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AUTHOR Shaw, Kenneth L.; Stark, Connie
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ABSTRACT

In 1989 Florida responded to the continuing crisis in mathematics and science education by developing a Comprehensive Plan: Improving Mathematics, Science, and Computer Education that identifies specific strategic goals and recommendations. Florida State University has been the sole evaluator of the Comprehensive Plan. Visits have been made at elementary, middle, and secondary schools ensuring representation from a variety of ethnic and socio-economic levels. This paper reports a study of two diverse middle school science classes. The demographics of the schools, science teachers, and learning environments are compared and contrasted. In addition, information from the mathematics and science teachers from each school is given about their own practices and beliefs about what their practices should be. The ethnic distributions at both schools were similar, but the socioeconomic distribution was different. Clarke Middle School has approximately 175 students, 75% Caucasian, 23% African American, 1% Hispanic, and 1% Asian. Fifty-five percent of the students are on free and reduced price lunches. Ocean Grove Middle School (a pseudonym), a magnet school has approximately 415 students, 65% Caucasian, 29% African American, and 6% Asian. Twenty-nine percent of its students are on free or reduced price lunches. Other differences included: resources; curricula; students' teachers' and researchers' perceptions of the learning environment; control; and teacher professionalism. (MKR)

Mathematics and Science Learning Milieus in Diverse Schools in Florida

Authors
Kenneth L. Shaw, Connie Stark

Presenters
Kenneth L. Shaw, Scott Robinson, Kenneth G. Tobin

Florida State University
4750 Collegiate Drive
Panama City, FL 32405

(904) 872-4750

Kshaw@garnet.acns.fsu.edu
72411.3037@Compuserve.com (Connie Stark)
Srobinso@garnet.acns.fsu.edu
Ktobin@garnet.acns.fsu.edu

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Kenneth L. Shaw Connie Stark
Florida State University

Introduction

The Legislature of the State of Florida passed pivotal legislation in the early 1980s which has greatly influenced education in Florida. The 1983 Educational Reform Act mandated actions which would guide the improvement of mathematics and science throughout the state. The initial actions resulted in: 1) a list of minimum standards, 2) a list of standards for excellence, and 3) course frameworks. Furthermore, in 1989 Florida responded to the continued crisis in mathematics and science education by developing A Comprehensive Plan: Improving Mathematics, Science, and Computer Education in Florida (Task Force to Improve Mathematics, Science and Computer Education, 1989) hereafter called the Comprehensive Plan. The Comprehensive Plan was developed by a group of business and educational leaders and was designed to coordinate all present and future mathematics and science initiatives.

The Comprehensive Plan identifies specific strategic goals and recommendations to make Florida a world leader in mathematics, science, and computer education by the year 1999. Since the State Board of Education adopted the plan in 1989, it has been adopted by every district in the state and the Florida Department of Education has undertaken over 30 initiatives as part of its implementation.

Goals

The Comprehensive Plan is made up of 8 goals and over 100 specific recommendations to implement these goals.

Goal 1: Strengthen the K-12 curricula in mathematics, science, and computer education. The emphasis should be on student learning rather than merely content coverage so that students are prepared to succeed in a society requiring a high degree of technological and scientific literacy.

Goal 2: Make mathematics, science, and computer education more exciting. Provide incentives to restructure schools and school systems to maximize student understanding, and share successful efforts statewide.

Goal 3: Increase the availability and use of state-of-the-art instructional technology to improve the productivity and effectiveness of mathematics, science, and computer education.

Goal 4: Increase the number of qualified teachers of mathematics, science, and computer education.

Goal 5: Provide greater motivation, incentives, and opportunities for minority, female, at-risk, disabled, and gifted students to pursue programs and careers in mathematics, science, and computer fields.

Goal 6: Implement and refine the Comprehensive Plan as necessary to make substantial, measurable improvements in mathematics, science and computer

education by 1999.

Goal 7: Re-examine and adjust the statewide testing program to support the Comprehensive Plan.

Goal 8: Increase productive collaboration of educators with parents, community resources, business and industry.

Evaluation

Florida State University has been the sole evaluator of the Comprehensive Plan since its inception. A state-wide evaluation was conducted in 1991 to determine how well Florida's teachers were implementing the goals of the Comprehensive Plan (e.g., Dana, Shaw, 1992; Tobin, Shaw, Dana, 1992). Our findings illustrated that few school districts had developed an extensive approach to improving their mathematics, science and computer education programs and were not using the Comprehensive Plan to any great extent in their improvement efforts. Results showed a heavy reliance on passive learning activities such as textbook readings and lectures. Additionally one office in the Department of Education was assigned to implement the Comprehensive Plan, but this office did not have the authority to coordinate the initiatives of the many program offices involved.

Thus, a second study was conducted during 1992 to evaluate the progress toward reaching the goals of the Comprehensive Plan from a state level perspective. Participants in the study included employees holding policy or programmatic positions in the legislature and in the Florida Department of Education. The results of this study illustrated success in some areas, but the focus has been on individual pieces of the Comprehensive Plan rather than the whole. Moreover, there has been little coordination by key players within the Department of Education to implement the goals and recommendations (Spiegel, Tobin, Shaw, 1993).

The current project repeats the first study in determining the progress made during the past two years (1991-1993) in implementing the goals of the Comprehensive Plan. In addition, 23 site visits have been made across 20 counties in the state to determine the status of the learning environments in mathematics and science classrooms in an assortment of settings (Shaw, Stark, 1994, in press). Visits have been made at elementary, middle, and secondary schools ensuring representation from a variety of ethnic and socio-economic levels. Pseudonyms will be used for names of teachers and locations.

This paper will focus on two diverse middle school science classes and will compare and contrast their learning environments.

Clarke Middle School

Demographics

Clarke, Florida has a population of 885 and is located in the Panhandle of Florida. The school in Clarke has made several changes over the past 10 years. In 1982, the school consisted of grades 6-12. For the 1983-1984 school year, the sixth grade was moved to the elementary school and for the 1985-1986 school year grades 7 and 8 became the middle school. The facility remains unchanged. There are now two schools within the same complex. There is one principal for both schools, with an assistant

principal having administrative responsibilities for the middle school. Ninety-five percent of the students are bused to school from surrounding small towns within a 20 mile radius. There are two high schools, two middle schools and two elementary schools within the county. For the most part students who attend Clarke Middle School and Clarke High School are polite and orderly. This was clearly conveyed by the students saying "Yes, Mam" and "Yes, Sir" to teachers. Even when the teachers talked to us, they would say, "Yes, Sir" and "Yes, Mam".

Clarke Middle School has approximately 175 students, 75% Caucasian, 23% African American, 1% Hispanic, and 1% Asian. Fifty-five percent of the students are on free and reduced lunches. There are 9 teachers, 1 administrator, and 4 support staff. The student/teacher ratio is 19:1. Seven of the teachers hold master's degree with two holding bachelor's degrees. The average salary for Clarke Middle School teachers is $30,000.

The philosophy of Clarke Middle School recognizes the challenge of teaching students from various socio-economic, intellectual, and emotional backgrounds. It promotes encouragement of individual differences so that all students have opportunity to develop leadership qualities and positive self-worth. The philosophy states that the classroom atmosphere must convey a desire to develop mutual respect, but must also provide structure and discipline to aid students in today's society.

Participant

Ms. Martin, the 7th grade science teacher, seemed nervous, yet polite and willing to share information when we came to visit her class. She is in her sixth year of teaching. Prior to teaching, she was a medical technologist. She began teaching high school biology and taught at that level for three years. Since 1990, she has taught 7th grade science at Clarke Middle School. This year, Ms. Martin teaches science to 100 seventh grade students each day. The average size of each class is 20 students.

Ms. Martin describes the students as coming from low socio-economic families. "Seventy-five percent are below middle income levels. Few students have normal families. I must be a mother to some students." She adds that many students are living with grandparents and aunts. She confesses that even in their small community, there exists drug problems; last year a high school student overdosed on drugs and that experience she claims has affected the entire community.

Learning Environment

Researchers' perspectives.

Observing Ms. Martin's class in February 1993, was the essence of what most people think of when they picture a traditional science lesson. Students were sitting quietly at their desks as the teacher lectured through each page from the textbook lesson. There were periodic breaks when the teacher would move to the overhead to show a textbook page on the overhead and explain the different parts of the lung. Questions posed by the teacher were immediately answered by the teacher, not allowing students time to think and respond. The teacher focused on lists, e.g., 3 reasons for breathing through your nose: 1. Warms air, 2. Hair to catch impurities, and 3. Mucous moistens the air. As an observer, most students were bored and not engaged in the lesson. There were several intermittent exceptions to this as the teacher asked students to determine their breathing rates,

or when she shared an experience she had as a medical technologist when seeing lungs that were effected by smoking, or when she asked the students to decide what made people snore. The summary of the lesson was simply asking students to review certain pages in the textbook.

Teacher's perspective.

Ms. Martin realized she had specific needs to improve her science instruction and thus improve the science learning environment. Hands-on activities was her highest priority. She perceived that students would like far more hands-on experience and less lecture from the teacher. She realized she needed to be educated in this area. There is a new computer/science laboratory in which she has access, but she realized she did not have the proper education to utilize the laboratory effectively, so she did not use it. The second priority was to have inservice sessions to help her understand how to integrate computers into her science instruction and furthermore, to integrate more hands-on experiences in science. This would influence the third priority Ms. Martin voiced, to have students use the computers more during science class.

In Ms. Martin's questionnaire, she states that she rarely (less than weekly) incorporates hands-on experience in her science lessons, integrates science lessons into other areas, has students work in cooperative groups, has students engage in laboratory activities, has students use computers, has students assess their own learning, discusses problems with colleagues or persons in science related professions, and uses alternative forms of assessment. In addition, she never uses interactive media such as videodiscs and CDs, she never uses a county or state library, nor does she buy into the Comprehensive Plan's priority to teach fewer topics in more depth. On the other hand, she believes her science class is frequently enhanced by: the utilization of student workbooks, worksheets, and textbooks; using lecture to disseminate information to students; and student-centered activities and discussion. It is not clear what she considers student-centered activities since she rarely has students engage in cooperative groups or laboratory activities. It may be that a typical student-centered activity is having the students determine their respiration rates and a typical discussion is having students guess at what causes people to snore. Even in Ms. Martin's responses, she conveys a very traditional approach to science teaching and learning.

Though Ms. Martin does not do many innovations in her teaching, she sees some of these as very important. For example, she realizes the importance of cooperative learning, laboratory experiences, student discussions, discussing problems with colleagues, but either does not know how to implement these or lacks the physical resources to do so. From a traditional perspective, she ranks the following as very important components for her teaching: using textbooks, lectures, multiple choice and commercial tests. She ranks as low importance the following components of teaching: use of calculators, interactive media, students' use and teacher's use of computers, alternative forms of assessment, and use of science equipment.

Some inherent inconsistencies surfaced. For example, Ms. Martin believes having students involved in laboratory experiences is very important, yet she believes having students use science equipment is not important. Possibly the global images of having students involved in laboratory inquiry is inviting, but the specific images of what students would do is still unknown. Another example is that students rarely work in

cooperative groups, yet Ms. Martin believes it is very important for students to be engaged in this style of learning. Accompanying these data is her belief that there is little need for her to learn about cooperative learning. It is as if she ideally wants the frequency of using cooperative groups to be high, yet does not recognize any need to grow professionally to meet this ideal.

Student's perspective.

A questionnaire was prepared to determine the students', teacher's, and researcher's perspective on the learning environment. The instrument was developed by the research team on this grant and by Barry Fraser, a noted expert in the study of learning environments (e.g., Fraser, 1985, 1986, 1987, 1991). Twenty-five statements were created to determine how often the statement happens in the class and how often would you like the statement to happen in class. Possible responses were given on a 5 point Likert scale: (1) Almost never, (2) Once a month, (3) Weekly, (4) Once per lesson, (5) More than once per lesson. The 25 statements were designed into five components that make up the learning environment: participation, autonomy, relevance, disruption, and commitment. Being cognizant of the varied grade levels of students who would be completing the questionnaire, every precaution was taken to ensure the statements were clear and that the questionnaire was not too long. An intensive pilot study of the questionnaire was conducted at all levels to determine ambiguity of statements as well as test the internal reliability of the different categories.

The results of the questionnaire data are illustrated in the table below. The first column shows the average responses to the statements as to how often they occur in the classroom. The second column shows the average responses to the statements as to how often they would like them to occur in the classroom. When the numbers approach 5, it indicates maximum

Clarke Middle School

Categories	Researcher		Teacher		All Students n = 16		Males n = 6		Females n = 7	
Participation	1.8	-	3.0	3.4	3.0	3.5	2.9	3.3	3.3	3.8
Autonomy	1.4	-	2.4	2.6	2.3	2.9	2.4	3.0	2.3	2.8
Relevance	3.6	-	3.4	3.4	3.7	4.2	3.5	4.2	3.9	4.2
Disruption	4.2	-	3.8	3.8	3.7	4.4	3.5	4.2	3.8	4.5
Commitment	3.6	-	3.6	3.8	4.1	4.6	4.1	4.6	4.1	4.5

participation, maximum autonomy for the student, maximum relevance, minimum disruption for students, and maximum commitment for learning.

In the category of participation, the researcher noted that there was seldom any participation occurring in the classroom. The teacher however perceived participation as being slightly more frequent (weekly). The teacher's response correlates closely to the students' responses. The teacher and the students both indicate (in the second columns) that they would like to have more participation in class. Questionnaire data

illustrate that female students try to understand other students' ideas daily while male students try about once a week.

Student autonomy in Ms. Martin's class is quite low across all those participating. Statements in this section focused on whether students decided how to solve problems, whether students decided if their answers were correct, and whether the activities done in class were always set by the teacher. The data clearly show that Ms. Martin did not want students to be autonomous learners. She wished to lecture and control the group by having them kept busy with reading the textbook or doing worksheets. Male and female student responses were very similar in this category. One statement determined if students perceived that other students thought they were important. Female students responded that this occurred about once a week while male students responded once a month. The students within this class had a very low self-image of themselves.

Several times, the teacher referred students to what they had done in the past and tied it in to real life. Recall, the example of breathing through one's nose or showing the color of a lung after smoking illustrated pertinence and relevance to the students. Male students perceived several time sin a lesson that they had time to think about what was said by the teacher. The females perceived that they had only a few times per week to think about what was said by the teacher. The females believed that new activities connected more with what they had done in the past on a weekly basis while the males believed it happened monthly. The females perceived that science lessons were about real problems daily while the males perceived science lessons were about real problems only weekly. Thus, female students viewed the science lessons as being more connected and relevant than their male counterparts.

In the disruption category, the higher numbers illustrate lack of disruption. Students and teachers rarely have problems with disruption since the class atmosphere is so tightly controlled by the teacher. However, students realized there was room for improvement since their responses for the ideal were higher.

Both the researcher's and teacher's perception of the students' commitment was lower than what the student's had for themselves. The students perceived themselves as being interested in the lessons, being willing to learn, realizing the importance of the material, trying hard to learn, and being very attentive during class. The students wished to have even a higher level of commitment to learn science. Even though the numbers are the same or similar for male and female students in the commitment category, itemized analysis illustrate these comparisons can be misleading. For example, male students were interested in the lessons on a daily basis while female students were interested only several times a week. Male students found the science subject matter more substantive while female students had more drive and effort to learn the material.

Summary.

The 7th grade science class at Clarke Middle School was indeed the epitome of the traditional science class. Students were cemented in their seats from the beginning of class to the end. They listened to a lecture about respiration and watched as the teacher pointed to all the parts of a lung from a textbook-prepared overhead. The teacher wished that she had the resources to learn more about science and science teaching, but the rural nature of the school did not permit this. For the most part, students were greatly influenced by the teacher. They molded to her

objectives and her style of teaching. The learning environment was lukewarm with scant glimpses of hope for true scientific investigation. The teacher admitted not having the alternatives to try new approaches. She requested inservices that would be hands-on in nature and that would integrate computers in the science curriculum. It is self-evident that rural counties have a difficult time obtaining inservices and resources that are geared strictly to the needs of the school. What is seen at Clarke Middle School is a teacher who has many years of experience in a science field, 6 years teaching experience, but lacks alternatives to make science exciting for her students. She also lacks the flexibility to move away from the textbook and strengthen the curriculum by utilizing her own science content knowledge.

Ocean Grove Middle School

Demographics

Ocean Grove Middle School (a pseudonym), a Magnet School has received a federal grant of $2.7 million and a school-wide waiver from the Florida Department of Education. With these resources and leeway, the principal and staff have invented a vitalized learning environment for middle school students. Many of the traditional ideas and paradigms have been eliminated. What takes the place of traditional methods is a curriculum model that incorporates the needs and concerns of students as well as focuses on the process of learning. This curriculum model consists of three tiers: acquisition, application and simulation, all embedded in a central theme. The themes are called "streams" and each quarter students select the stream they would like to study. To illustrate the curriculum model in regards to the three tiers, an example follows using the concept of lift ratios taught during a stream entitled "Flight". During the acquisition tier students were taught how to calculate lift ratios in regards to objects that fly. The application tier involved analysis of wing designs and how the design effects lift ratios. The simulation tier required the students to create their own non-mechanized flight vehicle and as part of their presentation show how the lift ratio could be calculated and used in the design. The tiers built upon one another and therefore students saw the relevance of learning and kept more focused and motivated.

Ocean Grove Middle School has approximately 415 students, 65% Caucasian, 29% African American, and 6% Asian. Twenty-nine percent of its students are on free or reduced lunches. There are 25 teachers, 1 administrator and 12 support staff. The student/teacher ratio is 17:1. Sixty percent of the teachers hold advanced degrees, mostly master's degrees. The average salary for Ocean Grove Middle School teachers is $27,110. Although Ocean Grove students are in grades 6, 7 and 8, there are no separate classes for the different grade levels; all the grade levels are blended together. The school facility is an old, traditional building surrounded by a chain-linked, barbed-wire fence. Although the interior walls has been recently painted, no significant renovations have been made to the school complex.

Participant

We visited the stream entitled, "Environmentality" with specific focus on one teacher, Mr. Vickers (a pseudonym). Each stream consists of

approximately 135 students and 5 teachers. Since Ocean Grove received a large grant and is using an unique curriculum, the classes have been observed by several groups of people on many different occasions. Accordingly the teachers and students seemed very comfortable with the visit and invited us to participate with the classes.

Learning Environment

Researcher's perspective.

When observing Mr. Vickers' classroom in February 1993, we could not help but be caught up in the thought provoking, interactive classroom environment. The 25 students worked in groups and looked at samples of water under a microscope. The water samples were from a pond and had been inoculated with different pollutants such as acid rain, fertilizer, and pesticides. The students came to the front of the class obtained samples and prepared slides. The assignment was to observe and record what they saw for future analysis. The students freely talked among themselves and with Mr. Vickers. The students stayed on tasked and were excited with what they were observing. When they had a question they would ask Mr. Vickers who would either refer them to a reference book or clue them so they could answer their own questions. Students would invite other students to come look at their samples. This produced conversations that compared and contrasted the different samples. Mr. Vickers encouraged students to jot down their ideas and assertions so they could be further analyzed in a report.

An example of the free interchange of ideas and free movement in the class was when a student observed a heart beating in a micro-organism and another student from across the room said she had one, too. The two students observed each other's slides and determined it was the same "thing". They decided to check the heart rates/minute and compare them. When they got different rates they tried to determine the reason why. They speculated that since the slides were from different samples, the different pollutants may affect the micro-organisms.

Mr. Vickers was dressed casually and seemed very open, confident and enthused with his teaching. He would guide the students on what task they needed to accomplish during the class and the process of preparing slides. Once those items were presented, the students took over by generating the questions and discussions during the class. Mr. Vickers seemed to be a learning participant in his classroom on a equal basis with the students.

The students moved freely about the classroom and some would exit and come back. Those who exited wrote their names on the board, where they were going and then notified Mr. Vickers that they were leaving. No hall passes were issued, and Mr. Vickers rarely questioned their movements. Later it was found that the policy of the school is to trust each student as to their whereabouts unless a reason was found not to trust them. Another teacher stated that only a few problems have arisen and they were handled individually rather then restricting all students.

Teacher's perspective.

Mr. Vickers stated that he was recruited by the principal to come and teach at Ocean Grove to strengthen the science curriculum. He stated that once the principal had explained her vision of Ocean Grove of focusing on learning through themes, he jumped at the opportunity. He was dissatisfied

with the traditional methods and felt that this new approach made sense and would be better. He stated that teaching at Ocean Grove is the most stimulating and challenging of all the jobs he has held in over 20 years of teaching. He could never go back to the traditional lecturing and teaching from a textbook. He believes the students stay motivated because they can see the relevance of what they are doing and enjoys the hands on approach.

In Mr. Vickers' questionnaire, he states that learning is enhanced on a daily basis by hands-on experiences, integration of science lessons into other areas, cooperative learning, student-centered activities and discussions, use of computer, discussing problems with colleagues, and utilizing a curriculum with fewer topics in more depth. He indicated that he placed high importance on these items. He seldom lectures or uses a textbook and never uses workbooks or worksheets. Video equipment, interactive media, audio-visuals and calculators are used on a weekly basis. He indicated that he felt that assessment with portfolios and other alternate forms of assessment is also done daily and is highly important.

The only needs he identified were collaboration with persons in science related professions, and utilization of female and minority role models. He indicated that he felt these needs were highly important. He listed his three greatest needs concerning science education: funds available for field trips/outside classroom studies, time to preview and test new technology and software, and 28 hour days.

Mr. Vickers responses to the questionnaire were very consisted with what we observed in his classroom. In that, it was obvious that learning was enhanced with the use of hands-on experiences, cooperative learning, student-centered activities and discussions as he placed high value on these items. The classroom also contained 14 Apple Computers with 7 printers and 2 file servers, videodisc player, a scanner to scan images into the computers, and a VCR with a large TV. All the equipment appeared to be frequently used and students stated that they completed a majority of their work on the computers.

Student's perspective.

The results of the learning environment questionnaire data are illustrated in the table below. The first column shows the average responses to the statements as to how often they occur in the classroom. The second column shows the average responses to the statements as to how often they would like them to occur in the classroom. When the numbers approach 5, it indicates maximum participation, maximum autonomy for the student, maximum relevance, minimum disruption for students, and maximum commitment for learning.

In the category of participation the researcher and teacher perceived that students participated throughout the lessons while the students perceived they participated about once per lesson. There is also a noted difference between how the Caucasian students and African-American students responded to the category of participation, where Caucasian students responded that they participated at a frequency of once per lesson while African-American students responded with a participation frequency of once a week. After review of each of the five statements concerning participation, it is found that four of the statements had similar responses from both groups with the African-American responses being slightly less. But the statement: I ask other students about their ideas, had over a full point difference with African American

Ocean Grove Middle School

Categories	Researcher	Teacher	All Students n = 38	Males n = 16	Females n = 20
Participation	5.0 -	4.6 5.0	3.7 4.1	3.8 4.1	3.7 4.1
Autonomy	4.2 -	3.4 3.8	3.0 3.2	3.1 3.2	2.9 3.2
Relevance	4.8 -	4.8 5.0	3.7 4.3	3.7 4.4	3.8 4.2
Disruption	4.6 -	4.2 4.8	4.1 4.6	4.2 4.7	4.1 4.6
Commitment	5.0 -	4.2 5.0	3.8 4.5	3.8 4.4	3.8 4.5

students responding with weekly and Caucasian students with once per lesson. With the second part of the statement addressing an ideal situation, African-American students response stayed the same at weekly while Caucasian students response increased to several times in a lesson. This suggested that minority students may be intimidated because of their small numbers and therefore do not participate nor feel that they want to participate more often.

Comparison between Caucasian and African-American Students

Categories	Caucasian Students n = 23	African-American Students n = 6
Participation	4.0 4.4	3.3 3.7
Autonomy	3.1 3.3	2.6 2.9
Relevance	3.8 4.4	3.9 4.3
Disruption	4.1 4.6	4.2 4.6
Commitment	3.9 4.5	3.7 4.6

The researcher scored the statements concerning autonomy higher than the teacher and all students. Reviewing each statement within the category of autonomy reveals one statement which had Caucasians scoring 3.5 and 4.4 on the actual and ideal scales while African-Americans scored 2.3 and 3.4. The statement is, "I decide how much time to spend on an activity." This suggests that Caucasian students feel more autonomous in their learning environment than do their African-American counterparts. The responses from the African-Americans may suggest that minority students might be intimidated because of their small numbers and therefore do not believe they have as great of autonomy in deciding how much time they can spend on an activity. The remaining statements in this category showed no significant differences. When comparing autonomy between the males and females, it was found that female responses were slightly lower than the males.

The researcher and the teacher had the same response for the category of relevance where they felt the frequency to be several times a lesson. The students' responses were significantly lower showing their perception

that the lessons were relevant only several times a week. This finding was surprising because with the curriculum changes at Ocean Grove, one would speculate that students would find high relevance in what they are learning. There is no significant differences between males and females or between African-American and Caucasian students in this category. Also, responses to the individual statements were consistent across the board.

The researcher's perception of disruption was significantly higher than the teacher's and student's. There is no difference between the female and male responses and just a slight difference between African-American students and Caucasian students.

In the category of commitment, the researcher's score was slightly higher than the teacher's and all students'. Comparing the responses between male and female students and between African-Americans and Caucasian students showed no significant differences. One exception stands out: I am interested in the lesson. African-American students responded that they were interested in every lesson while the Caucasian students were interested in lessons a couple times a week. One of the goals of the Comprehensive Plan is to increase motivation, incentives and opportunities for minority and females. With the higher response from minorities to this statement, it follows that these students' motivation is at a level commensurate with the majority Caucasian students.

Summary.

The learning environment at Ocean Grove Middle School was phenomenal, if the Comprehensive Plan is used as a guide. Within the environment theme, the science teacher had his students explore, conjecture, question, and validate what they were doing in a very hands-on approach. Students were "doing" science in Mr. Vickers classroom. The teacher was facilitating, moving around the room, answering questions, and asking probing questions. It was evident that he believed in his students and believed in himself as a teacher. He realized there was still much to learn and that he desired to have the resources to discuss science with practicing scientists and desired to have funds to take students on field trips where they could witness what people are doing when they are in science related fields.

Comparisons

Comparing the Two Science Classes

This section will focus on comparing the two science classes. In the description above, it is clear that both schools are very different. Ocean Grove Middle School is a magnet school and has almost all the resources a teacher would want. The Florida Department of Education has waived curriculum frameworks mandate and the use of standardized tests for this school. Ocean Grove Middle School has attracted several good teachers from other schools in the area. There is a waiting list of teachers and students who want to enter the school. Clarke Middle School, on the other hand, is located in a poor and rural area; teachers must abide by the Department of Education guidelines and mandates. Ms. Martin was a very traditional 7th grade science teacher and lacked alternatives to her teaching. Mr. Vickers had 4 teacher-colleagues. He had daily meetings with them and could easily observe another teacher to gain new ideas if he chose. How do the learning environments compare between a middle school

science class in an innovative magnet school and a traditional science class in a rural area?

From the descriptions, it is not surprising that students at Ocean Grove Middle School are participating more by communicating with other students than students at Clarke Middle School because the way the respective teachers established their learning environment. Likewise middle schoolers at Ocean Grove believe they have autonomy in the learning process more than the 7th grade students at Clarke Middle School. What seems initially surprising is that both schools have similar rankings on relevance and commitment. This suggests that the more innovative a

Comparisons of Ocean Grove Middle School and Clarke Middle School

Categories	Ocean Grove M. S.				Clarke M.S.			
	Teacher		Student n = 38		Teacher		Student n = 16	
Participation	4.6	5.0	3.7	4.1	3.0	3.4	3.0	3.4
Autonomy	3.4	3.8	3.0	3.2	2.4	2.6	2.3	2.9
Relevance	4.8	5.0	3.7	4.3	3.4	3.4	3.7	4.2
Disruption	4.2	4.8	4.1	4.6	3.8	3.8	3.7	4.4
Commitment	4.2	5.0	3.8	4.5	3.6	3.8	4.1	4.6

classroom learning environment is does not necessarily mean that subject matter relevance or the commitment level of the student will increase.

Both schools' students responded similarly in the category of relevance. However, upon examining the statements within the relevance category, several differences were found. For example, Clarke middle schoolers believe the teacher asks them more questions about what they have learned than middle school students at Ocean Grove. Our observations certainly reflect that the teacher at Clarke Middle School was talking more and did ask a lot of questions. However the depth of questions were quite different. Ms. Martin answered 95% of her questions and Mr. Vickers answered none of his. Mr. Vickers asked lots of specific questions to individual students as they were involved in the science laboratory, but rarely asked questions to the entire class. We have yet to find an explanation for the following analysis; students at Clarke believe they have more time to reflect on problems than students at Ocean Grove (4.0 to 3.6). Observations indicate otherwise. Nevertheless, both scores exhibit an "often" response to reflection. Students at Ocean Grove believe activities are more connected to what they have done in the past about once per lesson. Clarke students believe this occurs weekly. Since Ocean Grove's curricula is centered around thematic units, it seems reasonable that this difference would occur. At Clarke, the teacher consistently plods through the textbook disseminating its information in a very methodical way. Some connections were made, but the curriculum did not lend itself to making the connections in the way that Ocean Grove organized its curriculum.

In terms of commitment, students at both schools expressed similar levels of willingness and effort in wanting to learn. In the disruption category, there were also similar levels of effort with one noted

exception. With the Ocean Grove science class being like a beehive where talking and investigating throughout the entire period and the Clarke Middle School being very quiet, students at Clarke Middle School found the noise in the class to be more disruptive than students at Ocean Grove Middle School. Recall the higher number in this category reflects less disruption.

It is clear by comparing the teacher's responses to the learning environment questionnaire that expectations of the students are quite different for each teacher. Mr. Vickers believes in having students actively engage in learning science. He is certainly experienced with this approach and has the necessary content knowledge to be confident in what he does. Ms. Martin lacks the alternatives and content knowledge to provide a dynamic learning environment for her students. The self-image of the students at Clarke are lower than students at Ocean Grove. Interestingly, the teacher and students at Ocean Grove believe the students to be autonomous a couple times a week while the teacher and students at Clarke believe the students to be autonomous once a month. Mr. Vickers respects his students and gives them flexibility to gain their autonomy and self-confidence. It is also clear by observing the table (second columns) that Mr. Vickers has far higher expectations for his class than does Ms. Martin. These expectations drive Mr. Vickers to continue striving for new and better things to do in his classroom. Ms. Martin, on the other hand, realizes there is a need to change, but is constrained by the apparent lack of resources.

Comparing the Two Schools

In the following section, additional information from the mathematics and science teachers from each school is given about their own practices and about their beliefs of what their practices should be. The comparison includes all mathematics and science teachers at Clarke Middle School, but only those mathematics and science teachers visited at Ocean Grove Middle School.

Teacher Practices.

Several questions were asked of the teachers about the practices and beliefs as they relate to use of manipulatives, lab activities, cooperative learning, alternative assessment, lecture, and textbooks.

Figures 1-6 show that Ocean Grove Middle School incorporates manipulatives, lab activities, cooperative learning, and alternative assessment far more than Clarke Middle School. Clark Middle School teachers use lecture and rely on the textbook far more than teachers at Ocean Grove Middle School.

Our survey also illustrated if the teachers believed in what they doing. In most cases, the teachers' practices were aligned with their beliefs. For example, all of Ocean Grove Middle School teachers believe that using textbooks is of low importance and their practices reflect it. A majority of Clarke teachers felt the use of textbooks of high importance and their practices reflect it. Ocean Grove teachers believe that using lecture is of low or medium importance while Clarke teachers believe it to be of medium to high importance. Both groups of teachers believed using laboratory activities and manipulatives to be of high importance, yet Clarke teachers rarely used these strategies in their classrooms. Surprisingly, Ocean Grove teachers were equally split on the importance of

cooperative learning in that half felt it to be of low importance while the other half felt it to be of high importance. All the teachers surveyed at Ocean Grove viewed alternative assessment as highly important while Clarke teachers were equally split between low, medium and high.

Technology.

Ocean Grove Middle School mathematics and science teachers use and have their students use computers on a daily basis, while calculators are used less frequently (See Figures 7-9). Clarke Middle School teachers use and have their students use computers less frequently. The three teachers at Clarke Middle School were split in the frequency that they use calculators.

All the teachers surveyed at Ocean Grove Middle School believed the use of computers by both students and teachers to be of high importance. The Clarke Middle School teachers seem to be equally split between low, medium, and high importance in their beliefs in the use of computers. One wonders if the comfort level in the use of computers may affect the belief in the importance of this technology. The majority of the teachers at both schools believe that using calculators is of medium or high importance.

Professionality.

Ocean Grove teachers discuss problems with colleagues on a weekly or daily basis while Clarke teachers seldom have opportunities to discuss problems with others (See Figures 10-11). Clarke teachers seldom are able to observe other teachers. Ocean Grove teachers are equally split between seldom observing other teachers and being able to observe them on a weekly basis.

Both groups of teachers believe discussing problems with colleagues to be of medium or high importance. The groups differ in their beliefs concerning observing other teachers. Ocean Grove Middle School teachers are split between high and low importance while Clarke teachers believe it to be of medium or high importance.

Discussion

The ethic distribution of both schools are similar with Clarke Middle School having 75% Caucasian, 23% African American, and 2% other, while Ocean Grove Middle School has 65% Caucasian, 29% African American, and 6% other. The socio-economic distribution is different. Fifty-five percent of the students at Clark Middle School as compared to 29% of students at Ocean Grove Middle School are on the free or reduced lunch program.

There were other marked differences between Clarke Middle School and Ocean Grove Middle School. These differences can be seen in: resources, curricula, perceptions of students' learning environment, perceptions of teachers' learning environment, perceptions of researchers' learning environment, control, teacher professionalism. Ocean Grove Middle School had abundant resources as they had a multi-million dollar grant to assist them in creating innovative curricula while Clark Middle School mathematics and science teachers were holding fast to traditional curriculum on a limited budget. Perceptions of students, teachers, and researchers varied between the schools. Students, teachers, and researchers believed the learning environment at Ocean Grove was more dynamic, evoked inquiry, participation, and autonomy than what students, teachers and researchers at

Clark Middle School. Their teaching styles certainly reflected a more inquiry-based, hands-on approach at Ocean Grove while Clark Middle School Teachers employed lecture as their mainstay. There was an emphasis of control at Clark Middle School, focusing on keeping students quiet and not being a disciplinary problem. For Ocean Grove Middle School students, the focus was on assisting them to learn through hands-on experiences.

The teacher professionalism was apparent at Ocean Grove Middle School as teams of teachers met every day to discuss lessons, students' progress, etc. These teachers mentioned that they enjoyed coming to work and that it was exciting to be working together and to be empowered to make decisions to impact students' learning. At Clark Middle School, teachers rarely discussed problems with their colleagues. There was a lack of professionalism and autonomy as teachers seemed to be rigidly following the textbooks and seemed to be routinely carrying out the daily tasks.

This study has shown two very different middle school classes. Ocean Grove Middle School is highly atypical of what is taking place across the state of Florida. The science class at Clarke Middle School is the norm. Further questions must be addressed:

How can the Florida Department of Education and mathematics and science educators impact the poor rural schools?

How can change occur within these schools if there is no support group or resources?

What are the components of the school culture that make the learning environment different?

Can these components be integrated into other school cultures? If so, how?

How can teachers in rural schools learn about alternatives?

These questions need immediate answers if Florida will make its goal of being a world leader in mathematics, science, and computer education by the year 1999.

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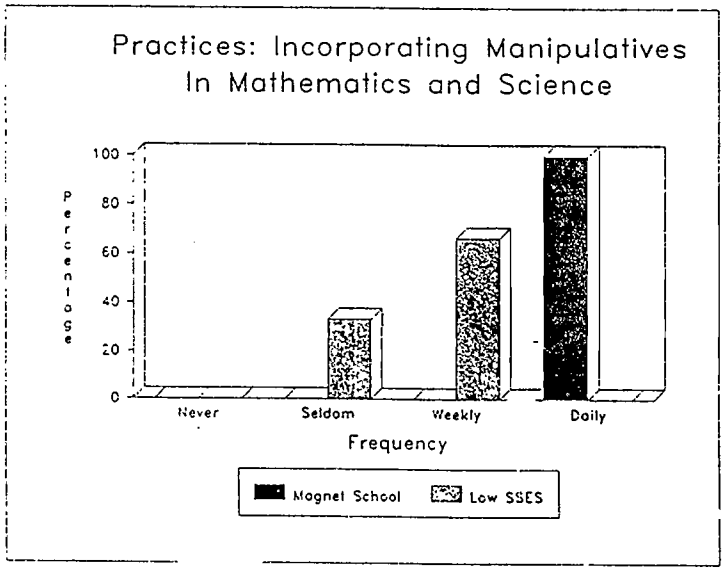
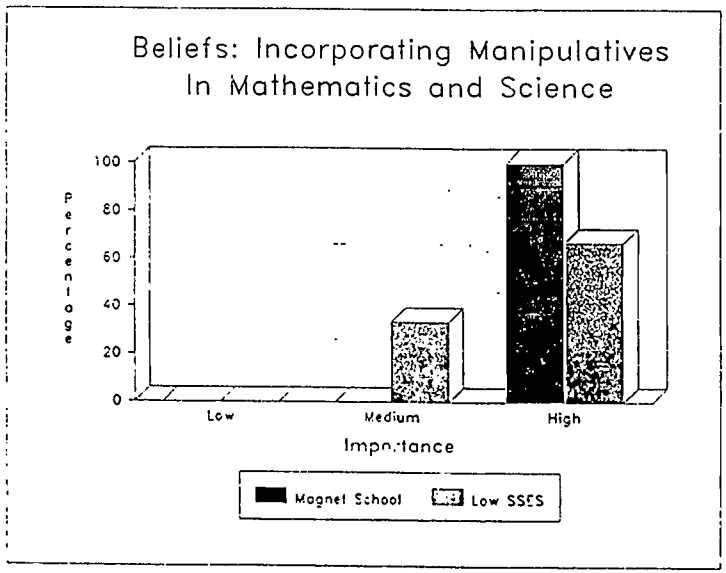
** This paper is a extension of the paper: Shaw, K., Stark, C, & Tobin, K. (1994, March). A survey of the science learning environments in Florida's public schools. Paper presented at the National Association for Research in Science Teaching, Anaheim, CA.





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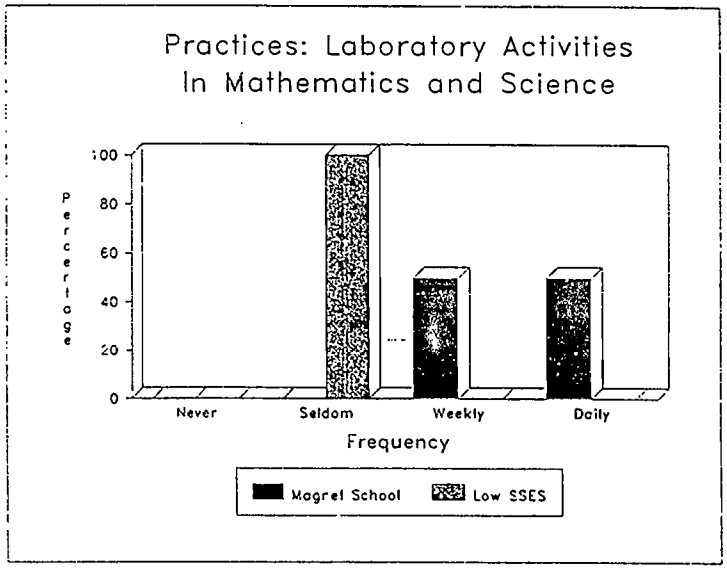

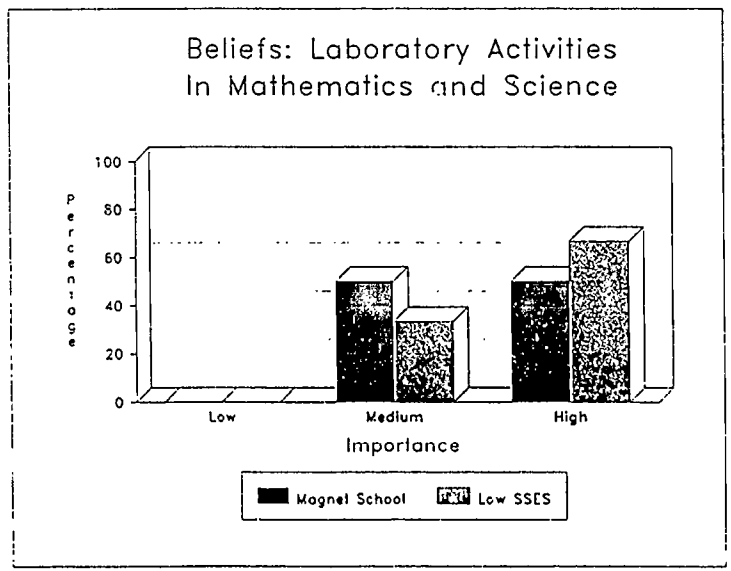

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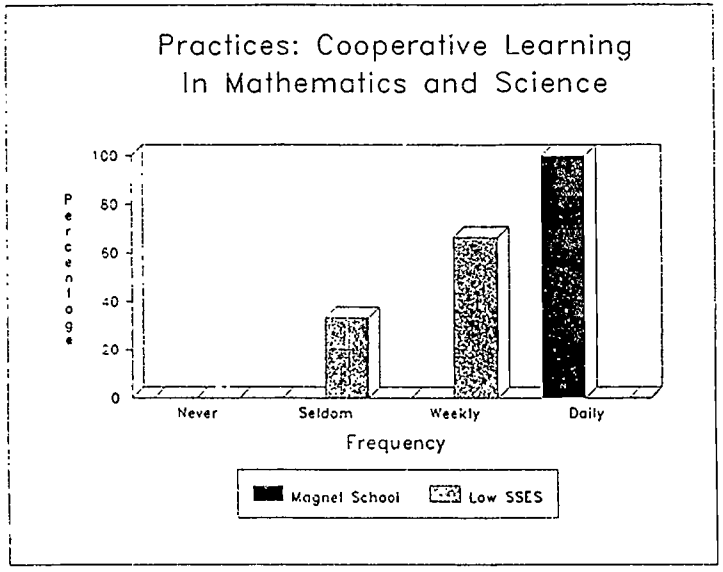

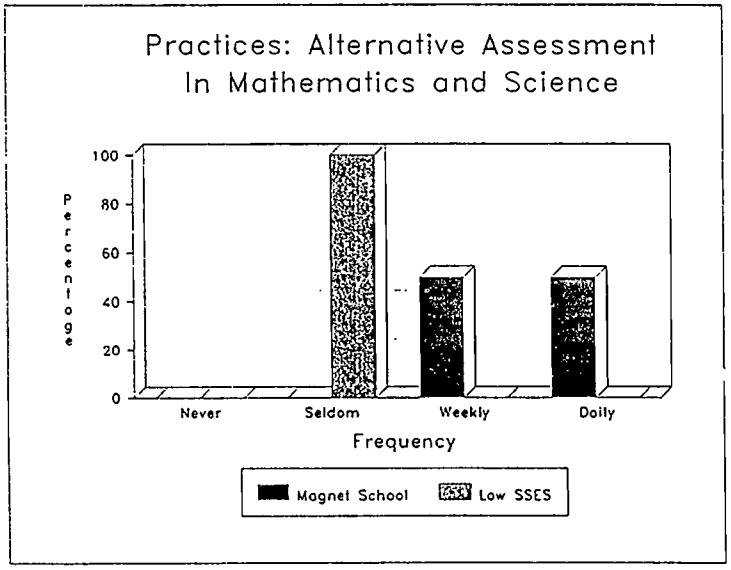

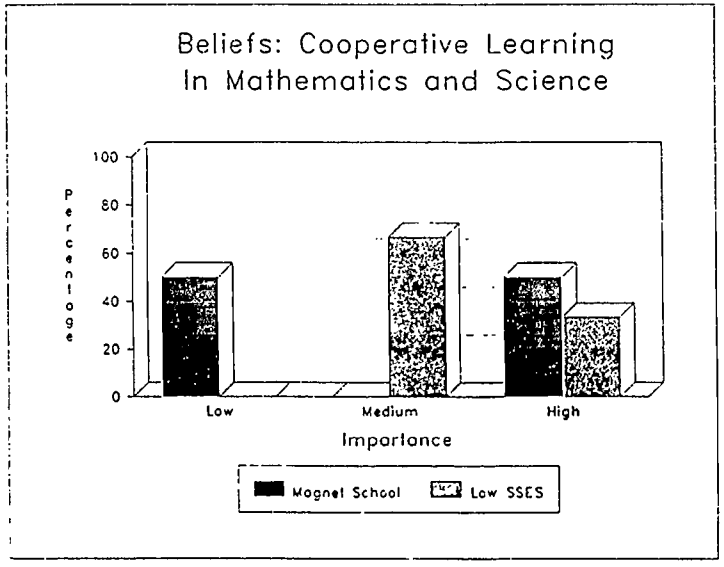

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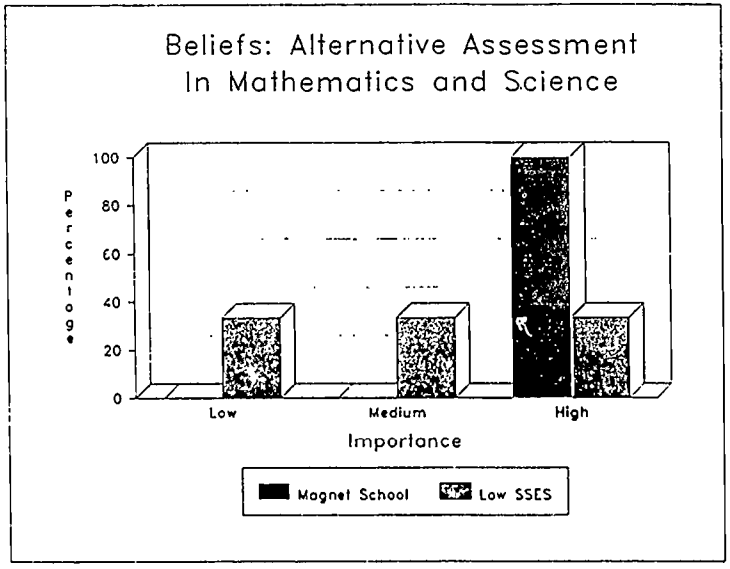

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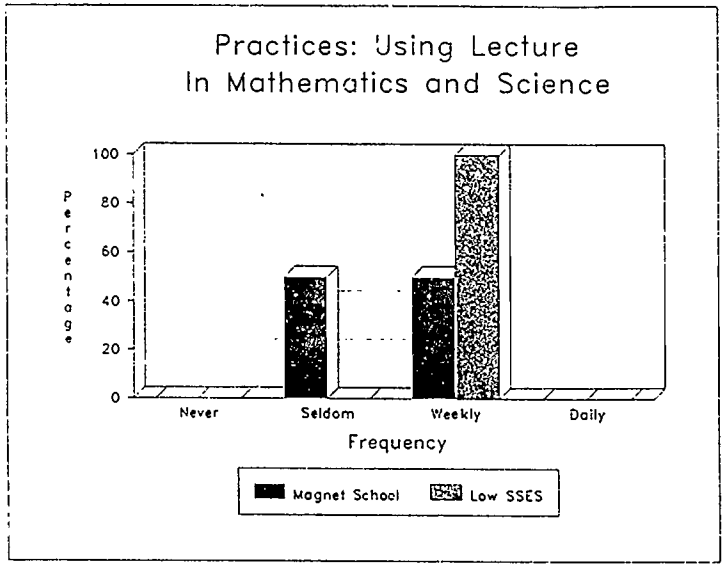
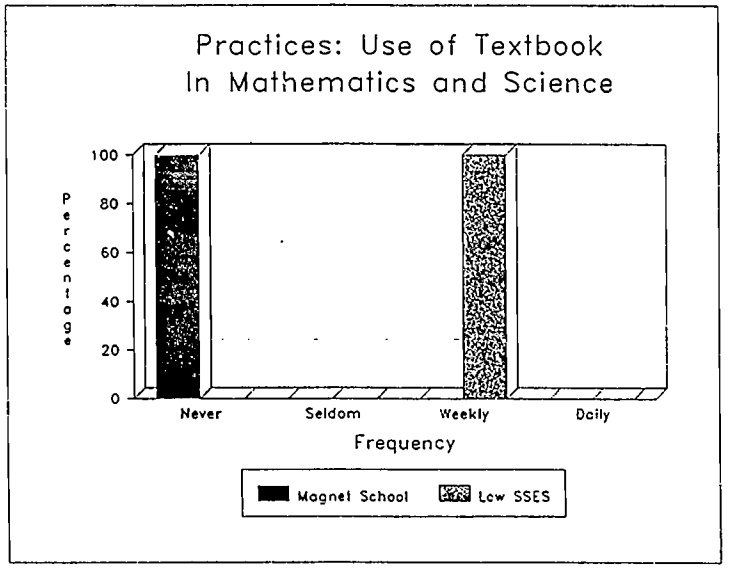
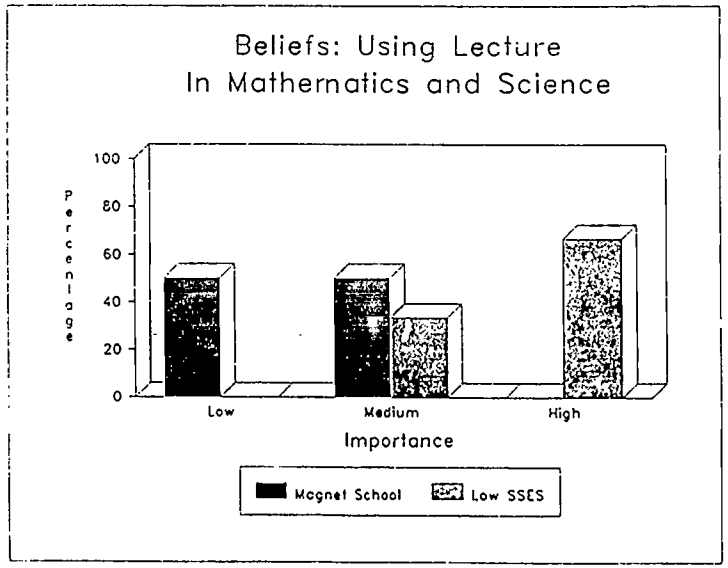






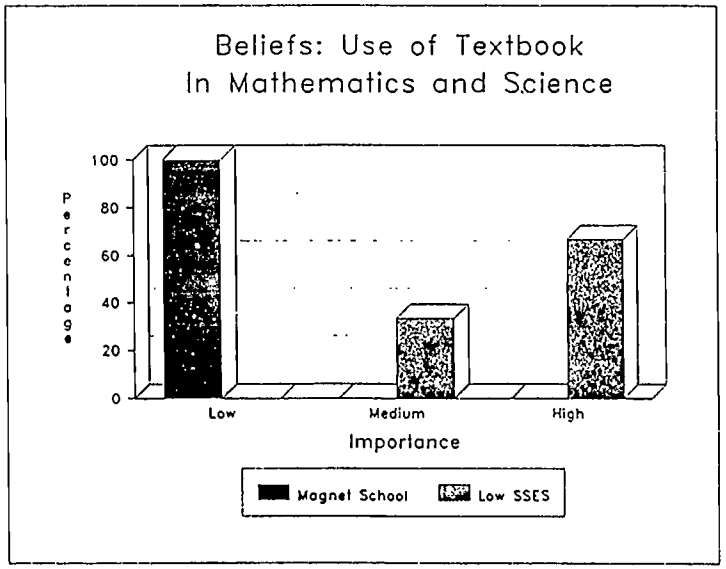
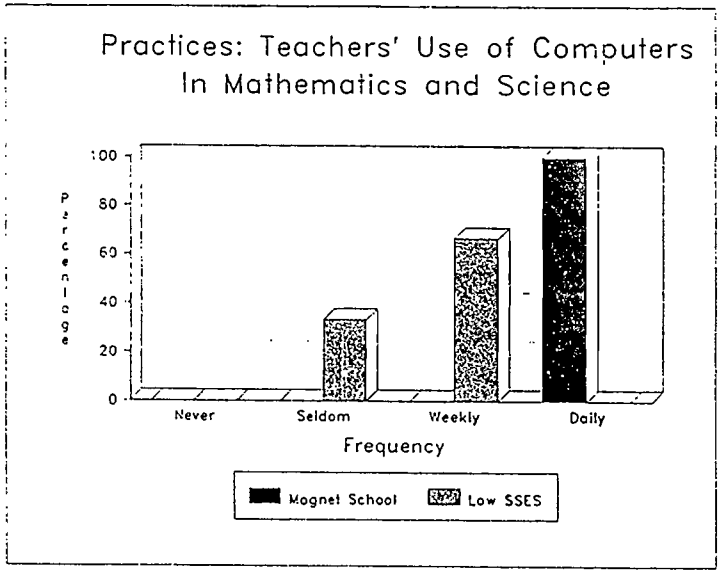
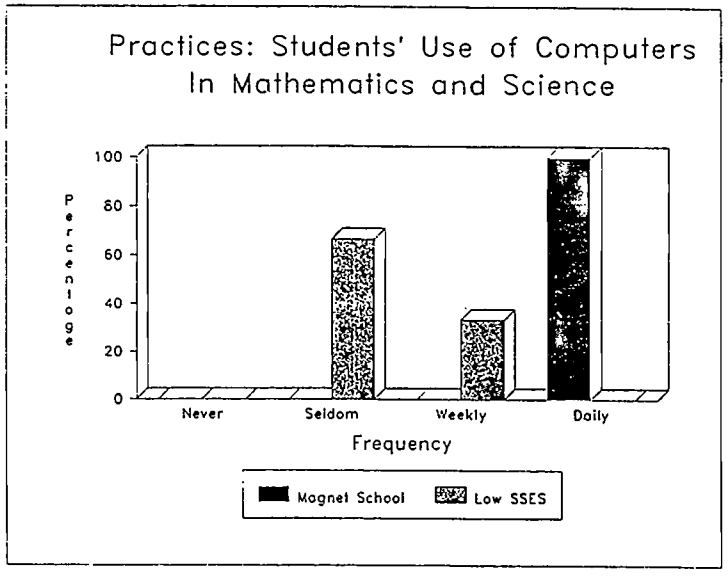
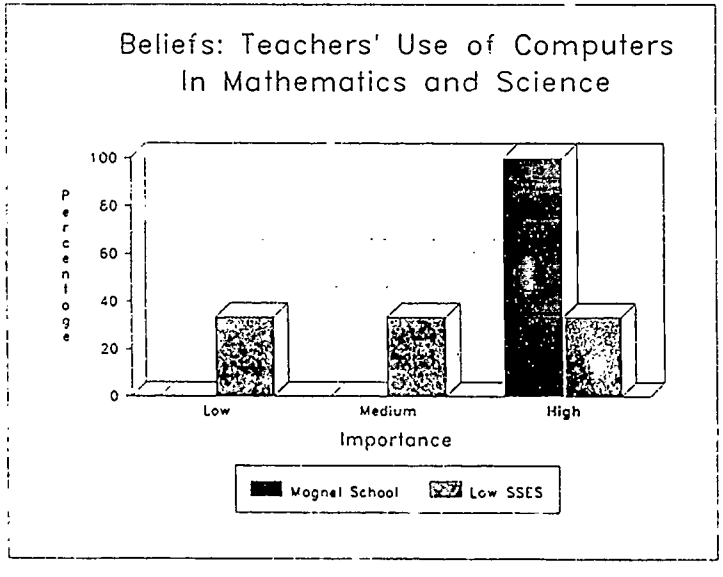


Figure 5

Figure 6







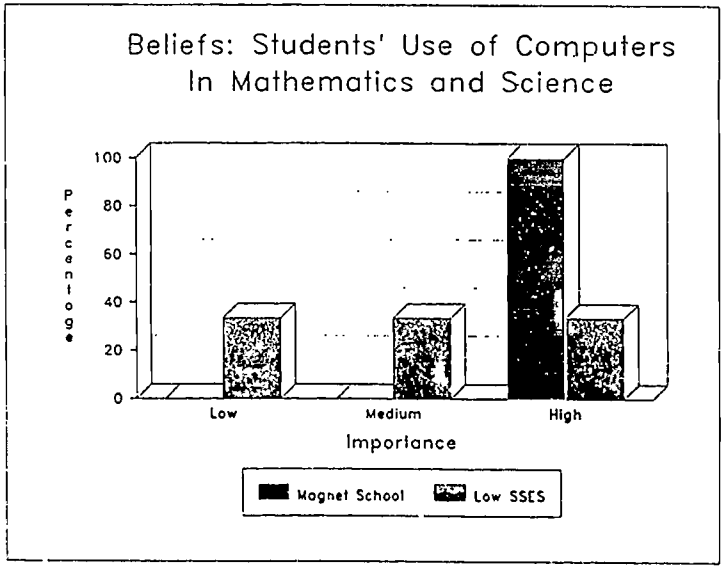
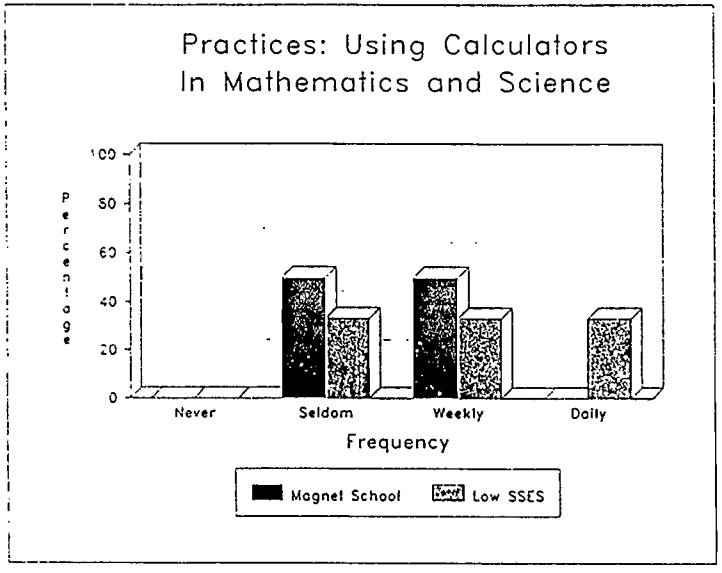


Figure 7

Figure 8


Practices: Using Calculators
In Mathematics and Science
Percentage
100
80
60
40
20
0
Never
Seldom
Weekly
Daily
Frequency
Magnet School
Low SSES

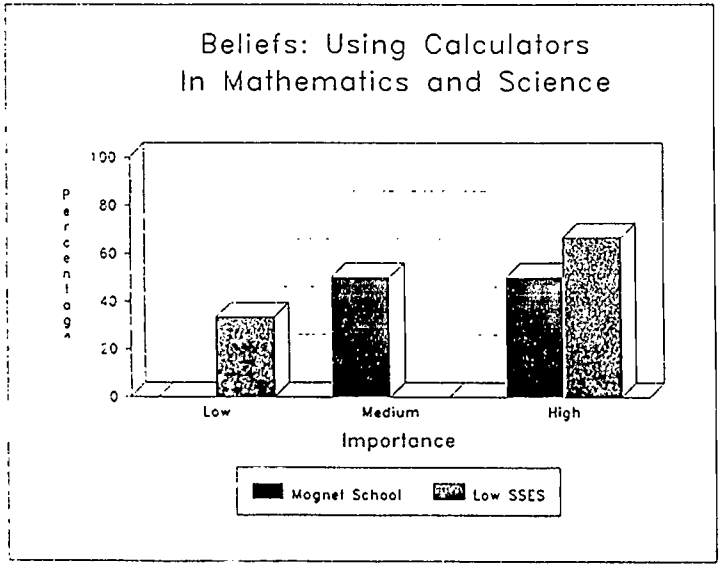
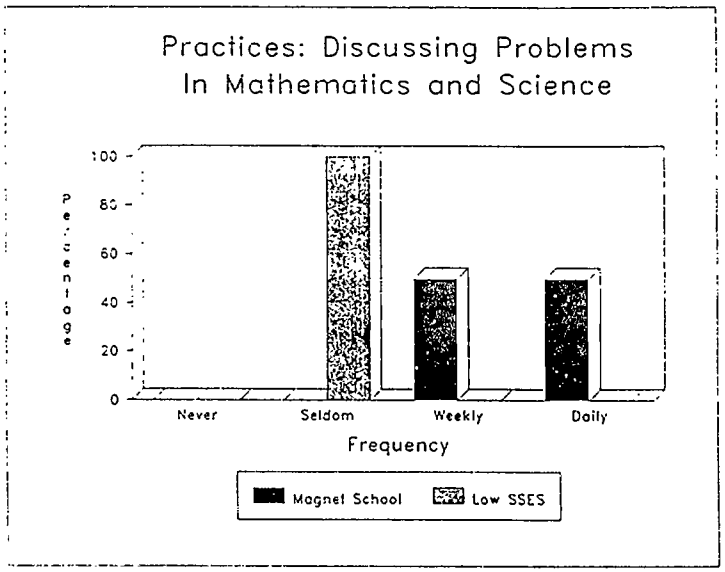
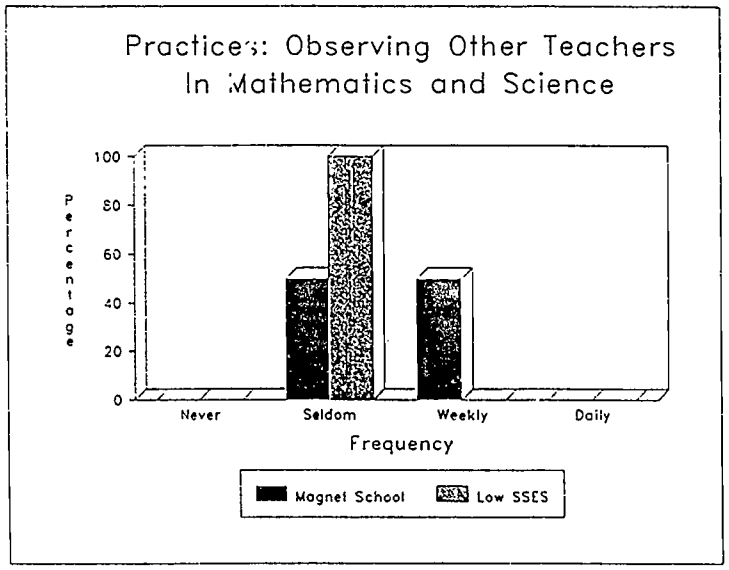
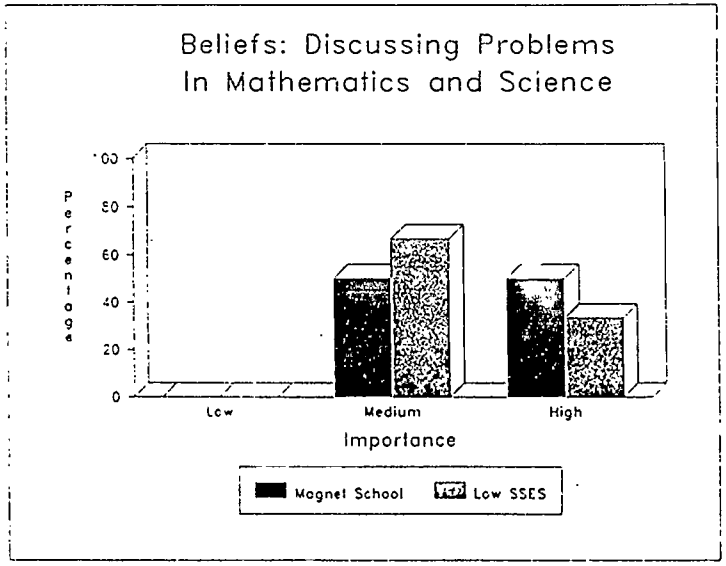

Beliefs: Using Calculators
In Mathematics and Science
Percentage
100
80
60
40
20
0
Low
Medium
High
Importance
Magnet School
Low SSES

Figure 9







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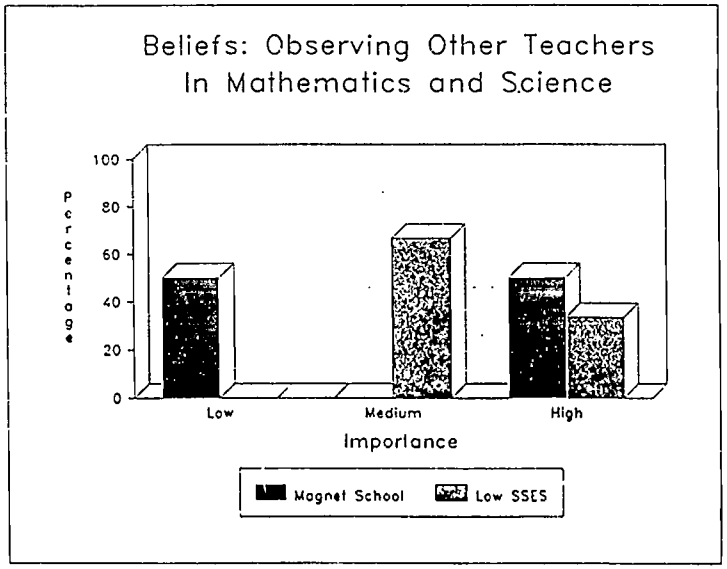

Figure 11