QUALITATIVE ASSESSMENT OF CHANGE READY AND CHANGE RESISTANT TEACHERS,

MASTER'S PROJECT

Submitted to the School of Education
University of Dayton, in Partial Fulfillment
of the Requirements for the Degree
Master of Science in Education

by

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CHAPTER I
INTRODUCTION

At the local level as well as on a national level, parents, educators, businesses, government organizations, and scientists are calling for improvement and reorganization of science programs. The Education Commission of the States' Task Force on Education for Economic Growth expressed concern with our country's future ability to compete in the global economy (1988). International tests show the United States is behind other countries in science achievement (The Science Report Card, 1988). In the 1988 Second International Educational Achievement Study science assessment of 17 countries, students in the United States were among the lowest achievers. Substantial reform in science education is needed. The literature supports hands-on experiences as the recommended method for science teaching and learning (Welch, 1984; The Nations Report Card, 1988). In The Science Report Card (1988), the authors note: "In limiting opportunities for true science learning, our nation is producing a generation of students who lack the intellectual skills necessary to assess the validity of evidence or logic or arguments" (p. 20).

Based on many studies and national reform reports, one large urban school district decided to reform its science
The district developed, with the help of a local university, a hands-on science curriculum. This hands-on curriculum is one in which students participate in science through the use of manipulatives and guided inquiry or discovery rather than relying on the rote memorization of facts. The new approach is more student-centered; the old curriculum was more teacher-centered. The new program, now in the pilot phase, is structured to give teachers in selected schools the opportunity to use a hands-on program in their classrooms and to make recommendations and evaluations regarding the units in the science program. Revisions in the units will be based upon teacher input.

In this qualitative research project, the primary research interest of the author is on how teachers respond to the change process in implementing the new hands-on science curriculum. That is, do new programs fail because the disciplinary content is unsatisfactory? Are some teachers more ready for change? Or, do programs fail because they are not properly implemented by teachers who do not understand or appreciate the need for change? Proper implementation of the new science curriculum is strongly dependent on the teachers' response to change. Hall (1987) and his colleagues at the Research and Development Center for Teacher Education at the University of Texas in Austin (R&DCT), researched and studied "how schools might go about the process of changing" (p. 4). In focusing on the change-agent, the
teacher, this study examines the ways teachers deal with and approach the change process. Techniques that are success-oriented in the change process will focus direct attention and add insight and understanding to the teachers' needs. The purpose of this study will be to generate hypotheses and themes for future research on how teachers respond to change.

ASSUMPTIONS

In this study it is assumed that process skills are important to the development of science knowledge in students; that moving beyond fact-oriented approaches in science will allow students to gain necessary science knowledge; and that the current instructional methodology of most elementary science teachers is fact-oriented and textbook-driven.

LIMITATIONS

The focus of this study is on urban schools and as such the findings can only be applied to that population. Generalizing to other settings is inappropriate. Another limitation is the limited science background of the researcher. Although she has a tremendous amount of classroom experience, she has not received any advanced training in science education.

DEFINITIONS

Hands-on: The term "hands-on" in the new science curriculum is
defined as the approach in which students participate in science through the use of manipulatives. This approach is more student-centered.

Unit Approach: The unit approach to teaching in the new science curriculum means that a topic in science is studied in depth for an extended period of time (suggested 9 weeks).
CHAPTER II
REVIEW OF RELATED LITERATURE

Three areas of research were reviewed relative to this study. They included: 1) research showing the need for improvement and reform in science programs; 2) research supporting hands-on experiences as the recommended method of instruction and learning in science; and 3) research focusing on teachers and their response to change.

Improvement and Reform in Science

Considerable research indicates a lack of preparation of students as well as of teachers in science, and the need for reform in science programs: "Alarming numbers of young Americans are ill-equipped to work in, contribute to, profit from and enjoy our increasingly technological society" (National Science Board Commission on Precollege Education in Mathematics, Science, and Technology, 1983, p.5). National and international findings on science achievement of American students are not encouraging ("A Summary of Research in Science Education - 1984"). These studies show that students in the United States are scoring below other industrialized nations in science. In the 1988 Second
International Educational Achievement Study science assessment of 17 countries, students in the United States were among the lowest achievers. *The Science Report Card* (1988) cites many national reports in the 1980’s calling for greater change and improvement in science education. However, thus far response to the reform calls has failed to increase science proficiency in the United States.

Various studies indicate science teachers are inadequately prepared to teach science (Jones, 1989: Rutherford, 1985). The Committee on Research in Mathematics, Science and Technology Education (1987) recommends improvements in teacher education especially with regard to math and science instruction. Jones (1989) states, "The National Science Foundation, private foundations, and universities should strive to support improvements in teacher education for mathematics and science" (p.335). Another study by the National Science Foundation (1978) found that most elementary science teachers had neither a strong interest in nor understanding of salient science concepts. Jones (1989) recommends an increase in academic preparations and in-service training for teachers in science. Rutherford (1987) calls for national dedication to the advancement of science education.

Vast amounts of literature and research are calling for reform in the science curriculum: "Evidence from NAEP and other sources indicates that both the content and structure of our
school science curricula are generally incongruent with the ideals of the scientific enterprise" (The Science Report Card Interpretive Overview, 1988, p. 20). The National Science Board Commission (1983) calls for revision of science curriculum to meet concrete objectives, with such revision allowing for enhanced levels of problem solving and critical thinking. Rutherford (1987) recommends having an independent organization define national standards in science education. This recommendation is also supported by the National Science Board Commission (1983).

Research Supporting Hands-on Experiences

The use of a hands-on science program is widely supported in the literature. Welch (1984) maintains that hands-on and laboratory experiences should be a central component in science teaching. The Nation's Report Card (1988) suggests there are positive associations between hands-on science activities in the classroom and science proficiency. The report further suggested that students should measure, experiment, and communicate with one another in order for students to gain an understanding of natural events: "The most effective learners are those who are actively engaged in the learning process and accept responsibility for their own learning" (p. 15).

Anderson and Roth (1989) suggest an approach to teaching science that stresses teaching depth of material rather than
focusing on the breadth of amount of material covered. The focus is on "producing conceptual change." In this conceptual change approach, the emphasis is on "a curricular commitment to teaching limited content for understanding rather than covering a wide range of content superficially, and recognition that teaching for conceptual change is a complicated process involving an array of teaching strategies that can be used flexibly in response to students needs" (p. 460). Anderson and Roth further suggest science at the elementary level should have students learning to think like scientists, ask questions, form theories, test hypotheses, observe results, and draw conclusions.

In "A Summary of Research in Science Education - 1984" various studies involving student hands-on, activity-based science programs are reviewed in a positive light. For example, Lawson, Costenson, and Cisneros (1984), state "study after study during the past several years has found hands-on activity-based 'inquiry' instruction far superior to lecture-based, fact laden expository instruction for practically every positive benefit to students imaginable" (p. 191).

In summary, the literature and research on hands-on activities and its implications for science curriculum and instruction strongly suggest that active participation in science programs provides opportunities for students to develop a better understanding of essential concepts, to interpret data, and to reason, problem solve, and engage in decision making skills. It
also enables students to function successfully in the classroom and in other settings.

The Change Process

Research and the extant science education literature recognizes the importance of the teacher in the process of change. In addition, teacher training is documented as fundamental to the change process in school programs.

Hall (1987) and his colleagues focused on how change in education could be successful. In their book *Taking Charge of Change*, Hall et al. (1987) state that there must be "direct attention to the needs of the people who must change" (p. 5). Their studies suggest that training is always needed for teachers to understand clearly how to use new materials. Training must be an ongoing process to facilitate teacher development. The team at R&DCT verified a number of assumptions about change that were the basis for the Concerns-Based Adoption Model (CBAM) they developed. These assumptions include:

1) Change is a process, not an event. Recognition of this is an essential prerequisite of successful implementation of change.
2) Change is accomplished by individuals. Individuals must be the focus of attention in implementing a new program.
3) Change is a highly personal experience. Paying attention to each individual's progress can enhance the improvement process.
4) Change involves developmental growth.
5) Change is best understood in operational terms. Teachers, and others, will naturally relate to change or improvement in terms of what it will mean to them or how it will affect their current classroom practice.
6) The focus of facilitation should be on individuals,
innovations, and the context. We tend to see school improvement in terms of a new curriculum, a new program or package - something concrete that we can hold onto. But in doing so, we forget that books and materials and equipment alone do not make change; only people can make change by altering their behavior. The real meaning of any change lies in its human, not its material component. (p. 5-6)

The CBAM views the teacher as the focal point of change.

In implementing new programs, Achieving Excellence (1990) maintains that changing beliefs about change influence the nature of change. Teachers can either support or inhibit change. New programs fail because of teachers' beliefs, not because of the demands of academic content. Individually, each teacher determines whether change will occur. A common fault of educational change is "the underestimation of teacher training needs" (p. 12). Assuming "things automatically will be the same in the future as they were in the past, that everyone is basically the same and wants the same things, and that people make decisions in a totally rational manner" (p. 9) leads to failed implementation of programs.

Another perspective on change is provided by Covey (1989). In his book, The Seven Habits of Highly Effective People, Covey presents lessons on personal change. Covey writes, "the way we see the problem is the problem" (p. 40). Changing starts from within a person, "with your paradigms, your character and your motives" (p. 43). Change for some is a painful process and "no one can persuade another to change. Each of us guards a gate of
change that can only be opened from the inside" (p. 61). The principles explained in Covey's book look closely at a person's habits, defined as the intersection of knowledge, skill, and desire. People who are effective are willing to "open the gate of change" and develop on a continuum from dependence to independence to interdependence. Covey writes . . . "dependence is the paradigm of you--you take care of me; you come through for me; I blame you for the results. Independence is the paradigm of I--I can do it; I am responsible; I can choose. Interdependence is the paradigm of we--we can do it; we can cooperate; we can combine our talents and abilities and create something greater together" (p. 49).

The literature relating to change indicates that the focus of change is individual; teacher training is necessary for real program change. Teachers are the focal point of change; they are at the heart of implementing a program. Training enhances change and provides a greater understanding of new materials. For productive change, direct concentration must be on the individual, in this case the teacher, who implements the educational process.

This study will generate hypotheses for future empirical study and derive themes for future researchers to examine on how teachers respond to change, primarily with regard to teachers who have had and have not had training in new hands-on programs in science. The author will generate the hypotheses by observing,
interviewing, and collecting data from two teachers who were purposely selected for participation in the study. Specifically, both are experienced Elementary School Teachers in two different urban schools; one is a male teacher, one is female; one is teaching in a departmentalized setting, one in a self-contained setting; and one has been trained in the new curriculum, and one has not been trained. Most importantly, one teacher was identified as "change ready"; the other teacher was viewed as more "change resistant". That is, one teacher had been substantially involved in training for the new science curriculum.
CHAPTER III
METHODOLOGY

During the 1992-93 school year, I observed, interviewed and collected data from these two elementary school teachers. In the interview, I asked the teachers questions about science instruction. (See Appendix A.) I also observed the teachers, teaching the new hands-on science program in their classes. And third, I asked the teachers to provide information relative to the science lesson that they were teaching. They recorded this information in a science log. (See Appendix B.) Using these three methods to triangulate the data, I found a distinct difference in the way the hands-on program was accepted and implemented. One teacher was "ready" to accept and teach the new program (change ready); the second teacher was "resistant" to the change process (change resistant).

Subject Selection

When a large urban school district decided to reform its science curriculum, a local university developed an instrument to assess the attitudes of teachers and administrators. The instrument consisted of three different types of items: demographics, beliefs, and perceptions. The researchers formulated two groups to depict the different viewpoints. One
item examined whether the quality of the school district's science education program measures up to the knowledge, skills, and attitudes needed in today's society. The teachers who responded "yes" were considered to be satisfied and were assumed less willing or ready to change and identified as "change resistant." The teachers answering "no" were judged to be dissatisfied and more likely to adopt changes in the curriculum; they were labeled "change ready." The teachers used in this study were selected by the university because of their known and expressed support for, or opposition to change efforts in the new hands-on science curriculum.

The "change ready" group indicated that the science curriculum "fails to measure up" in today's society. They wanted a new approach to teaching science. One change ready teacher, Nancy Miller was selected for study based on the recommendations of several different individuals who had developed the new science kits.

The "change resistant" group was supportive of the current science curriculum. The vast majority of the change resistant group felt the teachers in the district already use "critical thinking" in helping students learn science concepts. For them, a new approach to teaching science was just not justified. Teachers who feel that the current amount and quality of science being taught is satisfactory are less willing to change; they are change resistors. One teacher, Frank Johnson who was selected
for further study was identified as change resistant on the recommendations of persons who developed the district’s science kits.

Case Study 1: Nancy Miller

One elementary school I observed was Rosewood Elementary, a K through 6th grade school in a large urban school district. It is located in the western part of a large midwestern city in a neighborhood which has a mixture of business, industry, and residential homes and apartments. Even though the school is located in an urban area, the school is located on a large piece of land which gives it a sense of openness similar to that of a typical suburban school. Rosewood Elementary is an Environmental and Science Magnet School. Parents in this urban district select the school(s) their children will attend. Students who attend come from all areas of the city providing a racial population mix of students.

There are approximately 360 students attending the school. Some of the classes are self-contained and some are taught using team teaching methods. The sixth grade class I observed was self-contained. Nancy Miller’s sixth grade class has 25 students. Nancy is an experienced teacher with 12 years of teaching experience; she is "ready" for change in the science program. She is single and focuses much of her energy on her teaching.
The first time I visited Nancy’s classroom, the students' desks were grouped together. Colorful bulletin boards of the solar system decorated the walls, displays were on tables, student work was hanging from the ceilings, various live animals (including a dog) roamed the room, and literature and reference books were everywhere. On each visit, desks were arranged in different groupings and the room was filled top to bottom with displays and samples for the students to see and use.

During the first visit, I interviewed Nancy with set structured questions concerning science and the new science curriculum. (See Appendix A). When I asked, "What do you think a good science teacher does with kids to help them learn science?," she replied, "I think that instead of just presenting material, that the kids are able to use the material immediately." As I visited Nancy’s class, I saw her students engage in hands-on learning. Hands-on activity is Nancy’s approach to teaching science.

Nancy loves teaching science; it shows in her classroom, her views of science, and in her teaching. The excitement she creates is contagious. She attended two different NSF seminars during the summer of 1992 and learned a variety of techniques for teaching hands-on science. She is comfortable with an activity based curriculum.

In one observation, Nancy was presenting material on mollusks. Nancy, set up the safety rules for dissecting and
listed them on the board. She invited student participation instead of telling students what they needed to know. In this observation and others it is evident that Nancy uses this technique to help the students think for themselves as well as to keep the students interested and involved in the lesson. Students often generate definitions and examples. The following data were taken from the researcher’s field notes.

Nancy asks students, "What is the definition of a mollusk?" After a student tells what a mollusk is, Nancy asks students for examples. Another student provides examples. In addition to verbally presenting material, Nancy writes important points on the board and also has a wide variety of books, posters, and examples around the room. Actual examples are passed around the room while Nancy continues her lesson.

When Nancy asks students to define "univalve" and "bivalve," she helps them to really understand the concepts by pulling the words apart. "What does 'uno' mean in Spanish?" Many students verbally respond "one." "So, what would univalve mean?" One student responds, "one valve." Then Nancy asked what "valve" means. The students were able to identify that it means "shell." (Field notes, 12-10-93.)

Nancy is quite confident with the content she teaches. Students feel comfortable asking questions, and Nancy is just as
comfortable exploring their ideas and questions. She has a lot of hands-on materials to show the students. The students can see what she is talking about. Once again, field notes reveal Nancy’s commitment to high student participation.

Nancy consciously calls on lots of different students. At one point she asked a question and said, "I want to call on someone different. Who hasn’t responded thus far?" She also calls on some non-volunteers. Nancy has a very exciting, positive style, which makes students want to learn. The students are very attentive and interested in learning and really pay attention. (Field notes 12-10-92.)

Even though Nancy gives the students a lot of freedom in the classroom and the students respond spontaneously, Nancy’s class management is excellent. When someone starts talking while another student is talking, Nancy stops and politely requests that all students be respectful. She also has a real ability to create a sense of excitement by fostering anticipation. The following example is from the same lesson.

Each of the students was given a clam, which was still alive. Nancy tells the students that if they are very still, the clam will feel safe, and open up. Many of the students put their clams in the middle of their desks. After a couple of minutes several of the clams start to open. There is lots of excitement as students rush over to look. Nancy indicates that the only way to open a clam
shell is to steam it, or to have a special tool. Nancy collects the clams and puts them in a boiling pot in the back of the room to steam. She distributes pieces of paper and asks everyone to diagram a clam on the paper. Nancy goes over the different parts of the clam they will be looking for and uses the board to write down these parts. After the clams are steamed, she distributes the open shells to the students. She asks the students, "How can you tell if a clam is dead?" The students respond almost in unison, "If the shell is open." Before handing out the scalpel and magnifying glass, Nancy asks students the safety rules. Students respond by repeating the safety rules Nancy had stated at the beginning of the lesson. Nancy hands out a scalpel and magnifying glass and reminds students that they need to be responsible. Groups of four are formed and told to do the dissecting as a group. As the students dissect, Nancy moves around the room asking questions and students freely respond. Students talk among themselves looking at each others' clams as they dissect. Nancy allows students the freedom to talk and work together. I can hear students asking each other questions like, "Is this the heart?," and "Did you find the foot?" In this lesson and others I observed that cooperative learning is a major part of Nancy's science lessons. While students are working, a squid, crayfish, crab, and mussels
are passed around the room. As they are being passed around, Nancy continues to talk to the class about mollusks. A girl goes over and gets an encyclopedia off the shelf to look up something Nancy is talking about. She finds what she wants and shares this with a neighbor and then shows Nancy what she found in the encyclopedia. (Field notes 12-10-92.)

Despite the fact that Nancy’s lesson lasted an hour and a half, the students were so involved in the experience they did not have any problems with behavior. Few management problems occurred.

Nancy’s Science Log lessons are filled with student-centered activities; the students "do" science. Nancy has science every day of the week and sometimes twice a day. Lessons outline cooperative learning groups, student participation and discussion, and hands-on activities for each lesson. Instead of a teacher-centered class, Nancy serves as facilitator of science learning in a student-centered class. Nancy’s teaching is a reflection of her belief that students need to be actively participating in science.

In my interview with her, Nancy explains her thoughts on the old and new science curriculum:

"As far as following the curriculum with a textbook, I have never been one to do that. I think there are too many other essential resources that we can use to get
excitement. I don't think it's a bad idea to use a book for guidelines. If a book is taken verbatim every single day, I think that defeats the purpose of having the kids wanting to explore." (Interview, 10-6-92.)

Nancy is very comfortable with the new hands-on science curriculum. Moving away from the textbook is something Nancy feels comfortable with because for her, science is not something you read about, it is something you do.

Case Study 2: Frank Johnson

Townview is a K through 6th grade school located in the northern section of the city in a residential neighborhood. The enrollment is around 600 students. Townview is a Science and Math Magnet School. Parents choose what school they want their children to attend. The majority of students at Townview Elementary are from the immediate vicinity; however, there are students attending from all areas of the city. There is a racial mix of students attending Townview. Frank Johnson is an experienced teacher with 14 years of teaching experience. The fifth grade classes I observed are departmentalized, with three fifth grade classes. Frank teaches science, social studies, and health. A second teacher teaches math and spelling, and the third teacher teaches reading and English. Frank is a teacher "resistant" to change relative to the science program. Frank is married and has one child of his own. He loves to play tennis
and has a lot of tennis memorabilia in the classroom.

Frank's classroom was neatly organized with desks in rows, with his desk and lectern at the front of the room. Frank teaches almost exclusively by lecturing; the class is very teacher-centered with Frank telling the students what they need to know.

Frank is very much in control of the classroom, and the students behave accordingly. For example, students are not allowed out of their seats to sharpen their pencils or to get a tissue without Frank's permission. If a student needs to sharpen a pencil, the student has been told to raise his or her pencil in the air. Frank then acknowledges the student and allows him or her to go to the pencil sharpener. Students are not to answer a question until they have been called on by Frank. Frank asks students to do something once. If they do not do it the first time he asks, they are then verbally reprimanded.

From the first interview, in observations, and in the Science Logs, Frank shared concerns about the new science program. He indicated that he has limited science background knowledge. One suggestion made to fully implement the program was to have a science specialist to teach science. Frank indicated that teachers are "not prepared for it (teaching science) and unwilling to do it in general. So instead of taking a group of unprepared, unwilling individuals to do a task they don't want to do anyway, get that one person who wants to do it."
(Interview 10-6-92.)

Frank very candidly talked about his frustrations with the science units. The new science teacher manuals were very difficult to decipher. He indicated that connecting the hands-on materials with the content as specified in the units is very complicated. In his Science Log he wrote comments concerning the science program including the fact the materials were "much too difficult for students," "not a good experiment," and "these units need to be rewritten before they are ready to pilot, let alone teach." In January, on the back of one of the science logs, Frank wrote: "These work sheets have nothing to do with page 4 from Unit. The answers to these work sheets are NOT found anywhere in a 'lesson' to be presented to the class. This is the worst teacher's manual I have ever seen!"

Frank viewed science as "at least as important as the other non-important subjects." For Frank, reading and math were most important; English was next. Science was just not as important as English and math. For example students are not taken out of the classroom for special activities (such as band) during reading and math, but they are taken out during science or social studies. Frank stated, "I almost never have a full class of kids in front of me." Frank explained that if children miss lessons on amphibians, they can go on to the next unit on reptiles and learn about reptiles without knowing anything about amphibians. But in math, students need to build on previous
concepts to acquire new and higher level concepts. In this aspect, Frank believes that science is not as important as reading and math. The following is a description of one science lesson in Frank’s room.

The desks had been moved from the usual rows to desks in groups. Frank’s presentation is on the relative hardness of rocks. Frank thoroughly goes over the lesson and the work the students are to complete. After he has extensively gone over safety rules and given instructions on how students should work together, the students begin working independently to classify the rocks. Frank walks around the room, responding to students’ questions. Frank clearly has a lot of energy in teaching his lessons and he maintains control of the class. The lesson calls for students to bring rocks of their own; however, Frank decided he would use rocks that he wanted them to test. He indicated he did not know how to identify all the rocks himself and that students would probably forget to bring in the rocks. Further, he had concern with what might happen if kids were walking around with rocks in their pockets. The class and Frank have not had many experiences in working cooperatively, and the students lack knowledge of how to work together as a group. Frank constantly interrupts the groups with comments on their work. (Field notes, 11-24-92.)
In an interview with Frank, he indicated that he tries to teach science two times a week. On one observation day, Frank indicated that he was putting off teaching science. If there is an assembly (or whatever) interfering with a daily lesson, he skips the science lesson. He also indicated this on one of the Science Logs. He wrote that he "put off" teaching science and is "not sure if it is due to the new program or not." He realizes that he is not teaching science as much as he should. On another observation day, Frank indicated he felt that the new science program is "worthless," "frustrating," "cumbersome," and "doesn’t correspond with anything." He asserts that other teachers are not doing it (teaching the new science program). Frank continues, "if it were flammable, I think I’d throw in a match." Just before one observation Frank indicated that he was frustrated with the content and structure of one science unit. There are things (science concepts) in the unit he has never heard of. He says he is "clueless if I am teaching this correctly. It’s bad," he says. "There is no cohesiveness to it."

The lesson that day on faults and plates reveals Frank’s insecurity with the new science program.

In the middle of going over a work sheet with the students, Frank states (loudly), "What is the answer to #5? I hate to be fooled. . . I hate people who are smarter than me, that’s why I hate this stupid manual. I have read it 12
times and still don’t understand it. We will go over this
second page, I don’t understand it, so I will have to
believe what the book says, but I don’t know why." Frank
is clearly frustrated and upset. As the lesson continues
Frank talks to me from across the room and says, "Do you
know these terms? This doesn’t deal with anything else."
Then after the work pages are completed, Frank asks if I
would like to go to the computer lab with his class. The
class goes down to the computer lab where Frank starts
students on a program about earthquakes. Frank is
obviously proud of the computer lab. He shows me the
program on earthquakes; he tells me about the lab, which
he is in charge of, and describes what his responsibilities
entail. Frank is almost a different teacher in the
computer lab. He raves about the positive things that can
be accomplished with computers, individualization, enhanced
learning, increased interest, and so on. "This is what
students need to be doing in this unit." We stay for
thirty minutes while students work at their own pace
through the program. (Field notes 1-12-93.)

Working with computers and in the computer lab is something
Frank has extensive background knowledge about and interest in.
He wanted to teach what was familiar, not develop a new expertise
in science.

There are indeed differences in the goals pursued and
results achieved between Frank’s and Nancy’s teaching styles. Nancy Miller accepts and implements the new hands-on program in a positive and confident style. The new science program affirms her own beliefs about how students should learn science: students should learn science by *doing* science. The NFS seminars Nancy took during the summer had given her the additional content knowledge needed to fully implement the new science program.

By contrast, Frank Johnson is not convinced that the new hands-on science program is necessary. He realizes he does not have the content knowledge in science to be teaching the new hands-on science program. Frank also realizes the much time and effort is needed to implement the new hands-on science program. With personal and family commitments, the new science program is just not a high priority for Frank. Frank is reluctant to take the training classes and to spend the additional preparation time necessary to teach the new hands-on science program.
CHAPTER IV
SUMMARY AND RECOMMENDATIONS

New programs are implemented in schools around the country each year. School systems must decide when and how to develop and implement new programs. However, many times school systems overlook one vital component in implementing new programs, the teacher. The teacher’s attitude and perception about the need for change is an integral component to the success of any new program. The change process must occur within the individual, but some teachers do not recognize the need for change. Activating change within teachers is a challenge which facilitators need to focus on when they are attempting to introduce new programs in the teaching of science. Providing training in the new program is instrumental to implementing a new program.

A large urban school district recognized the need for reform in the science curriculum. With the help of a local university, a hands-on science program and training programs were developed. This researcher observed, collected data, and interviewed two teachers who were identified as either "change ready" or "change resistant." The teachers were identified as such by faculty at
the University. Based on the collected data, several distinctly different characteristics were apparent between the "change ready" and the "change resistant" teachers.

One of the most visible characteristics of a "change ready" classroom teacher is emphasis on student-centeredness. The change ready teacher uses many cooperative learning techniques to foster student interaction. Students are encouraged to work together and to ask other students for help in solving a problem. When giving instructions, a student-centered teacher asks students to share with others and help each other. Students are given freedom to seek out answers from encyclopedias, literature, and displays. Student-centered classroom teachers consciously call on different students, both volunteers and non-volunteers, and in turn students feel comfortable in student-centered classrooms, freely ask questions and offer their own opinions and thoughts. The atmosphere in a student-centered classroom is conducive to learning. Students want to learn; they want to discover; they want to do science. Students are actively involved in the use of manipulatives in science during each lesson.

Another quality that was evident in the "change ready" teacher is that teachers' possession of content knowledge in science. Change ready teachers are comfortable with new material. The change ready teacher in this study had taken two NSF classes offered during summer terms. Change ready teachers
have the content knowledge which enables them to be more effective with students. With the experiences gained in the training session, they are able to use the appropriate manuals and materials with ease. They exhibit confidence in their knowledge of science and are able to entice and excite students with new hands-on programs.

"Change ready" teachers also recognize the need for change. The change ready teacher in this study did not believe that the current science curriculum was meeting the needs of students. She believed students should be learning science by doing science. She realized that there are numerous resources, besides the text, that can and should be used when teaching science. Change ready teachers are comfortable moving away from the text. They view new hands-on science programs as another opportunity to improve student understanding and comprehension of science knowledge and to enable students to achieve the skills to live successful lives in the rapidly changing society.

By contrast, a characteristic which was most evident in the "change resistant" teacher was his teaching style. The change resistant teacher's class was extremely teacher-centered. His lessons were basically lecture-oriented. He lectured, the students listened; he asked questions, the students answered. The students did in class exactly what they were told to do. The change resistant teacher was always in control of the classroom. The students' desks were in rows, always very neat and organized.
The teacher's desk and lectern were at the front of the class. Even when the change resistant teacher tried a cooperative learning situation, it was not actually cooperative learning. The students and the teacher did not have much experience with this style of learning.

Another characteristic of "change resistant" teachers was evident in his lack of science background knowledge. The change resistant teacher in this study did not feel he had the proper training to teach the new science curriculum. Because he had not taken the training classes, he continually confronted frustrating situations. During my observations of, and my interviews with this teacher, and also in his own science log, this change resistant teacher expressed concerns about the hands-on program.

The "change resistant" teacher viewed the science program as relatively unimportant compared with reading, math or even English. This change resistant teacher found himself skipping the science lesson if something else came up in his schedule.

The differences between the change ready and change resistant teacher are apparent. Acknowledgement of need to change the science curriculum and the willingness to take training classes are two key factors for the proper facilitation of any new program. For the change resistant teachers who do not believe a change is needed, the new programs will not be taught in a manner that will be effective and beneficial to students.

Based on this study, it is critical that a curriculum
planner must understand change occurs in the individual. It is recommended that the first step in successfully implementing a new program is to identify what the teachers' attitudes and views are toward a new program. The focus of change is the teacher. The teachers need to be part of the process; their needs and concerns must be addressed. Change does not occur with the new program; successful change centers foremost on change of individual teacher change. Focusing attention to the needs and beliefs of teachers will assist curriculum planners in readying teachers for change. Teachers must view the change as needed before they can successfully implement a new hands-on science program. Teacher training is indispensable in that such training gives the teachers the content based knowledge essential for teaching new programs. Teachers with proper training are more confident, willing to change, feel comfortable with their knowledge base, and have a clearer understanding for the need to change. This confidence is reflected in their teaching.

This study shows that several additional investigations of change ready and change resistant teachers are needed. The following questions could form the basis for such investigations:

1. Are male teachers more prone to be change resistant than female teachers?

2. Do teachers who are single evidence a greater willingness to change than teachers who are married?

3. Are older teachers more likely to be resistant to change
than younger teachers?

4. Would teachers who have taken additional graduate level classes be more ready to change than teachers who have not taken graduate courses?
Appendix A
STRUCTURED INTERVIEW QUESTIONS

1. How important do you think science is in the school curriculum?

2. What do you think a good science teacher does with the kids to help them learn science?

3. How good a teacher do you think you are? Why? What do you do?

4. What is your opinion of the science curriculum?

5. What do you think about the new science curriculum?

6. What else do you think you need to fully implement the new science curriculum?
Interview with Nancy Miller
10-6-92

Q. How important do you think science is in the school curriculum?

A. I think that science is something that can’t be taught like math. I think that it is something that kids can learn the basics and take home and learn immediately and don’t have to wait for the results.

Q. What do you think a good science teacher does with kids to help them learn science?

A. I think that a good science teacher would probably qualify as a person who is excited about science. I think that instead of just presenting material, that the kids are able to use the material immediately. For example; if a person is excited about what a rock is, they are able to go out and see the rock and even like an artifact, they can see what they are and be able to touch them. For example, something I did last year. We were able to study marine biology and the kids were able to be close to the various animals in the water. I went and purchased some octopi and we dissected them and then afterwards, after the kids were able to do all the experimenting they wanted, they were able to cook and eat it.

Q. So are a lot of things you do in science, instead of just taking it out of the book, trying to bring it into real life for them so they can experience day-to-day?

A. Yes

Q. How good of a teacher do you think you are?

A. I think I’m a very good teacher. I think we all have our days when we question if what we are doing is for the best for the children. But, I really think that deep down I am. I don’t just teach to be teaching. I teach so that they enjoy learning. I do a variety of activities that they incorporate and get excited about and hopefully carry on for their adult years. For example, with science or social studies they can take it to another country and they can explore.

Q. What is your opinion of the science curriculum?

A. As far as following the curriculum with a textbook, I have never been one to do that. I think there are too many other
essential resources that we can use to get excitement. However, I don’t think it’s a bad idea to use a book for guidelines. If a book is taken verbatim every single day, I think that defeats the purpose of having the kids wanting to explore.

Q. What do you think about the new science curriculum?

A. I think the new science curriculum is an excellent opportunity for teachers who are afraid to do things in science without having to feel threatened. However, I still think that some teacher, if something is new to them and they haven’t had the background preparation such as a workshop, are still apprehensive about starting that unit. It’s kind of interesting to see, now that we have these materials, that the teachers are feeling forced to do it and it makes them teach something new.

Q. Do you feel forced to do it?

A. I don’t feel forced because I like science. I think now that we don’t have that one textbook to use as our bible anymore, it takes away the security from some people.

Q. Do you have a science textbook now?

A. Yes

Q. Are you going to be moving away from the textbook?

A. In my opinion, I think that’s what the new science curriculum is. From my understanding, they feel (whoever they is) that the textbook is too vague and it’s not interesting and I agree. However, I still think that it’s a good book and has a lot of good pictures that we can run off on the copier. There are still a lot of cute little ideas that the kids can use. I think that it’s a good program, but being in its new stage, you still have a lot of apprehension and a lot of fear.

Q. What else do you think you need to fully implement the new science curriculum?

A. Well, (I took two classes this summer), and I don’t think that two is going to fully be able to teach the history or whatever behind the science. For example; there are some things that the third graders have been doing that I think my sixth graders could really benefit from. I would like to have the opportunity to take the classes that they are
taking to see where they are coming from and, maybe, the areas that they didn’t cover I can still cover that or expand upon it.

Q. OK, so some of the classes were set up for sixth grade and some for third grade?

A. Yes, but you can see why it would help to take what was offered to the third grade or fourth grade so that you could go more across the board with science.

Q. Is the new science curriculum set up so that you’re going to teach solar system in the sixth grade. For example, rocks in the fifth grade so that it’s not overlapping over the years?

A. I don’t see it as being overlapping as much as I think we’re so sectionalized now. Where if fifth grade only gets to do it so that kind of takes it away from the sixth grade. I think we should still be able to take little bits and pieces of the different grades.

Q. You think that would be beneficial to the kids to be doing those activities at the different grade levels?

A. Definitely.

I really appreciate your help.
Appendix B

Science Log

We are asking your assistance in monitoring the types of activities and amount of time committed to science in your classroom. Specifically on the next pages we would like for you to provide information relative to the following:

LESSON: Describe in one or two sentences the topic of the lesson you taught in science.

DAY/TIME: Indicate the date (e.g. October 5, 1992) and the exact starting and ending time of the lesson (e.g. 10:05-10:40 am).

ASSIGNMENT: Briefly describe what type of lesson you taught in science. For example, did you lecture, provide students with reading material, or have the students collect some type of data? Be as specific as possible. Include written assignment or reading work you provided and place a copy of the work or handout in the Science Folder that is provided.

If you have any questions, feel free to call either Dr. Thomas Lasley (229-3327), or Becky Ditmer (748-1984).
<table>
<thead>
<tr>
<th>LESSON</th>
<th>DAY/TIME</th>
<th>ASSIGNMENT</th>
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<tbody>
<tr>
<td>Sample: Concept of rocks.</td>
<td>September 28, 1992 10:30-11:10</td>
<td>Students read pp. 34-36 of text. I showed students different igneous rock samples. Students discussed how igneous rocks are formed.</td>
</tr>
<tr>
<td>LESSON 1</td>
<td>Oct. 6, 1992 8:00-8:25 am 9:15-9:40 am</td>
<td>Open discussion with overhead notes from Solar System Unit. Use page 51 to classify information.</td>
</tr>
<tr>
<td>LESSON 2</td>
<td>Oct. 7, 1992 8:00-8:25 am</td>
<td>Use of overhead transparency to show planets order. Students will develop three different sentences to show order of planets.</td>
</tr>
<tr>
<td>LESSON 3</td>
<td>Oct. 8, 1992 8:00-8:25 am</td>
<td>Discussion on histories - pp. 35-37 in Solar System book to be done by students.</td>
</tr>
<tr>
<td>SCIENCE LOG</td>
<td>DAY/TIME</td>
<td>ASSIGNMENT</td>
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<tr>
<td>LESSON 4</td>
<td>Oct. 7, 1992 8:00 - 8:25 am 1:00 - 1:50 pm</td>
<td>Students will name the various skies (fall, spring, etc.) and create a star finder to help locate the many constellations.</td>
</tr>
<tr>
<td>LESSON 5</td>
<td>Oct. 12, 1992 8:00 - 8:25 am</td>
<td>Students discuss the constellations shapes they are familiar with. Using the handouts, the students will color the various shapes.</td>
</tr>
<tr>
<td>LESSON 6</td>
<td>Oct. 13, 1992 8:00 - 8:25 am 1:00 - 1:55 pm</td>
<td>Using black construction paper, students will draw two skies, trace over with chalk and punch through paper with a tack.</td>
</tr>
</tbody>
</table>
| LESSON 7    | Oct. 14, 1992 8:00 - 8:25 am | With group discussion, students compare planet sizes using various clay balls and information in space book developed previously by students. I helped using p. 39 to show...
<table>
<thead>
<tr>
<th>LESSON 8</th>
<th>DAY/TIME</th>
<th>ASSIGNMENT</th>
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</thead>
<tbody>
<tr>
<td>Students will compare Mercury and Venus.</td>
<td>Oct. 15, 1992 8:00 - 8:25 am</td>
<td>Using the overhead of both planets, students will compare the planets. Open discussion. Students will transfer information onto fact sheet p.51 to complete space book.</td>
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<tr>
<th>LESSON 9</th>
<th>DAY/TIME</th>
<th>ASSIGNMENT</th>
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</thead>
<tbody>
<tr>
<td>Students will scribe some of major theories relating to the origin of the moon.</td>
<td>Oct. 16, 1992 8:00 - 8:25 a.m. 9:15 - 9:45 a.m.</td>
<td>Students research in groups of 4 some of the theories. Using construction paper, students explain theories and support with facts.</td>
</tr>
</tbody>
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<tr>
<th>LESSON 10</th>
<th>DAY/TIME</th>
<th>ASSIGNMENT</th>
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<tbody>
<tr>
<td>Some</td>
<td>Oct. 19, 1992 8:00 - 8:25 a.m. 1:00 - 1:40 a.m.</td>
<td>Students in groups explain their theory. Class then votes on the theory they agreed with.</td>
</tr>
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<th>LESSON 11</th>
<th>DAY/TIME</th>
<th>ASSIGNMENT</th>
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<tbody>
<tr>
<td>Students will recognize a variety of animals and their skeletal structures.</td>
<td>Oct. 20, 1992 8:00 - 8:25 a.m.</td>
<td>Using the Big Book on skeletons of animals students try to guess various animals.</td>
</tr>
</tbody>
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Appendix C
Demographic Data

Dayton Public Schools

1. I am:
   _____ Male
   _____ Female

2. I teach:
   _____ First grade
   _____ Second grade
   _____ Third grade
   _____ Fourth grade
   _____ Fifth grade
   _____ Sixth grade
   _____ Seventh grade
   _____ Eighth grade
   _____ High School

3. I am:
   _____ 21 - 30 years old
   _____ 31 - 40 years old
   _____ 41 - 50 years old
   _____ 51 - 60 years old
   _____ 61 or over

4. I graduated with a B.A. or a B.S. from:

   ____________________________________________

5. I graduated with a B.A. or a B.S.:
   _____ prior to 1960
   _____ 1961-1980
   _____ 1980-1985
   _____ 1986 to present

6. I had courses in the following areas in college:
   _____ Physical Science (Physics, Chemistry)
   _____ Natural Science (Biology)
   _____ Earth Science (Geology)

7. I try to teach science:
   _____ every day
   _____ four times a week
   _____ three times a week
   _____ two times a week
   _____ once a week
   _____ seldom
REFERENCES


