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ABSTRACT

Fourth-grade students (83% of whom were identified as "at risk") in an inner-city school in the southeastern United States participated in a hands-on, interdisciplinary unit about the environment for 2 weeks. Lessons covered a wide range of environmental issues such as pollution, rainforest devastation, recycling, and Earth appreciation. Students engaged in activities with environmental topics including soil, water, insects, trees, trash, paper, and recyclable items. Children discovered environmental problems through experiments, art work, and literature-based activities and became active participants in solving these problems. Attitudes about science and learning were gauged through surveys of 19 students and interviews with 7 students before and after the intervention. Results indicated that positive attitudes toward science and toward learning about science increased from before to after the intervention. Student interest in science also increased. However, positive attitudes toward the environment actually decreased. Student attitudes toward active learning remained the same. Attitudes toward learning were influenced by teaching style. The paper includes an examination of literature regarding active learning and at-risk students. Appendixes contain the questionnaire, interview questions, and the learning unit titled "Our Earth in Danger." (Contains 28 references.) (JDD)

Active Learning and the At-Risk Student: Cultivating Positive Attitudes Towards Science and Learning

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Running Head: ACTIVE LEARNING AND THE AT-RISK STUDENT

Abstract

The purpose of this study is to find the link between active learning and at-risk student attitudes towards science and learning. The study took place in a fourth grade classroom in which 83% of its population was identified "at-risk" by the school. Students participated in a hands-on, interdisciplinary unit about the environment for two weeks. Attitudes about science and learning were gauged through surveys and interviews, before and after the intervention. The results indicate that students became more interested in science after the intervention. The students' enjoyment of the learning did not significantly improve. There was, however, a noticeable change in attitudes and perceptions of the learning process.

The Problem

Education is not a gamble; it is the right of every American. Why then does the expression, "students at-risk," exist in our schools? The word "risk" conjures up images of people rolling dice or playing the stock market. It implies that someone may win it all or lose everything. It is a word that belongs in Las Vegas or on Wall Street, not in the classroom.

Unfortunately, our children at-risk are facing bigger stakes than any gambler. They are in jeopardy of failing to complete their education. Factors such as low socioeconomic status and race/ethnicity increase the odds that they will not finish school (Ekstrom, Goertz, Pollack, & Rock, 1986). Those that have already lost, the dropouts, tell us that school had no meaning in their lives (Ekstrom et al., 1986; Jacobs, 1989). They did not see the connection between life and education.

As educators we must find ways to take the "risk" out of our schools and help all of our students become winners. Active learning may be the key. It effectively places the learning process in the hands of the students. By giving students the opportunity to explore and discover, they are able to relate their world to the world of learning.

The purpose of this study is to find the link between active learning and student interest. Students in a fourth grade classroom will experience a hands-on science unit about the environment. Upon completion of the unit, student attitudes will be examined through interviews and questionnaires.

It is expected that this inquiry will highlight the use of active learning as an effective tool to increase student interest in the learning process. The author predicts that students' attitudes will improve toward learning science. Results should also indicate that students who learn actively, will have a better appreciation for learning.

This study will begin with an examination of current literature regarding active learning and at-risk students. A description of the design, following this review, will detail the process in which the research was conducted. Upon analysis of the results, the author will offer suggestions and implications based upon this study.

Literature Review

Research on active learning is prevalent. Within the extensive literature, many "catch phrases" have been denoted. For the purpose of this study, active learning will be defined as learning in which the children are active participants in the learning process. Terms such as hands-on, activity-centered, and materials-centered may be used interchangeably (Hein, 1987).

There is a wealth of literature that promotes the use of hands-on learning for all children (Brophy, 1987; Benjamin, 1989; Kyle et al., 1985; National Council of Teachers of Mathematics [NCTM], 1989; National Science Teachers Association [NSTA], 1983; Penick, 1986; Wittmer & Myrick, 1980). However, this study will focus on research on active learning and the at-risk child, or the student that is "...at risk for academic failure" (O'Sullivan & Tennant, 1993, p.4). Literature about minority learning also has been consulted to examine the effects of hands-on instruction on the particular population involved in this study. This review will consider the following information about active learning: the positive impact on children at-risk, the impediments of implementation, and the influence on improving student attitudes.

Benefits of Active Learning for the At-Risk Student

Relevancy in student life

Active learning gives meaning to the education process for the at-risk student. Jacobs (1989) found that high school dropouts commonly attribute the lack of relevance of learning to their decision to drop out. Research indicates that active learning may bridge the gap between learning and meaning. Henderson & Landsman (1992) studied the impact of an integrated, hands-on mathematics unit on culturally at-risk students. According to the authors, "learning based on concrete activities rather than on textbook abstractions enables learners to make real-world sense of their school experiences" (Henderson & Landsman, 1992, p. 3). By involving connecting the students in the learning process, they are no longer outsiders of education. This connection is vital when the culture at home varies so greatly with the culture of school (Tharp, 1989). In a proposal to help teachers and principals improve school for at-risk children, Cubin (1989) insists upon the connection of abstract ideas with the child's background. Active learning must oscillate between "student experience and school concepts" (Cubin, 1989, p. 31)) [cited in Au (1980), Heath (1983) and Banks (1987)].

Brophy's (1987) expectancy x value theory further supports the importance of giving meaning to the underachiever through active learning. If students can find value in the participation of the task, than they will be more likely to expend effort on the task. They will also eventually become more independent in their learning (Lehr & Harris, 1988).

Learning styles

The research also indicates that active learning is the best match for the various learning styles of the at-risk student. Midkiff, Towery, and Roark (1991) describe the best learning environment for the rural at-risk student: this student prefers pair or group work, needs movement, learns best through kinesthetic or tactile activities and learns impulsively. According to the authors, these students "need to be physically involved in the learning process...[they] remember best what they have done, not seen or heard" (Midkiff et al, 1991, p. 6). Lehr and Harris (1988) also advocate a multisensory approach with particular emphasis on using the whole body to learn. Beyond the physical learning needs, Carbo & Hodge (1989) have found that minority students need to be involved emotionally with "high-interest" materials. These studies indicate that experiential learning is a necessity in meeting the various learning needs of at-risk children.

Effects on student learning

Active learning not only meets the emotive needs of underachieving students, it also helps improve student learning. Although research indicates mixed results in measuring achievement gains, many studies verify that active learning, when incorporated in an integrated unit, enriches various skills. Cuban (1989) advocates the use of involvement to improve higher order thinking skills. Using this as one of her objectives Betters (1991) developed a hands-on unit as an intervention in a self-contained at-risk classroom. By making a connection between the hands-on experience and thinking, a 202% increase was evidenced in the group's critical thinking score (CTS) in creative writing (Betters, 1991). Such a gain can be explained by increased participation in the (CTS) activity. These results show that experience gives students an environment for cognitive development. Norris (1990), found similar results in her hands-on unit intervention. On the critical thinking test, all of the students met the stated objective. Norris found decision making and critical thinking to be so important for at-risk students that two of her units revolved around the theme. Using a hands-on mathematics unit with language minority students, Henderson & Landsman (1991) tested both their control group and theme group on math concepts and applications with a standardized achievement test. The group that learned through experience outperformed the group that learned through traditional instruction.

<u>The other options</u>

Research further supports the use of hands-on learning by demonstrating the ill-effects of hands-off learning. Midkiff et al. (1991) suggest that paper learning, such as worksheets, workbook pages and review sheets fail to motivate or allow learning to take place. For the at-risk student, "they compound the problem by causing more stress and frustration with the process of learning..." (Midkif et al, 1991, p. 3).

The use of textbooks can be equally problematic. Powell and Garcia (1985) studied the portrayal of minority students in the illustrations of seven elementary science textbooks. The authors found that only 17% of the adults displayed in the textbooks were minorities. When minorities were pictured they were seldom shown in science related roles or activities. They were more likely seen in familial roles or occupations such as mechanical workers. These depictions give a false representation of society and lack appropriate role models for minority students.

In an article written to promote minority learning, Carson (1988) asks teachers "to emphasize scientific and intellectual achievement as a worthy goal and to try to identify people of color who have succeeded in that area" (Carson, 1988, p. 340). Thus, if a textbook fails to demonstrate roles in which minority students may aspire, they are failing the students. Another alternative must be sought. As Powell and Garcia (1985) suggest in their conclusion, students should be involved in a variety of activities to offset the negative effect of textbook bias.

Impediments In Active Learning

Although research is limited in negating the effectiveness of active learning in the at-risk classroom, several researchers have pointed towards general limitations of this instructional method.

Teacher knowledge and skill

Studies indicate that may teachers may not have an adequate knowledge base to teach active units. This is especially true in two of the most "active" subjects, science and math. In the study of the effects of active math units, Henderson & Landesman (1992) discuss the weak mathematics background of most middle school teachers. From their study the authors state that it would be "difficult for teachers with a superficial grasp of mathematics to recognize the opportunities to incorporate important mathematical concepts and problem solving into a theme." Thus, without a strong knowledge base in math, teachers may rely upon passive learning to teach the concepts.

Teachers are often grossly unprepared to teach science actively. The NSTA (1983) found that one third of teacher preparation programs do not adequately prepare elementary school teachers with the design of their science courses. Only 18% of the institutions require teachers to take science courses in all three of the science areas. Anderson & Smith (1987) caution that this poor preparation makes active learning an ineffective teaching tool. "Activity-driven teachers unknowingly modify or delete crucial parts of the program, making learning of the scientific theories almost impossible for their students" (Anderson & Smith, 1987, p. 100) (cited in Olsen, 1983; Smith & Sendelbach). Hands-on activities are therefore useless unless teachers understand the subject matter.

Teacher perceptions

Studies indicate that some teachers lack confidence in their ability to teach with hands-on instruction. Pollack (1989) studied the difficulties that teachers have with hands-on science. In the qualitative study, all five of the teachers interviewed stated that they disliked teaching science. One teacher indicated that hands-on teaching made her feel uncomfortable, "especially since we don't use books much with the kids and I have to gather all the material and write my own lessons" (Pollack, p.13, 1989). Therefore a teacher lacking confidence in a topic may be unprepared to engage the students. Glasgow & Carson (1986) report that this problem evoked action in the Little Rock School District. To solve the problem of "teachers considering themselves poorly trained" to teach hands-on science, the district began to teach mini-courses so teachers can "confidently use the same ideas and activities with their...students" (Glasgow & Carson, 1986, p.22).

Another factor that makes active learning less appealing to some teachers is the perception of the time commitment. Henderson & Landesman (1992) state that when writing thematic active units, "...time for such detailed planning may be difficult to find amid the daily pressures of teaching" (p.12). Interviews with teachers and administrators indicate a similar perception. In Pollack's (1989) study of obstacles of active learning, one teacher indicated that she disliked teaching science because of the time commitment involved. Dawes (1987) witnessed similar perceptions in his study of primary teacher attitudes. According to a principal whom he interviewed, "science instruction suffered in her setting because the lack of preparation time given to primary teachers" (Dawes, 1987, p. 10).

Supplying the active learning classroom

Active learning by nature requires more materials in the classroom. Several researchers indicate that school systems are having difficulty meeting this need in the active learning classroom. Pollack (1989) took inventory of the supply of materials needed for hands-on science in two school districts. The findings indicate that, while the schools did not provide most of the materials for hands-on science, teachers had supplies in their classroom. The author found that teachers had to rely on PTA funds or spend their own money to purchase supplies. Teachers with tight budgets may therefore be inclined to rely on textbooks, rather than purchase materials. In Dawes' (1987) study, the school district allocated only 5 to 10% of its curriculum budget to science supplies. The author anticipated that a 60% funding increase would be necessary to "support a quality hands-on program" (Dawes, 1987, p. 11-12). For active learning to be successful, school districts must give teachers adequate supplies in the classroom.

Meeting curriculum needs

Proponents of active learning find that this method of learning may not work in the current framework in the curriculum. Henderson & Landesman (1992) questioned whether an integrated math unit could cover content necessary for students to continue in advanced learning of math. This study used a thematic "active" unit as an intervention. The authors compared the material covered by the active learning to textbook learning. The findings indicate that with active learning the teacher covered one half of the curriculum requirements; with traditional textbook learning she covered three fourths of the material. This study indicates a need to revise the curriculum to incorporate active learning.

Another obstacle in the current framework is assessment. Active learning invites children to think independently. But Hein (1987) suggests that the multiple choice tests currently used to measure achievement allow "...a student only to 'solve' a problem defined by the testmaker" (p. 8). Using their higher order thinking skills, students may select a "correct" answer that the testmaker deems incorrect. An example cited by the author demonstrated a question that asked children to mark the picture of the plant that needed less water. Many children naturally marked the head of cabbage, because it was no longer living! Unfortunately the testmakers had designated that the picture of the potted cactus was the "correct" answer. Hein (1987) demonstrates the need to develop assessments that appropriately measure the acquisition of skills that active learning teaches.

Improving Attitudes

Although the literature indicates strong support for active learning, research shows conflicting results in attitude improvement. Researchers who have tested the effects of hands-on learning on attitudes of heterogeneous populations have noted improvement the attitudes of their students. Kyle, Bonnstetter & Gadsden (1988) tested the effects of a district-wide, "Science Through Discovery" curriculum package on elementary students and teachers. The authors chose two treatment and two control classrooms at each grade level to test the attitudes. The authors found that

75% of the treatment students found science to be "fun, exciting, and interesting" (Kyle et al, 1988, p. 116). On the other hand, half of control group thought science was boring and only one quarter found science to be fun. Such results indicate that active learning has a positive impact on attitudes in the typical classroom.

Dawes' (1987) study of active science learning in a private school setting also centered on student attitudes. Focusing on eight primary classrooms, the author implemented a year-long hands-on science intervention. By setting up a "Science Center" where all students could actively learn, the author was able to improve student attitudes toward science over the school year. Through the utilization of a questionnaire applied before and after, the author found that hands-on learning caused 182 out of 210 students' to improve their attitudes (Dawes, 1987).

Kyle et al (1988) and Dawes (1987) also show that active learning can add enjoyment to the learning process. Both researchers were able to improve student attitudes in mostly middle class or heterogeneous classrooms. But similar research in the at-risk environment has yielded mixed results.

At a dropout prevention school, Norris (1990) successfully increased the middle school children's attitudes toward school. The author's intervention contained four interdisciplinary units which included activities such as role play, creative dramatics, simulations, and guest speakers from the community. Focusing on issues such as education or career awareness, the units attempted to attach meaning to the learning process. The attitude survey administered upon completion of the units, asked students to rate, on a scale from one to four, statements that reflected their appreciation for education and learning. The results of this survey indicated that 43 out of 45 students answered 80% of the preferred answers (Norris, 1990, p.29). This study indicates the possibilities that active learning holds for the at-risk child.

Other studies have shown active learning to be less than effective in increasing attitudes of at-risk students. Betters (1991) studied the impact of a hands-on unit in a self-contained classroom of 18 at-risk children. The twelve week unit integrated math and communication through the students' construction of a doll house. The author anticipated a 50% increase in attitudes measured by an attitude survey administered before and after the intervention. Students answered "yes" or "no" to questions about enjoyment of school and learning. The results fell short of the author's objectives. Only 66% of the students increased an average of 31% (Betters, 1991, p. 83) Nearly one-third of the class showed a decrease in positive attitude toward school. The author claims that attitudes could not improve significantly because the children began with good attitudes. This, however, does not explain the reason that the attitudes of 5 out of 18 children actually decreased. Betters' suggested that oral presentation of the attitude survey might improve the results of this study.

Henderson & Landesman (1992) also witnessed a lack of improvement in student attitudes in the study of integrated mathematics and the at-risk Hispanic student. Set in a middle school comprising of 90% Hispanic students, the authors demonstrated that the subjects were at-risk for failure. For two years the study selected 102 students to be part of the treatment and control groups. The treatment group learned mathematics through hands-on, integrated mathematics units over the entire school year. The authors administered two attitude surveys focusing on the students' view on general school subjects and mathematics. The results of attitude surveys pooled from the treatment group over time showed no improvement. After the hands-on intervention, fewer students answered yes to questions such as "[I] like math" or "[I] feel good when I solve a math problem by myself" (Henderson et al, 1992, p. 8). Such results led the authors to conclude that more research must be done to help generate positive attitudes with thematic teaching.

This study of at-risk children and active learning follows this suggestion in an attempt to establish a definite connection between active learning and the attitudes of the at-risk student. The literature reveals that quantitative research has been ineffective in gauging the improvement of attitudes. This study will extend the previous research by examining the problem using both qualitative and quantitative inquiry. Through student interviews, this investigation will uncover the children's personal response to the effects hands-on learning.

Design Of The Study

Work Setting

This study was conducted in an inner city K-4 elementary school in the Southeast region of the country. The population of the school reflects its uniqueness. Among the 390 students that attend, 63% are African-American and 37% are Caucasian. For the purpose of this study, the author used the school's definition for at-risk population which equates its at-risk population with participation in the free or reduced lunch program. Using this definition, 77% of this elementary school's population is at-risk for failure in school. In addition, 68% of the students live in single family homes.

The population of the fourth grade classroom in which this study was held, reflects statistical trends similar to the school at large. Based upon the current enrollment of twenty-five students, one half of the population is African-American and the other half is Caucasian. The free lunch enrollment indicates that 83% of these students are classified as at-risk by the school. Only 46% of the children live in two-parent families. The remaining students live with grandparents or in single parent families.

An understanding of the academic picture is as important as the demographic composition of this class. This sample was chosen partly for its high make-up of students with learning needs. Before this survey was initiated, one-third of the population in the classroom was identified or in the process of being identified for special education. At the time of the investigation, however, only 18% of the students were identified for special education. One member of the class participates in the gifted education program. The reading level of the class can be broken down by grade level. While fifty percent of the students are reading on a fourth grade level, 27% read on a third grade level. The remaining 23% of the class reads on a second grade level.

Seven students were interviewed to increase the depth of this study. Among those interviewed, four participate in the free lunch program. Only two of these students live in two-parent homes. Three of the interviewees were girls and four students were African-

American. The pool included two students identified for special education. Three of these children are on a fourth grade reading level. Three of those interviewed read on a second grade level. The remaining child reads on a third grade level.

The atmosphere of the classroom is significant to understanding the purpose of this study. Around the room, bulletin boards contain class rules and schedules, a calendar and a poster of Monticello. Student math worksheets are displayed in the rear of the room. At the beginning of the study, students were arranged in clusters of three desks. This arrangement was changed to a row configuration during the two week intervention. A behavior management system stresses the loss of privileges. Students receive a check for off-task behavior. When they accrue four checks they lose a point. Point loss may lead to participation in detention rather than a motivational club. This program was instituted by the school to keep students on-task.

Instruction in this classroom is structured. The teacher relies heavily upon various textbooks and worksheets to teach math, social studies, health and language arts. When students arrive in the morning, they are expected to solve math problems and write six sentences about the teacher's chosen topic. A type of reading and writing workshop has been instituted in this classroom. During the reading workshop students read a book of their choice and discuss it with their peers. Writing workshop involves students writing about their own topic and then giving themselves a grade. Writing samples are shared with the class. Science and social studies instruction is divided equally among the fourth grade teachers. Each teacher prepares a topic and teaches that subject in each classroom for two weeks. Instruction for this "Core Content" varies with teachers. The author observed lessons taught through lecture, whole class use of a textbook, worksheets, a video, and demonstration. One lesson on measurement had students measure objects in the classroom. This is the only hands-on learning observed in the entire curriculum.

Measures

Two forms of measurement were utilized to compile both qualitative and quantitative results. A survey was conducted before and after the intervention to assess an increase in positive attitudes. This test was designed by the author based upon a survey used by Robertson (1993) to assess reading attitudes [cited in McKenna & Kean (1990)]. The test used forty questions to probe student attitudes towards science and learning (see Appendix A). Incorporating Robertson's (1993) strategy to put the students at ease, the children were told that they were taking part in the survey because their thoughts and feelings were important to the researcher. Based upon the results of Betters' (1991) research, the test was read aloud to the entire group and students were asked to remain with the class as each question was read.

A five face rating scale was used to determine student response. Incorporating the strategy used in Robertson's (1993) study, students were asked as a group to explain what they thought each face represented. They were allowed to pick a crayon to use for coloring the faces. Two example questions were then answered for practice. For the purpose of analysis, the faces represent an agreement scale suggested by Henerson (1978). The happiest face is equivalent to the "strongly agree" response. The happy face represents "agree." The use of a middle face, the undecided answer, threatened the clarity of positive and negative attitudes. Thus, the results of these responses were not analyzed. Similarly, the degree of disagreement was represented by a frown and very unhappy frown. This parallel between faces and the agreement scale aided in analyzing the results of the data. As suggested by Robertson (1993), the happy side of the scale was considered a positive response and the sad face answers were calculated as negative.

Student attitudes were also gauged by the qualitative interview. An operational construct sample was used to determine selection for interviews. This method, described by Patton (1990), allows a researcher to a sample "...people on the basis of their potential manifestation or representation of important theoretical constructs" (p. 183). This allowed the selection of seven students based on their response to their questions. Seven students were chosen because they disliked science or learning on the survey.

The guide approach interview was utilized because of its flexibility to probe students. A list of eight questions was prepared in advance to gain insight into student understanding and appreciation of science and learning (see Appendix B). Interviews were held in the teacher's lounge and in the conference room and were tape recorded. A pseudonym was chosen based upon Robertson's (1993) suggestion. Each child chose their own name and was assured that the interview would be confidential. The students were told that the purpose of the interview was to learn more about what they thought and that their responses were valued by the researcher. The discussions from the interviews were then transcribed and studied using cross-case analysis.

Procedure

The field investigation was originally designed for a three week time frame. Unfortunately, due to severe winter weather and school closings the original plans were scaled down to be completed within two weeks. The inquiry may be broken into three phases: 1) pre-assessment of attitudes, 2) unit intervention, and 3) post-assessment of attitudes.

Pre-assessment of attitudes

The researcher administered the attitude survey to the class as a group. Nineteen members of the class handed in completed surveys. One student chose not to participate in this activity. His responses were not included in the results. Seven students were then selected and interviewed. Due to time constraints, four students were actually interviewed for the pre-assessment after the introductory lesson.

Unit intervention

Students learned about the environment through a hands-on, interdisciplinary unit taught by the researcher (see Appendix C). Lessons covered a wide range of environmental issues such as pollution, rainforest devastation, recycling, and earth appreciation. Students interacted with many environmental materials including soil, water, insects, trees, trash, paper, and recyclable items. Children discovered environmental problems through experiments, art work, literature-based activities, and became active participants in solving these problems. The original lessons were adapted to fit into the abbreviated time frame.

Post-assessment of attitudes

Upon completion of the unit, the research administered the questionnaire to the same nineteen participants. The two example questions were omitted, but students were again asked to explain what the faces represented. The seven students originally interviewed were then asked to answer same questions about learning and science.

Analysis

Quantitative Results

Due to the two-pronged nature of the hypothesis, the results of the survey will be analyzed in two categories. A discussion on the impact of active learning on attitudes towards science will precede the explanation of learning attitudes.

Student attitudes toward science

The results of the science portion of the surveys indicate that most students have a positive attitude about learning science both before and after an active learning intervention. Before the intervention the majority of the class showed a positive attitude in thirteen out of the nineteen responses. After the intervention the majority of the class indicated a positive attitude in 18 out of 19 responses.

The data reflects an increase in positive attitudes.

Insert Table 1 about here

The entire class increased their positive responses on fourteen of the nineteen questions. The question that concerned peer interaction showed no increase, while students' negative attitudes increased on three of the questions. These questions were related to the topic of the intervention, and exploring science outdoors.

The questions on the survey involved several common themes. The answers to the questions, when categorized by subject, yield interesting results. The explanation of the results will be examined by each category.

Learning about science

When the questions asked students how they actually felt about learning about science, every response showed an increase in positive attitudes. Two of the most dramatic increases on this survey occurred under this category. The positive attitudes toward "learning about science," increased by 77%. A similarly significant increase was noted on the question, "How do you feel when you spend your free time learning about science?" The number of happy faces on this question increased by 85%. Although the attitude trend on all of these questions swung upward, it must be noted that the majority of students maintained a negative attitude toward learning outside of school. After the intervention, more than half of the students still felt unhappy about learning science at home.

General interest in science

According to the results, student interest increased in science. Students were more interested in reading and talking about science after learning actively. Fewer students wanted to miss a science lesson. This is also reflected in the dramatic increase of positive responses to the question, "How do you feel when it's time for science?" Whereas 42% of the class answered positively on the pretest, 79% answered positively on the post test. This increase of 88% was the most dramatic increase on the entire survey. This category also held the questions with the fewest positive responses. On the pretest, only 42% of the class wanted to become a scientist or felt good about science time. Although attitudes about science time increased significantly, student desire to become a scientist remained low.

Active learning and science

Students' attitudes toward active learning and science demonstrated interesting results. Most student responses were positive about active learning both before and after the intervention. Although student appreciation for doing different activities, experiments and discovering new facts increased, fewer students enjoyed exploring science outdoors after the intervention. Smaller changes in attitude are reflected in this section when compared to the other categories.

Interest in the environment

Three questions related to the environment were included in this survey. Although more students responded positively to these questions than the other categories, the results indicate that positive attitudes toward the environment actually decreased. On each of the questions, one student out of the class felt less positive about the environment after the intervention. Although statically this decrease may not be dramatic, the impact of this result will be addressed in the discussion section.

Students' attitudes toward learning

Both the pretest and post test results of learning portion of the survey reflect that these at-risk students have a positive attitude toward learning. On both tests the majority of the class had a positive attitude on all of the 21 questions about learning. The lowest percentage of positive responses on the learning section was 58%,

Insert Table 2 about here

whereas on the science portion the lowest positive response rate was 37%. The class gave more positive responses on the learning questions than on the science themes.

Despite the large number of positive responses, the data suggests that the active learning intervention did not significantly increase student attitudes towards learning. Approximately one-fifth of the student responses did not change from the pretest to the post test. More questions saw a decrease in positive attitudes than an increase. Only 7 of the 21 questions that asked about learning increased in the number of positive responses. However, the eight questions that showed a decline in positive attitudes toward learning were small changes. Only one question in the survey showed a dramatic change in the number of responses.

Active learning

When the ten questions concerning active learning are grouped, the outcome reflects little change in the responses. Student attitude remained the same when asked how they felt about measuring and describing objects. One student improved his or her attitude in each of the questions about handling objects, designing and choosing what to learn about. One or two students disliked touching and working with objects, drawing, creating things and choosing what do with their time after the intervention.

Traditional/passive learning

Most of the passive or traditional questions upheld the similar trend of little change. The active learning intervention had no impact on attitudes toward reading. There was a slight change in attitudes towards memorizing information and writing stories (one student). Interestingly, more students enjoyed listening to the teacher on the post test. Although student interest in listening to the teacher give information improved slightly, attitudes improved most dramatically on feelings about listening to stories. This question, with a 55% increase in positive attitudes, reflects the largest change in attitudes in the learning section. However, the significance of this figure must be approached with caution based upon the diverse reading styles of the classroom teacher and the researcher.

Self-esteem

The student response to the "self-esteem" type questions do not demonstrate a dramatic improvement in attitudes. While students felt better about doing their work and solving problems in their life, fewer students felt positive about working hard in school. Students did not feel better or worse about coming to school after the intervention. The number of positive responses to self-esteem questions on the pretest and post test were high.

Other

One question, "How do you feel when you solve problems," falls into the "other" category because of its vagueness. The author intended this question to gauge how students felt about solving problems they encountered (for example, stopping water pollution). However, students may have interpreted problem solving to be the algorithms or math worksheets they are accustomed to in class. The outcome of this question relies on the student's interpretation of the meaning. It could reflect attitudes toward active or passive teaching. The results, are nonetheless, interesting. Although the entire class (100%) felt good about solving problems on the pretest, only 84% felt positive on the post test. These results will be considered in the discussion.

Qualitative Results

The qualitative results further support the results of the survey. Active learning showed a greater improvement in science attitudes. Students were asked directly if they liked science. Before the intervention only three students answered yes. Afterward all of the students either liked it "a lot" or "sometimes." Most of the children liked learning before and after the intervention. After the intervention one student liked it more and one student liked it "so-so."

The above results directly answer the questions posed by the researcher. However, the children's responses gave an incredible account of the effect of active learning on their interest and feelings about learning. This section will focus on three trends that may explain why students like to learn actively. In addition, the data also uncovered support for active learning that was not hypothesized originally. A final trend, "feeling good", will demonstrate the need to incorporate goals in an active learning classroom. All of these issues will support the effectiveness of active learning as a tool in the at-risk classroom.

Active ideas versus passive ideas

Comparison of the replies of individual children before and after the intervention signify an increase in active language. Although active ideas were mentioned in the first interview, there was a noticeable increase in active ideas. Before the intervention many students described science and learning as passive activities. Afterward students were more likely to see themselves as part of the process.

In the first interview Jeannie stated that when you study about animals and science "you take a dictionary and read it." She realized afterward that "science is when you do stuff." Likewise, Damion previously felt that science was fun based on what other people said about it. In the follow up interview, science was fun because "you can get something and describe it...you can add something to it." Damion also defined science by the topics he studied: animals and rocket ships. In the final interview he said that science was about the environment when you save it.

This trend continued in the questions based on learning. At first Wolverine equated learning to topics such as math, science and social studies. Afterward, learning became planting a tree; getting involved with the material. Charles reconsidered his belief that learning is a lack of knowledge. In the follow up, he described learning as making stuff. Another student noted before the active learning unit that she learned by memorizing and using the dictionary. She later explained that learning could be fun because "you can do experiments and do more fun things." Changes such as these occurred throughout the interviews. Although "active" ideas were mentioned before the intervention, the increase in the individual and group perception is significant.

Learning/teaching gap

Results show that the students' perception of the role of their teacher contrasts sharply with their desire to learn actively. In the post interview students wanted to learn by describing, exploring, and touching things. They liked drawing, writing, doing experiments, and learning about things that interest them. Both Kimberly and Damion expressed a desire to work with their peers. In Kimberly's words, learning was fun "when everybody got to do a little bit."

Jeannie mentioned that if she was going to teach, she would bring a nest to school, so her students could watch the eggs hatch. During the final interview, Kimberly suggested that as a teacher she would play fun games with her students. Damion suggested that learning was fun because students can "Make stuff.

Change stuff. Add stuff." These students want to be involved in their learning process.

However, the view of their teacher's role in the classroom is at odds with this involved outlook. During both interviews, students saw the teacher as an autocrat. D.J.'s impression of a teacher as one who gives a page of math work, homework and more work changed slightly. In the second interview he said he'd just "give 'em work."

Teachers also give students things to memorize and they teach in segments, "ten minutes on one subject then ten minutes on another." According to Charles, teachers must tell students when to cut out their spelling words.

Several students focused on the importance of being quiet and listening to the teacher. Wolverine suggested in the last conversation, that you must pay attention to the teacher and do what you are told. If he was a teacher he would tell his students to be quiet and do their work. Damion stated that learning means that you "listen to the teacher and the teacher says you are learning about something."

The children's idea that the teacher is an "autocrat" does not work with the students' desire to actively learn. Thus, the students' experience in the classroom, does not meet their needs. The significance of this learning/teaching gap will be noted further.

The impact of teacher style

A surprising trend in the qualitative data was the impact of past experiences with certain teaching styles. When asked about their science and learning experiences many students drew from "guest" teachers as well as teachers from previous grades. Three types of teachers emerged in the results.

The first type of teacher that impacted students was the active teacher. Students looked back on these experiences with excitement. Charles mentioned two detailed science experiences he had with Mr. O'Conner in third grade. Not only did this teacher do a volcano experiment, but he also took his class outdoors in the snow to learn "hands-on" about ice and snow. Naomi remembers having fun when she touched things in science with Mrs. March. She also enjoyed learning about weather with a former student teacher. These students remember and have fun when they participate actively.

Another type of teacher that affected student thought and feeling was the traditional/passive teacher. Due to her exposure to coercive teaching, Naomi believes that you can only learn from a book. She suggests, "If we put our Virginia books away, we ain't learning." She goes on to explain that if her book is not open, Mrs. March will take a motivational point away from her. Thus, Naomi's logic is that she must have her book for her to learn. If she doesn't have her book, she'll be punished. Naomi is not learning because it's interesting, but to avoid being penalized.

Kimberly also indicated the impact that a "traditional" teacher can have on students' attitudes and feelings. Before the intervention, Kimberly only liked science when it wasn't boring. Science is "boring when you got to read a bunch of stuff that isn't interesting." Being in a classroom where you must read or be punished may enhance this boredom. Furthermore, the traditional style of teaching is creating anxiety. In the post interview, she elaborates: "Teachers read long stories and I got real bored listening to it. And I got real anxious and I wanted to write something." D. J.'s attitude was also affected by traditional teaching. He liked science in second grade because he didn't have to do it. The teacher did it.

The other type of teacher that impacted students was the teacher that did not teach. Charles says that he didn't like science in second grade because the teacher hardly did it. D.J. attests that many schools he attended in second and third grade did not teach science at all. Both of these students indicated a "so-so" interest in science after the intervention.

Feeling good about themselves

When students were asked why they liked science and learning, an unexpected pattern surfaced in the responses. Although students demonstrated interest in active learning activities they also highlighted the importance of feeling good about what they did. Regardless of the activity (whether passive or active), six out of the seven subjects explained that they had fun when they accomplished something.

Both Naomi and Charles liked math only after they realized a goal. According to Naomi: "At first I didn't like [math] but then I did when I knew my times [tables]." However, she did not like another subject, science, when it was difficult. D.J. also indicates the need for accomplishment. He likes math because it "teach[es] you something else you don't know; a problem you don't know." Both Damion and Kimberly echo their love of learning when they know more and understand more. One student in the initial interview mentioned that she liked learning when she got good grades. Interestingly, she did not mention grades after the intervention.

Summary of Results

As the results show, active learning can directly impact the at-risk student's attitude toward science. The improvement of learning attitudes did not increase as dramatically. However, it is hopeful to see that at-risk students generally have a positive attitude about learning. The interviews reveal that after active learning students have a more "active" impression of learning. Their attitude toward learning is influenced by teaching style and they may be uncomfortable in the traditional classroom. Students also like learning not only when it is active, but when they feel a sense of accomplishment.

Limitations

It is important to note several limitations to this study. The role of the researcher as the teacher may affect the outcome of the results. Students may not have viewed their former student teacher as one of their "teachers" when they answered the surveys. This may be the result of the short intervals that the researcher used to teach the intervention. Students may view this as "play time." Although the author took strides to separate the role of researcher and teacher, students may not have understood the transition.

Adding to the artificial setting is the time limit of the intervention. Due to time constraints, the original twelve lesson unit was cut to eight lessons. A longer intervention would be more desirable.

In addition to these limitations, it must be noted that these results represent a unique sample of children. The surveys and interviews must be seen as a window into the minds of these 19 children, not fixed pieces of data.

Discussion

Active Learning and Science

The children and their surveys indicate that active learning can improve student attitudes toward learning about science. Students liked learning science more after being active participants in the process. This statement can be supported by the significant improvement of attitudes toward learning science, spending free time learning about science, and enjoying "time for science" after the intervention.

These significant increases demonstrate the value of active learning as a tool. The numbers indicate that students are happier when they are having fun and directly involved in science. They are also more willing to pursue their interest outside of the classroom. It seems to give them the encouragement to continue the learning process on their own. Their improvement in attitude toward science time is equally important. This dramatic increase indicates that students don't just like the subject; they like the process of learning!

Although attitudes toward science improved in interviews and surveys, several aspects of learning science saw little change. Students did not significantly improve their interest in active learning on the surveys. This may be explained by the fact that most students enjoy handling objects with or without the experience of active learning. If a student is asked whether he or she would rather hold a baby chick or read about it, they will more likely choose to hold the animal. Thus, the intervention doesn't improve the attitude because it already sounds like fun to the student.

An interesting contrast to the improvement in attitudes in science is the shift of attitude on the environment questions. The student ~~that~~ who changed his mind may not have realized what learning about the environment entailed. Thus, he or she may have made a more educated response after the intervention. This decrease also brings into question whether students viewed the integrated science unit as pure "science." When students are drawing or making paper, they may not realize they are learning about science.

It is reassuring to find that at-risk children generally have a positive outlook toward science. Since many of the students liked science activities from the beginning, active learning seems to work with student enjoyment of the topic. However, student attitude remained very low on two questions ~~that~~ which raises concern. Although more than three-fourths of the children liked learning about science, barely one half of the students felt bad about becoming a scientist after the intervention. This demonstrates the possible need to talk about science careers in the classroom. Students may be unaware of the opportunities in the science profession. As the previous research suggests, minorities and women in this class may be affected by the misrepresentation in the science books or lack of role models. This would be a valuable subject for further investigation.

The majority of students, even after the intervention, do not want to learn about science at home. One explanation for this low response rate could be that students do not like to do school work at home. They may not see learning science as "fun" when it is not in the classroom. A more disturbing interpretation of this result is that students are unhappy with the environment in their home. Although active learning may help student interest in science, it is not a panacea for the stresses many students face in their lives. Therefore, it is recommended that active learning be a part of a multi-faceted program to help these children beat the odds.

Active Learning and Learning Attitudes

Active learning did not significantly help at-risk students improve their attitudes towards learning. The lack of improvement is most noted by the fact that one-fifth of the responses did not change. This trend was viewed across the various categories of questions.

Due to the "empowerment" of active learning, the author anticipated a significant increase in positive responses to the self-esteem questions. It is reassuring, however, that a large majority of students felt good about their learning experiences before and after the intervention. These results are in contrast to much of the literature concerning the at-risk student.

The results of the active responses were equally surprising. The author surmised that the intervention would increase positive attitudes toward active learning. However, the author realized that students like the "sound" of active learning in the questions before they are even exposed to it. This would account for the high response rate before and after the intervention. Although students may also enjoy passive or traditional learning, they feel "happier" about active learning. This indication of students' appreciation for active learning cannot be ignored.

The vagueness of the problem solving question opens the field for more research. As mentioned above, student interest in solving problems decreased. Were the students thinking of solving environmental problems or doing their math worksheets? Since the literature demonstrated that active learning improves critical thinking skills, student appreciation for this skill should be gauged in the future.

One explanation for little improvement in learning attitudes may be found in the beginning of the study. Most of the children began with a positive attitude toward learning. In a study about hands-on learning and at-risk children, Betters (1991) attributed the small improvement in attitudes to the high response of positive attitudes from the beginning. Likewise, this current study indicates that the at-risk child has a great appreciation for learning. This suggests that the label of "at-risk" does not define how a child feels about learning. The circumstances that put him or her in the at-risk category may not directly influence his love of learning. Similarly, the question must be raised that if these children enjoy learning now, why does the education system fail them later?

Additional Insights

The interviews uncovered several issues that demonstrate the need to use active learning to help students "feel" good about (ie. their attitude) learning. Students were no longer bystanders in the learning process. When they participated "hands-on" in the environment unit, their perception of themselves as a learner transformed. For them, learning was no longer opening up the dictionary. It involved, in their words, "doing things," "adding stuff," "changing stuff." Thus, students' perceptions shifted from passive to active. These children moved from being uninvolved in learning to being a part of the process. Such a shift in attitude may reveal that active learning can change the way students view learning and see themselves in the learning process.

The children indicate, especially after working "hands-on," that they enjoy active learning; it's fun for them to participate. But these students' ideas about learning is at odds with their perception of the teacher's role in the classroom. The autocratic teacher works against the student's desire to learn and explore. Students have formed their perception through their own experiences in the classroom. It is important, therefore, that teachers redefine their role of the teacher as they involve their at-risk students in the learning process. Teacher and student must work together, not against each other. Further investigation could focus on the effect that this teamwork has on attitudes toward school.

Students also suggest that learning is fun for them when they achieve. Passive or traditional activities are enjoyable when students are able to attain mastery. This piece of advice must be transferred to active learning. When students feel good about their work, they like learning. Thus, a curriculum that allows students to achieve tangible goals may enhance the positive effects of active learning.

The results indicate that active learning can make a difference in the learning experiences of at-risk children. Unfortunately, traditional learning can have an equally profound effect on the students. Past research indicates that busy work and textbook learning can be detrimental to the at-risk student (Midkiff et al, 1991; Powell & Garcia, 1985). The findings from this study further support the negative effects of traditional teaching.

Traditional teaching influences the way students view learning. When students lose a point if their books are not out on the desk, they learn that a book must be the only way to learn. These students view learning as something that must be done "or else." Their perception of the learning process is one of helplessness. The children's natural desire to explore is squelched, because they believe that learning comes only from a book, not themselves. Likewise, traditional teaching can directly stir "bad feelings" in students. A classroom in which students are bored and, in Kimberly's words "anxious," may lead an at-risk student away from his or her inclination to learn.

Summary And Conclusions

This study examined the impact of active learning on at-risk students attitudes toward science and learning. The results of the interviews and surveys suggest that an eight lesson active learning intervention improved the students' interest in learning science. Although "attitudes" toward learning were not significantly improved per say, the conversations with the children suggest a change in how students felt about the learning process.

These results promote the use of active learning with students at-risk. If exposure to hands-on activities during a two week science unit can improve attitudes toward science, than the possibilities of several years of instruction seem endless. Educators may be able to improve student interest in "low interest" areas with hands-on instruction. It logically follows that if students are more interested in learning, they will feel happier in the classroom. As Brophy (1987) demonstrated, students also work harder when they value their participation. This hopefully will improve their experience in education.

Likewise, if such a short intervention can give students a new perception of their role as active members in the classroom, than the ownership of the process will most likely continue. Jacobs (1989) and Ekstrom et al., (1986) demonstrated that students drop out because school had no meaning in their lives. This study indicates that active learning may help make that connection.

Can active learning take the "risk" away from the at-risk learner? This type of learning cannot remove many of the obstacles that at-risk children face in their daily lives. Active learning can't give food to hungry children or take drugs off of the streets. For some students day to day living is a gamble.

But active learning can help take the gamble out of the classroom. When students are engaged in learning, they are not bystanders watching the roulette wheel decide their fate. They can see that they are not outsiders, but an integral part of the process. This empowerment will help them make a connection with the value of education in their lives. Active learning makes learning "friendlier." If students feel better about learning, they may be more willing to beat the odds. Active learning may not be the cure-all for society's ills, but it can definitely play a role in making every child a winner in the classroom.

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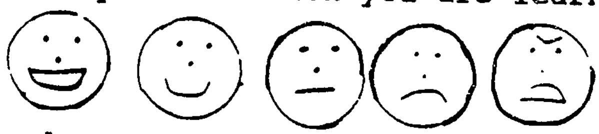
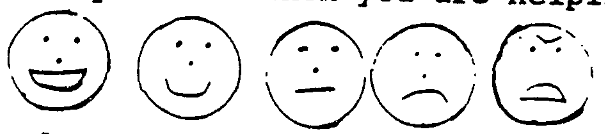
Appendix A

<u>Science and Learning Questionnaire</u>

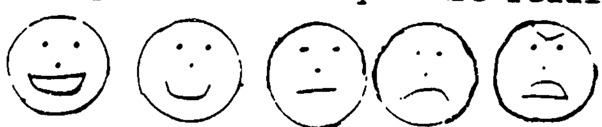
1. How do you feel when you are learning about science?



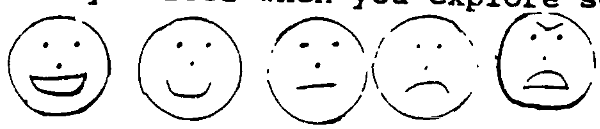
2. How do you feel when you are helping the environment?



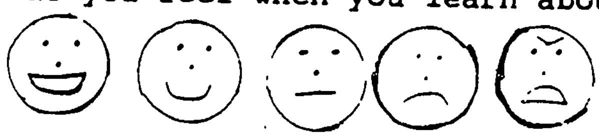
3. How do you feel when you are reading about science?



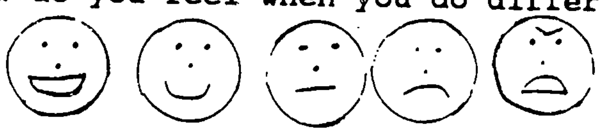
4. How do you feel when you explore science outdoors?



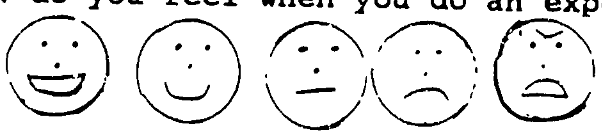
5. How do you feel when you learn about science at home?



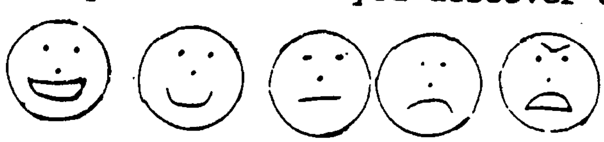
6. How do you feel when you do different activities in science?



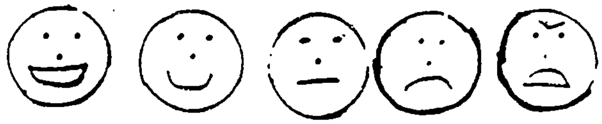
7. How do you feel when you do an experiment?



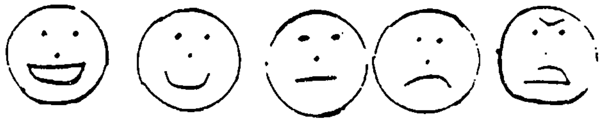
8. How do you feel when you discover a new fact about science?



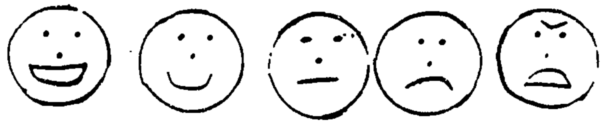
9. How do you feel when you show a friend what you know about science?



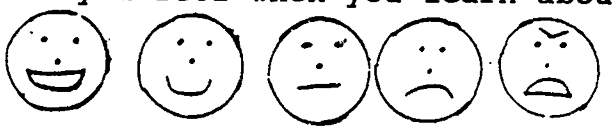
10. How do you feel when you understand what you are learning in science?



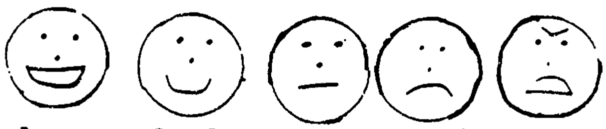
11. How do you feel when you start a new science topic?



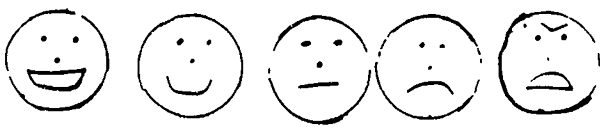
12. How do you feel when you learn about the environment?



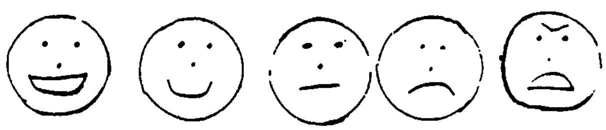
13. How do you feel about spending free time helping the environment?



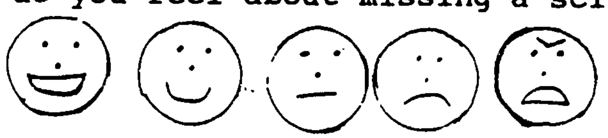
14. How do you feel about spending free time learning about science?



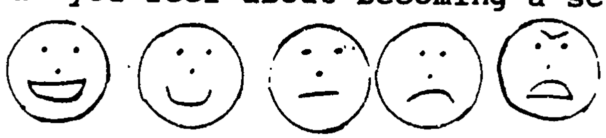
15. How do you feel about talking about science with your friends?



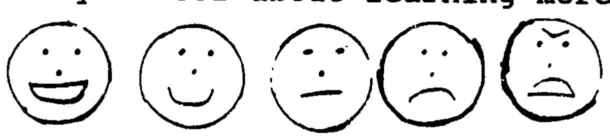
16. How do you feel about missing a science lesson?



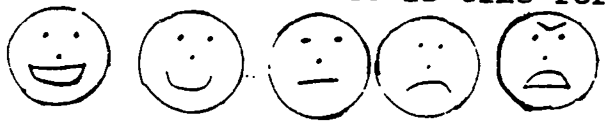
17. How do you feel about becoming a scientist?



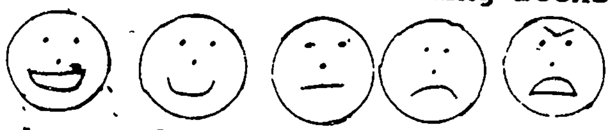
18. How do you feel about learning more information in science?



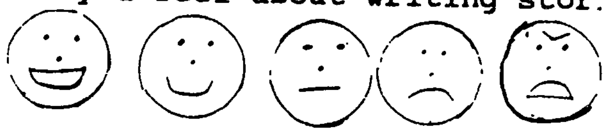
19. How do you feel when it is time for science?



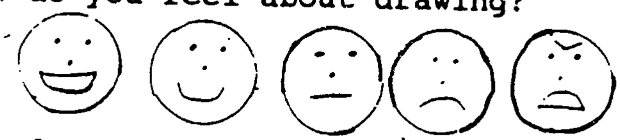
20. How do you feel about reading books?



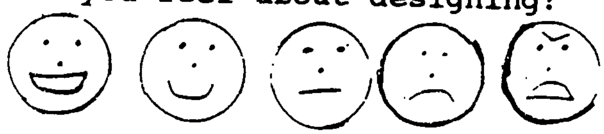
21. How do you feel about writing stor:es?



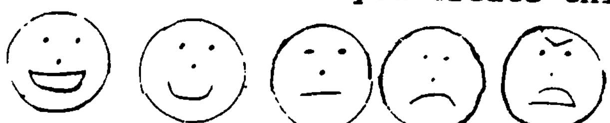
22. How do you feel about drawing?



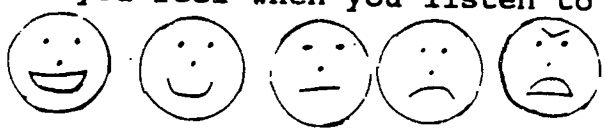
23. How do you feel about designing?



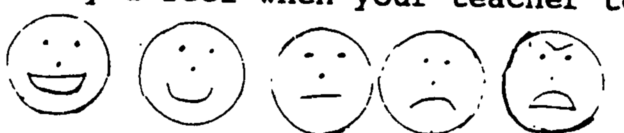
24. How do you feel when you create things?



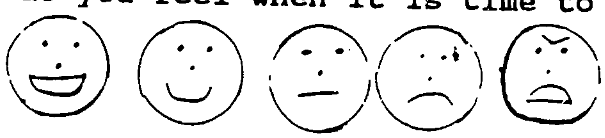
25. How do you feel when you listen to stories?



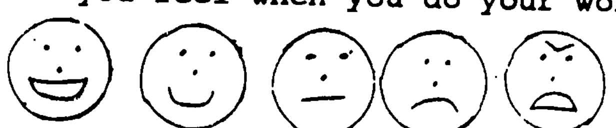
26. How do you feel when your teacher tells you information?



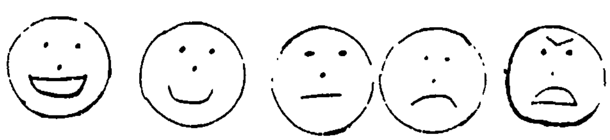
27. How do you feel when it is time to read?



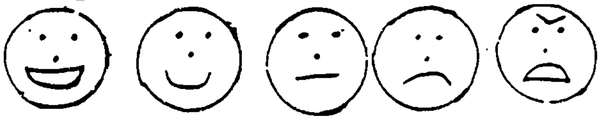
28. How do you feel when you do your work?



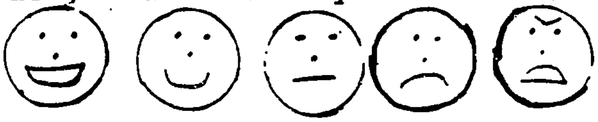
29. How do you feel when you choose what to do with your time?



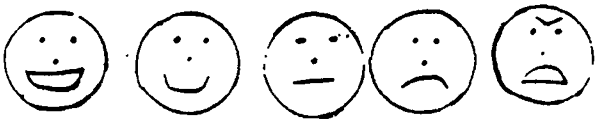
30. How do you feel when you work hard in school?



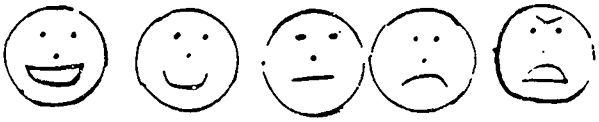
31. How do you feel when you memorize information?



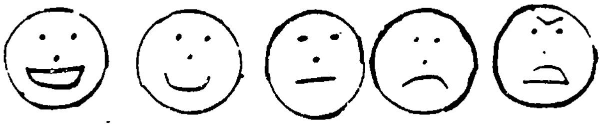
32. How do you feel when you solve problems?



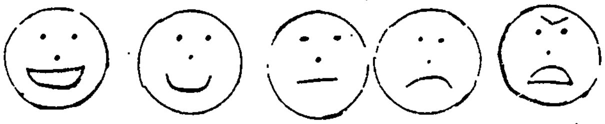
33. How do you feel when you find solutions to problems your life?



34. How do you feel when you come to school?

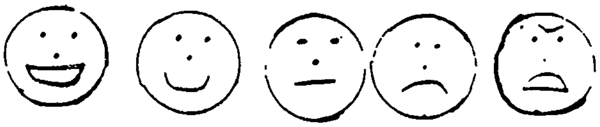


35. How do you feel when you describe objects?

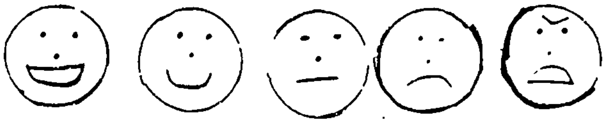


36. How do you feel when you handle objects?

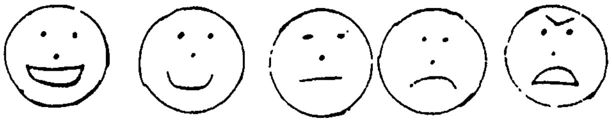
37. How do you feel when you measure objects?



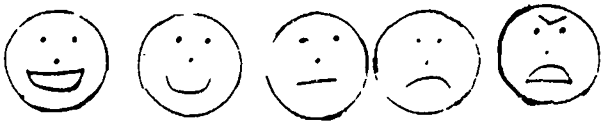
38. How do you feel about learning by touching the object?



39. How do you feel when you learn about something you like?



40. How do you feel when you work with real objects?



Appendix B

INTERVIEW QUESTIONS

Describe "science" to me.

Do you like or dislike science? What do you like or dislike about it?

What would you do to make science "fun"?

Describe "learning" to me.

Do you like or dislike learning? Tell me what do you like or dislike about it?

Do you think that it is possible for learning to be fun?

Can you tell me what would you do to make learning fun?

Suppose you could be a teacher for a day. How would you help your students learn?

Appendix C

INTERVENTION:

OUR EARTH IN DANGER,

AN ACTIVE LEARNING UNIT

Meet the Earth

Objectives: Students will:
1. recognize at least one part of the earth that they care about and describe how it makes them feel,
2. identify at five features of the environment.

Concept Definition:
The environment is made up of air, water, soil, sunlight and living things (plants, animals and people).

Materials:
poster for information, circles, magazines, paper, container of water, soil, bug, plant.

Procedure:
1. Read "Earth Songs". Students will choose an aspect of earth that they care about, and discuss it.
3. Discuss what makes up the environment.
4. Pass around containers of soil, water, bug, etc. Have students discuss what they see.
5. Make Earth collage on one half of circle. Students will put the parts that make up the environment--people, plants, animals, soil, water, air, sunlight.
6. Begin catch the pollution experiment.

Assessment:
Discussion about earth.
Check collage. Should comprise of at least 5 parts of the environment.

The Air We Breathe

Objectives:
Students will:
1. identify two causes of air pollution,
2. demonstrate an understanding of the "before and after" of air pollution
3. describe the appearance of air pollution
4. explain that human action affects the air
5. formulate strategies to help the air

Concept Definition:
Air pollution may be caused in part by the following: factories, burning tires, home fires, car exhausts or fertilizers.

Common effects of air pollution include: illness or death of people, animals and plants; "ugly air" or smog.

Materials:
Wump World, several air pollution pictures, paper, blank tape and recorder, index cards, vaseline, yarn, tape.

Procedure:
1. Talk about air pollution. Show pictures of causes and effects.
2. Read Wump World. Discuss why the Wumps left. Identify the causes.
3. Discuss "Catch the Pollution" experiment. Have students generate ideas about why one card may look different that another. Discuss air pollutants in our area (buses, factories).
4. Discuss solutions. Graph bus riders, car riders and walkers. Discuss cost/benefits of walking vs. car riding. Have students decide ways to cut down on air pollution.

Assessment:
On index card
1. Name two causes of air pollution.
2. Why is air pollution bad? (If prompt is needed--what does pollution do to the air?)

What's Wrong With the Water?

Objectives: Students will:
1. identify two ways water is polluted
2. examine the pollution and describe what can happen
3. explain how it makes them feel

Concept Definition:
Water pollution can be caused by factories, waste, garbage, and oil spills. This pollution takes away the water supply that all of us need to survive, kills animals and plants, and looks ugly.
We can help this problem by picking up trash (and not polluting in the first place) and conserving our use of water.

Materials:
Paper, pond, pictures of water pollution, cooking oil, feather, detergent, glass bowel, water.

Procedure:
1. Have students, use crayons and markers to show the color of water. Discuss the different colors.
2. Brainstorm ways that water gets polluted. Show pictures of pollution and oil spills. Have students describe how they feel when they see it.
6. Oil Spill Experiment--Show how oil spill effects wildlife using cooking oil, rubbing alcohol and a feather (see attached sheet). Discuss and record observations.

Assessment:
1. Have students draw two ways water gets polluted.
2. Record of observation from experiment.

Conserving Water

Objectives: Students will:
1. show an understanding that water is often wasted
2. describe two ways students can help save water at home.

Materials:
Buckets, paper.

Procedure:
1. Have students write all the ways they used water today. We'll add up the total of the class, graph and discuss.
2. Calculate how many gallons of water the class used to take a shower or bath.
3. Experiment--"Catch the drip". Demonstrate how much is lost when students wash hands. Hold bucket under faucet and have each student wash hands. Look at how much water was wasted. How can we save water? Have students describe what they see.
4. Make a "water friendly" poster on a drip made out of construction paper to display in class. Have them pick two ways they can help and draw them on poster for family, school to see.

Assessment:
1. Discussion. Is water wasted?
2. Water friendly poster. Ensure 2 strategies were learned.

On The Land: Too Much Trash

Objectives: Students will be able to:
1. predict how much trash they use in two days and then compare the results,
2. sort garbage into several categories: recyclable (glass, plastic, aluminum) vs. non-recyclable,
3. name and describe the three R's of saving the earth.
4. distinguish the different look and feel of trash and the features of the earth.

Concept Definition:
The three R's of reducing waste are reduce, reuse and recycle.
Glass and aluminum can always be recycled. Plastic recycling is trickier. Soda bottles are made from a plastic that is more easily recycled. Even though some products have the recycle sign, they may not be recycled in the community. Juice boxes, aerosol spray cans, and pure styrofoam cannot be recycled.

Materials:
Recyclable products, cut up trash, original earth collages.

Procedure:
1. Read "Sarah Cynthia Stout Would Not Take The Garbage Out."
2. Have students make their predictions of height and weight for the trash and paper waster over two days.
3. Set up paper recycling box. Talk about trees and paper waste. Impromptu paper experiment--have students throw balled up paper in one pile and flat paper in another at the same time. Which takes up more space?
4. Discuss landfills and the needs to cut down on garbage.
5. Pass around products that can and can't be recycled. Discuss why we still might use a product even if it can't be recycled. Have student generate ideas about the 3 R's.
6. Using an assortment of trash, students will make a trash collage on the other half of their original environment collage. This will produce the effect of a world covered on one half by the beauty of the

environment and covered by trash on the other half. Students will look at the completed collage and discuss what they see and feel.

Assessment:

1. Students will draw a picture of two ways they can cut down on trash.
2. Discussion.

On The Land: Too Much Trash

Objectives: Students will be able to:
1. define "precycling"
2. identify environmentally friendly and "unfriendly" products
3. form strategies to cut down on garbage
4. take action against land pollution
5. sort garbage

Concept Definition:
Precycling means thinking about the environmentally "friendliness" of a product before you buy it.

Materials:
Various products (laundry detergents, peanut butter, Hostess cupcakes, etc.), scale, ruler.

Procedure:
1. Weigh trash can. Measure it. Have students analyze the results along with their predictions. How much garbage do we produce in a day? How much might we produce in a week? month? school year? How much would the entire school produce? Do we produce more trash at school or at home? Defend your answer.
2. Review the three R's--reduce, reuse, recycle.
3. 3 R Relay. Students put hand into bag and grab an item. They must then place it in the bag marked reduce, reuse, recycle or trash. Students must be able to defend their placement.
4. Examine several types of packaging that children use everyday and determine how much of it is necessary. Use a Hostess cupcake container as an example. Show packaging from product that can't be recycled. Take packaging out and throw cupcakes around. Have student volunteer step on cup cake without packaging. Why might children as consumers, continue to buy product that can't be recycled. Explain to students that "precycling" is an individual's personal decision. Many times they will have to weigh the need for packaging versus harm to the environment.
5. Make recycled paper as a group. Assign tasks to students. Have students predict how the paper will look when completed.

Assessment:
1. Relay results
2. Discussion

Endangered Lives: Animals and Trees

Objectives: Students will:
1. identify at least three ways that plant and animal life is being affected by destruction in the rain forest.
2. show an understanding of humankind's effect on living things
3. express the feelings of living things through cartoon drawings.

Materials:
The Great Kapok Tree, cartoon balloons, comic strip example, Kapok tree cutups.

Procedure:
1. Read The Great Kapok Tree. Discuss the rain forest problem. Ask students why the animals are talking in this book. What made the man change his mind? Why do people cut down trees when it causes animals and plants to suffer? Talk about what is linked to one tree's life. Have students put up pictures of the animals impacted by one tree. Then think about the entire forest. Since animals can't speak for themselves, how can we help them?
2. "If Trees Could Talk..." Students will make a cartoon caption of a tree or animal telling humans how they feel about being destroyed and harmed. Students will draw picture along with the caption.

Assessment:
1. Group assessment with discussion.
2. Cartoon captions--how did students react in the role?

Making a Difference

Objectives: Students will be able to:
1. plant a tree with assistance
2. display an understanding for the impact that planting a tree can have on the environment.

Concept Definition:
Several ways a tree can help the environment include giving living things oxygen (therefore cleaning up the air), providing a home for animals, attracting animals to the area, adding beauty to the environment.

Materials:
Loblolly pine tree seeds, paper cups, planting soil, trowels.

Procedure:
1. Have students brainstorm ways that a tree can help our environment.
2. Plant tree. Discuss the type of tree we are planting. Have students talk about tree as we plant. Each student will plant their own tree to take home. Students will draw one way they helped the earth today.

Assessment:
"A tree is nice" activity

Culminating Activity: Triarama

Objectives: Students will:
1. name a source that is ruining the environment
2. identify effects of that source
3. display an action that can change the problem.

Activity Description:
A triarama is a three dimensional mobile that the students construct independently. There are three triangular spaces which may be used for students drawings and ideas.

Procedure:
1. Give the following directions:
   a. Draw picture of a problem in #1. Draw picture of effect in #2. Draw picture of what you can do to stop it in #3.
   b. Fold along lines.
   c. Cut dotted line.
   d. Glue.
   e. Have hole punched.
   f. Get yarn.
2. Monitor student work.

Assessment:
This activity is in itself an assessment of my unit. Students should be able to identify one idea for each section.

For a possible total of six points:
One point for each triangle containing a problem, an effect and a solution.

Table 1

Percentage of Positive Responses Toward Science

	Pre test	Post test
LEARNING ABOUT SCIENCE		
Learn about science	47	84
At home	37	47
Understand science	68	79
Spend free time	37	68
Learn more info about science	68	79
ACTIVE LEARNING AND SCIENCE		
Explore science outdoors	68	63
Do different activities	74	79
Do an experiment	63	74
Discover new fact	68	74
GENERAL INTEREST IN SCIENCE		
Read about science	53	63
Show friend what you know	84	84
Start a new science topic	58	63
Talk about science	68	74
Miss a science lesson *	58	53
Become a scientist	42	53
Time for science	42	79
INTEREST IN THE ENVIRONMENT		
Help the environment	84	79
Help environment in free time	74	68
Learn about the environment	84	79

* A decrease here indicates an increase in positive attitudes.

Table 2

Percentage of Positive Responses Toward Learning

	Pre test	Post test
ACTIVE LEARNING		
Draw	100	95
Design	89	95
Create things	95	89
Choose what to do with time	100	89
Describe objects	68	68
Handle objects	79	84
Measure objects	63	63
Touch the object	84	74
Learn about what you like	89	95
Work with real objects	95	84
TRADITIONAL/PASSIVE LEARNING		
Read books	68	68
Write stories	79	84
Listen to stories	58	90
Teacher tells information	68	79
Time to read	58	58
Memorize information	84	79
SELF ESTEEM		
Do your work	71	89
Work hard in school	89	79
Come to school	68	68
Solve problems in your life	68	79
OTHER		
Solve problems	100	84