1979

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ESE 6947-EDG6906
March 12, 1979

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Many secondary school students and teachers begin the school year in a classroom equipped with a teacher's desk, file cabinet, thirty or more student desks, a bulletin board and a chalkboard. Obviously, there are some things that the students and teacher cannot change about the design of a classroom, such as the window and wall locations. However, with a little creativity and resourcefulness, they can take the basic elements and construct a more comfortable environment within any classroom.

Secondary school students have often voiced complaints about their learning environments. Some of these have included the lack of ventilation, uncomfortable temperatures, the monotony of color schemes and decor, and poor seating arrangements. As a result, the students have come to look upon schools as large ugly boxes with which they can find little identity. Some students claim that if their classrooms were more comfortable, they would feel better about their schools, and, as a result, perform better academically.

Much research exists on the various components of the physical classroom environment and how they affect students' academic achievement and attitudes. Some of these components include: student density, use of lighting, use of music, and window locations. However, the wholistic effect of an improved, more humane physical environment, as constructed by the students and teacher, on student academic achievement and attitudes merits further investigation.

An attempt will be made in this study to determine if a decorated, well-maintained biology classroom has any influence on the attitudes of students toward their classroom, school, subject and teacher. A twenty-item survey containing items which will measure each of the previously mentioned attitudes will be administered to a biology class which uses a decorated, well-maintained classroom. Another biology class taught by the same teacher will also be administered the same survey. However, this class is taught in a poorly-maintained, undecorated classroom. Both classes consist of students who were assigned to them in no particular fashion.

An analysis will be made of the survey results to determine if there are any differences in the attitudes between the students in the decorated classroom and the

undecorated classroom. The eighth, ninth and tenth grade first semester science grades of all of the students using these classrooms will also be compared to determine if their classroom environment has had any possible effect on their achievement in this subject.

The problems being investigated can be stated as two questions: Can decorated, well-maintained classrooms in secondary schools produce a difference in student attitudes toward their classrooms, schools, subjects and teachers? Can they also produce a difference in academic achievement from these students?

OPERATIONAL DEFINITIONS

For a more thorough understanding of this study, read and refer to these terms and their definitions. They are part of the working vocabulary of the classroom environmentalist.

alienation. Indifferent, unfriendly attitude.

artificial light. Light produced by a means other than sunlight.

audiovisual materials. Teaching materials involving the use of the perceptions of hearing and sight.

brightness contrast. Difference in illumination.

classroom environmentalist. One who studies the classroom environment.

classroom physical environment. The surroundings of a person which are tangible within a classroom.

cognitive variables. Variables pertaining to knowledge.

color dynamics. Using varying degrees of and combinations of colors.

conventional classroom. Classroom characterized by rows of student desks; traditional classroom.

curriculum. A regular or present course of study at a school.

departmentalization. Separated into many sections or departments.

detached atmosphere. Climate of being separated from something.

direct lighting. Light having the straightest course; coming directly from a light source.

dislocation. Feeling out of place.

elementary school. School consisting of grades one through six.

ellipse. A conical section. 

humidity. The ratio of the amount of water vapor actually in the air to the total amount it could hold at the same temperature.

indirect lighting. Lighting that is reflected, as from a white ceiling or diffused to give a minimum of glare or shadow.

junior high school. School consisting of grades seven, eight and sometimes nine.

magenta. Purplish red color.

multidimensional classroom. Classroom having a large variety of audiovisual materials available for student use.

natural light. Light derived from nature; sunlight.

open classroom. Classroom characterized by a large amount of space, without doors or lacking rows of student desks.

secondary school. School consisting of grades seven through twelve.

sedentary curriculum. Referring to classwork done in the sitting posture.

senior high school. School consisting of grades ten, eleven, twelve and sometimes nine.

self-disclosure. Exposition of one's personal feelings.

student density. Number of students per unit of area.

student-teacher ratio. Number of students assigned to a teacher.

traditional classroom. Same as the conventional classroom.

ultraviolet rays. Rays having high frequency wavelengths below the violet end of the visual spectrum.

unidimensional classroom. Classroom lacking a variety of audiovisual materials for student use.

ventilation. Circulation of air.

visual displays. Any displays perceived by sight such as charts, models, pictures or posters.

REVIEW OF RELATED LITERATURE

This study concerns itself with how an improvement in the classroom physical environment might affect students'

attitudes towards their classroom, school, subject and teacher. How an improved classroom environment might affect students' academic achievement within the subject being taught in this classroom will also be investigated.

There are many variables which may be considered when studying the classroom physical environment. Only those pertinent to this study will be discussed. Some of the variables can be manipulated by the students and teacher, such as the use of visual displays and proper ventilation. Others, such as wall and window locations, cannot be manipulated. Nevertheless, it is assumed here that any classroom physical environment can be improved to some extent by the students and teacher.

Basically, the teacher possesses most of whatever control is possible over the classroom physical environment. Maria Montessori describes the teacher as an "environmental manager".[1] According to Clark and Starr, students should also play a role in maintaining the classroom. They claim that students who are given the responsibility of taking care of the classroom do so better than those who are not.[2]

In a study by Hansen and Atman (1976) on university students, it was found that throughout an academic year, students decorated and maintained about twice as much space

as did dropouts.[3] It could be concluded that these students found some identity with their environments which contributed somewhat to their academic success.

According to Rivlin, secondary school students should be given more of an opportunity to find identity with their environments.[4] Sommer believes that asking students directly about their classroom physical environments is the most feasible, economical and meaningful way to receive information from them for improving their environments.[5]

Students in grades seven through twelve do not all cooperate with their teachers to the same degree in maintaining their classrooms, according to Clark and Starr. In the junior high school, if the students are appealed to cordially by the teacher, they will help to improve the appearance of a classroom. However, in the senior high school, due to departmentalization, the teacher may have to do most of the classroom maintenance work himself. The reason for this is that the classroom is often used by more than one set of students per day.[6]

Clark and Starr believe that the classroom should be a laboratory of learning with many work areas and much equipment with which to work.[7] This is, or course, the ideal

classroom. Unfortunately, many teachers are faced with four barren walls, thirty or more student desks and a few other articles at the onset of a school year. This lack of materials is often due to a lack of school finances. Many authorities agree that environmental limitations due to this can be overcome by imaginative students and teachers. A room in an older school which has been tastefully decorated with student art work and other signs of life is often more preferrable to the students and teacher than a new classroom with barren walls and shelves.[8]

In addition to decorations, there are several critical environmental factors that the students and teacher should monitor at all times. Walton cites these as lighting, temperature and ventilation.[9] Cleanliness is also mentioned in the literature as something to monitor continuously. The classroom should be kept clean, but not so clean as to spend the majority of class time on this task. Cleaning up at the end of each class session is a good practice.[10]

Another important environmental factor mentioned in the literature is the flexibility of the classroom environment. Rosenfeld states:

> "The most advanced curriculum has little chance of surviving without a physical learning environment which supports it."[11]

He suggests that one reason why some teachers find little success with some of the new innovations in curriculum is that they have no supportive environment in which to implement them.

Several studies support the conclusion that there has been a continued interest in learning environments over the years. A study by Maslow and Mintz (1956) compared subjects' responses to a task in a beautiful, an average and an ugly room. Those in the beautiful room gave significantly higher rating responses than those in the other two rooms. Subjects' ratings in the average room were closer to those in the ugly room than those in the beautiful room. Then Mintz (1956) attempted to determine if the effects of being in a beautiful room were longlasting.

> "The results were dramatic: subjects in the ugly room had such reactions as monotony, fatigue, headaches, irritability and hostility. Those in the beautiful room responded in opposite fashion: they had feelings of comfort, pleasure, enjoyment, importance and the desire to continue their task."[12]

In another study, Simpson (1977) found that performance inequality was greater between two groups of students in unidimensional classrooms than in multi-dimensional classrooms.[13] This study showed that students benefited more from classrooms which provided a wide variety of audio-visual materials which they could use. It also suggested

that students perform better when they have a degree of control over the selection of what they will learn.

Secondary schools are plagued with discipline problems. However, there are fewer discipline problems in colleges and universities. Mehrabian believes that the lower number of discipline problems that occur in colleges and universities is partly due to the better environments that exist in these places. He suggests that if more emphasis were put on improving secondary school environments, the number of discipline problems there would decrease.[14]

Research on the classroom physical environment has concentrated on the various components which contribute to the environment. These include: furniture and student density, temperature, ventilation, colors, lighting, the use of visual displays and music. A review of the literature on each of these components will illustrate how they are integrated into the classroom environment.

Furniture and Student Density

Furniture in the classroom, particularly the student desks, is one of the components of the classroom physical environment that should be as flexible as the curriculum.

According to Clark and Starr, moveable furniture is preferrable to fixed furniture, for not all teaching situations are the same.[15] Rivlin's recommendation for classrooms with fixed furniture is to unfasten it so that it can be shifted or removed to provide a better, more flexible, use of space.[16] However, if a teacher spends most of the year lecturing or uses primarily one method of teaching, then perhaps fixed seating might be adequate.

According to Rivlin, in a room with moveable furniture, a semicircle of ellipse is preferrable to a circle in discussion groups. This prevents some students from facing the bright light of the windows in classrooms having them.[17]

Classrooms with straight rows of desks have often been called traditional classrooms. Rosenfeld believes that the most important lesson that students learn from the traditional classroom environment is that school is a place in which teachers "do something" to students.[18] He also believes that straight rows set forth a restrictive environment which shows that the teacher's needs are more important than the student's needs.[19]

Much of the furniture in today's classroom is "hard", a descriptive term used by Chaikin, Derlega and Miller.

It is secure, difficult to marr and reduces students' feelings of control over their environments.[20] It can, therefore, produce a feeling of alienation. This "hardness" can be reduced by substituting a few sofas and cushioned chairs for the "hard" furniture. In a study by Chaikin, Derlega and Miller (1976) regarding the use of "hard" versus "soft" environments in counseling rooms, a warm, softened room was found to facilitate counseling effectiveness. It reduced alienation and counselor-client distance by increasing client self-disclosure.[21]

Students may eventually come to accept their classroom physical environments as a fact of life. In a study by Gifford (1976), furniture in a university laboratory was arranged so that it was uncomfortable. Students accepted the new arrangement rather than attempting to alter it to make it more comfortable. The reason why this happened was not apparently clear to the investigators. One hypothesis proposed that students do not perceive institution-owned furniture as within their area of control.[22]

Over the years, the student-teacher ratio has greatly increased. Many physical facilities have not increased in size along with this ratio. As a result,

overcrowding exists in many schools. Winer and others (1977) have shown that increased student density can be a cause of student arousal.[23] In child care centers, twenty to twenty-five square feet of floor space are recommended for a sedentary curriculum. Most states allow thirty-five square feet for each student indoors and seventy-five square feet for each student outdoors.[24] However, many overcrowded secondary schools provide less space than this for the sedentary curriculum.

In classrooms with fixed furniture, space can be created by unfastening the furniture and moving it. In some rooms, tables, cabinets, files and shelves can be removed to create space. This space can be used to reduce student density within the existing walls of the traditional classroom.

According to research, males require more room in a classroom than females. There is hardly any provision for this in today's classroom. Heston and Garner (1972) found that in classrooms, on the average, males distance themselves twenty-two inches apart. Females, on the average, distance themselves thirteen inches apart and the average distance between males and females is seventeen inches.[25]

At Columbia University another study was conducted which indicated that males and females require different amounts of space in rooms. It was found that people working in extremely crowded rooms work just as effectively as in those not crowded.

> "However men became more competitive, suspicious, and combative. Women became more intimate, less competitive, and easier to get along with."[26]

Many students claim they learn better when the number of students in the classrooms is small. Abramowitz (1977) found that students seemed to enjoy class when they were part of a smaller educational unit.[27]

The open classroom provides students with more space, thereby reducing student density. Morris and others (1977) found that in a study of students in both open classroom environments and conventional classroom environments over a two and a half year period, they differed on several achievement variables in favor of conventional classrooms. However, no differences were found in any of the cognitive or personality variables measured.[28]

Temperature

Many modern schools today have central air conditioning and heating. However, there are also many schools

without these comfort features. Temperature has been found to affect students' behavior. According to Clark and Starr, classrooms that are too cold distract pupils from their work. Classrooms that are too hot slow pupils down. A temperature range of 67° to 73°F is acceptable depending upon the work being done.[29] In places of high physical activity, such as in a machine shop, Butler recommends that the acceptable temperature be lowered towards 67°F.[30] Not all authorities agree on the range of 67° to 73°F as being acceptable. For instance, Kowinski advises a less humid range of 64° to 68°F. This prevents, to a certain extent, respiratory illness and produces less fatigue.[31] Butler recommends that the humidity in a classroom be between forty and sixty per cent.[32]

Ventilation

Ventilation is one of the three major environmental factors of which students and teachers should be aware at all times. Air should be in motion, but drafts should be avoided. Butler recommends that the air be pure, fresh and clean without fumes or dust.[33] This can help to prevent respiratory illness. The major difficulty in maintaining

proper ventilation is that the teacher so often remains in the same room over an extended period of time and thus may become accustomed to the stale air.[34] A problem with ventilation may therefore not be noticed by the teacher. Walton claims that a lack of ventilation produces drowsiness, restlessness, lack of attention and a thickness of human odor.[35]

In classrooms with central air conditioning and heating, ventilation is not as much of a problem as in classrooms without them. In classrooms without them, adjustment of windows and doors can aid in proper ventilation.

Color

Color can be used to set the atmosphere of a classroom. It is often easily manipulated. According to Rosenfeld, magenta creates a subdued atmosphere. Red may be used to excite, green to relax and yellow to elate.[36]

Color can also be used to create the illusion of space. Rosenfeld claims that maroon and pink, which are warm colors, may be used to make small rooms or spaces appear larger. Using cooler colors, such as blue or green, may help to make large rooms or spaces appear smaller.[37]

Color preferences change with age. According to Thompson, kindergarten children prefer blue, red and yellow. He states:

> "In the elementary classroom color specialists recommend warm yellows, peach and pink as the dominant colors. These colors are stimulating for young children, encouraging them to move about, participate and express themselves. For the secondary classroom, green, blue-green and gray are recommended to avoid distraction and aid in concentration."[38]

Rosenfeld also concludes that as the child grows older, color preferences change from warm to cool colors.[39]

Extreme contrasts between colors or lighting in a classroom may cause severe eyestrain. To reduce brightness contrast due to color, Clark and Starr claim that modern schools use bright pastels, cool greens and blues for the warm, sunny side of the classroom. For the cool, shady side of the classroom, warm orange and yellow are used.[40]

Some interesting color schemes have been used in athletic locker rooms. The locker room of the University of Texas home team is painted a bright orange. But the visiting team's locker room is painted gray. This was done with the hope that the colors would influence the teams' performances on the field. Ketcham mentions that Knute Rockne

kept his players lively during half-time with a red-walled dressing room. He had the visiting team's dressing room painted blue in order to calm them down.[41]

The University of Kansas studied people's responses in a museum to two rooms painted different colors. In a dark brown room the people moved more quickly and spent little time. However, in a beige room they spent more time. The dark brown room seemed to stimulate activity but caused the activity to be concluded sooner.[42]

The State Department of Education in Connecticut (1966) found that students showed greater pride in their schools after they were painted new colors. In addition to the increase in school pride, vandalism and behavior problems decreased.[43]

Ketcham describes a study of three kindergartens which used different color schemes in the classrooms. The first needed paint and was left unpainted. The second was traditionally painted in light buff walls and white ceilings. However, the third was painted using color dynamics. Its corridors were painted a cheerful yellow with gray doors and baseboards. Classrooms with a northern exposure were painted a pale rose, while those facing south

were painted in cool shades of blue and green. The front walls were painted darker than the side walls. Green chalkboards were installed to reduce glare. The art room was painted a neutral gray to accent the students' artwork. Over a two-year period student behavior in each school was observed. The third school, the one using color dynamics, showed the greatest improvement on several variables measured. These included social habits, health habits, safety habits, achievement in language arts, arithmetic, science, social studies, and music.[44]

Lighting

Next to color, lighting is perhaps the easiest environmental factor to manipulate.[45] Often color and lighting are interrelated in the classroom environment. Williams believes that the associations with colored lighting are similar to those for colors in general.[46] In addition to color, lighting can also be used to set the atmosphere of a classroom. Rosenfeld mentions that red lighting sets an atmosphere of danger; orange, warmth and excitement; pale yellow, contentment; pale green, kindness; dark green, death; gold and pink, gaity; yellow-orange,

stimulation and elation. Cool white lighting, daylight and fluorescent lighting produce a cold and detached atmosphere.[47] As a result, white lighting, used in many classrooms, may not be the best kind of lighting. Furthermore, according to Abbott, it contains some ultraviolet rays which may cause headaches.[48]

Lighting can be categorized as either natural or artificial. Many schools today are designed with few windows. This is an energy conservation measure. This practice may also reduce distractions from outside the classroom. However, Romney (1975) found that student aggression increases in windowless environments.[49] Sommer (1969) found that escape behaviors were immediately evident in students being taught in windowless classrooms. In one windowless classroom students petitioned the teacher to meet outside.[50]

Clearly, research shows that windowless classrooms have their problems. Butler recommends that if a classroom is to have windows, the glass area of the windows should not be less than fifteen per cent of the floor area of the classroom. The ideal percentage, he recommends, is any percentage greater than twenty per cent of the floor area.[51]

Certain lighting conditions should be maintained for the students in the classroom. According to Butler, the best light is unilateral and from the left. The light should shine over the left shoulders of the students when they are writing.[52] This rule only applies to right-handed students. Clark and Starr mention that the needs of left-handed students are different. They recommend that these students sit so that the light comes over their right shoulders when they are writing.[53]

Butler mentions several other "rules of thumb" to follow for lighting conditions in the classroom. He claims that additional lighting from the rear is acceptable. However, extra lighting from the front or opposite sides is not advisable. In side and rear lighting, two-thirds or more should come from the side. The window located closest to the front of the room should be at least six feet from the front wall. Shades, should there be any, should be adjusted to prevent direct sunlight from hitting the desks.[54]

Students should never have to face the light while facing blackboards or greenboards. Butler recommends that blackboards or greenboards not be located in walls having windows. Nor should they be located immediately adjoining windows or between windows.[55]

Lighting in a classroom should be similar to that found in a home, according to Brown. The light should fall on the objects in the room, such as pictures, and not on the students. He claims that this provides a pleasing effect and also reduces eyestrain.[56]

Rosenfeld believes that areas of a classroom should be lit to support their use. Quiet spots should receive little light. Group areas should be well lit and reading areas should have lighting adjustable for intensity and position. He also believes that different textures require different lighting. Shiny surfaces require indirect lighting to prevent glare. Textured surfaces require more direct lighting.[57]

One precaution should be followed when lighting the classroom. Large differences in lighting should not occur side by side. Kowinski (1975) found that if some areas of the classroom are overlit and others are underlit, fatigue and a sense of "dislocation" can result. This is due to the constant adapting and readapting of the eye's pupil to the lighting. Subtle variety in lighting allows the eye's pupil to adjust slowly and often. This is a stimulating process so long as the eye is not overworked.[58]

As mentioned earlier in this review, brightness contrast in the classroom is one of the major causes of eye-strain. This is one reason why greenboards have replaced blackboards in many classrooms. To reduce brightness contrast, Clark and Starr recommend that walls next to windows be painted light pastels or white.[59] Walton believes that brightness contrast should be greatest within the immediate range of vision, for example, while reading the page of a book. However, within the peripheral sight brightness contrast should be reduced as much as possible. He claims that brightness contrasts are distractions which can exert a "pull" on the vision.[60]

Visual Displays

Visual displays such as posters, maps, charts, and pictures can be added to any classroom to improve the environment. They can be used to reinforce what is being taught. According to the National Education Association:

> "The primary function of these materials is to provide experience, more or less direct, whereby a child can build up his storehouse of meanings."[61]

When using visual displays, there are some guidelines which should be followed. Rivlin recommends that they

be displayed at eye level. Printed material should not be crammed onto the displays. Such displays can become so full that nothing is emphasized. The material should be large enough to be seen at the distance from which it will be viewed. The best displays are similar to advertisements in newspapers and magazines in that they are short, succinct and to the point. In addition, any article worth displaying is worth mentioning and discussing.[62]

Visual displays, according to Clark and Starr, should be pertinent to what is being studied. However, they also believe that non-curricular materials may also be displayed at any time. These materials can reflect the personalities of the students and teacher.[63] This can facilitate the students and teacher in finding identity with some part of their environments.

Clark and Starr also recommend that articles not be displayed for a long period of time. They can become stale and overlooked by the students.[64]

For visual displays of large bodies of information, Rivlin suggests that the information be placed on dittos and run off. He believes that the blackboard or greenboard should be used for shorter bodies of information.[65]

MUSIC

Though many schools have the facilities for playing music, Rosenfeld states:

> "It is rare to find music used in the classroom for other than instructional purposes.[66]

Background music has been widely used for industrial purposes.

> "Muzak Corporation, the largest producer of music for industry, provides evidence for music increasing production, reducing errors, tension and absenteeism.[67]

Allsop and Muzak (1967 to present) have also found that music may be used to combat mid-morning and mid-afternoon fatigue.[68] Clearly, strong consideration should be given to the use of background music in the classroom.

Concluding Remarks

In conclusion, almost any classroom environment can be improved. This can be accomplished, for example, by adjusting the furniture, regulating the temperature and ventilation, using color dynamics, adjusting the lighting, using visual displays and playing music. The improvement of the physical classroom environment is limited only by the imagination of the students and teacher who live there.

Most research favors improving the classroom environment by making it more attractive and comfortable. However, not all of the research favors this. In an experiment at Brandeis University, laboratory assistants were assigned to three rooms, one "ugly", another "average" and a third "beautiful". The laboratory assistants in the "ugly" room always finished their tests faster. Beauty may indeed not always be a virture.[69] Clearly, however, the effects of the physical classroom environment on student behavior merit further investigation.

EXPERIMENTAL PROCEDURES

This study will be conducted at Orange Park High School located in Clay County, Florida. The school serves approximately 2,700 students who live in Orange Park, Middleburg and the surrounding areas north of Green Cove Springs. Since the school is located near the Jacksonville Naval Air Station, many of its students belong to military families. Consequently, there is a large student turnover from year to year.

The school's personnel includes a teaching staff of approximately 127 and a supportive staff of about forty. Most of the teaching staff have between one and five years

of teaching experience. The number of students in most of the academic classes is approximately thirty.

The school includes a two-story brick main building constructed in 1968. It also includes a separate gymnasium, music building, stadium, vocational building and twenty-two portable classrooms.

Of primary concern is the main building. The classrooms in which the study will be conducted are located here. Some characteristics of its interior include: four wings adjacent to a central media center, central air conditioning and heating and moveable metal walls. All of the halls and classrooms, except for those in the science wing and the home economics classroom, are carpeted.

This study will be conducted in the science wing of the main building. Each of the classrooms here contains approximately seventeen laboratory or trapezoid tables with thirty-five chairs or stools. Each classroom also has a teacher's desk, chair, garbage can, flag and a file cabinet or storage cabinet. At least one wall of each classroom contains a greenboard. Some of the classrooms contain a small window, either at the front or the back of the room. Two of the rooms in the science wing depart slightly from this description. They contain permanent laboratory tables,

sinks, gas jets and electrical outlets. A few of the other science rooms also contain demonstration tables with a sink and gas jet. The rooms of the science department are different from most of the rooms in the school in that they have doors. These were added two and a half years ago to increase the security of the science equipment, often stored in the rooms.

In the science department one teacher travels meeting with his four Biology I classes in four different classrooms each day. The students in these classes signed up for Biology I the prior year. During the summer they were assigned to these classes in no particular fashion. Three of the classes use classrooms which are, for the most part, undecorated, with little attention given to the classroom environment. However, the fourth class uses a well-decorated classroom which receives much attention with regard to the classroom environment.

A twenty-question attitude survey will be administered to two of the four Biology I classes taught by the traveling teacher. One class uses an undecorated, poorly-maintained classroom. The other uses a decorated, well-maintained classroom. The attitude survey will measure the students' attitudes

towards their classroom, their school, Biology I and their Biology I teacher. An attempt will be made to determine if any differences exist between the two classes with regard to attitudes toward the classroom, school, Biology I and Biology I teacher.

As a first hypothesis:

> Secondary school Biology I students using a decorated, well-maintained classrom, show different attitudes toward their classroom, their school, Biology I and their Biology I teacher at the 0.05 level of significance than Biology I students using an undecorated, poorly-maintained classroom.

In addition to the attitude survey, the eighth, ninth and tenth grade first semester science grades of the students in the two classes will be compared. The tenth grade first semester Biology I grades will be compared to determine if those students using the decorated, well-maintained classroom have performed differently in Biology I from those students using the undecorated, poorly-maintained classroom. The eighth and ninth grade first semester science grades will be compared to determine if any differences exist between the two classes with regard to which class should be performing better. Stated as a second hypothesis:

> Secondary school Biology I students using a decorated, well-maintained classroom show different academic achievement in Biology I taught in this location at the 0.05

level of significance from Biology I students using an undecorated, poorly-maintained classroom.

The attitude survey will be administered to the two classes of Biology I students in January. Cumulative records of the students will be checked and data collected during the months of January and February so that the study will be completed by March.

RESULTS

From the attitude survey the items were grouped into the four attitudes that were being tested. The number of responses for each item were multiplied by values assigned to the responses to yield response subtotals. The response subtotals were then totaled. This procedure was performed for the undecorated, poorly-maintained classroom (X) and the decorated, well-maintained classroom (Y) (see Tables 1 - 4).

According to Popham, some individuals believe that most of the data dealt with in educational research are measured on scales which are probably not so strong as an interval scale. Such data should be subjected to non-parametric rather than parametric procedures.[70] Since the data gathered by the attitude survey was an ordinal scale, a scale not as strong as an interval scale, a non-parametric procedure known as the Mann-Whitney U test was used.

A Mann-Whitney U test was performed on the totals of each of the four attitude subtests. All four tests failed to produce U values that would reject the null hypothesis for a

TABLE 1.--Responses, response subtotals and response totals for classroom attitude items

Item	No. of responses				Subtotals No. of responses x values				
	1	2	3	4	1=4	2=3	3=2	4=1	
Undecorated classroom X 4th period									
4	3	13	6	1	12	39	12	1	
8	0	3	12	8	0	9	24	8	
12	1	11	8	3	4	33	16	3	
16	0	8	8	7	0	24	16	7	
20	3	13	4	3	12	39	8	3	
					28	144	76	22	Totals
Decorated classroom Y 3rd period									
4	6	11	4	2	24	33	8	2	
8	3	9	9	2	12	27	18	2	
12	5	12	5	1	20	36	10	1	
16	5	11	7	0	20	33	14	0	
20	8	13	2	0	32	39	4	0	
					108	168	54	5	Totals

TABLE 2.--Responses, response subtotals and response totals for school attitude items

Undecorated classroom X 4th period

Item	No. of responses				Subtotals No. of responses x values				
	1	2	3	4	1=4	2=3	3=2	4=1	
1	0	10	9	4	0	20	18	4	
5	4	9	2	8	16	27	4	8	
9	4	9	5	5	16	27	10	5	
13	8	9	3	4	32	27	6	4	
17	4	12	5	2	16	36	10	2	
					80	137	48	23	Totals

Decorated classroom Y 3rd period

1	0	12	6	5	0	36	12	5	
5	1	17	2	3	4	51	4	3	
9	3	15	2	3	12	45	4	3	
13	4	16	1	2	16	48	2	2	
17	6	13	2	2	24	39	4	2	
					56	219	26	15	Totals

TABLE 3.--Responses, response subtotals and response totals for subject attitude items

Item	No. of responses				Subtotals No. of responses x values				
	1	2	3	4	1=4	2=3	3=2	4=1	
Undecorated classroom X 4th period									
3	1	3	11	8	4	9	22	8	
7	1	2	10	10	4	6	20	10	
11	1	11	6	5	4	33	12	5	
15	2	10	4	7	8	30	8	7	
19	4	7	8	4	16	21	16	4	
					36	99	78	34	Totals
Decorated classroom Y 3rd period									
3	2	4	7	10	8	12	14	10	
7	2	1	10	10	8	3	20	10	
11	3	11	6	3	12	33	12	3	
15	3	10	6	4	12	30	12	4	
19	2	6	10	5	8	18	20	5	
					48	96	78	32	Totals

TABLE 4.--Responses, response subtotals and response totals for teacher attitude items

Undecorated classroom X 4th period

Item	No. of responses				Subtotals No. of responses x values				
	1	2	3	4	1=4	2=3	3=2	4=1	
2	1	11	11	0	4	33	22	0	
6	4	16	2	1	16	48	4	1	
10	6	16	1	0	24	48	2	0	
14	3	20	0	0	12	60	0	0	
18	8	12	0	3	32	36	0	3	
					88	225	28	4	Totals

Decorated classroom Y 3rd period

2	7	10	6	0	28	30	12	0	
6	9	11	3	0	36	33	6	0	
10	11	9	1	2	44	27	2	2	
14	9	12	2	0	36	36	4	0	
18	14	9	0	0	56	27	0	0	
					200	153	24	2	Totals

two-tailed test at the 0.10 level of significance (see Tables 5 - 8).

Following the first set of Mann-Whitney U tests, another set were performed on the subtotals of each of the four attitude subtests. Again all four tests failed to produce U values that would reject the null hypothesis for a two-tailed test at the 0.10 level of significance (see Tables 9 - 12).

A Mann-Whitney U test was then performed on the entire attitude survey using all of the subtotals from the four subtests. In addition to this, a Mann-Whitney U test was also performed on the entire attitude survey using all of the totals from the four subtests. Both tests failed to produce U values that would reject the null hypothesis for a two-tailed test at the 0.10 level of significance (see Tables 13 - 14).

From the students' cumulative folders, 19 students out of each classroom were found who had eighth, ninth, and tenth grade first semester science grades. The mean for each class's eighth, ninth and tenth grade science grades were calculated. By inspection there appeared to be no significant differences between the means of classroom X and classroom Y. It was also seen that the means of classroom X were all higher than those of classroom Y and that classroom X was apparently performing better in science than classroom Y. For this reason, a Mann-Whitney U test was not performed on this data (see Tables 15 - 16).

TABLE 5.--Mann-Whitney U test performed on classroom attitude totals

		R's	
8.	168Y		
7.	144X		
6.	108Y		
5.	76X	7	8
4.	54Y	5	6
3.	28X	3	4
2.	22X	2	1
1.	5Y	$\Sigma R_x = 17$	$\Sigma R_y = 19$

$n_1 = 4$ $\quad U = n_1 n_2 + \frac{n_1(n_1+1)}{2} - \Sigma R_x \quad U = 9$

$n_2 = 4$ $\quad U_1 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - \Sigma R_y \quad U_1 = 7$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 6.--Mann-Whitney U test performed on school attitude totals

		R's	
8.	219Y		
7.	137Y		
6.	80X		
5.	56Y	6	8
4.	48X	4	7
3.	26X	3	5
2.	23X	2	1
1.	15Y	$\Sigma R_x=15$	$\Sigma R_y=21$

$n_1 = 4$ $U = 11$

$n_2 = 4$ $U_1 = 5$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 7.--Mann-Whitney U test performed on subject attitude totals

		R's	
8.	99X		
7.	96Y		
6.	78X		
5.	78Y	8	7
4.	48Y	6	5
3.	36X	3	4
2.	34X	2	1
1.	32Y	$\Sigma R_x=19$	$\Sigma R_y=17$

$n_1 = 4$ $U = 7$

$n_2 = 4$ $U_1 = 9$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 8.--Mann-Whitney U test performed on teacher attitude totals

		R's	
8.	225X		
7.	200Y		
6.	153Y		
5.	88X	8	7
4.	28X	5	6
3.	24Y	4	3
2.	4X	2	1
1.	2Y	$\Sigma R_x = 19$	$\Sigma R_y = 17$

$n_1 = 4$ $\quad$ $U = 7$

$n_2 = 4$ $\quad$ $U_1 = 9$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 9.--Mann-Whitney U test performed on classroom attitude response subtotals

				R's	
40.	39Y	20.	12X	39	39
39.	39X	19.	12Y	39	37
38.	39X	18.	10Y	35	35
37.	36Y	17.	9X	30	35
36.	33X	16.	8X	30	33
35.	33Y	15.	8X	24.5	32
34.	33Y	14.	8Y	24.5	30
33.	32Y	13.	7X	20.5	27.5
32.	27Y	12.	4X	20.5	27.5
31.	24X	11.	4Y	20.5	26
30.	24X	10.	3X	17	23
29.	24Y	9.	3X	15	20.5
28.	20Y	8.	2Y	15	18
27.	20Y	7.	2Y	13	15
26.	18Y	6.	1X	11.5	11.5
25.	16X	5.	1Y	9.5	7.5
24.	16X	4.	0X	9.5	7.5
23.	14Y	3.	0X	5.5	5.5
22.	12X	2.	0Y	2.5	2.5
21.	12X	1.	0Y	2.5	2.5
				ΣR_X=384.5	ΣR_Y=435.5

$n_1 = 20$ $\quad$ $U = 225.5$

$n_2 = 20$ $\quad$ $U_1 = 174.5$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 10.--Mann-Whitney U test performed on school attitude response subtotals

				R's	
40.	51Y	20.	10X	35.5	40
39.	48Y	19.	8X	34	39
38.	45Y	18.	6X	32	38
37.	39Y	17.	5X	32	37
36.	36X	16.	5Y	32	35.5
35.	36Y	15.	4X	29	30
34.	32X	14.	4X	28	25.5
33.	27X	13.	4X	25.5	22.5
32.	27X	12.	4Y	25.5	22.5
31.	27X	11.	4Y	25.5	16.5
30.	24Y	10.	4Y	20.5	12
29.	20X	9.	4Y	20.5	12
28.	18X	8.	3Y	19	12
27.	16X	7.	3Y	18	12
26.	16X	6.	2X	16.5	7.5
25.	16X	5.	2Y	12	7.5
24.	16Y	4.	2Y	12	4.5
23.	12Y	3.	2Y	12	4.5
22.	12Y	2.	0X	4.5	4.5
21.	10X	1.	0Y	1.5	1.5
				$\leq R_x = 435.5$	$\leq R_y = 384.5$

$n_1 = 20$ $\quad U = 174.5$

$n_2 = 20$ $\quad U_1 = 225.5$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 11.--Mann-Whitney U test performed on subject attitude response subtotals

				R's	
40.	33X	20.	10Y	39.5	39.5
39.	33Y	19.	10Y	37.5	37.5
38.	30X	18.	9X	36	33
37.	30Y	17.	8X	35	33
37.	22X	16.	8X	33	31
35.	21X	15.	8X	29.5	28
34.	20X	14.	8Y	29.5	24.5
33.	20Y	13.	8Y	24.5	24.5
32.	20Y	12.	8Y	20	24.5
31.	18Y	11.	7X	18	24.5
30.	16X	10.	6X	14.5	24.5
29.	16X	9.	5X	14.5	20
28.	14Y	8.	5Y	14.5	20
27.	12Y	7.	4X	11	14.5
26.	12Y	6.	4X	10	14.5
25.	12Y	5.	4X	8.5	14.5
24.	12Y	4.	4X	5	8.5
23.	12Y	3.	4Y	5	5
22.	12X	2.	3Y	5	1.5
21.	10X	1.	3Y	5	1.5
				$\Sigma R_x = 395.5$	$\Sigma R_y = 424.5$

$n_1 = 20$ $\quad U = 214.5$

$n_2 = 20$ $\quad U_1 = 185.5$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 12.--Mann-Whitney U test performed on teacher attitude response subtotals

				R's	
40.	60X	20.	12Y	40	39
39.	56Y	19.	6Y	37.5	36
38.	48X	18.	4X	37.5	33.5
37.	48X	17.	4X	33.5	33.5
36.	44Y	16.	4Y	30.5	33.5
35.	36X	15.	3X	29	30.5
34.	36Y	14.	2X	24	28
33.	36Y	13.	2Y	23	27
32.	36Y	12.	2Y	22	25.5
31.	33X	11.	1X	20.5	25.5
30.	33Y	10.	0X	17	20.5
29.	32X	9.	0X	17	19
28.	30Y	8.	0X	15	17
27.	28Y	7.	0X	13	13
26.	27Y	6.	0X	11	13
25.	27Y	5.	0Y	5.5	5.5
24.	24X	4.	0Y	5.5	5.5
23.	22X	3.	0Y	5.5	5.5
22.	16X	2.	0Y	5.5	5.5
21.	12X	1.	0Y	5.5	5.5
				$\Sigma R_x = 398.0$	$\Sigma R_y = 422.0$

$n_1 = 20$ $\quad U = 212.0$

$n_2 = 20$ $\quad U_1 = 188.0$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 13.--Mann-Whitney U test performed on the entire attitude survey using response totals

				R's	
32.	225X	16.	54Y	32	31
31.	219Y	15.	48X	27	30
30.	200Y	14.	48Y	26	29
29.	168Y	13.	36X	24	28
28.	153Y	12.	34X	22	25
27.	144X	11.	32Y	21	23
26.	137X	10.	28X	19.5	19.5
25.	108Y	9.	28X	18	17
24.	99X	8.	26Y	14.5	16
23.	96Y	7.	24Y	13	14.5
22.	88X	6.	23X	12	11
21.	80X	5.	22X	9.5	8
20.	78X	4.	15Y	9.5	7
19.	78Y	3.	5Y	6	4
18.	76X	2.	4X	5	3
17.	56Y	1.	2Y	2	1
				$\Sigma R_x = 261.0$	$\Sigma R_y = 267.0$

$n_1 = 16$ $\quad U = 131.0$

$n_2 = 16$ $\quad U_1 = 125.0$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 14.--Mann-Whitney U test performed on the entire attitude survey using response subtotals

160.	60X	128.	28Y	96.	16Y	64.	8Y	32.	3Y
159.	56Y	127.	27X	95.	14Y	63.	8Y	31.	3Y
158.	51Y	126.	27X	94.	14Y	62.	8Y	30.	3Y
157.	48X	125.	27X	93.	12X	61.	7X	29.	3Y
156.	48X	124.	27Y	92.	12X	60.	7X	28.	2X
155.	48Y	123.	27Y	91.	12X	59.	6X	27.	2X
154.	45Y	122.	27Y	90.	12X	58.	6X	26.	2Y
153.	44Y	121.	24X	89.	12X	57.	6Y	25.	2Y
152.	39X	120.	24X	88.	12Y	56.	5X	24.	2Y
151.	39X	119.	24X	87.	12Y	55.	5X	23.	2Y
150.	39Y	118.	24Y	86.	12Y	54.	5Y	22.	2Y
149.	39Y	117.	24Y	85.	12Y	53.	5Y	21.	2Y
148.	36X	116.	22X	84.	12Y	52.	4X	20.	2Y
147.	36X	115.	22X	83.	12Y	51.	4X	19.	1X
146.	36Y	114.	21X	82.	12Y	50.	4X	18.	1X
145.	36Y	113.	20X	81.	12Y	49.	4X	17.	1Y
144.	36Y	112.	20X	80.	12Y	48.	4X	16.	0X
143.	36Y	111.	20Y	79.	10X	47.	4X	15.	0X
142.	36Y	110.	20Y	78.	10X	46.	4X	14.	0X
141.	33X	109.	20Y	77.	10X	45.	4X	13.	0X
140.	33X	108.	20Y	76.	10Y	44.	4X	12.	0X
139.	33X	107.	18X	75.	10Y	43.	4X	11.	0X
138.	33Y	106.	18Y	74.	10Y	42.	4Y	10.	0X
137.	33Y	105.	18Y	73.	9X	41.	4Y	9.	0X
136.	33Y	104.	16X	72.	9X	40.	4Y	8.	0Y
135.	33Y	103.	16X	71.	8X	39.	4Y	7.	0Y
134.	32X	102.	16X	70.	8X	38.	4Y	6.	0Y
133.	32X	101.	16X	69.	8X	37.	4Y	5.	0Y
132.	32Y	100.	16X	68.	8X	36.	4Y	4.	0Y
131.	30X	99.	16X	67.	8X	35.	3X	3.	0Y
130.	30Y	98.	16X	66.	8X	34.	3X	2.	0Y
129.	30Y	97.	16X	65.	8Y	33.	3X	1.	0Y

TABLE 14.--Continued.

R's			R's		
160	100	54.5	159	110.5	44
156	100	44	158	110.5	44
156	100	44	156	106	44
150.5	100	44	154	106	44
150.5	100	44	153	100	44
145	100	44	150.5	94.5	44
145	86.5	44	150.5	94.5	32
138	86.5	44	145	86.5	32
138	86.5	44	145	86.5	32
138	86.5	44	145	86.5	32
133	86.5	44	145	86.5	24
133	76.5	32	145	86.5	24
130	76.5	32	138	86.5	24
124.5	76.5	32	138	86.5	24
124.5	72.5	24	138	86.5	24
124.5	72.5	24	138	86.5	24
119	66.5	18	133	76.5	24
119	66.5	18	130	76.5	18
119	66.5	0.0625	130	76.5	0.0625
115.5	66.5	0.0625	128	66.5	0.0625
115.5	66.5	0.0625	124.5	66.5	0.0625
114	66.5	0.0625	124.5	66.5	0.0625
110.5	60.5	0.0625	124.5	66.5	0.0625
110.5	60.5	0.0625	119	58	0.0625
106	58	0.0625	119	54.5	0.0625
100	58	0.0625	110.5	54.5	0.0625
100	54.5	ΣR_x=6315.5	110.5	44	ΣR_y=6564.5

$U = 3324.5$ $\qquad z = \dfrac{U-(n_1n_2/2)}{\sqrt{n_1n_2(n_1+n_2+1)/2}}$ $\qquad z = 0.43 \quad n_1 = 80$

$U_1 = 3075.5$ $\qquad z_1 = \dfrac{U_1-(n_1n_2/2)}{\sqrt{n_1n_2(n_1+n_2+1)/2}}$ $\qquad z_1 = -0.43 \quad n_2 = 80$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 15.--Classroom X 1st semester science grades and numerical equivalents

	Grade					
Student	Eighth		Ninth		Tenth	
1	D	1	F	0	C	2
2	B	3	B	3	A	4
3	B	3	C	2	A	4
4	C	2	C	2	C	2
5	B	3	B	3	B	3
6	B	3	D	1	D	1
7	C	2	C	2	B	3
8	C	2	D	1	F	0
9	B	3	B	3	B	3
10	B	3	D	1	A	4
11	B	3	C	2	A	4
12	C	2	D	1	B	3
13	C	2	D	1	C	2
14	C	2	C	2	C	2
15	C	2	C	2	C	2
16	A	4	D	1	B	3
17	B	3	A	4	A	4
18	B	3	C	2	B	3
19	C	2	D	1	B	3
Totals		48		36		52
Mean $\bar{X}$		2.53		1.89		2.73

TABLE 16.--Classroom Y 1st semester science grades and numerical equivalents

	Grade					
Student	Eighth		Ninth		Tenth	
1	B	3	B	3	A	4
2	B	3	C	2	B	3
3	B	3	C	2	C	2
4	D	1	D	1	C	2
5	C	2	D	1	C	2
6	C	2	D	1	D	1
7	D	1	D	1	C	2
8	B	3	B	3	A	4
9	B	3	B	3	A	4
10	D	1	F	0	F	0
11	C	2	C	2	B	3
12	C	2	D	1	B	3
13	B	3	A	4	A	4
14	C	2	C	2	D	1
15	C	2	F	0	D	1
16	B	3	B	3	B	3
17	C	2	F	0	F	0
18	B	3	B	3	B	3
19	A	4	B	3	B	3
Totals		45		35		45
Mean $\bar{X}$		2.37		1.84		2.37

Post Hoc Analysis

The non-parametric Mann-Whitney U test produced disappointing results from the attitude survey data. Popham states:

> "Parametric procedures can be computed on data whenever they are represented in numerical form. . . . Since the majority of data encountered in educational research probably falls somewhere between ordinal and interval strength, the educational researcher is usually on safe grounds when he applies parametric tests to numerical (ordinal or interval) data."

For this reason a parametric t test was performed on each of the four attitude subtests using response subtotals. In each case, however, a t was produced that failed to reject the null hypothesis for a two-tailed test at the 0.10 level of significance (see Tables 17 - 20).

A t test was also performed on the entire attitude survey using response subtotals. This produced a t which also failed to reject the null hypothesis for a two-tailed test at the 0.10 level of significance (see Table 21).

Three t tests were performed on the students' grades in classroom X and classroom Y. All three tests failed to produce t's that would reject the null hypothesis for a two-tailed test at the 0.10 level of significance (see Tables 22 - 24).

CONCLUSIONS

Inspection of the data suggests that perhaps some differences exist between the students in classroom X and

TABLE 17.--t test performed on classroom attitude response subtotals

	Classroom X			Classroom Y		
	Sub-totals	Deviations x	Squared Deviations x^2	Sub-totals	Deviations x	Squared Deviations x^2
1.	12	-1.5	2.25	24	7.25	52.56
2.	39	25.5	650.25	33	16.25	264.06
3.	12	-1.5	2.25	8	-8.75	76.56
4.	1	-12.5	156.25	2	-14.75	217.56
5.	0	-13.5	182.25	12	-4.75	22.56
6.	9	-4.5	20.25	27	10.25	105.06
7.	24	10.5	110.25	18	1.25	1.56
8.	8	-5.5	30.25	2	-14.75	217.56
9.	4	-9.5	90.25	20	3.25	10.56
10.	33	19.5	380.25	36	19.25	370.56
11.	16	13.5	182.25	10	-6.75	45.56
12.	3	-10.5	110.25	1	-15.75	248.06
13.	0	-13.5	182.25	20	3.25	10.56
14.	24	10.5	110.25	33	16.25	264.06
15.	16	2.5	6.25	14	-2.75	7.56
16.	7	-6.5	42.25	0	-16.75	280.56
17.	12	-1.5	2.25	32	15.25	232.56
18.	39	25.5	650.25	39	22.25	495.06
19.	8	-5.5	30.25	4	-12.75	162.56
20.	3	-10.5	110.25	0	-16.75	280.56
			$\Sigma x_1^2 = 3051.00$			$\Sigma x_2^2 = 3365.70$

Mean $\bar{X}_1 = 13.50$ Mean $\bar{X}_2 = 16.75$ $n_1 = 20$

Variance $s_1^2 = 160.58$ Variance $s_2^2 = 177.14$ $n_2 = 20$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

variance formula $s^2 = \frac{\Sigma x^2}{n-1}$

$t = 0.79$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 18.--t test performed on school attitude response subtotals

	Classroom X			Classroom Y		
	Sub-totals	Deviations x	Squared Deviations x^2	Sub-totals	Deviations x	Squared Deviations x^2
1.	0	-14.4	207.36	0	-15.8	249.64
2.	20	5.6	31.36	36	20.2	408.04
3.	18	3.6	12.96	12	-3.8	14.44
4.	4	-10.4	108.16	5	-10.8	116.64
5.	16	1.6	2.56	4	-11.8	139.24
6.	27	12.6	158.76	51	35.2	1239.04
7.	4	-10.4	108.16	4	-11.8	139.24
8.	8	-6.4	40.96	3	-12.8	163.84
9.	16	1.6	2.56	12	-3.8	14.44
10.	27	12.6	158.76	45	29.2	852.64
11.	10	-4.4	19.36	4	-11.8	139.24
12.	5	-9.4	88.36	3	-12.8	163.84
13.	32	-14.4	207.36	16	0.2	0.04
14.	27	12.6	158.76	48	32.2	1036.84
15.	6	-8.4	70.56	2	-13.8	190.44
16.	4	-10.4	108.16	2	-13.8	190.44
17.	16	1.6	2.56	24	8.2	67.24
18.	36	21.6	466.56	39	23.2	538.24
19.	10	-4.4	19.36	4	-11.8	139.24
20.	2	-12.4	153.76	2	-13.8	190.44
			$\Sigma x_1^2 = 2126.40$			$\Sigma x_2^2 = 5993.20$

Mean $\bar{X}_1 = 14.40$ Mean $\bar{X}_2 = 15.80$ $n_1 = 20$

Variance $s_1^2 = 111.92$ Variance $s_2^2 = 315.43$ $n_2 = 20$

$t = 0.30$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 19.--t test performed on subject attitude response subtotals

	Classroom X			Classroom Y		
	Sub-totals	Deviations x	Squared Deviations x^2	Sub-totals	Deviations x	Squared Deviations x^2
1.	4	-8.35	69.72	8	-4.70	22.09
2.	9	-3.35	11.22	12	0.70	0.49
3.	22	10.65	113.42	14	1.30	1.69
4.	8	-4.35	18.92	10	-2.70	7.29
5.	4	-8.35	69.72	8	-4.70	22.09
6.	6	-6.35	40.32	3	-9.70	94.09
7.	20	7.65	58.52	20	7.30	53.29
8.	10	-2.35	5.52	10	-2.70	7.29
9.	4	-8.35	69.72	12	0.70	0.49
10.	33	20.65	426.42	33	20.30	412.09
11.	12	-0.35	0.12	12	0.70	0.49
12.	5	-7.35	54.02	3	-9.70	94.09
13.	8	-4.35	18.92	12	0.70	0.49
14.	30	17.65	311.52	30	17.30	299.29
15.	8	-4.35	18.92	12	0.70	0.49
16.	7	-5.35	28.62	4	-8.70	75.69
17.	16	3.65	13.32	8	-4.70	22.09
18.	21	8.65	74.82	18	5.30	28.09
19.	16	3.65	13.32	20	7.30	53.29
20.	4	-8.35	69.72	5	-7.70	59.29
			$\Sigma x_1^2 = 1486.80$			$\Sigma x_2^2 = 1254.20$

Mean $\bar{X}_1 = 12.35$ Mean $\bar{X}_2 = 12.70$ $n_1 = 20$

Variance $s_1^2 = 78.25$ Variance $s_2^2 = 66.01$ $n_2 = 20$

$t = 0.13$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 20.--t test performed on teacher attitude response subtotals

	Classroom X			Classroom Y		
	Sub-totals	Deviations x	Squared Deviations x^2	Sub-totals	Deviations x	Squared Deviations x^2
1.	4	-13.25	175.56	28	9.05	81.90
2.	33	15.75	248.06	30	11.05	122.10
3.	22	4.75	22.56	12	-6.95	48.30
4.	0	-17.25	297.56	0	-18.95	359.10
5.	16	-1.25	1.56	36	17.05	290.70
6.	48	30.75	945.56	33	14.05	197.40
7.	4	-13.25	175.56	6	-12.95	167.70
8.	1	-16.25	264.06	0	-18.95	359.10
9.	24	6.75	45.56	44	25.05	627.50
10.	48	30.75	945.56	27	8.05	64.80
11.	2	-15.25	232.56	2	-16.95	287.30
12.	0	-17.25	297.56	2	-16.95	287.30
13.	12	-5.25	27.56	36	17.05	290.70
14.	60	42.75	1827.56	36	17.05	290.70
15.	0	-17.25	297.56	4	-14.95	223.50
16.	0	-17.25	297.56	0	-18.95	359.10
17.	32	14.75	217.56	56	37.05	1372.70
18.	36	18.75	351.56	27	8.05	64.80
19.	0	-17.25	297.56	0	-18.95	359.10
20.	3	-14.25	203.06	0	-18.95	359.10
			$\Sigma x_1^2 = 7171.70$			$\Sigma x_2^2 = 6212.90$

Mean $\bar{X}_1 = 17.25$ Mean $\bar{X}_2 = 18.95$ $n_1 = 20$

Variance $s_1^2 = 377.46$ Variance $s_2^2 = 326.99$ $n_2 = 20$

$t = 0.29$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 21.--t test performed on the entire attitude survey using response subtotals

Classroom X

	Sub-totals	Deviations x	Squared Deviations x^2		Sub-totals	Deviations x	Squared Deviations x^2
1.	12	-2.28	5.20	36.	4	-10.28	105.68
2.	39	24.72	611.08	37.	16	1.72	2.96
3.	12	-2.28	5.20	38.	36	21.72	471.76
4.	1	-13.28	176.36	39.	10	-4.28	18.32
5.	0	-14.28	203.92	40.	2	-12.28	150.80
6.	9	-5.28	27.88	41.	4	-10.28	105.68
7.	24	9.72	94.48	42.	9	-5.28	22.88
8.	8	-6.28	39.44	43.	22	7.72	60.00
9.	4	-10.28	105.68	44.	8	-6.28	39.44
10.	33	18.72	350.44	45.	4	-10.28	105.68
11.	16	1.72	2.96	46.	6	-8.28	68.56
12.	3	-11.28	127.24	47.	20	5.72	32.72
13.	0	-14.28	203.92	48.	10	-4.28	18.32
14.	24	9.72	94.48	49.	4	-10.28	105.68
15.	16	1.72	2.96	50.	33	18.72	350.44
16.	7	-7.28	53.00	51.	12	-2.28	5.20
17.	12	-2.28	5.20	52.	5	-9.28	86.12
18.	39	24.72	611.08	53.	8	-6.28	39.44
19.	8	-6.28	39.44	54.	30	15.72	247.12
20.	3	-11.28	127.24	55.	8	-6.28	39.44
21.	0	-14.28	203.92	56.	7	-7.28	53.00
22.	20	5.72	32.72	57.	16	1.72	2.96
23.	18	3.72	13.84	58.	21	6.72	45.16
24.	4	-10.28	105.68	59.	16	1.72	2.96
25.	16	1.72	2.96	60.	4	-10.28	105.68
26.	27	12.72	161.80	61.	4	-10.28	105.68
27.	4	-10.28	105.68	62.	33	18.72	350.44
28.	8	-6.28	39.44	63.	22	7.72	60.00
29.	16	1.72	2.96	64.	0	-14.28	203.92
30.	27	12.72	161.80	65.	16	1.72	2.96
31.	10	-4.28	18.32	66.	48	33.72	1137.04
32.	5	-9.28	86.12	67.	4	-10.28	105.68
33.	32	17.72	314.00	68.	1	-13.28	176.36
34.	27	12.72	161.80	69.	24	9.72	94.48
35.	6	-8.28	68.56	70.	48	33.72	1137.04

TABLE 21.--Continued.

	Sub-totals	Deviations x	Squared Deviations x^2		Sub-totals	Deviations x	Squared Deviations x^2
71.	2	-12.28	150.80	76.	0	-14.28	203.92
72.	0	-14.28	203.92	77.	32	17.72	314.00
73.	12	-2.28	5.20	78.	36	21.72	471.76
74.	60	45.72	2090.32	79.	0	-14.28	203.92
75.	0	-14.28	203.92	80.	3	-11.28	127.24
							$\Sigma x_1^2 = 14,006.40$

Mean $\bar{X}_1 = 14.28$ $n_1 = 80$

Variance $s_1^2 = 737.18$ $n_2 = 80$

Classroom Y

1.	24	8.07	65.12	21.	0	-15.93	253.76
2.	33	17.07	291.38	22.	36	20.07	402.80
3.	8	-7.93	62.88	23.	12	-3.93	15.44
4.	2	-13.93	194.04	24.	5	-10.93	119.46
5.	12	-3.93	15.44	25.	4	-11.93	142.32
6.	27	11.07	122.54	26.	51	35.07	1229.90
7.	18	2.07	4.28	27.	4	-11.93	142.32
8.	2	-13.93	194.04	28.	3	-12.93	167.18
9.	20	4.07	16.56	29.	12	-3.93	15.44
10.	36	20.07	402.80	30.	45	29.07	845.06
11.	10	-5.93	35.16	31.	4	-11.93	142.32
12.	1	-14.93	222.90	32.	3	-12.93	167.18
13.	20	4.07	16.56	33.	16	0.07	0.0049
14.	33	17.07	291.38	34.	48	32.07	1028.48
15.	14	-1.93	3.72	35.	2	-13.93	194.04
16.	0	-15.93	253.76	36.	2	-13.93	194.04
17.	32	16.07	258.24	37.	24	8.07	65.12
18.	39	23.07	532.22	38.	39	23.07	532.22
19.	4	-11.93	142.32	39.	4	-11.93	142.32
20.	0	-15.93	253.76	40.	2	-13.93	194.04

TABLE 21.--Continued

	Sub-totals	Deviations x	Squared Deviations x^2		Sub-totals	Deviations x	Squared Deviations x^2
41.	8	-7.93	62.88	61.	28	12.07	145.68
42.	12	-3.93	15.44	62.	30	14.07	197.96
43.	14	-1.93	3.72	63.	12	-3.93	15.44
44.	10	-5.93	35.16	64.	0	-15.93	253.76
45.	8	-7.93	62.88	65.	36	20.07	402.80
46.	3	-12.93	167.18	66.	33	17.07	291.38
47.	20	4.07	16.56	67.	6	-9.93	98.60
48.	10	-5.93	35.16	68.	0	-15.93	253.76
49.	12	-3.93	15.44	69.	44	28.07	787.92
50.	33	17.07	291.38	70.	27	11.07	122.54
51.	12	-3.93	15.44	71.	2	-13.93	194.04
52.	3	-12.93	167.18	72.	2	-13.93	194.04
53.	12	-3.93	15.44	73.	36	20.07	402.80
54.	30	14.07	197.96	74.	36	20.07	402.80
55.	12	-3.93	15.44	75.	4	-11.93	142.32
56.	4	-11.93	142.32	76	0	-15.93	253.76
57.	8	-7.93	62.88	77.	56	40.07	1605.60
58.	8	-7.93	62.88	78.	27	11.07	122.54
59.	20	4.07	16.56	79.	0	-15.93	253.76
60.	5	-10.93	119.46	80.	0	-15.93	253.76
							$\Sigma x_2^2 = 17,289.17$

Mean $\overline{X}_2 = 15.93$ $n_1 = 80$

Variance $s_2^2 = 909.96$ $n_2 = 80$

$t = 0.18$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 22.--t test performed on the eighth grade 1st semester science grades

	Classroom X		Classroom Y	
	Deviations x	Squared Deviations x^2	Deviations x	Squared Deviations x^2
1.	-1.53	2.34	0.63	0.40
2.	0.47	0.22	0.63	0.40
3.	0.47	0.22	0.63	0.40
4.	-0.53	0.28	-1.37	1.88
5.	0.47	0.22	-0.37	0.14
6.	0.47	0.22	-0.37	0.14
7.	-0.53	0.28	-1.37	1.88
8.	-0.53	0.28	0.63	0.40
9.	0.47	0.22	0.63	0.40
10.	0.47	0.22	-1.37	1.88
11.	0.47	0.22	-0.37	0.14
12.	-0.53	0.28	-0.37	0.14
13.	-0.53	0.28	0.63	0.40
14.	-0.53	0.28	-0.37	0.14
15.	-0.53	0.28	-0.37	0.14
16.	1.47	2.16	0.63	0.40
17.	0.47	0.22	-0.37	0.14
18.	0.47	0.22	0.63	0.40
19.	-0.53	0.28	1.63	2.66
		$\Sigma x_1^2 = 8.72$		$\Sigma x_2^2 = 12.48$

Mean $\bar{X}_1 = 2.53$ Mean $\bar{X}_2 = 2.37$ $n_1 = 19$

Variance $s_1^2 = 0.48$ Variance $s_2^2 = 0.69$ $n_2 = 19$

$t = 0.65$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 23.--t test performed on the ninth grade 1st semester science grades

	Classroom X		Classroom Y	
	Deviations x	Squared Deviations x^2	Deviations x	Squared Deviations x^2
1.	-1.89	3.57	1.16	1.35
2.	1.11	1.23	0.16	0.02
3.	0.11	0.01	0.16	0.02
4.	0.11	0.01	-0.84	0.71
5.	1.11	1.23	-0.84	0.71
6.	-0.89	0.79	-0.84	0.71
7.	0.11	0.01	0.84	0.71
8.	-0.89	0.79	1.16	1.35
9.	1.11	1.23	1.16	1.35
10.	-0.89	0.79	-1.84	3.39
11.	0.11	0.01	0.16	0.02
12.	-0.89	0.79	-0.84	0.71
13.	-0.89	0.79	2.16	4.67
14.	0.11	0.01	0.16	0.02
15.	0.11	0.01	-1.84	3.39
16.	-0.89	0.79	-1.16	1.35
17.	2.11	4.45	-1.84	3.39
18.	0.11	0.01	1.16	1.35
19.	-0.89	0.79	1.16	1.35
		$\Sigma x_1^2 = 17.31$		$\Sigma x_2^2 = 26.57$

Mean $\bar{X}_1 = 1.89$ Mean $\bar{X}_2 = 1.84$ $n_1 = 19$

Variance $s_1^2 = 0.96$ Variance $s_2^2 = 1.48$ $n_2 = 19$

$t = 0.14$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

TABLE 24.--t test performed on the tenth grade 1st semester science grades

	Classroom X		Classroom Y	
	Deviations x	Squared Deviations x^2	Deviations x	Squared Deviations x^2
1.	-0.73	0.53	1.63	2.66
2.	1.27	1.61	0.63	0.40
3.	1.27	1.61	-0.37	0.14
4.	-0.73	0.53	-0.37	0.14
5.	0.27	0.07	-0.37	0.14
6.	-1.73	2.99	-1.37	1.88
7.	0.27	0.07	-0.37	0.14
8.	-2.73	7.45	1.63	2.66
9.	0.27	0.07	1.63	2.66
10.	1.27	1.61	-2.37	5.62
11.	1.27	1.61	0.63	0.40
12.	0.27	0.07	0.63	0.40
13.	-0.73	0.53	1.63	2.66
14.	-0.73	0.53	-1.37	1.88
15.	-0.73	0.53	-1.37	1.88
16.	0.27	0.07	0.63	0.40
17.	1.27	1.61	-2.37	5.62
18.	0.27	0.07	0.63	0.40
19.	0.27	0.07	0.63	0.40
		$\Sigma x_1^2 = 21.63$		$\Sigma x_1^2 = 30.48$

Mean $\bar{X}_1 = 2.73$ Mean $\bar{X}_2 = 2.37$ $n_1 = 19$

Variance $s_1^2 = 1.20$ Variance $s_2^2 = 1.69$ $n_2 = 19$

$t = 0.92$

Cannot reject the null hypothesis for a two-tailed test at the 0.10 level of significance.

classroom Y with regard to attitude towards their classroom, school, subject and teacher. Perhaps some differences also exist between the two classes with regard to achievement in science in favor of classroom X. However, by running the Mann-Whitney U tests and t tests as prescribed earlier, the differences were not found to be significant enough to reject the null hypothesis in each case. This ultimately means that according to the data gathered in this study, no differences exist between the students in classroom X and classroom Y with regard to attitude towards their classroom, school, subject and teacher and their achievement in science.

A discussion of the reasons why classroom Y did not produce significantly different results from classroom X must include some information about how the classroom is decorated and used. Classroom Y is decorated entirely with chemistry materials for the teacher who uses it for the majority of the day teaches exclusively chemistry. The students who use the classroom for chemistry contributed to its decoration and continue to maintain it. The students who use the classroom for biology did not decorate it, do

not maintain it and therefore find little, if any, identity with it. Indeed, the classroom is equipped with a stereo and bean bags for more informal class sessions. However, the traveling teacher rarely uses them for he does not feel that he can claim ownership of these materials since they belong to the chemistry students and teacher.

Classroom X for the most part is a typical high school classroom. Perhaps the students have become accustomed to this type of classroom and thereby find identity with it. Students using this type of classroom all day might find classroom Y overwhelming, even disturbing. Since the majority of the high school classrooms are undecorated, it is possible that this might have nullified any effect that the decorated classroom might have had on the students.

As far as the purpose of the study is concerned, some discussion of the hypotheses needs to be made. The hypotheses were looking for the decorated, well-maintained classroom to have an effect on the students' attitudes towards their classroom, school, subject and teacher and an effect on their science achievement. With the fact that the students in the study use this classroom one-sixth of every

school day, it appears that the classroom was assigned quite a demanding task. It might be expected that this classroom might affect students' attitudes toward itself. But as far as affecting students' attitudes toward their subject, teacher and even school, and affecting their science achievement, the chances seem remote. Many factors affect students' attitudes and academic performance such as the teacher's personality, former experiences, peer pressures, home life, jobs, extra-curricular activities, inherent capabilities and interpersonal relationships. These are all interwoven into a network that produces student behavior. The study was hoping that a decorated, well-maintained classroom could play a major role in this network.

If this study were to be repeated, it might be interesting to note the survey responses of the two classes and their differences in science achievement after the two classes were exposed for a short time to the opposite classrooms. This time the students should play a role in the decoration and maintenance of the decorated, well-maintained classroom. The teacher should also use the classroom to its full potential bringing the decorations into focus by incorporating them into the daily curriculum. Finally, more reasonable expectations of the study should be set in the

hypotheses. For example, the study might just compare the students' attitudes toward their classroom, subject and teacher using a decorated and an undecorated room. Also the level of significance expected might be lowered to a 0.10 level to assure some level of success with rejecting the null hypothesis since there are so many factors affecting student behavior.

FOOTNOTES

[1]Robert Sommer, "Classroom Layout," Theory Into Practice, XVI (June, 1977), p. 174.

[2]Leonard H. Clark and Irving S. Starr, Secondary School Teaching Methods (London: Collier-Macmillan Limited, 1970), p. 410.

[3]William B. Hansen and Irwin Atman, "Decorating Personal Places," Environment and Behavior, VIII (December, 1976), p. 491.

[4]Harry N. Rivlin, Teaching Adolescents in Secondary Schools (New York: Appleton-Century-Crofts, Inc., 1961), p. 380.

[5]Sommer, p. 174.

[6]Clark and Starr, p. 410.

[7]Ibid., p. 411.

[8]Rivlin, p. 380.

[9]John Walton, Toward Better Teaching in the Secondary Schools (Boston: Allyn and Bacon, 1966), p. 273.

[10]Clark and Starr, p. 410

[11]Lawrence B. Rosenfeld, "Setting the Stage for Learning, "Theory Into Practice, XVI (June, 1977), p. 169.

[12]Ibid., p. 168.

[13]Carl Simpson, The Impact of Classroom Structure on Performance Inequality Between Minority and Non-minority Students, Education Resources Information Center, ERIC 152 881. (Stanford University, California: Stanford Center for Research, 1977), p. 3.

[14]Albert Mehrabian, Public Places and Private Spaces (New York: Basic Books, Inc., 1976), p. 154.

[15]Clark and Starr, p. 414.

[16]Rivlin, p. 383.

[17]Ibid.

[18]Rosenfeld, p. 168.

[19]Ibid.

[20]Alan L. Chaikin, Valerian J. Derlega, and Sarah Jane Miller, "Effects of Room Environment on Self Disclosure in a Counseling Analogue," Journal of Counseling Psychology, XXIII (September, 1976), p. 479.

[21]Ibid., p. 480.

[22]Robert Gifford, "Environmental Numbness in the Classroom," Journal of Experimental Education, XLIV (Spring, 1976), p. 7.

[23]Janice I. Winer, et al., Factors Affecting Perception of and Responses to Crowded Classroom Environments, Education Resources Information Center, ERIC 151 634. (Washington, D.C.: National Science Foundation, 1977), p. 1.

[24]Elizabeth Prescott and Thomas G. David, Effects of Physical Environments in Child Care Systems, Education Resources Information Center, ERIC 142 284. (Pacific Oaks College, 1977), p. 9.

[25]Rosenfeld, p. 168.

[26]David Dempsey, "Man's Hidden Environment," Playboy, XIX (May, 1972), p. 110.

[27]Susan Abramowitz, The Effect of School and Task Structure on Teacher Interaction, Classroom Organization and Student Affects, Education Resources Information Center. ERIC 138 560. (Washington, D.C.: National Institute of Education, 1977), p. 1.

[28]Lee A. Morris, et al., The Open School: Cognitive and Phenomenological Correlates, Education Resources Information Center, ERIC 139 507. (University of Oklahoma, 1977), p. 19.

[29]Clark and Starr, p. 413.

[30]Frank A. Butler, The Improvement of Teaching in Secondary Schools (Chicago: The University of Chicago Press, 1966), p. 325.

[31]Rosenfeld, p. 170.

[32]Butler, p. 326.

[33]Ibid., p. 325.

[34]Rivlin, p. 379.

[35]Walton, p. 273.

[36]Rosenfeld, p. 169.

[37]Ibid.

[38]Ibid.

[39]Ibid.

[40]Clark and Starr, p. 410.

[41]Rosenfeld, p. 169.

[42]Dempsey, p. 110

[43]Rosenfeld, p. 169.

[44]Ibid.

[45]Ibid.

[46]Ibid.

[47]Ibid.

[48]Ibid.

[49]Bryan Miles Romney, The Effects of Windowless Classrooms on the Cognitive and Affective Behavior of Elementary School Students, Education Resources Information Center. ERIC 126 622. (University of New Mexico, 1975), p. 1.

[50]Rosenfeld, p. 168.

[51]Butler, p. 326.

[52]Ibid.

[53]Clark and Starr, p. 413.

[54]Butler, p. 326.

[55]Ibid.

[56]Rosenfeld, p. 169.

[57]Ibid., p. 170.

[58]Ibid.

[59]Clark and Starr, p. 413.

[60]Walton, p. 274.

[61]Rivlin, p. 225.

[62]Ibid., p. 380.

[63]Clark and Starr, p. 411.

[64]Ibid.

[65]Rivlin, p. 233.

[66]Rosenfeld, p. 170.

[67] Ibid.

[68] Ibid

[69] Dempsey, p. 109.

[70] W. James Popham, Educational Statistics (New York: Harper and Row, Publishers, 1967), p. 272.

[71] Ibid., p. 273.

BIBLIOGRAPHY

Abramowitz, Susan. The Effect of School and Task Structure on Teacher Interaction, Classroom Organization and Student Affects. Education Resources Information Center. ERIC 138 560. Washington, D.C.: National Institute of Education, 1977.

Butler, Frank A., The Improvement of Teaching in Secondary Schools. Chicago: The University of Chicago Press, 1966.

Chaikin, Alan L. and Derlega, Valerian J. "Effects of Room Environments on Self-Disclosure in a Counseling Analogue," Journal of Counseling in Psychology, XXIII (September, 1976), pp. 479-481.

Clark, Leonard H. and Starr, Irving S., Secondary School Teaching Methods. London: Collier-Macmillian Limited, 1970.

Dempsey, David. "Man's Hidden Environment," Playboy, XIX (May, 1972), pp. 108-110, 222-226.

Downie, N. M. and Heath, R. W., Basic Statistical Methods. New York: Harper and Row, Publishers, 1970.

Fried, Robert., Introduction to Statistics. New York: Gardner Press, Inc., 1976.

Gifford, Robert. "Environmental Numbness in the Classroom," Journal of Experimental Education, XLIV (Spring, 1976), pp. 4-7.

Hamburg, Morris., Basic Statistics. New York: Harcourt Brace Javonovich, Inc., 1974.

Hansen, William B. and Atman, Irwin, "Decorating Personal Places: A Descriptive Analysis," Environment and Behavior, VIII (December, 1976), pp. 491-504.

Marascuilo, Leonard A. and McSweeney, Maryellen., Non-parametric and Distribution-Free methods for the Social Sciences. Belmont, California: Wadsworth Publishing Company, Inc., 1977.

Mehrabian, Albert, Public Places and Private Spaces. New York: Basic Books, Inc. 1976.

Morris, Lee A., et al. The Open School: Cognitive and Phenomenological Correlates. Education Resources Information Center, ERIC 139 507. University of Oklahoma, 1977.

Popham, W. James., Educational Statistics. New York: Harper and Row, Publishers, 1967.

Prescott, Elizabeth and David, Thomas G. Effects of Physical Environments in Child Care Systems. Education Resources Information Center. ERIC 142 284. Pacific Oaks College, 1977.

Rivlin, Harry N., Teaching Adolescents in Secondary Schools, New York: Appleton-Century-Crofts, Inc., 1961.

Romney, Byran Miles. The Effects of Windowless Classrooms on the Cognitive and Affective Behavior of Elementary School Students. Education Resources Information Center, ERIC 126 622. University of New Mexico, 1975.

Rosenfeld, Lawrence B. "Setting the Stage for Learning," Theory Into Practice, XVI (June, 1977), pp. 167-173.

Simpson, Carl. The Impact of Classroom Structure on Performance Inequality Between Minority and Non-minority Students. Education Resources Information Center. ERIC 152 881, Stanford University, California: Stanford Center for Research, 1977.

Sommer, Robert. "Classroom Layout," Theory Into Practice, XVI (June, 1977), pp. 174-175.

Walton, John, Toward Better Teaching in the Secondary Schools. Boston: Allyn and Bacon, 1966.

Winer, Janice, et al. Factors Affecting Perception of and Responses to Crowded Classroom Environments. Education Resources Information Center. ERIC 138 560. Washington, D. C.: National Science Foundation, 1977.

APPENDIX

Student Attitude Survey

Circle either 1, 2, 3, or 4.

1=Strongly Agree
2=Agree
3=Disagree
4=Strongly Disagree

1	2	3	4	1.	School is an enjoyable place to be.
1	2	3	4	2.	My Biology teacher is my favorite teacher.
1	2	3	4	3.	Biology is my favorite subject.
1	2	3	4	4.	My Biology classroom is ugly.
1	2	3	4	5.	I hate going to school.
1	2	3	4	6.	My Biology teacher is interesting.
1	2	3	4	7.	If I could, I would take a second course in Biology.
1	2	3	4	8.	My Biology classroom is one of the nicest in the school.
1	2	3	4	9.	I care about my school.
1	2	3	4	10.	I would rather have a more interesting Biology teacher.
1	2	3	4	11.	Biology is an interesting subject.
1	2	3	4	12.	I like my Biology classroom.
1	2	3	4	13.	I would rather not attend school.
1	2	3	4	14.	I enjoy my Biology teacher.
1	2	3	4	15.	I would never take another course in Biology.
1	2	3	4	16.	I wish that more of my classrooms were like my Biology classroom.
1	2	3	4	17.	I enjoy attending Orange Park High School.
1	2	3	4	18.	I hate my Biology teacher.
1	2	3	4	19.	I would rather be taking something better than Biology.
1	2	3	4	20.	I would rather take Biology in another classroom.