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COMPARISON OF HIGH SCHOOL SCIENCE STUDENTS' ACHIEVEMENT IN A "TRADITIONAL" CLASSROOM TO STUDENTS ENROLLED IN AN INTEGRATED CURRICULUM COURSE

By

Dawn M. Schuen

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ABSTRACT

COMPARISON OF HIGH SCHOOL SCIENCE STUDENTS' ACHIEVEMENT IN A "TRADITIONAL" CLASSROOM TO STUDENTS ENROLLED IN AN INTEGRATED CURRICULUM COURSE

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Dawn M. Schuen

The purpose of this study was to compare the achievement, mainly in science, of ninth grade students enrolled in an integrated studies program, the study group, to students enrolled in a 'regular' ninth grade science course, the control group. The integrated program (the block) incorporated the subjects of science, english, health, social studies, and technology during a three hour block of time while the two regular science courses met daily in the afternoon. All known variables were kept constant between the two groups. Each group had the same science teacher (me), were expected to meet the same outcomes (the Michigan Education Goals and Objectives for Science Education), were given the same instructional strategies (except for those involved in the interdisciplinary projects in the block which are discussed in the body of this paper), and were evaluated using the same tests, examinations, activities, and surveys. Student groups were compared through objective tests and subjective activities. Chi square statistics and examination of student samples were used to determine if there was a significant difference in student achievement between the two groups. There was not a significant difference between the two groups in any of the assessments and any differences can be attributed to chance.

TABLE OF CONTENTS

LIST OF TABLES....................iv

LIST OF FIGURES....................v

INTRODUCTION....................1

LITERATURE REVIEW....................8

DEMOGRAPHICS OF CLASSROOMS: THE 'BLOCK CLASSROOM VERSUS THE 'REGULAR' SCIENCE CLASSROOM....................15

IMPLEMENTATION....................21

EVALUATION....................28

SUMMARY AND EVALUATION.................... 43

BIBLIOGRAPHY....................48

APPENDIX A: STUDENT ACTIVITIES....................50

APPENDIX B: STUDENT SAMPLES....................58

APPENDIX C: STUDENT REACTIONS....................59

APPENDIX D: TEACHER COMMENTS....................61

LIST OF FIGURES

Figure 1-Objective Unit Test Results....29

Figure 2-Student Opinions Regarding the Relationship Between Science and English....35

Figure 3-Student Opinions Regarding the Relationship Between Science and Health....35

Figure 4-Student Opinions Regarding the Relationship Between Science and Social Studies....36

Figure 5-Student Opinions Regarding the Relationship Between Science and Technology....36

Figure 6-Student Opinions Regarding the Practicality of Science.... 37

Figure 7-Student Opinions Regarding How Interesting Science is....37

Figure 8-Student Opinions Regarding Whether Science is About Real Things....38

Figure 9-Student Opinions Regarding Whether Science is For Everyone....38

Figure 10-Student Opinions Regarding Whether Science is Valuable to Society....39

INTRODUCTION

STATEMENT OF PROBLEM AND RATIONALE FOR STUDY

This study compares the performances of ninth grade science students at the High School level who were enrolled in an integrated learning program (the study group), which will be referred to as the "block" from here after, to that of students in a "typical" science classroom (the control group). There were 103 students in the block and 50 students in the control group. Both groups were taught by me to ensure as many variables were kept constant as are possible in a school situation.

The High School in this study is composed of about 1200 students in a community that used to be primarily an agriculture community but is now a growing suburb of middle to upper class people. Education is highly valued in this district and many community members are educated beyond high school. The community is composed of mostly white people, the percentage of minorities in the high school is less than one percent.

This district is one of many schools researching and implementing restructuring of the curriculum in education. Both educators and non educators complain about the state of education in America today. The arguments include; students are not prepared for further study; they are not adequately prepared to enter the work force; they cannot compete with students of other nations; they cannot work collaboratively with one another, and they are lacking other life skills. Many school districts react to these criticisms by looking at ways to change the way we teach students. One "popular" restructuring method today is integrated instruction. Integrated instruction is when a teacher or group of teachers teaches main ideas which incorporate many disciplines (Sizer 1992). For example, students may learn how change affects people from many perspectives. There are many science, math, english, social studies, and other subject area topics that can easily be brought under this topic. Integrated instruction is an attempt to help students make connections within the curriculum and their world. The block program was in the planning stages for two years prior to its implementation in the school year of 1995-1996. Because I was involved in the development of this program from the beginning, I thought it would be beneficial for me and my school if I focused my thesis project on it. I feel an in depth study is necessary to assess if this type of teaching and learning is, in fact, more effective compared to what we have been doing all along.

I began teaching at this High School during the school year of 1993-94. During this year, a few teachers began exploring the idea of offering an integrated program in which two or more subjects are taught together during a large block of time. There were already a couple of integrated programs in progress in this school, but they only included two courses which were more 'natural' partners. For example; they had a physics/calculus two hour block course and a two-hour team taught integrated course including English and Social Studies. Both of these courses were electives for upper-classmen and, as said earlier, were more natural blocks.

To develop powerful teaching and learning, teachers working as team members are central to this idea. Every student must learn in an active, participatory context, contribute, be encouraged to succeed. They should excel if expectations are kept high. Teachers and students should be engaged in an interactive relationship to learn together. Learning is linked to standards, known beforehand, that must be attained in each area of study. The standards needing to be addressed in the area of science came from the Michigan Education Goals and Objectives in Science Education. Learning goes beyond the bounds of the textbook and should have students participating in the learning process through research, exploration, presentations, role playing, team work, and other techniques that force them to synthesize knowledge. Learning cannot take place when students are passive participants in the learning process which can often take place when they are only 'given' information through reading and lectures and not permitted to be involved in acquiring this knowledge (Cushman 1994). Many teachers, however, feel outside pressures from parents, universities, and standardized tests to teach many science concepts in one year. This often indirectly forces teachers to teach mainly through lecture and readings due to time constraints.

There are several models already in existence that attempt to restructure the curriculum by integrating subjects. *Teaming* is one such approach in which some number of teachers, from two to several, share a group of students. Each teacher is in a separate room and continues to teach in the same manner used previously. The teachers share a common planning time which enables them to discuss the progress of students and to

better serve the needs of individual students. The main benefit of this model is the contact teachers have regarding individual students. I have spoken with teachers involved in this type of model, the middle school of the district in this study practices it, and they have commented that some of the benefits are: 1) having common rules and expectations helps students to know what their limitations are and prevents them from 'playing teachers against one another' (For example: "Why can't I put my feet on the desk? Mr. Jones let me!"), 2) teachers become much more familiar with what students are learning in other classes which enables them to better help students and also creates seeds for future team-taught lessons, 3) teachers can more easily identify students 'at-risk' of failure or future drop-outs when they communicate with each other about specific students, 3) when it is necessary to meet with a parent regarding a student it can be done in one meeting with all teachers, 4) teachers act as moral support for one another when dealing with difficult situations, and there were other benefits not included here. The biggest problem with this type of model is the loss of personal preparation time. I agree this is a big problem, especially for laboratory/activity based courses where more set-up and clean-up time is needed. Also, some parents may have too high of expectations and anticipate there to be more integration within the subjects. Another type of approach is *interdisciplinary instruction* in which two or more disciplines, such as science and technology, are grouped together. In this model students attend each class separately, but both classes are centered around a common theme or similar ideas. In this model it is likely that some lessons will be team taught further bringing the curriculum together. In *integrated* instruction two or more disciplines, such as science

and technology, are grouped together and may be in separate rooms or in large combined classes. In this model there will be team teaching and material may be taught at the same time together for two or more disciplines. Also, projects and group assignments will combine disciplines.

Research and practical application from workshops taught us that the best way to change the curriculum into a 'block' design, was to follow distinct steps. It was suggested that the first year be as described above under *team* in which a group of teachers share the same students, have a common planning time, and discuss individual student progress and needs. During the second year teachers may begin to look at common course outcomes and teach similar outcomes at the same time. Then, during the third and fourth years, teachers should begin team teaching specific lessons that overlap curricular areas. And finally, during the fifth and sixth years teachers may begin developing projects and lessons that cross all curricular areas. It was indicated to us many times that what we were attempting was a six year process. Unfortunately, we felt we didn't have the luxury to slowly implement this program due to outside pressures. As stated earlier, the middle school had just completed the first year of this process where they had a 'team' approach and simply shared students and had a common planning time. A survey of students (and their parents) leaving that program and entering our program showed a general dissatisfaction with that program due to the lack of cross-discipline activities. Because of this and administrative expectations that our proposed program would be really different and great, we felt pressure to implement as much integration as possible. The ninth grade block team decided to employ what we called an interdisciplinary, integrated, team approach. We actually skipped to about the projected fifth or sixth year, a mistake I will discuss in the evaluation portion of this paper.

The committee who developed this program also decided to have the district Exit Outcomes also be Block (study group) Outcomes. Exit outcomes are the outcomes all students should achieve before graduation. They are written; Students demonstrate skills as:

- Competent Communicators
- Responsible Citizens
- Collaborative Contributors
- Self-Directed Learners
- Effective Thinkers
- Healthy Lifestyle Managers

The specific outcomes of the block were:

1) To allow for cross-discipline instruction so that students can make connections between subjects and to eliminate teaching some of the same topics in different classrooms which would, in theory, save instruction time.
2) To create an environment where students can develop a sense of indepen-dance, maturity, self-discipline, and motivation due to the flexibility and responsibility given to them.

3) To have students involved in interdisciplinary projects that make connections between what is being learned in school to what is happening in the *students'* lives. We wanted learning to have a purpose for each student.

4) To create a 'family' type atmosphere within the block where each student feels he/she belongs. When students enter high school, they often feel intimidated and isolated. We wanted to have a 'school within a school' where each student could feel 'safe'.

5) To be able to monitor student progress better by having six teachers sharing the same students, allowing them to discuss concerns about individual students regularly. This would help prevent students from 'slipping between the cracks'.

This report will assess our success in achieving these goals. During my research I looked for studies from other schools where a similar integrated program occurred. There were many schools involved in such programs, but I could find only qualitative studies. I could not find qualitative studies where actual test scores and grades were compared. However, most of the reports included many of the 'problems' I will discuss in the summary that we also encountered.

LITERATURE REVIEW

Careers and jobs are continually changing along with the marketplace. Because of this education must also change and continue to meet these new demands. Education must strive to help students develop skills which they can apply to these new circumstances rather than simply giving them knowledge. Many educational systems today are preparing students for specific jobs rather than giving them the skills to be used in any job. Students need to work with a desire for success rather than a fear of failure, they should be able to accept and understand that from failures they will learn and grow and be more likely to be successful in the future. Schools today need to have high academic standards and assess the meeting of those standards through performance based assessment. Performance based assessment is a method of assessing student understanding and often takes place during an activity as well as upon completion of that activity. This type of assessment is used to determine the process students are using rather than only assessing the product, which is what is usually done. Teachers must also learn to better and more appropriately reward students for reaching the goals we set and rewarding the educators who assist them in attaining those goals. Public schools are beginning to realize that it is necessary to educate in a different way to prepare students for the 21st century. It is important that all students have high self esteem and a sense of self-worth and pride which will enable them to continually achieve new goals and learn new skills as the workplace demands, whether they enter the workplace after high school or college. The way to ensure that all students acquire these goals is by preparing them to enter the workforce which in turn will enable them to be successful and then have a sense of accomplishment and pride.

Piaget, a famous Swiss psychologist, developed many ideas related to cognitive development which are still studied and practiced today (Papalia 1986). He claimed two general characteristics, organization and adaptation, of cognitive development. Organization is the bringing together of all one's learning into one overall system. Adaptation is the process where the learner must adapt new information into what has already been learned and involves assimilation and accommodation. Assimilation means absorbing new information while accommodation is when the learner changes previously learned knowledge to fit the new information.

Often times in the secondary years of formal education it seems these basic principles are forgotten. Many educators focus on 'covering' the ever expanding curriculum and scientific body of knowledge without regard to the process in which students learn. Many science teachers feel great pressure due to curricular demands and the many academic tests we must prepare our students for, such as the Michigan High School Proficiency Test, the ACT, and the SAT. Pressures also come from parent expectations and expectations for college which further limit the methods which can be employed. For example, when I teach students why we have seasons in Michigan, I begin with a class discussion about what the students currently believe drives seasons. An overwhelming majority of them think the reason for the seasons is due to the Earth's distance from the sun as it revolves around it. They have learned that the Earth does rotate on its' axis and revolves around the sun. They have also learned from experience that when you get closer to a very hot object, you get warmer yourself. I believe it is the responsibility of the teacher to help students to reconstruct this knowledge which will allow them to perform what Piaget called assimilation. This type of teaching is now called constructivism. After I have determined if indeed the misconception does exist, I have students perform an activity using globes and a light source to actually demonstrate the seasons in Michigan. I have found this activity to be quite effective in helping students fit this new information into their previous knowledge. I also know from previous teaching experiences that when I have lectured to students, the true understanding of the concepts has not generally lasted long.

Piaget is the father of constructivism, which helped begin the movement for experience learning. "The basic idea of constructivism is that knowledge must be constructed by the learner; it cannot be supplied by the teacher. This is vividly expressed by the proverb 'A well must produce its own water.'" (Holzer 1997). Piagets definitions of knowledge are as follows:

- Knowledge is an interaction between subject and object...
- Knowledge...is a perpetual construction made by exchanges between...thought and its object...
- Knowledge...isn't a copy of reality...it's a reconstitution of reality by the concepts of the subject, who, progressively and with all kinds of experimental probes, approaches the object without ever attaining it in itself. (Holzer 1997)

What is implied by the premises of constructivism and thus Piaget is that learning must be experienced and is the responsibility of the learner. The responsibility of the teacher is to create an environment and to provide experiences to allow the learner to learn. When these experiences are provided, through such things as inquiry, experimentation, collaboration, exploration, discussions, etc., the students are involved in active learning. Interdisciplinary instruction, which is the focus of this study, is by nature broad and open ended, rarely offering one, easily attainable answer. This type of instruction forces students to be actively involved in the learning process.

One technique of integration we learned about is called "Theme Immersion" (hereby referred to as "TI") is one technique of instruction which helps students make connections between classroom learning and their world. Although we did not completely adopt the TI methods exactly, we did decide to have a theme for each unit project. TI involves a long term (usually), in depth study of one topic or concept. Many TI teachers actually involve the students in the choosing and planning of the unit. Students should also be involved in deciding how they will communicate what they have learned. This can be done through poetry, simulations, stories, songs, models, experiments, or any method that demonstrates knowledge. In this type of classroom, the teacher becomes a learner alongside the students, not the supplier of information (Manning 1994).

Jean Piaget's basic principles also support the ideas of TI. He believed that students construct their own knowledge internally, they do not construct meaning from having information given to them. He believed that social interactions will strongly influence a students ability to construct that knowledge (Brooks 1993).

John Dewey had several ideas regarding teaching strategies that are still applicable, especially as related to TI. He believed the curriculum should not be a study of separate subjects not related to the lives of the students. Teachers need to look at the world through the eyes of their students to determine the best teaching strategy that will make connections between the academic concepts and the student's world. He also believed that the curriculum should not be a progression from one topic to another, but should help students develop new attitudes and interests towards learning. This will then help create students who have the interest to learn throughout their lives, and in doing so will help make the world a better place to live (Manning 1994).

When choosing a topic for a TI unit, it must be one in which students will be interested and one in which there is no definitive answer. It should also include mandatory outcomes and testing of outcomes that would be part of the curriculum regardless of the theme. It is also recommended that the theme includes world and local events and history. When the theme topic holds interest for students and involves events that directly impact their lives, it creates an environment where students must take risks and defend their points of view. Piaget argues this is necessary for active learning.

Another important part of TI is how students demonstrate their knowledge, or assessment. This can be done in a number of way such as through art, music, writing, technology, dramatizations, and models. The method used to demonstrate student knowledge may or may not be part of the assessment and evaluation process (tests). Assessment simply refers to the gathering of data taken from samples of students' work. From this data a teacher can determine how a student is progressing towards meeting the expected outcomes. Evaluation is the analysis or making judgments of the data based on selected criteria. These processes should occur continuously throughout the unit as opposed to traditional tests that usually take place at the end of a unit of study.

There is much research to support the idea that for students to actually learn the concepts we intend to teach them, they must be involved in active learning rather than passive learning (Farmer 1981). Students should be directly involved in the learning process through research, debates, interviews, and activities. When students are forced to acquire the knowledge for themselves and are given a meaningful purpose for attaining the information, they are more likely to remember what they have learned. Passive learning is when students are not directly involved in attaining information, but are 'given' the information from some other source. It has been shown that people remember only a small percentage of what they learn through this manner (Brooks 1993). Unfortunately, many science teachers in Michigan that I have spoken with feel they do not have enough time for much active learning due to the many topics they are expected to teach.

In this study we did not follow any one method we had learned about. Instead we decided to use the knowledge we had acquired and incorporate the methods we thought best would meet the needs of our students. One advantage we thought we had was that we knew there were some outcomes common to two or more subjects which would allow us to either team teach these outcomes or to at least teach them once and save time. We all agreed it was necessary to involved active, rather than passive, learning when teaching towards those outcomes whenever possible. We also wanted each unit integrated project to revolve around a central theme that was important to students' lives. Many of the ideas we learned through the study of constructivism, theme immersion, active learning, and integrated instruction were fused into our curriculum, but we did not simply choose one style to implement directly.

DEMOGRAPHICS OF CLASSROOMS: THE 'BLOCK' CLASSROOM VERSUS THE 'REGULAR' SCIENCE CLASSROOM

The following are course descriptions of the two groups, the study and control groups, exactly as they appeared in the handbook:

> Ninth Grade Integrated Block Course Description:
> During the summer and continuing into the school year of 1996/97 an interdisciplinary team of six teachers (English, Social Studies, Health, Special Education, and Technology teachers) with a common planning period have planned and implemented a block of integrated studies composed of about 110 freshman students. This was a three hour block which offered credit in English 9; Health; Integrated Science; Social Studies I and II; and Living with Technology. This unique, student-centered program of studies challenged ninth grade students to expand their knowledge and abilities within an integrated philosophy of learning. Students were engaged in activities involving "real life" models and hands-on projects, using both traditional and non-traditional approaches. Teaming and problem-solving skills were emphasized as students designed projects which took into account individual interest and ability levels. The teachers developed daily lessons which integrated the content areas of English, Social Studies, Science, and Health with an infusion of Technology. The students represented a cross section of the ninth grade class. Students of all abilities were involved in the block. A special education teacher worked closely with special needs students within the student teams as well as a teacher's aide assisting an inclusion student.
>
> 9th Grade "Integrated Science" Course Description:
> The 9th grade science program is designed to show the interrelatedness of the various branches of science: Life Science, Earth Science, and Physical Science (Physics and Chemistry). The three disciplines are not presented as separate and exclusive rather unified by the concepts and processes that are common to them all. For example, the concept of ENERGY in the past has been presented various times relating to the specific discipline being studied but no application to other disciplines is mentioned. In this science course ENERGY will be presented as a unifying concept and will be studied from the point of view of all three branches of science. Emphasis will be placed on the fact that all events and processes involve transformations of energy.
>
> In each unit the emphasis will be on presenting material to be studied by students, teaching students how to gather information, analyze it, draw conclusions, and present findings. The approach will be a process oriented one. Students should

> be regularly exposed to processes that reoccur continually in nature and unify all the branches of science (IE. change over time), and processes that are used by the scientist to study the world around him. Student investigations should be activity based whenever possible. In this light activities, laboratory experiments, discussions, debates, and computer simulations should be the order of the day. A significant focus should be placed on group work and skills necessary to work productively in small groupings.

For both 9th grade science programs, the study group and the control courses, the content goals were written so as to satisfy all the requirements of the Michigan State Core Curriculum and the Michigan State Proficiency Test.

The study program was composed of 103 freshman students who spent the first three hours of the day, 8:15-11:10, in the program. There were five subjects in the study group; science, English, health, social studies, and technology. Twenty-four of the students were enrolled in 9A, an advanced English program offered only in the block. These students had to be occasionally separated from the group to receive necessary instruction and assignments to satisfy the advanced requirements. The study program also had 9 special education students and one inclusion student. Students signed up for the study group at the end of their 8th grade year. We had a cap of 110 students and had to resort to a lottery system to determine who would get into the program. Since, it was very important to ensure we had a heterogeneous group, so we first selected the 24 9A students and 9 special education students before choosing the rest of the group from the lottery system. Six teachers were assigned to the study group program, one representing each curricular area, and a special education consultant. Each week's schedule varied

depending on the work to be completed in each course, the amount of time needed for such work, outside school events (such as assemblies), etc. Following is a sample study group schedule. When studying this sample weekly schedule, I understand that it may not be clear how integration is accomplished when it appears all classes are separate. The integration took place within the unit projects that are discussed in the "Implementation" section. During some weeks students may have one or two hours for project work, they may work on projects in an elective class (like technology) each day, or they were sometimes even given an entire morning to work in their groups.

****the numbers before the subject refer to the room number****

SCHEDULE FOR WEEK OF...

		Group A	Group B	Group C	Gro. D
MONDAY					
	8:20	**27/science**	26/health	1/English	2/soc.
	9:05	**2/social studies**	27/science	26/health	1/English
	9:50	**1/English**	2/social studies	27/science	26/health
	10:30	**26/health**	1/English	2/social studies	27/science
TUESDAY					
	8:20	**27/science**	26/health	1/English	2/soc. s
	9:45	**2/social studies**	27/science	26/health	1/English
WEDNESDAY					
	8:20	**1/English**	2/social studies	27/science	26/health
	9:45	**26/health**	1/English	2/social studies	27/science
THURSDAY					
			Same as Monday's schedule		
FRIDAY					
			"OPTION DAY"		

As one can see from this schedule, longer periods of time can be allotted for each subject for in-depth study, this was of great benefit for teaching science, especially for lab activities. Most weeks we had what we referred to as an "option day". On this day, students usually had four choices of activities to select for three to five sessions. Sessions included activities such as: a tutorial for students missing assignments in any block class, an interesting enrichment science lab, constructing toothpick bridges in technology, acting out "Romeo and Juliet" in English, discussing a career in law in social studies, an extra review session prior to a test in any course, an exciting video, etc. Teachers encouraged students to make positive choices on how they spent their option day sessions. It was the hope that by the end of the year, most students would make selections based on interest and need of help in some content area rather than on where their friends were going. This goal was realized for many students who no longer were attending sessions exclusively with their friends and would specifically ask me for assistance for an upcoming test or to complete a lab assignment.

Students in the regular science class met daily for 55 minute periods. A typical week might include a discussion introducing the week's objectives on Monday with a reading assignment as homework. The rest of the week consisted of lectures, class discussions, activities, and laboratory experiences. Though I am calling this a 'typical' science class, this is a typical science class the way I teach. For example, some science teachers teach by having students read from their textbooks, answering questions based on that reading, discussing those questions in class with the teacher doing most of the talking, and finally

taking a standard objective-type test at the end of the unit. I do NOT mean this when I say 'regular' classroom. I begin a topic of study by determining students' prior knowledge. This is usually done by a journal assignment followed by a group discussion where *students* discuss what they have written. We might also have a brainstorming session to find out what students already know about the new topic. These two techniques allow me to determine what students' misconceptions are so I can build future lessons from that point. I now know this type of teaching strategy to be called 'constructivism' though at the time of this study I was unaware of this term. I find if I first have students' discuss and think about what they believe to be true (which are sometimes misconceptions) it is easier to construct their learning from that point of view, they will be learning for long-term understanding rather than short-term retention. Referring back to the example regarding the reason Michigan has seasons, if I simply *told* students the reason, I know from past experience that many of my students would remember this information only for the test. I also know from experience that most of my students would NOT remember this information for very long. What they WILL remember is the misconceptions they had to begin with.

The two programs were taught using *basically* the same teaching strategies and the same activities. A sample of these activities which were developed or adapted by me to help *all* students learn science is included in Appendix "A". Students in the study had much less time for science class alone and had more integrated science with the other subjects. In a typical week, I had students from the study group to myself for about 175 minutes

while I met with my control classes 260 minutes per week. Please refer to the schedule at the beginning of this section to follow the schedule of one group of students through a typical block week. I have highlighted group "A" in bold.

IMPLEMENTATION

For each of the four marking periods, and a short introductory two-week time period, we had students involved in a unit project. The purpose of the projects was to provide an extensive interdisciplinary experience for each marking period. We did not attempt to integrate the subjects other than within the projects. Project topics were chosen by the block teachers as we brainstormed together. The goal was to design projects that were not only interdisciplinary, but also were interesting and of value to the students. The projects are discussed in detail later.

The interdisciplinary projects accounted for 20% of the marking period grade for *each* block class. Before designing any of the four interdisciplinary projects (one per quarter) all study group teachers made a list of all course objectives they either couldn't or wouldn't give up. We looked for common outcomes in all curriculums and/or between any combination of curriculums. For example, some writing outcomes were common to all subjects. Another outcome found in all block curriculur areas was problem solving, which is also a high school exit outcome. Some outcomes were common to all areas while others were specific to a certain subject area. For example, in science, students must learn atomic structure which is obviously not within the other disciplines. We then decided upon a sequence for the outcomes based on the sequence of the science outcomes. Science was chosen to determine the sequence simply because it was the only course that did have some topics that must be learned before more advanced study can take place. Then, we determined which objectives were to be covered each quarter from each course. Based on the objectives we were able to design projects that were relevant to the students while incorporating many of the necessary concepts. Based on training the study group teachers were involved in we did learn that you should not pick a project and then try to "fit" your curriculum around it. It was important that all mandated objectives be met in the curriculum and that any projects serve to further the study of those objectives. We also quickly realized that some objectives would have to be taught outside the scope of the project, especially, if not exclusively, in science. For example; it was a state mandate that I teach the structure of the atom which does not nicely fit into any of the four unit projects. Students were then scheduled for a science session to meet such objectives. A few block teachers argued that if it didn't fit into this 'new way of doing business', then what was the justification for teaching it? I strongly argued that although it would be nice to be able to determine for my students what is important for them to learn, the state and hence school district has already decided this for me. Another reason why science was chosen to drive the sequence for the objectives, was because the other courses have many objectives which can easily be covered within the framework of the science curriculum. For example; many writing objectives can be met by writing in science. Also, problem solving was an outcome common to all subject areas. The process can be taught in science and applied to the other classes.

Below is a brief description of each interdisciplinary unit project:

Unit "Zero":

"Setting the Stage"

At the beginning of the school year we wanted to begin with a 'mini' project to acquainted with one another and the teachers. This project lasted only two weeks, compared to the nine week projects that came later. Students were randomly assigned to groups of eleven and were given the task to create a documentary entitled "WE ARE THE BLOCK" starring each person in the group. The presentation (documentary) was to include an introduction of each member of the group, each member speaking on the tape, some interesting and "typical" props from around the school and community, and tell something about "The Block". Groups were asked to consider using music for background, using technology equipment to create titles and credits, and to mix the required information rather than having straight introductions. Each presentation was to last five to six minutes and was videotaped to create one final long video representative of the block.

1st marking period interdisciplinary project:

"The Effects of Growth in the Community"

The first interdisciplinary project was entitled "The Effects of Growth in our Community". This community fairly recently was a small, rural farming community. Since this time it has slowly grown into a small suburban community often considered a 'bedroom' community of a large suburban university city. Also, because of this university community and it's strong academic base, the community is populated with many professionals and not as much agriculture activity is present. We thought that having students study the effects of this growth from different perspectives would be a 'real-world' problem for them worth their time and efforts. The students were placed randomly into groups of about ten. It is important to note here that for each project, the special education students were evenly distributed within the groups. Each group had to research the effects of the growth of the community from the perspective of a community group and prepare and present a multi-media presentation for the other block members. The community groups represented were; agriculture, business executives, high school students, merchants, police and fire personnel, hospital administrators, educators, residents, church leaders, city officials, and environmental groups.

Second Marking Period Interdisciplinary Project:

"The Scrambler"

The second unit project had students working in groups of two of their choice. This project had three components: building a device to transport an uncooked egg without hitting a wall and breaking the egg, writing a manual that describes the vehicle and how it was built, and designing an advertisement to "sell" the vehicle. This project was adapted from a Michigan Science Olympiad event also entitled "Scrambler". The system had to transport a Grade A uncooked chicken egg a distance of 12 meters along a curved track, stopping as close to possible to a terminal barrier without leaving a two meter lane. The only source of energy used to move the vehicle was a falling mass not to exceed two kilograms. Points were awarded for having the vehicle ready on the competition day,

having a moving vehicle, the vehicle getting within a certain distance of the terminal barrier, the vehicle staying on the track, and not breaking the egg. Each team was given two trials to test their vehicle and prizes were awarded for the top winners.

Third Marking Period Interdisciplinary Project:

"A Student Portfolio"

Throughout the year we wanted to have different sized groups for the unit projects. The zero and first project had students working in groups of about ten, the second unit in pairs, so we decided to have this project be completed by individual students. Students welcomed this project because they have a difficult time working in large groups with the various personalities of their classmates. Students who are more concerned with achieving high grades feel their grades are affected by other students' performance. Parents often express this concern also. For this unit, students developed their school portfolios which were to include pieces of work from each block class. They completed a career resource center worksheet where they had to research many various careers in the schools' career resource center. This introduced them to different career areas and forced them to begin thinking about career choices. They also compiled a 'bagfolio', which is a bag brought from home filled with items that represent who they are. Many students brought awards, items related to their hobbies, and photographs of family and friends. This was done before construction of the portfolio to help students understand the purpose of one. Finally, the portfolios included evidence and written explanations for items showing they had developed academic skills, personal management skills, and teamwork skills. A resume was made during this unit along with an educational development plan which mapped out their future school courses and plans for the future beyond high school. This project was the most popular by the students because (according to a survey discussed in Appendix C) they enjoyed exploring career areas, giving them the opportunity to plan their future. I personally think they enjoyed it because it was an *easy* project relative to the previous ones. I was not pleased with this project because it wasn't as effective as the other projects at crossing curricular lines and thus not integrated. The teachers also wanted an easier unit for ourselves because during the "Scrambler" unit we had *many* complaints from both students and parents.

Fourth Marking Period Interdisciplinary Project:

"Career Exploration, Booth & Fair"

For the fourth and final marking period project students worked in groups ranging in size from two to six members. Groups were selected based upon a career inventory survey completed during the portfolio project. The task of this project was to prepare for a career fair at two elementary schools. Students prepared booths which were to include an informational brochure, a banner, and a career related activity. The groups included career focus areas such as small business, agriculture, psychology, marketing, education, automotive, medical trades, engineering, and veterinary science. Each group was assigned a teacher, depending on the teacher's area of expertise, to act as the group's mentor. This project had five components including a job shadowing experience with a community member, a detailed questionnaire, a poster exhibiting or highlighting a career or a product derived from a career, a review of your portfolio by a community member, and a job interview and letter of application. The task of each group was to design a booth and accompanying brochure for a career fair to be held at two different elementary schools on two consecutive days.

EVALUATION

OBJECTIVE ASSESSMENT:

There were six major objective tests in science for both the study and control groups, not including the semester exams, throughout the year. The tests included multiple choice, short answer, and essay items. Both the control and study groups were administered the same tests at about the same time. I have included a graph indicating the average score for each group and a table including important data. I determined that a test score average or higher (73% or higher) is 'acceptable' while a test score below 73% is 'not acceptable'. Then I placed all scores into either the 'acceptable' or 'not acceptable' category and performed a chi square to determine if the differences in the scores of the two groups is significant or likely due to chance. Based on my data, one degree of freedom was appropriate and I determined my data needed to be significant to the .05 level. The following graph includes the average percent scores for each of the six unit tests for both groups. The chart also includes the percents for each test as well as the chi square value calculated for each test to determine if the differences in the test scores were significant.

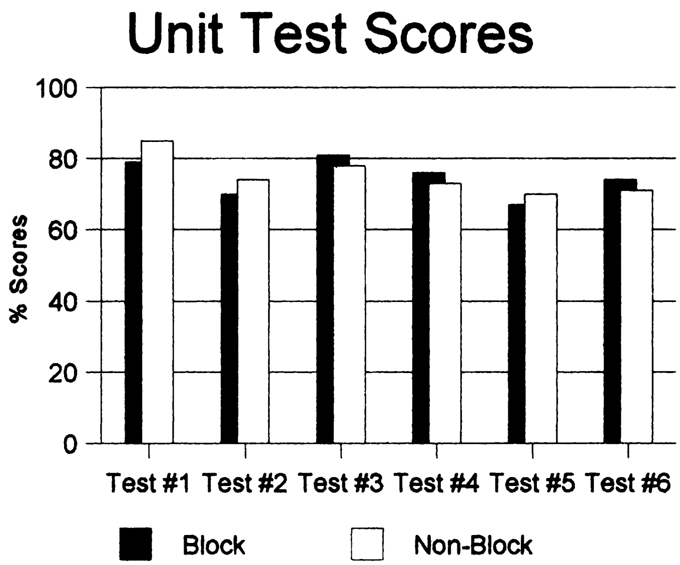


Figure 1 - Objective Unit Test Results

Table 1 - Objective Test Scores For Both Groups and Chi Square Values

Test #	Study Group Scores	Control Group Scores	Chi Square Value	Significant?
1	79	85	.223	NO
2	70	74	1.38	NO
3	81	78	.153	NO
4	76	73	.811	NO
5	67	70	.279	NO
6	74	71	.845	NO

Table 2 - First Final Examination Scores For Both Groups and Chi Square Values

	STUDY GROUP	CONTROL GROUP
# of student scores included	104	45
average % of group	78	78
chi square value*	.0242=not significant	XXXXXXXXXXXXXXXXXX

*=significant to the .05 level with one degree of freedom

Table 3 - Second Final Examination Scores For Both Groups and Chi Square Values

	STUDY GROUP	CONTROL GROUP
# of student scores included	100	45
average % of group	78	72
chi square value*	.176=not significant	XXXXXXXXXXXXXXXXXX

*=significant to the .05 level with one degree of freedom

Students in both groups were given the same science tests and final examinations at about the same time. There was not a significant difference in the scores for any of the tests. The hope was that the scores for the block students would be higher which may indicate that when students learn science within the context of 'real-world' projects, the learning will be more meaningful resulting in higher scores. But it is true that many of the science outcomes were not taught within the scope of the unit projects which would have invalidated that argument if the tests had been higher. It could be argued however that although the tests scores in the block were not higher, this type of instruction may be more effective considering students in the block received significant less science class per week. Perhaps this type of program is a more efficient use of time allowing outcomes from different subjects to be taught concurrently through the integrated projects. This was one of the original thoughts that began the development of the program two years prior to its' implementation. It is difficult to draw absolute conclusions based on only one year's data. The questions that cannot be answered at this point and that may have had great effects on the data include; 1) Is there a certain type of students who is more likely to enroll in a new program? 2) Were the tests an effective measure of student academic achievement? and 3) Did the time of day each group had science effect student test performance? Though these are just a few of the many variables that cannot be controlled in a study such as this, I do believe that when the students were involved in the science through the projects, they were learning at a much higher level than students in the control group. For example, when building the 'Scrambler' students had to learn first hand how friction would affect the speed and stopping of their vehicles. They could experiment by changing the size of their tires and using different textures to determine how to either increase and reduce the effects of friction. This type of experience is more meaningful than studying friction using blocks of wood covered in various grades of sandpaper to measure friction, which is a common activity used to demonstrate this concept. If many of the science outcomes could have been taught more directly within the projects as the example just described, I believe the science unit test scores for the study group would have been significantly higher than the control group.

SUBJECTIVE ASSESSMENT

SEMANTIC DIFFERENTIAL SURVEY

A semantic differential survey was given to both the study group and the control students at the end of the school year. This type of survey is intended to indicate attitudes of the participants. I chose to evaluate the items asking if science is related to english, health, social studies, and technology because the block program was designed to assist students in making those connections. I also studied the selections students made for the items addressing their attitudes about science to allow me to compare students' attitudes about science in both groups. The survey administered was as follows.

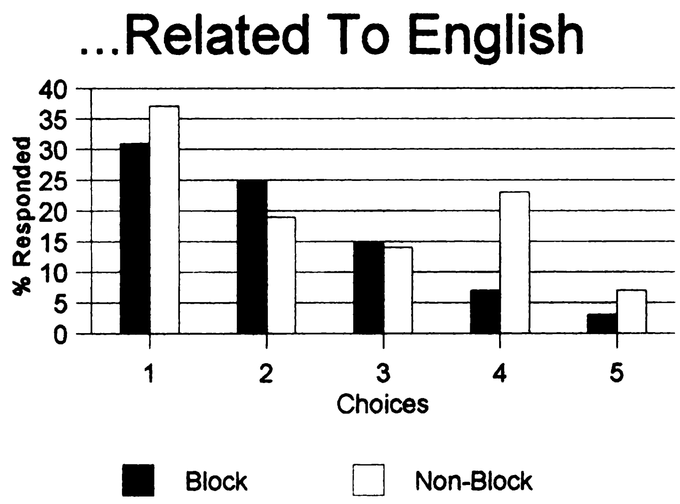
Directions: Read each pair of opposite statements referring to your opinions about science in general. Scan in "1" for definitely not, "2" for I don't think so, "3" for I can't decide, "4" for I think so, and "5" for definitely yes.

Simple	1	2	3	4	5	Complex
Easy to learn	1	2	3	4	5	Difficult to learn
Boring	1	2	3	4	5	Interesting
Impractical	1	2	3	4	5	Practical
For everyone	1	2	3	4	5	For scholars only
About real things	1	2	3	4	5	About theories
Valuable to society	1	2	3	4	5	Worthless to society
Worthless to me	1	2	3	4	5	Valuable to me
Related to math	1	2	3	4	5	Unrelated to math
Related to english	1	2	3	4	5	Unrelated to english
Unrelated to health	1	2	3	4	5	Related to health
Unrelated to social studies	1	2	3	4	5	Related to social studies
Related to technology	1	2	3	4	5	Unrelated to technology

Notice with the scale used above, a 'positive' response may be either a 1 or a 5 as the scale has been reversed several times on the survey items. This was to ensure that students would *think* about their responses rather than simply marking all ones or all fives, depending on how they may be feeling that particular day. Also, some of the items are written as a positive while others are written as a negative. These strategies were recommended from the source I used to develop this survey (McRel 1995). However, I would NOT write a survey using either of these strategies in the future because of the

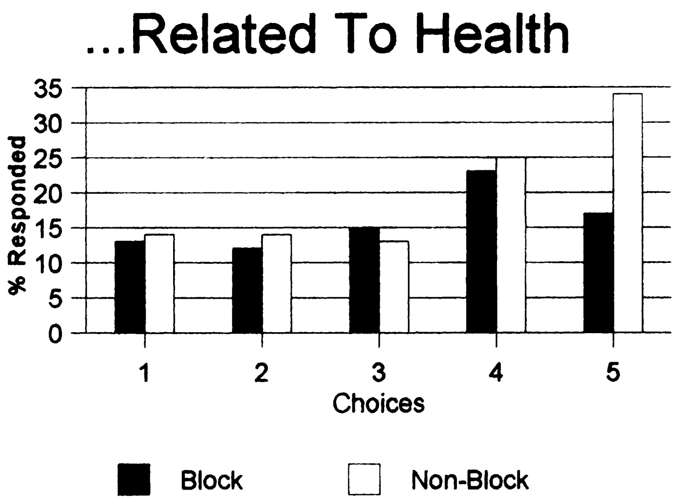
MAJOR confusion it caused both the students while taking it and myself while analyzing the results. I would recommend ranking numbers (1-5) consistently representing the same chosen response and to write all the survey items as positive statements (or negative). Then, to ensure students were honest in their responses, I would eliminate any surveys having the same chosen responses for each item (all 3's or 5's for example).

The following graphs indicate students' opinions about the degree of relationship between science and english, health, technology, and social studies which were the other subjects in the study program. The next graphs indicate students' opinions about science being interesting, practical, and relevant to them. A response of "5" indicates strong agreement, "4" is an agreement, "1" is a strong disagreement, and "2" is a disagreement.



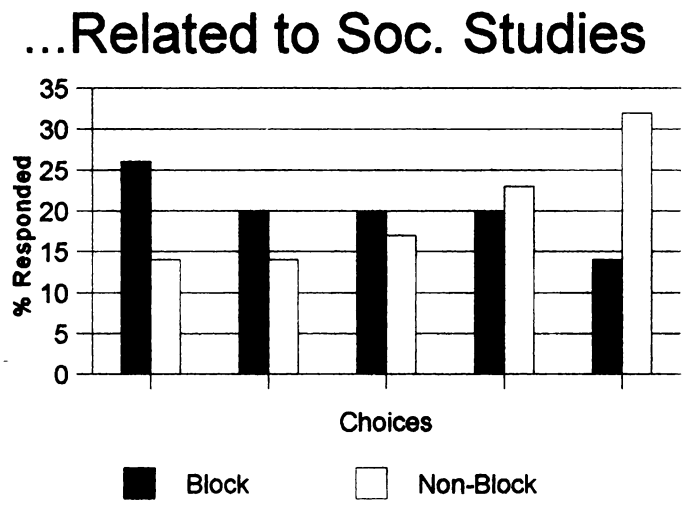
Block	31	25	15	7	3
Non-Block	37	19	14	23	7

Figure 2 - Student Opinions Regarding the Relationship Between Science and English



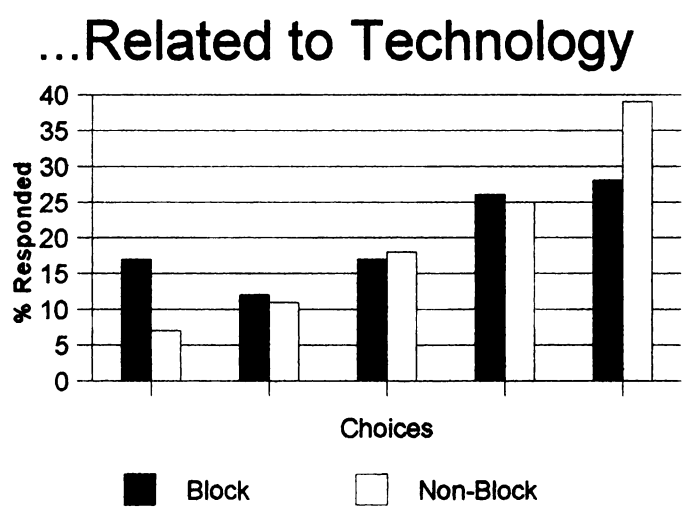
Block	13	12	15	23	17
Non-Block	14	14	13	25	34

Figure 3 - Student Opinions Regarding the Relationship Between Science and Health



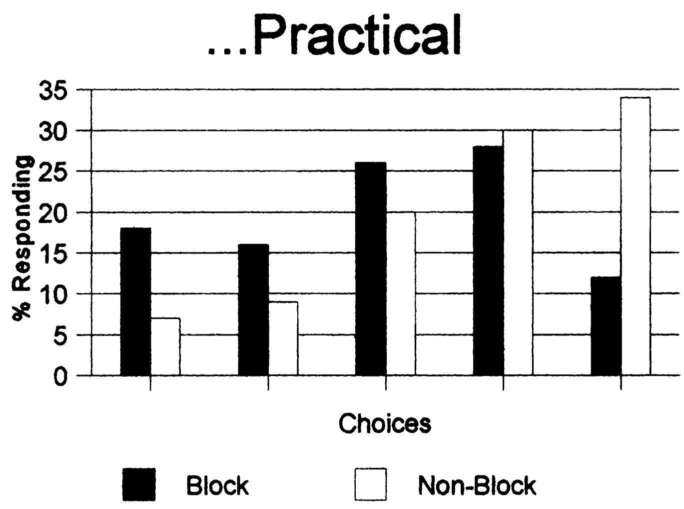
Block	26	20	20	20	14
Non-Block	14	14	17	23	32

Figure 4 - Student Opinions Regarding the Relationship Between Science and Social Studies



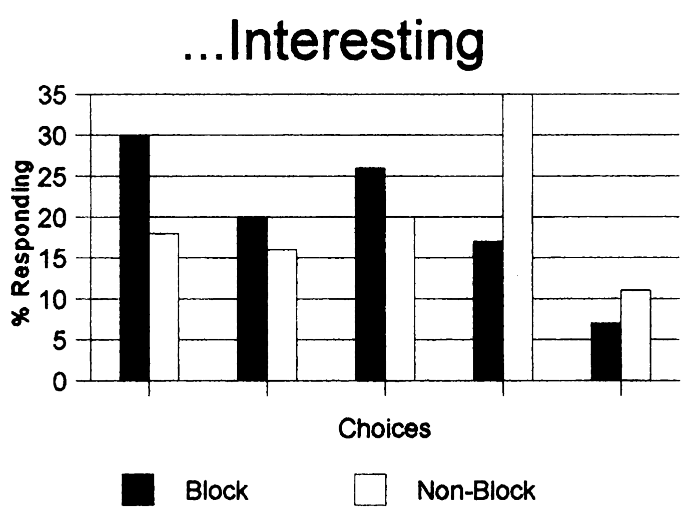
Block	17	12	17	26	28
Non-Block	7	11	18	25	39

Figure 5 - Student Opinions Regarding the Relationship Between Science and Technology



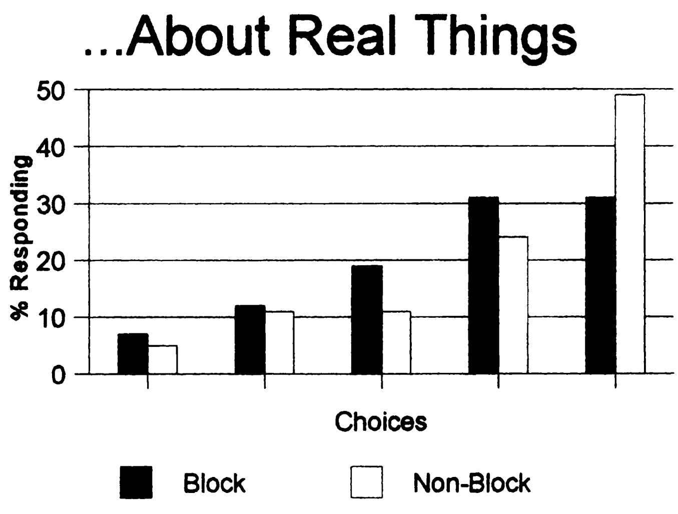
Block	18	16	26	28	12
Non-Block	7	9	20	30	34

Figure 6 - Student Opinions Regarding the Practicality of Science



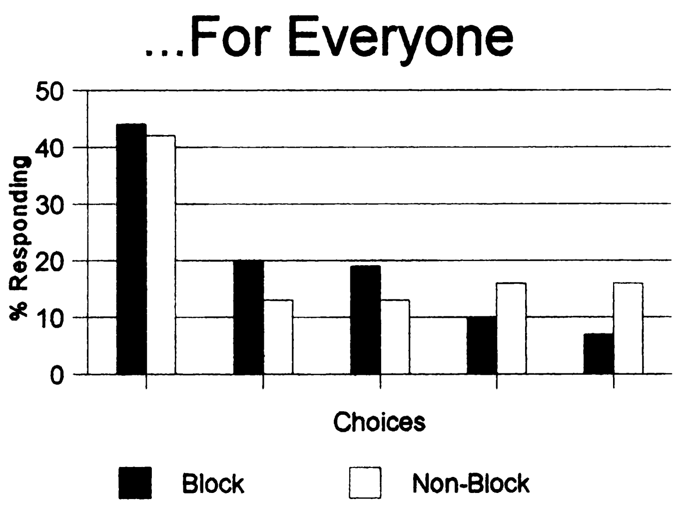
Block	30	20	26	17	7
Non-Block	18	16	20	35	11

Figure 7 - Student Opinions Regarding How Interesting Science is



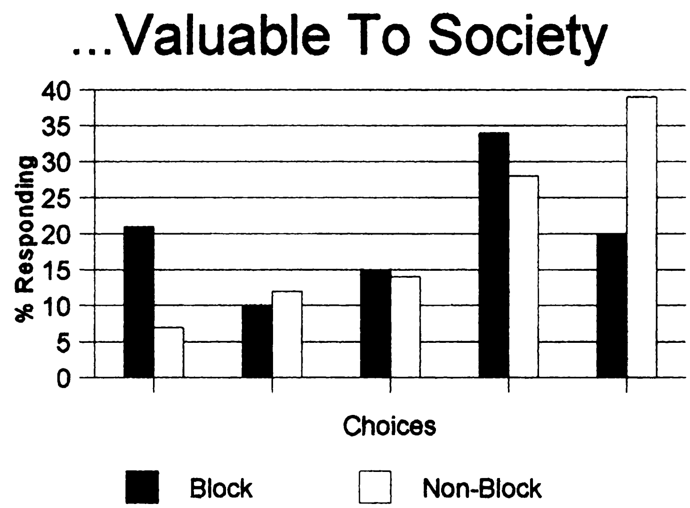
Block	7	12	19	31	31
Non-Block	5	11	11	24	49

Figure 8 - Student Opinions Regarding Whether Science is About Real Things



Block	44	20	19	10	7
Non-Block	42	13	13	16	16

Figure 9 - Student Opinions Regarding Whether Science is For Everyone



Block	21	10	15	34	20
Non-Block	7	12	14	28	39

Figure 10 - Student Opinions Regarding Whether Science is Valuable to Society

Based on the information obtained from this survey and the preceding graphs, it is clear that less students in the study group agreed that there were connections between science and the other subjects in the program. In fact there was also a higher percentage of them that strongly disagreed that the subjects were connected. This is quite surprising because the program was designed with the intention of exploring these relationships. It was also indicated by the survey that study group students had more negative opinions regarding whether science is about real things, valuable to society, for everyone, practical, and interesting. I am not confident that the results of this survey are valid. The students in the study group did not like the program which may have influenced their choices when responding to the survey. I have found that students at this age have a difficult time being objective, their emotions seem to control them. I believe if this survey could have been given at least one year following enrollment in the program, the results would have been either closer or reversed because of the maturity of the students.

ESSAYS:

All students were assigned two essays and asked to develop a concept map at the end of the year. I randomly chose six students from each group, block and non-block, from which to draw conclusions. The random sampling technique used is discussed in Appendix "B". The essays were; "What science means to me..." and "Science is only applied to math. Do you agree or disagree with that statement? Give reasons to support your position". At the end of the school year both groups were asked to complete these sentences in a minimum of one paragraph. I then read the same six students essays from each group to determine if there was a difference between their attitudes towards science. Understanding that this is very subjective, I came to the conclusion that there was no difference based on this essay.

Students in both groups were asked to develop a concept map given a certain number of concepts or ideas. They place each word, and more if they choose, within oval shapes on a piece of paper. The challenging part of this activity is using linking verbs to connect concepts to one another. I gave students the five subject areas (science, health, english, social studies, and technology) and a few additional terms to include in their concept map. I then randomly chose six students from both groups to analyze to determine the

number of connections they were able to make between the subject areas.

SOLVING A "REAL-LIFE" PROBLEM

At the end of the school year I asked students in both groups to explain how they would solve a typical problem. The purpose was to determine if either group had better skills at using a problem solving skills after the year of instruction. There were several problems for students to choose from based on the variety of student interests. Three example problems were:

1) You are a college student who has limited time for studying, you would like to determine at what time of the day your studying efforts will promise the greatest results. How can you determine this?

2) You are a skateboarder/rollerblader and are in the market to purchase new wheels. You would like to test several brands to determine which will allow you to go faster. How would you do this?

3) You are a cook trying to determine the correct number of eggs for a new recipe which will allow for the best texture in your creation. How will you determine how many eggs to use?

Again, I looked at the six student samples to determine if the problem solving skills were better in either of the two groups. There was no difference between the two groups in the ability to solve the problem, and actually I was quite pleased in the responses from all my students.

SUMMARY AND EVALUATION

It is difficult to determine whether or not this program, the integrated 'block' program, was 'successful' as there are many variables to consider. To determine this I looked at not only student grades, but also student opinions, student behavior, teacher opinions, the amount of planning time involved, student attitudes and my own personal day-to-day life during this year. Moreover, a program such as this should be in place for about six years before one can truly draw conclusions regarding it's success or failure.

When analyzing student grades I considered the six unit tests, and two final exams for both groups. Both the control and study groups were given the exact same tests at the same time in all cases . By using a chi square statistic I have determined that in none of these scores was there a significant difference in scores, which means any differences in the scores can be attributed to chance. Therefore; based on academic grades, following one year of this program's implementation, there was no impact on students' academic achievement. I was somewhat surprised in this because much of the science content was taught outside of the integrated projects, this meant I had very little time for exclusive science teaching. During an average week the study group students had 175 minutes of science instruction while the control students had 260 minutes. My hypothesis was that the study group students would have a better understanding of the concepts taught *within* the interdisciplinary projects, but less understanding of the concepts taught the 'regular' way. Because the tests did not distinguish between concepts taught in projects and those not in projects, the average scores were so similar despite the fact that the study group had less instruction time. I didn't feel it would be realistic to separate those concepts because it was my job to teach *all* the objectives well, not just the ones involved in the project.

Though students in the block did not perform better on objective tests than the non-block students, there were other areas where it seemed to me they were more advanced. The study group students had to be more self-sufficient and motivated than is typical for ninth grade students. When working on unit projects involving large groups, students had to delegate responsibilities among the group and each member had to independently carry out their tasks. Each group was working on its' own unique project in most cases and teachers were acting as mentors to assigned groups. For this reason, students were given great freedom. On a project day, some students may be researching in the library, making phone contacts, constructing something. Others may be acting as the group leader, making sure everything is moving on schedule. Students basically had the freedom to go where they needed to be and I never once found a student not on task. If I had left the room in one of my control classes, I believe that there would be a much greater chance they would take advantage of the situation and cause trouble.

The only difference I determined between the two groups was in student attitudes and in my daily life. First of all, the majority of students did not like the block (study group). A detailed evaluation of a survey given to them is in Appendix "C". Their complaints included: they didn't like not being able to switch classes on the bell schedule, which prevented socializing with their friends; they thought the block was disorganized because the schedule continually changed; they didn't like working in groups; they didn't feel they had enough time in science or english-the two full credit academic classes; and they thought it was too hard. Even though I disagree with their point of view, I have finally come to the conclusion that it doesn't matter if their complaints are valid because if *they think* they are valid, that in itself creates a difficult situation. By the end of the year I could *feel* their unhappiness when I entered the room, while in my afternoon classes, the control, I felt the typical end of the year craziness and excitement. I prefer the latter as one of the main reasons I became a teacher is because I like kids and feel disappointed if they are not satisfied with the science education they receive. I agree with the students that they didn't get enough time in science class alone, and this is a battle I fought all year with my co-workers. They all felt I should 'give up' some of my curriculum for the benefit of the block, that true integration can only come when teachers can teach concepts only relevant to that integration. Though I agree with that point of view in theory, I also felt strongly that I had a responsibility to teach all students *all* the outcomes that were part of the ninth grade science curriculum. Students, my science department co-workers, administrators, parents, and the state of Michigan were expecting me to do this. Another problem I faced was that the 'Integrated Science' course for both groups was also in it's first year following *many* years of a biology course for ninth graders. The curriculum changes the science department was implementing came with *great* opposition from students, parents, some administrators, and many

teachers. All ninth grade science teachers were dealing with defending the curriculum throughout the entire year, and still today. Many teachers and administrators, including myself, now feel it was a big mistake having both the new science and the new block courses together. I was destined for double trouble! Besides the daily problems I had in dealing with general dissatisfaction about science from students, my daily life was also quite stressful because I had no personal planning time. Each day the block teachers met to plan projects and student schedules, actually we usually met through lunch also. This left all the laboratory preparation and all other daily activities until after school.

Overall, I feel we did a great job in implementing this new program with the limited resources, time, and support we were given. If I were asked to do this again given the same circumstances, I would decline, as would the rest of the teachers in the block and in the science department (they witnessed what I went through!). However, I would welcome the chance to try this type of program again with the following conditions: a personal preparation hour for each teacher, financial support to support unique ideas, working with a team of teachers who all choose to work together towards this effort, and if I felt I could effectively teach all the science outcomes in the program. The exact comments of the other teachers involved in the block are included in Appendix "D".

In summary, though I have stated I would not be interested in being involved in this program again as it was, I do believe the concept of interdisciplinary instruction is a positive method of teaching. I would suggest to anyone interested in starting a program similar to the one described in this study to consider the suggestions listed below, which we did not follow: 1) the program must be teacher driven; 2) teachers involved must volunteer for the position and choose to work together; 3) plan to take five or six years before complete integration of the curriculum is expected, start simple; 4) administrators must be supportive both financially and when concerns from parents arise; and 5) financial support must be specific for unique projects and activities in the program. I believe if we had followed these guidelines, the year would have been less difficult for all those involved and hence considered to be more 'successful'.

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APPENDIX A: STUDENT ACTIVITIES

I have included in this appendix the labs I developed (or adapted) during my research summer at MSU. I have only included the procedure for each because I rarely give my students pre-made data tables or pre-written post lab questions. My students become very good at organizing their own data which I feel forces them to think more about what they are doing rather than simply going through the motions of the lab. For the analysis portion, I have them write a summary about the lab discussing the purpose, data, interpretation of the data, problems encountered during the lab, and their conclusions. I find this is much more effective than having them fill out data tables and answer (or usually copy) answers.

LAB: DNA EXTRACTION

Purpose: The purpose of this lab is to extract DNA from at least two plant sources.

Materials:
DNA source: lima beans, onions, apples
dishsoap
ice cold ethanol
distilled water
mortar and pestle
test tube
wooden stirrer
salt

Procedure:

DAY 1:

1. Rinse out all glassware before using and put on gloves before touching glass again or onion.
2. Dice up 12 g onion into pieces no larger than 3mm x 3mm.
3. Loosely cover onion, label container with wax marking pencil and place in

refrigerator.

DAY 2:
1. Add diced onion to 50ml of homogenization medium (previously made).
2. Incubate this mixture at 60 C for 15 minutes (NO LONGER).
3. Quickly cool this preparation in an ice bath and incubate on ice for a further 6 minutes.
4. Blend in a blender on high for 1 minute, 15 seconds.
5. Store this solution in a 250 ml beaker in the refrigerator overnight.

DAY 3:
6. Filter the homogenate through four thicknesses of cheesecloth into a 250ml beaker. It is critical that the foam be left behind.
7. Cool this filtered solution for 10 minutes in a ice bath.
8. During this incubation label two test tubes, one "homogenate" and a line is marked 2 cm from the bottom, and the other "ethanol' with a line 3.5cm from the bottom.
9. Pour enough homogenate into the first test tube and cold ethanol into the second tube to fill them to their respective lines.
10. Precipitate the DNA by slowly adding the ethanol to the homogenate test tube. A visible precipitate should appear which can be wound onto a wooden applicator by spinning it in the test tube in one direction.

<u>Data:</u> Construct a data chart to compile the following data: source of DNA, source used to rupture cells, source used to precipitate DNA, and results. (4 pts.)

PRECAUTIONS:
- ♦ Each student MUST wear gloves *at all times* during the procedure to prevent enzymes which are *always* present on hands from interfering with the experiment.
- ♦ You MUST follow the directions *exactly*. This procedure will only work if all
conditions are precisely controlled.

MEASURING HEAT OF COMMON FOODS

Materials:

thermometer	food samples	food holder
kitchen wooden matches	utility clamp	slit rubber stopper with one hole
ring stand	4-inch ring	100mL graduated cylinder
cold water	can cut in half and cut edge taped	

Procedure:

1. Set up apparatus
2. Obtain two food samples
3. Record the mass of the can and the food holder (separately)
4. Add 50mL cold water to the can and determine the mass
5. Determine the mass of one food sample
6. Measure the temperature of the water in the can before and after burning the food to calculate the change in temperature
7. Place the food sample on the food holder (while not under the can) and ignite with a match once food is burning. Place under can
8. Repeat steps 4-7 for food sample two (you must startwithh cold water)

PLANARIA REGENERATION

Materials:

pond or river water	Planaria culture	shallow aluminum pan
sharp razor blade	glass petri dish-chilled	plastic well container
disposable dropper pipette		

Note: Planaria cultures can be purchased through Carolina Biological Supply company. The company provides a care manual with each purchase. Basic tips:

* keep in pond or river water only
* change water daily- do not use soap to clean tray-water only
* feed one week after delivery and weekly thereafter. Feed egg yolk-about the size of a pencil eraser per 50 planaria. Remove remaining food after 30 minutes. Better yet-change the water.

Procedure:

1. Using a dropper, fill each well depression with the planaria's water.
2. Place one worm on a chilled petri dish and cut the head off. Place each piece in separate wells. Observe for several days.
   Note: Make sure each well has enough water to prevent complete evaporation overnight and drying out of the worms.
3. Repeat the above trying several different cuts.

EFFECTS OF DRUGS ON BRINE SHRIMP

Materials:

brine shrimp culture	regular coffee beans	decaf. coffee beans
sleep-aid	cigarette	ethyl alcohol
5 small beakers	6 large droppers	hand lens or
dissecting scope		
depression microscope slides		

Procedure:

1. Remove a brine shrimp from it's salt water environment and place in a depression slide. Use a dropper to transfer brine shrimp. Use paper towel to absorb excess water.
2. Count the number of times the appendages "wave" during 10 seconds. This number should be very close to the heartbeat. Multiply this number by 6 to calculate the "beats per minute".
3. Place the same shrimp in the solution of coffee (see solution section) for 3 minutes, then repeat step 2.
4. Repeat steps 1-3 for the remaining solutions. Use a different brine shrimp for each test.

Solutions:

Coffee: Grind 1 bean (~.1g) in a mortar and pestle. Dissolve in 10 mL distilled water. (Make separate regular and decaf. solutions) Let sit 1 hour (not necessary, but more dramatic if done). Strain through filter paper and keep liquid.

Nicotine: Remove the contents of one cigarette and soak in 50mL distilled water. Let sit 1 hour (again, not necessary). Strain and keep liquid.

Sleep-Aid: Crush up and dissolve one sleeping pill in 20mL distilled water, filter, keep liquid.

Alcohol: 2mL alcohol in 98mL distilled water

THE EFFECTS OF CHEMICALS ON CHICK EMBRYOS

Materials:

fertilized chicken eggs-can be purchased from MSU poultry farm for ~$5.00/dozen-use at 72 hours of age
chick ringers solution-see reagent section
eye dropper
bright light source
shallow bowl
sharp razor blade
nicotine solution
caffeine solution
distilled water
paper toweling
needle
alcohol solution
sleeping pill solution

Procedure:

1. "Candle" an egg. This is done by holding the egg up to a bright light source and gently rotating it until you see a dark spot. Circle this spot with a marker-it is the embryo. Do not turn the egg any more as the embryo will shift position.
2. Use a needle to gently jab a hold in the wide end of the egg. This will permit the membranes to drop away from the shell.
3. Place the egg in a shallow bowl filled with warm paper towels.
4. Carefully remove the shell and membrane around the marked embryo. This will expose the pulsating embryo.
5. Determine the heart rate by counting the beats in ten seconds and multiplying by
6. Calculate the average of three trials.
7. Drop ten drops of the drug you were assigned directly onto the embryo.
8. Wait five minutes and repeat step 5.

TESTING TOPICAL ANTIBIOTICS

Materials:

petri dishes	nutrient agar	topical antibiotic(s)
hot plate	large beaker	stirring rod
mass balance		

Procedure:

1. Pour liquid agar into ten petri dishes and cover.
2. Measure .3g antibiotic and smear on bottom of five different petri dishes.
3. Pour agar into plates and swirl 20 left, 20 right, cover.
4. Repeat 2 & 3 using .6g antibiotic.
5. When agar solidifies, contaminate with touch.
6. Wait ~ 2 days, record results.

EXTRACTION OF ENZYMES IN PINEAPPLE

Materials:

knox unflavored gelatin
fresh pineapple
dropper
shallow pan
canned pineapple
can opener
triple beam balance
plastic well container

Procedure:

1. Prepare gelatin-dissolve 1 package in 1 cup boiling water-set in shallow pan in refrigerator.
2. Mass .5g gelatin (x6) and place in shallow well.
3. Drop equal amounts of fresh juice versus canned juice into pineapple.
4. Observe results and record in data table.

APPENDIX B: STUDENT SAMPLES

Sampling Technique:

To obtain samples for evaluation to support the conclusions of this paper I applied a simple random sampling technique. First, I wrote the names of students who granted me permission to use their work on individual pieces of paper. Then, I sorted those names into three groups based on their final semester grades. In one pile I placed students with grades 85% or higher. In the second pile I placed students with grades between 70% and 84%. In the third pile I placed students with grades less than 70%. Then I placed all names face down and randomly selected two names from each pile. There is one student in the less than 70% group who qualified for special education services in both groups. Those names are the students whose samples are included in this appendix.

APPENDIX C: STUDENT REACTIONS

The information in this appendix was obtained by the administration in an attempt to possibly discover why enrollment for the block was down for the following school year and was acquired at the end of the school year. The first part of this data was obtained through a written survey, while the second part was obtained through group oral discussions. Because I feel strongly that having group oral surveys with 9th grade students is a *very* poor method of obtaining unbiased data, I have decided to include this information in an appendix rather than in the evaluation portion of this paper. Also, because these are the *opinions* of the students and not based on concrete data, I felt it much too subjective. It is also important to mention that the administrators also administered the written survey to students not in the block program.

Survey Question:

Circle the answer that best summarizes your experience for your ninth grade classes. (Reported by Percentages): The questions were:

1) When you think about how much you learned and how valuable each class was, would you rate it excellent, good, fair, or poor?

2) Think about how difficult the subject was and how much work you did, would you rate it excellent, good, fair, or poor?

Data Analysis:

By combining the excellent to good ratings, Block students ranked English (89%) the highest in value, followed by Social Studies (72%), Health (66%), Technology (50%), and Science (12%). Health and Technology were ranked easiest, English and Social Studies were average difficulty, and Science was ranked most difficult.

Non-Block students also ranked English the highest (72%), followed by Health (60%) and Science (42%). English was ranked average in difficulty, Health was ranked average/easy, and Science was average/difficult.

Data Analysis of Project Ratings:

Students gave the Portfolio project slightly higher rankings than the Career Exploration Project in all three categories of value, amount of information, and amount of time, but they liked the Career Exploration project a little better overall. The Scrambler received low ratings on value and many felt they had neither enough time or information for this project. The Effects of Growth on the Community Project received moderate ratings for value, with nearly a third of the students preferring to have had more time and more information.

APPENDIX D: TEACHER COMMENTS

I asked each of the teachers directly involved in the block program to write down pros and cons related to the year and I received responses from four of the five teachers. Below I have made two columns, pros and cons, incorporating the lists provided by each of them. The responses that I have included were stated by at least three of the four teachers and in many cases they are unanimous points.

PROS

Heterogeneous grouping
Grades were about the same as non-block students (could also be a 'con')
Chance to integrate curriculum
Interdisciplinary work
Student directed learning
Promotes organization
Does not promote tracking
Teachers determined students' daily schedules
Flexibility
Group work-cooperative learning
Discipline problems were less

Cons

Lack of organization
Administration failed to give direction to teachers
Lack of administrative support in general: backing teachers, financial
Teachers not trained to work together effectively-very diverse group
Teachers wanting to teach in the block were not 'chosen', some who didn't want to be involved at all were 'forced'
Lack of curriculum training for teachers
Teachers had no individual preparation time
'Old' curriculum in some areas could not be changed due to mandates
No additional resources provided
Administration failed to commit to the three year program as expected
Parents didn't always support this 'new way of doing business', though at the beginning this is exactly what they asked for
Students generally dissatisfied with the block
We should have communicated better with students and parents regarding our plans
We did too much, too soon, it was too complicated

Too confusing for special most education students

Some of the points may seem vague, but these are not my words so I did not feel comfortable with too much interpretation of them. I do know, however, from end of the year discussions we had as a team what the general consensus of the group was regarding the success of the program. We were *all* happy to see the year end as we were all very tired and felt somewhat stressed. We were proud of all that we accomplished and felt that many of the problems with the program could easily have been corrected if a second year was to occur, except for the problems associated with lack of administrative support. The biggest mistake we agreed we made was doing too much for the first year. As I discussed earlier, true integration of the curriculum takes several years to accomplish, but we did it in the first year. We believed we did a great job of developing projects to satisfy the integration, it was simply too overwhelming for not only us due to the tremendous amount of work it took, but also to the students and their parents. What we did was *very* different to what they were used to, and though the majority of students and their parents signed up for the program because they wanted something new and different, we may have changed too much at one time. However, this is a tough call because the administration made it quite clear to us that they wanted this program to be very 'different'. The middle school, where our students were directly coming from, has implemented the 'teaming' concept (discussed previously) and many parents were upset because there was no integration. Sometimes I feel we place too much emphasis on what parents think and want which is evident in this example, there are simply too many of

them to please. Another thing we wish we would have done better was communication with the parents. We could have been sending more information home to them and having more meetings with them (though two of us did not agree that we could have possibly had more time to hold more than the four meetings we did hold with parents). Probably the biggest problem we had throughout the year was lack of administrative support. First of all, we did not receive the training necessary to help us learn how to work together (we were a very diverse group-we did not choose to work together) or the continual training to support us as we developed the curriculum. Also, there was no financial resources available to purchase supplies necessary to complete the projects. In some cases, departmental supplies were used and in many cases we went without. This became a serious problem during the 'Scrambler' project as there was not enough supplies or equipment and students often had to wait a long time to proceed from step to step. This was during the second semester and it seems that is when many of the students and parents started to become dissatisfied with the program. Administrators also did not support teachers during difficulties with parents, nor did they stay with their original commitment to run the program at least three years to determine it's success. But, even given all the problems we encountered we still felt confident the block was a good program that simply needed a couple more years to work the problems out, like any new program. However, we *all* agreed that we were not interested in being involved in the program the following year given the same circumstances.