .05 confidence level.

There are two strong implications as a result of this study. Hands-on teaching methods engage students in their learning and help produce positive student attitudes. Teachers should, therefore, utilize hands-on teaching and learning. The second implication is that once a District or school philosophically embraces a hands-on approach to teaching and learning, that hands-on teaching method must be employed by all teachers at all grade levels. To cease using the hands-on method is to run the risk of both negative student attitude as well as poor student academic performance. What could not be measured with this singular attitudinal survey is the long-term impact on

the students: whether they will take more science classes, or approach science classes with skepticism instead of enthusiasm and a desire to explore the world around them. Since it is a goal of teachers to instill in students a love for learning and exploring, employing teaching methods which are more likely to produce these positive attitudes is imperative.

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APPENDIX B

Statement of Consent

A survey is being conducted concerning the attitudes of students about science. The 12-question survey will be conducted in class. It will take approximately 5 minutes to complete the questionnaire. It is hoped that the survey results will help teachers to better understand what shapes positive attitudes of students about science. Participation in the survey is voluntary. Students who do not want to participate in the survey do not have to do so. All responses will remain anonymous. No students are to sign the questionnaire. You may change your mind at any point and withdraw from the study without penalty.

Having read and understood the information provided, agree to allow my son/daughter, _____ to participate in this survey .

Signature of Parent/Guardian _____

Date _____

## APPENDIX A

### A SURVEY ABOUT SCIENCE ATTITUDES

This survey is being conducted to learn more about the attitudes of students towards science. Your personal, thoughtful answers to the following questions are greatly appreciated.

Grade _____ School _____ Boy Girl

1. I like studying science.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

2. Science is interesting.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never .

3. I listen to the ideas of other students about science.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

4. I think I would like to take more science classes.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

5. During science class I like reading a textbook and talking about what we have read.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

6. During science class I like doing experiments and talking about what we have seen.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

7. During science class I share my ideas with other students.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

8. During science class I mostly like to listen to the teacher talk about science.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

9. During science class I mostly like to watch the teacher do science experiments or demonstrations.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

10. During science class I mostly like to read books about science.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

11. During science class I mostly like to do science experiments.

   a. almost all the time
   b. most of the time
   c. some of the time
   d. almost never

12. I like science class ( circle one of the following ):

   very much  a lot  some  a little  not at all

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