THE EFFECTS OF ADAPTIVE MATERIALS ON SEVENTH GRADE SCIENCE STUDENTS

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PREFACE

This study is concerned with the effects of adaptive materials on seventh grade science students. The purpose is to determine if the use of adaptive materials has any impact on the students' academic performance on content-related chapter tests; on their affective preference for materials; and on their varying performance in relation to their study attitudes.

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CHAPTER I

INTRODUCTION

The problem of how to successfully teach students with a wide diversity of academic abilities has faced regular classroom teachers for the past several years. In the average junior high classroom, it is not unusual to find a ten-year spread in the students' reading abilities (McClain, 1981). Additionally, not all students are able to learn by the lecture/listen method because of differences in their learning styles (McClain, 1981). Student performance is further affected by the wide variety of background experience and the varying degrees of interest in the subject matter that the students bring with them to the classroom (Zintz, 1975). With the passage of Public Law 94-142, the Education of All Handicapped Children Act in 1975, teachers found themselves dealing with not only the "average" student but also with the "exceptional". A student is considered "exceptional" when the educational programs must be altered to meet his or her educational needs (Kirk and Gallagher, 1979).

Students upon entering secondary school find an entirely different educational environment from what they had encountered in elementary school. Elementary school is

very student orientated, while secondary school has a subject orientation. Today's secondary school environment is very complex. The student is faced with several different teachers during the course of the school day, each having different expectations and teaching styles (Morsink, 1984). Secondary teachers tend to be very subject oriented, and in many cases are forced to adhere to the rigid demands of lengthy curricula dictated by state or local school boards (Morsink, 1984). In most cases, secondary school curricula do not take into consideration the various functioning levels of the students. Thirty percent of the students will find the pace set by secondary curricula developed for the "average" student too demanding (Armstrong, 1971), while over two percent find the curriculum unable to challenge their advanced levels of abstract thinking (Kirk and Gallagher, 1979).

A recent article in Educational Leadership (1985) suggested that adapting education to the individual differences of the students remains an essential goal of quality education (Warman, Wang, Anderson and Walberg, 1985). On the secondary level, the increasing demands of the curriculum and the decreasing amount of time set aside solely for instruction has caused many teachers to look toward alternative methods of material presentation to meet this goal.

As a teacher begins to investigate the various alternative instructional methods available, the attitudes

of the students in their classroom should be kept in mind. The attitude a student has toward the subject matter of the class will have either a positive or negative effect on how they act, feel and learn (Lefrancois, 1979). Research has shown this to be especially true in the field of science. A correlation was found to exist between the students' attitude towards science and their subsequent academic achievement (Bloom, 1976). Adaptive instructional techniques can help overcome negative student attitudes (Dole and Johnson, 1981).

Adaptive instructional techniques available for teacher consideration include the use of learning modules and various reading modification methods. Learning modules, including learning centers and learning activity packets, provide the student with an organized collection of learning experiences assembled to achieve a specified group of objectives, which are usually based on the cognitive domain of Boom's Taxonomy (Musgrave, 1975). The use of Bloom's Taxonomy provides the teacher with a direction for teaching and material development. The taxonomy also contributes guidance for the evaluation process and facilitates student learning by supplying structure and organization (Jenkins and Neisworth 1973).

Modifications of reading materials are useful techniques for a teacher who is trying to meet the varying cognitive levels and abilities of the students. Jorgenson (1977) found that if the required reading material is too

difficult it can cause repeated student failures, which in turn can lead to frustration, confusion and discouragement. If, on the other hand, the material is too easy, the student rapidly becomes bored (Zintz, 1975). Various techniques have been developed to assist the teacher in modifying reading materials. Among the most widely used are study guides, advanced organizers, taping or rewriting the text material, and the use of high interest, low vocabulary reading materials (Harris and Sipay, 1985).

The affective preferences of students for various methods and materials should also be taken into consideration. Studies have shown that when students are actively involved in the selection process and allowed to generate their own ideas and goals, academic gains follow (Penick and Yager, 1985).

In synthesizing the research on adaptive education, Warman, Wang, Anderson, and Walberg (1985), concluded that effective education must be based on the assessed capabilities of the students. The materials and procedure must permit each student to progress at a pace suited to their abilities and interests. Students should also share in the responsibility of planning and pursuing their individual learning activities. Where needed, alternative learning activities and materials must also be available to help students acquire the necessary content. Students should also be allowed choices concerning educational goals, activities and outcomes.

The use of adaptive materials and reading modification techniques are alternatives available to teachers to help them meet these needs. Research done at the elementary level has demonstrated that the use of adaptive materials is an effective instructional method (Armstrong, 1971). Little research has been conducted at the secondary level and what is available are simple lists of "how-to's". Studies also show that failure to match the material and instruction used to the students' reading capabilities is the most important cause of reading disabilities in the classroom today, thus the need for reading modifications (Bond and Tinker, 1973).

Statement of Problem

The purpose of this study is to investigate the effects of adaptive materials vs. traditional methods in seventh grade science focusing on: (1) the students' performance on content-related chapter posttests; (2) students' affective preference for adaptive materials; and (3) students' varying performance in relation to their study attitudes.

For the purpose of definition, the term adaptive materials in this study will mean modification of reading material and the development of learning modules. Modification of reading material will meet the students' varying cognitive levels and abilities, reading skills and personal

interests. Learning modules will provide an organized collection of learning experiences assembled to achieve a specified group of objectives, based on the cognitive domain of Bloom's Taxomony.

Statement of Hypotheses

HO_1: There will be no significant difference in the posttest scores measuring knowledge of plants, their structure, function and behavior, between the seventh grade science class that used the adaptive materials and the seventh grade science class that followed the traditional instruction.

HO_2: There will be no significant differences in the posttest scores measuring knowledge of rocks and ores between the seventh grade science class that used the adaptive materials and the seventh grade science class that followed the traditional method of instruction.

HO_3: There is no significant difference in the proportion of students who expressed a preference for the use of the adaptive materials as part of their instruction compared to those who did not prefer the materials.

HO_4: There is no significant difference between the proportion of students who scored above and below the median of the Survey of Study Habits and Attitudes, Student Attitudes subscale, in terms of their preference to use or not use the adaptive materials as part of their instruction.

$H0_5$: There is no significant relationship between academic success as measured by the posttest for Chapter Seven, Plants-Structure, Function and Behavior, and the students' study habits and attitudes.

$H0_6$: There is no significant relationship between academic success as measured by the posttest for Chapter Eight, Rocks and Ores, and the students' study habits and attitudes.

Definition of Terms

1. Learning Modules: An organized collection of learning experiences usually in a self instructional form, assembled to achieve a specified group of related objectives (Musgrave, 1975).

2. Advanced Organizers: A 300-500 word passage given to the student before he/she reads an assignment for the purpose of (a) clarifying the organization of the assignment, (b) briefly summarizing the main ideas of the material, (c) reviewing previously studied ideas upon which the present lesson is based, and/or (d) previewing the larger generalized concepts to be explored as the reading is done (Mayer, 1979).

3. Learning Activity Packets: Instructional packages designed for individual student use, usually permitting them to move at their own speed through a given unit of content (Schultz and Turnbull, 1984).

4. Learning Centers: Selected space in the classroom where students may go to work on new assignments, skills or previously taught lessons (Wood, 1984).

5. Study Guide: Teaching aid written by the teacher to be used by the student to assist the student in developing reading skills for the purpose of enhancing comprehension of textual material (Tutolo, 1977).

Limitations

1. The total number of subjects involved in the study was fifty-two.

2. The subjects should ideally be exposed to the experimental treatment for a longer period of time in order to assess its effectiveness. Permission was granted to the researcher to be in the class for only six weeks.

Assumptions

1. At some point all students enrolled in the Seventh Grade Science Class will use the adaptive materials.

2. The content taught to both the control and the experimental group will be the same.

3. The method used to present the content will be the same for the control and the experimental group.

4. Tests will adequately measure learning and affect.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Teachers of today have the fundamental task of designing settings for education that are flexible enough to meet the individual differences of the students (Glaser, 1977). This design must take into account the varying needs, interests, abilities, talents, and learning styles of the individual students. A 1980 national needs assessment, conducted by the U.S. Bureau of Education, discovered that 49% of the teachers surveyed believed training in how to adapt materials to meet students' academic, emotional and physical needs to be of great value (Lambie, 1980; Stowitscheck, Gable and Hendrickson, 1980).

On the secondary level many students will find the curricula developed too demanding, while others find it lacking (Thompson, 1981). Teachers at this level tend to be subject-oriented, using a uniform method of instruction that requires all students to learn the same skills at the same rate, with little attention given to the individual learning styles and the varying levels at which their students function (Dodd, 1980). The majority of the materials used follow the same fixed course with little thought given

to the mismatch between material and student. The adaptive approach assumes there are different ways available to help students succeed, and that no one set of materials or method of presentation is effective with all learners all of the time (Glaser, 1977; Lambie, 1980; Morsink, 1984; Stowitscheck, Gable and Hendrickson, 1980).

Over the past several years, various research studies have been conducted for the purpose of investigating the use of adaptive materials as a form of content modification at the primary level. This research has shown the use of learning modules, primarily learning centers and learning activity packets and the modification of reading material to be effective (Cheyney and Strichart, 1981; Thompson, 1981). Studies conducted using 7,200 students grades K-12th have also shown adaptive programs to have a positive effect on the attitude and the classroom behavior of the student involved (Warman, Wang, Anderson and Walberg, 1985).

The present study is an investigation of the use of adaptive materials in a seventh grade science class. The study lead to a review of the literature to discover how attitudes and affective preference effect student learning, and how reading modification and learning modules are used in secondary schools.

Attitude and Affective Preference

The attitude a student has toward a subject of study can either be a positive or negative predisposition that will influence how they act, feel, and think. Attitudes are a powerful influence that are not easily modified (Lefrancois, 1979). They are the product of what has occurred in the persons life to that point and are the primary determinate of how much education will be used and remembered (Biehler, 1971). Several studies have been conducted in the area of student attitudes toward science classes. Bloom (1976) investigated the correlation between attitude toward science and academic achievement. His findings indicate that as attitude becomes less positive academic achievement declines. Similar studies have concluded that a student's attitude toward science stabilizes by the ages of 10-14, usually beginning to show a decline at the beginning of the seventh grade or age 13 (Cannon and Simpson, 1985; Hofstein and Welsh, 1984; James and Smith, 1985).

Several variables have been identified that relate toward positive science attitude: the students' sense of the importance of science; student fatalism; the quality of the teachers and the perceived learning environment (Haladyana, Olsen and Shaughnessy, 1983). Hofstein and Welsh (1984), surveyed students in junior high and repeated the same survey as the students became seniors. They found most students thought science was important and useful if

done by someone else. They supported the idea that research was important but was not considered to be personally useful.

Student fatalism, the student's perceived ability to affect success at school, is another variable that influences student attitude. This fatalism is due to the long term effects of schooling and the teacher/learner environment (Haladyana, Olsen and Shaughnessy, 1983). The student enters junior high usually with a minimal exposure to science. Seventh grade is the first instance, in many cases where science is treated as a separate subject, it is presupposed by the teacher that the student has the necessary background to understand the material presented. This presupposition on the part of the teacher leads many students, whose previous exposure to science was limited to 19-35 minutes per week, to feel a sense of fatalism and alienation (Cannon and Simpson, 1985; James and Smith, 1985). Penick and Yager (1985), surveyed 2000 students of which 57% report that science makes them unhappy.

In a study conducted in North Carolina, students perceive the teachers as frequently getting in a "rut" and involving only interested students in the learning process. They see the curriculum as irrelevant, the methods used by the teachers, mainly the textbook/lecture approach as ineffective and the actual school environment inhibiting (Cannon and Simpson, 1985). A new curricular approach, based on the use of adaptive materials will influence these

attitudes by giving students a more positive attitude toward the education process (Cannon and Simpson, 1985; Warman, Wang, Anderson and Walberg, 1985). Adaptive materials can help motivate study and help combat the students' preconceived beliefs and attitudes toward science (Dole and Johnson, 1981).

The affective preference of a student for one type of material over another is an area which can be used to meet the students' needs. In West Nyack, New York, students have been allowed to generate their own ideas and create their own programs. Students worked long and hard on material they chose and moved ahead academically when they were given the opportunity to set their own goals. The students became more self-reliant, confident and capable of making decisions about what their educational preferences were (Penick and Yager, 1985). Teachers can move into more of a creative role when they allow children to carry their own load and become a more active participant in their education (Jenkins and Neisworth, 1973).

Research on the use of adaptive materials on the secondary level has been limited. However, a study conducted by Page (1968) using junior high students did show that adaptive materials can be used successfully. His study centered around material adaptation done by the students themselves. They were allowed to develop worksheets, tests, methods for charting their progress, and individual projects. The results showed the students to have an

improved attitude toward schoolwork because of their involvement in the process.

Reading Modifications

In order to meet individual educational needs, teachers have to recognize, accept and provide for the varying reading abilities of their students. A teacher needs to provide reading materials for the student where the difficulty level matches their ability level. If the reading selection is too difficult, it can lead to failure, confusion and discouragement on the part of the learner; if the selection is too easy it will lead to boredom (Jorgenson, 1977). Bond and Tinker (1973), for example, state that

> Failure to adjust the material and the instruction to the range of reading capability found within the classroom is probably the most important single cause of reading disability (p. 49).

Studies show that on an average, a teacher can expect to encounter a ten-year differential in the reading abilities of the students in their classroom, and the discrepancy between the poorest and the best readers will increase with age (Bond and Tinker, 1973; Ekwall and Milson, 1980; Harris and Sipay, 1985; Zintz, 1975).

The students' ability to read the text material goes hand and hand with the variety and difficulty of the subject matter presented (Earle and Sanders, 1973). This is particularly true in the field of science, where the texts contain technical vocabulary, high concept loads, complex

and, in many instances, abstract ideas. The texts used regularly in science classrooms are generally of a higher reading level than the students for which they were written (Gilbert, 1973; Mallison, 1972). In a study conducted by Kline (1967) comparing the readability levels of five textbooks adopted for use in Texas by eighth grade Earth Science students, only one was found to be written on the eighth grade level, two were written on a ninth to tenth grade level and two were on the eleventh to twelfth grade level.

Students' comprehension of science material is often adversely affected by their prior beliefs and preconceptions that science is much too difficult for them to ever be able to achieve any type of academic success (Harris and Sipay, 1985). These attitudes can be dispelled if science educators begin to realize the frequent mismatch that occurs between the students' ability level and the reading material they are required to use. By determining the type of mismatch and adapting the material accordingly the teacher can do much to motivate the students toward academic success.

There are a wide variety of methods available to teachers interested in adapting their students' required reading material. Among these are the use of tape recordings, study guides, advance organizers, supplementary materials, rewriting text material on a more appropriate level, and so forth.

The use of tape recordings as an additional means of material presentation has proven to have many advantages. It has been shown that many students have a more positive attitude toward audio equipment than to the printed page. Tape recordings also allow the teacher to carefully structure the lessons so they provide success and reinforcement (Schultz and Turnbull, 1984). This method of reading modification is of great benefit to students who learn primarily through the auditory channel by allowing them to not only see the material but to hear it simultaneously (Roe, Stoodt and Burns, 1978).

Many students in secondary schools read at a functional level which is often inadequate to meet curricular demands. Taped material allows students who are unable to gain the necessary classroom information through the traditional lecture format with accompanying reading assignment to circumvent this difficulty (Deshler and Graham, 1980).

Tape recordings should be presented simultaneously with the reading material, so the student can follow along (Schultz and Turnbull, 1984). It is not recommended, however, that the entire book or chapter be taped, only key sections that match the identified goals and objectives for the particular selection. By using a shortened version, the teacher can require repeated listenings which gives concentrated exposure to the key content, leading to retention and application on the part of the student. Various marking systems have been developed that allow the student

to identify which passages will be found on the tape, including highlighting and marginal markings. The key is consistency, so the student knows what to expect when they see markings in their texts (Deshler and Graham, 1980; Ekwall and Milson, 1980; Wood, 1984).

The tapes should include activities that foster motivation, comprehension and learning on the part of the student. The material should also be interesting and moderately familiar. Follow-up exercises can then be geared to any level student (Deshler and Graham, 1980).

The use of taped material is not appropriate or effective for every student. Their use should be reevaluated on a continuous basis to guarantee that the student user is gaining the necessary key content (Monteith, 1978).

Study guides are another effective reading modification method because they allow the teacher to set the stage for the reading assignment. A study guide is defined as a set of questions given to the student to help guide his/her reading and understanding of an assignment. Questions are arranged in the same sequence in which the content is presented in the text, and whenever possible are arranged in a hierarchy from simple to more complex (Harris and Sipay, 1985; McClain, 1981). They identify the reading task or objective and offer a plan to the reader (Tutolo, 1977).

Typically, a secondary student is expected to learn the necessary class content through lecture and outside reading assignments. Little, if any, work and development

is actually done by the teacher with the textbook. The use of study guides can correct this deficit. Few studies have been conducted to evaluate the effectiveness of study guides, but available evidence generally indicates their use facilitates comprehension (Harris and Sipay, 1985).

Study guides permit material of the same reading level to be used. Teachers can make guides for either the group or the individual that can include different skills and incorporate different levels of sophistication.

A study guide typically contains five sections. The first section states the purpose for the reading assignment. It should also give the student background information related to their own experience. Vocabulary new to the student comprises the second section. In order for comprehension to result, the student must be aware of the specialized vocabulary they will encounter while reading (Roe, Stoodt and Burns, 1978).

Sections three through five, are composed of questions requiring the student to go back and reread the text to find the answers. Not all students should be required to answer all questions. They can be written in such a way that the teacher can easily individualize the guide to match the ability level of the students by using a simple marking system. One example of a marking system, developed by McClain (1981), employs the use of asterisks. One asterisk identifies questions that require the student to answer question on a simple, factual knowledge level. Two

asterisks require the interaction of the reader with the material to determine the causes and effects of certain occurrences. Three asterisks represent the highest levels of questioning, requiring the students to state opinions and syntheses or apply the information to various situations. By employing study guides properly teachers can help their students learn how to learn, by thinking about and using the material they are required to learn (Zintz, 1975). Study guides are shown to be extremely helpful in the field of science where much of the material must be understood on three different levels; literal, interpretive and applied (Karlin, 1972).

Advanced organizers are another reading technique used by teachers in secondary schools. Advanced organizers are 300-500 word passage given to the student before he or she reads an assignment. They are given to the students for the purposes of (a) clarifying the organization of the assignment, (b) briefly summarizing the main ideas of the material, (c) reviewing previously studied ideas upon which the present lesson is based, and/or (d) previewing the larger generalized concepts to be explored as the reading is done (Clark and Bean, 1982; Mayer, 1979). The use of advanced organizers is based on Ausubel's theory of subsumption and are consistent with the current schema theory (Ausubel, 1960; Clark and Bean, 1982). Ausubel states that new information will be learned and retained to the extent that it can be tied to the student's prior knowledge. The

function of advanced organizers is to give the students an organizational framework or cognitive structure to which they can relate the new material (Ausubel, 1960; Clark and Bean, 1982).

A great deal of research has been conducted over the past twenty years yielding little unequivocal evidence regarding the efficacy of advanced organizers and their optimal use. What evidence that has been presented shows that they do have only a small positive effect on learning and retention (Luiten, Ames and Ackerson, 1980; Mayer, 1979). They seem to be effective with individuals of all ability levels and in all content areas; however, older students of higher ability levels seem to benefit the most (Clark and Bean, 1982).

The use of supplementary or alternative materials such as multilevel textbooks, high interest and low difficulty material as well as magazines is another option open to teachers. The use of these materials need not be restricted to the lower level students because it allows every student to be exposed to differing points of view, different methods of presentation, and additional information that may or not be included in the regular text (Dole and Johnson, 1981; Roe, Stoodt and Burns, 1978; Mason, 1984).

Rewriting of textual material is a very popular idea with teachers who have students in their classes who cannot read the required reading material (Craig, 1977). Many

students read text material at a frustration level (less than 50% comprehension; five word recognition errors/100 words), not because of the concepts but because of the readability level of the material (Ostertag and Rambeau, 1982).

Various techniques have been developed to guide a teacher in rewriting material (Ekwall and Milson, 1980; Ostertag and Rambeau, 1982; Wood, 1984). Beech (1983) recommends that a teacher rewrite the text so all ideas are presented logically and in chronological order. Clustering related information also aids the student in recall and comprehension. The teacher should eliminate any information that is extraneous, while being sure to include all specialized vocabulary.

Rewriting may be the most difficult reading modification technique for teachers to use, but for a science text, it may be the most effective (Smith, 1972). Authors of science text books are subject matter specialists, not reading specialists; lengthy complex sentences are often written, using abstract terms and concepts that are not likely to be part of the students' experiential background. Also adding difficulty to students' comprehension is the fact that many scientific terms encountered in texts can assume different technical meanings in different context (Beech, 1983; Smith, 1972). Studies have shown that by simplifying the writing style and using less technical

vocabulary, the teachers have been able to increase both reading rate and comprehension (Wood, 1984).

Rewriting also allows the teacher to use the gifted readers in the class to prepare materials for those who do not have their academic skills. The more able readers can be used to summarize the chapters or underline the key concepts so the lower level reader does not have to pour through page after page of words without gaining the material they need (Ekwall and Milson, 1980; Schultz and Turnbull, 1984). This method helps to meet the needs of both levels of exceptional students.

Learning Centers

The choice of instructional materials used in the classroom situation exerts a strong influence on the education that takes place. Studies have shown that 75-99% of the instruction that occurs revolves around materials (Mercer and Mercer, 1985). Research shows there is a need for sequential and structural organization of the content materials (Armstrong, 1971). Both teachers and students need to know the precise learning objectives on which the materials are based and the learner must take the responsibility for meeting those objectives.

The students are basically controlled by the school curriculum. The majority of school related problems are curriculum induced because adjustments are not made to fit

the individual needs of the students (Gickling and Thompson, 1985). One way to overcome such problems is to adapt the materials used by the students. By using this approach teachers can overcome the problem of complex directions, boring content, confusing format and long tedious assignments (Mercer and Mercer, 1985).

One proven method of adaptation is the use of learning centers. Learning centers can take on many different shapes and types. Most are self-contained units which are written using behavioral objectives based on the various levels of Bloom's Taxonomy. The activities are usually self-instructional in nature and generally include some type of pre and post assessment (Bennett, 1986; Musgrave, 1975).

The use of Bloom's Taxonomy has been incorporated into learning centers because it is reasonably simple to use and applicable to all content areas and all levels of students (Maker, 1982). The taxonomy serves three basic functions: it serves as a direction for teaching and material development, provides guidance for the evaluation process and facilitates learning on the part of the student (Jenkins, and Neisworth; 1973).

A review of the research conducted regarding the use of behavioral objectives shows that the students' knowledge of the unit objectives plus the expected target performance facilitate the acquisition of the required knowledge (Maker, 1982). The research also indicates that by using

Bloom's Taxonomy in material development the general structure of the content is improved, there is better organization of time and learning experiences and finally, the taxonomy based materials provide immediate feedback and task reinforcement (Jenkins and Neisworth; 1973).

Learning centers are generally arranged in such a manner that allows the students to work on an instructional topic without direct instruction from the teacher. Learning centers are as diverse as the curriculum and as simple or elaborate as appropriate to the needs of the individual teachers and students (Anderson and Miller, 1983; Mercer and Mercer, 1985; Wood, 1984).

Many teachers use centers because they are a way to organize material that make it easy for the student to use and return. They also allow for the incorporation of activities on multiple academic levels. There are as many different types of learning centers as there are teachers who use them. Piechowiak and Cook (1976), however, found that the majority of centers fell into four basic categories: Basic Skills, Listening, Discovery and Exploration, and Creative. Schultz and Turnbull (1984) found in most cases learning centers emphasize materials designed to help students acquire new skills, retain previous learning or to transfer what has already been learned to a new and different situation.

Voight (1971) formulated a basic criteria for teachers to follow when establishing learning centers. A center

should always contribute to the achievement of the students involved with their use by incorporating basic skills, facts and concepts while at the same time encouraging the student to pursue larger ideas. Secondly, a center should deal with a significant area of study. The materials used should be interesting and open-ended, and should include opportunities for the student to develop problem-solving, creative and critical thinking skills. Third, the activities incorporated in the center should relate to the students' past learning experiences. Fourth, the teacher needs to set practical time limits so the student can complete the task. Fifth, the directions should include a brief overview and be written in such a manner that the student understands where to begin and knows when the task is completed successfully. Last, the design of the center depends on the students involved.

It is important for the teacher to include a wide range of activities in any learning center. They should include activities to accommodate the levels of the various students. There are various methods that a teacher can use to present the material including boxes, folders and bulletin boards (Morsink, 1984). No matter what method a teacher selects the centers should be neat and attractive. The more pleasant, comfortable and appealing the centers are the more students become involved in their work (Mercer and Mercer, 1985).

The most effective materials are self-correcting, durable and reusable. Self-correcting materials provide rapid corrective feedback, which prevents students from practicing mistakes. Laminating increases durability and will also enable students to write, erase and reuse them (Mercer and Mercer, 1978; Morsink, 1984; Wood, 1984).

Learning centers have been shown to be a valuable adaptation to instruction. They enable students to work at their own rate without pressure, rather than at a required daily regimented schedule which is the same for all students. Many students prefer to work alone when the activities are appropriate to their own level. Teachers are also able to provide additional activities which insure learning of required material. Learning centers have also been shown to be motivational, allowing the student freedom to select material that is compatible with his or her preferred learning style (Piechowiak and Cook, 1976).

The learning activities packets are self-instructional units designed to help students learn one basic concept or idea broken down into several components. They are geared to specific ability levels and provide flexibility in activities students may choose to use (Schultz and Turnbull, 1984; Woodward, 1981). Bennett (1986) states the rationale for the use of learning activity packets is that simple concepts must be the foundation for future, complex learning, that every student is capable of higher achievement although their rates and preferred approaches to

learning are different. Learning activity packets meet this need.

A learning activity packet contains four basic sections. Each packet begins with a list of the objectives, written for the individual students which specifically describe the final behavior expected. A pretest follows allowing the teacher to individualize the ensuing activities based on earned scores. The instructional phase of the learning activity packet provides the students with options, practice and chances to apply newly acquired knowledge. The final section is the posttest, where the teacher assesses the student to determine if the objectives for the packet were met (Schultz and Turnbull, 1984; Woodward, 1984).

The advantages of learning activity packets for the teacher as well as the learner include: a student is able to learn at his or her own rate, giving the student a feeling of success which in turn gives a motive for future learning. It allows students of differing ability levels to work in the same room at the same time and extends the teacher's time. These advantages are of particular importance when considering the use of learning activity packets with adolescents. They are an effective technique for providing directions and security while at the same time allowing for some degree of independence (Cheyney and Strichart, 1981; Woodward, 1981).

CHAPTER III

METHODOLOGY AND DESIGN

Introduction

The purpose of this chapter is to describe the research methodology employed in the present study. Description of the subjects, instruments used for the collection of data, the research design and variables, the procedures followed, and the statistical analysis of the data are presented.

Subjects

The subjects for this study were the members of the seventh grade enrolled in Bayfield Middle School in May of 1986. Bayfield is a small rural community located in Southwest Colorado. The population is predominantly Caucasian with a few Mexican-American and Native American families. The economic base for the area is ranching. The majority of the population, however, commute to other surrounding communities to work predominantly in service-related areas.

The school district encompasses 824 square miles, with the majority of the students bussed to school. The enroll-

ment in May of 1986 in the three district schools was 689 total students, 147 of which were in the Middle School.

Fifty-two students participated in the investigation. Seven of the students were classified as learning disabled and five were classified as gifted. The students were enrolled in two sections of seventh grade science. The only criterion used during the enrollment process to determine to which class the student would be randomly assigned was the students' selection of elective classes.

Instrumentation

Chapter Tests

The pretest and posttest instruments selected to be used for this study were the end-of-chapter tests written to accompany the textbook, Earth Science (Pasachoff, Pasachoff and Cooney, 1983) and Life Science (Balzer, Goodson, Slesnick, Lauer, Collins and Alexander, 1983). Whereby no measures of the reliability and validity were reported by the authors of the textbook series, content validity was therefore assessed by determining the extent to which the test items matched the instructional objectives of the teacher who used it. It was reported that the objectives for the chapters as well as the concepts measured by the test matched the objectives covered in the class.

An analysis was done to determine the internal consistency of each of the pretest and posttest instruments using the Kuder-Richardson 8. The analysis of the Chapter Seven

data showed a reliability factor of 0.63, with a standard error of measurement of 1.58, mean difficulty of 50.51, and a mean discrimination of 0.37. The data for Chapter Eight showed a reliability factor of 0.85, standard error of measurement of 1.50, mean difficulty of 57.05 and mean discrimination of 0.54. (See Appendix A for copies of tests.)

Affective Preference Rating Scale

The affective preference of the students for the various adaptive materials used in the study was determined using a five-point (Smiley Face) rating scale developed by Dr. K. Bull and Dr. I. Land of Oklahoma State University (1985). The students were shown the adaptive materials they had used, one by one. They were then asked by the researcher to mark their answer sheet with an "X' over the smiley face, either happy or sad, that best described their feelings regarding the material. (See Appendix B for copy of questionnaire and instructions.)

Survey of Study Habits and Attitudes

The students' study habits attitudes was measured using the Survey of Study Habits and Attitudes (SSHA), Form H, written by Brown and Holtzman (1967). The SSHA is a 100 item self-report questionnaire. It asks the student to indicate whether various questions rarely, sometimes, frequently, generally, or almost always apply to them person-

ally. The instrument was standardized using 5,425 students in grades seven through nine. Evidence for validity is presented in terms of low correlation coefficient of .27 between SSHA and aptitude tests and a correlation of .29 between SSHA and grades. Test-retest reliability was calculated after four-and fourteen-week intervals varying from .83 to .94 (Burros, 7th Ed., 1972). The basic assumption underlying the inventory is that some students earn poor grades because of poor study habits and attitudes, and that the scores on the SSHA can be used to predict future success based on attitude.

Only the student attitude subscale was used in this study. The subscale score represents the combined raw scores on the teacher approval and educational acceptance items. The teacher approval items cover the students' opinions of teachers, and their classroom behavior and methods. The educational acceptance items deal with the students' feelings regarding the educational objectives, practices, and requirements they encounter while in school (Brown and Holtzman, 1967).

Research Design and Variables

The design used in this study was a quasi-experimental group design (Table I). This design was selected because it controls for all threats to validity except pretest-treatment interaction. This potential threat is considered to be minimal because the use of a pretest instrument is

TABLE I

QUASI-EXPERIMENTAL DESIGN

	Pretest	Treatment	Posttest
GROUP A Second Hour Class n=27	Chapter 7 Form B Plants	Regular Instruction plus adaptive materials	Chapter 7 Form B Plants
GROUP B Seventh Hour Class n=25	Chapter 7 Form B Plants	Regular Instruction	Chapter 7 Form B Plants
GROUP A Second Hour Class n=27	Chapter 8 Form A Rocks and Ores	Regular Instruction	Chapter 8 Form A Rocks and Ores
GROUP B Seventh Hour Class n=25	Chapter 8 Form A Rocks and Ores	Regular Instuction plus adaptive materials	Chapter 8 Form A Rocks and Ores

routine in these science classes, one being administered every chapter.

The independent variables in this study are the separate treatments which were administered to the experimental and the control groups. The treatments for the groups consisted of the following:

Treatment One: This treatment consisted of adaptive materials covering plants, their structure, function and behavior. The materials included a tape recording of the chapter, an advanced organizer that summarized the chapter information, a wildflower identification guide to be compiled by the students, and an article from The Rocky Mountain Wildflower Guide (Dannen and Dannen, 1981), with accompanying questions covering five levels discussed in Bloom's Taxonomy of Educational Objectives (knowledge, comprehension, application, analysis, evaluation and synthesis).

Treatment Two: The adaptive materials for this treatment covered rocks and ores. Again the materials included a tape recording of the chapter, an advanced organizer, a companion study guide and an activity. The activity chosen was a crystal building worksheet. An article dealing with rocks and ores was included as well as a companion Bloom's level worksheet.

The dependent variables in this study were the student's academic and attitudinal scores on the posttests,

plus their affective preference for any of the adaptive materials used.

Procedures

Summarized below is the sequence of activities carried out by the investigator in developing and implementing the adaptive materials approach with a group of seventh grade students in the Bayfield Public Schools:

1. Presented the program and obtained approval and support from the superintendent, principal and the science teacher;

2. Developed the adaptive materials to be used in the classroom;

3. Administered the SSHA pretest;

4. Administered the pretest over Chapter Seven, Plant-Structure, Function and Behavior, to both the second- and the seventh-hour classes. The second-hour class was then introduced to the adaptive materials and instructions were given regarding the completion of the activity. The students were told to select ten flower pictures from those made available to them by the researcher. Using the resources listed in the activity directions, they were to color them correctly and place them in booklet form. (See Appendix C for examples of the adaptive materials used.) The materials were removed by the investigator at the end of every class session;

5. Administered the posttest for the end of Chapter Seven to both the second- and the seventh-hour classes;

Administered the Smiley Face Questionnaire to the second-hour class to determine if the students had any affective preference for any of the materials they had been introduced to;

7. Administered the pretest over Chapter Eight, Rocks and Ores, to both classes. The students in the seventh-hour class were then introduced to the materials and instructed on how to complete the activity. The activity used in this treatment was a worksheet over the various types of rock crystals. The student was to cut the crystals out, then by following the directions fold the cut out and hold it together by placing toothpicks as directed. (See Appendix D for examples of the materials.) The materials were put away at the end of each class session;

8. Administered the posttest for the end of Chapter Eight;

9. Administered the Smiley Face Questionnaire to the seventh-hour class;

10. Administered the SSHA posttest.

Data Analysis

Based on the statistical hypotheses, the following methods of data analyses were selected to be used in the study:

HO_1: There will be no significant difference in the posttest scores measuring knowledge of plants, their structure, function, and behavior, between the seventh grade science class that used the adaptive materials and the seventh grade science class that followed the traditional method of instruction.

HO_2: There will be no significant difference in the posttest scores measuring knowledge of rocks and ores between the seventh grade science class that used the adaptive materials and the seventh grade science class that followed the traditional method of instruction.

The analysis of covariance was selected to be used with the content-related pretest and posttest scores because it allows for the use of intact student groups. The analysis of covariance allows the investigator to determine if there is a significant difference between the two groups that are due to exposure to the treatment, and the use of adaptive materials. The scores on the pretest serve as the covariate.

HO_3: There is no significant difference in the proportion of students who expressed a preference for the use of the adaptive materials as part of their instruction compared to those who did not prefer the materials.

The Chi Square Test for Goodness of Fit was selected to be used to determine if the students preferred specific adaptive materials they were exposed to. A significant Chi Square indicated if the deviation between the observed and

the expected frequencies is larger than what we would expect due to chance.

HO_4: There is no significant difference between the proportion of students who scored above and below the median of the Survey of Study Habits and Attitudes, Student Attitude subscale, in terms of their preference to use or not to use the adaptive materials as part of their instruction.

The Chi Square Test for Independence was selected to be used to determine if the students who scored above the median on the SSHA Study Attitude subscale preference for specific adaptive materials differed significantly from those who scored below the median. Again, a significant Chi Square indicates if the deviation between the observed and expected frequencies is larger than what we would expect due to chance.

HO_5: There is no significant relationship between academic success as measured by the posttest for Chapter Seven, Plants-Structure, Function and Behavior, and the students' study habits and attitudes.

HO_6: There is no significant relationship between academic success as measured by the posttest for Chapter Eight, Rocks and Ores, and the students' study habits and attitudes.

The relationship between the posttest scores on both content related posttests were compared to the posttest scores on the SSHA Student Attitude subscale using the

Spearman Rank Order Correlation. A significant r indicates that a correlation does exist between the two sets of scores that is not just due to chance.

CHAPTER IV

RESULTS OF THE STUDY

The purpose of this study was to investigate the effects of adaptive materials vs. traditional methods in seventh grade science focusing on: (1) the students' performance on content-related chapter posttests; (2) students' affective preference for adaptive materials; and (3) students' varying performance in relation to their study attitudes.

Testing the Hypotheses

The data obtained from this investigation were used for the primary purpose of testing the null hypotheses presented in Chapter One.

The presentation and analysis of data for this research were reported as they relate to each of the individual hypotheses. Whatever statistical tests were employed to test the hypotheses, it was assumed that differences were not statistically significant unless they were equal or greater than the .05 level of confidence.

HO_1: There will be no significant difference in the posttest scores measuring knowledge of plants, their structure, function, and behavior, between the seventh grade

science class that followed the traditional method of instruction.

HO_2: There will be no significant difference in the posttest scores measuring knowledge of rocks and ores, between the seventh grade science class that used the adaptive materials and the seventh grade science class that followed the traditional method of instruction.

The analysis of covariance was utilized to statistically equate the posttest performance of the second-hour class to that of the seventh-hour class on both content related posttests. Presented in Table II are the means and standard deviations of the pretest and posttest scores by class hour, while in Table III the unadjusted and adjusted means are presented for the Chapter Seven and Chapter Eight posttests by class hour and treatment group. The results of the analysis of covariance shown in Tables IV and Table V indicated that there is no significant difference ($F = .375$, $df = 1/49$, $p > .05$; $F = 1.896$, $df = 1/49$, $p > .05$) for the posttests from Chapters Seven and Eight respectively. Therefore, null hypotheses one and two are not rejected.

HO_3: There is no significant difference in the proportion of students who expressed a preference for the use of the adaptive materials as part of their instruction compared to those who did not prefer the materials.

Table VI shows the results of the Chi Square Goodness of Fit Test. The results indicate a significant difference

TABLE II

MEAN AND STANDARD DEVIATION OF CHAPTER SEVEN AND CHAPTER EIGHT PRETEST AND POSTTEST SCORES REPORTED BY HOUR

Class	Test	N	Mean	Standard Deviation
Second Hour	Pretest - 7	27	5.778	2.562
	Posttest - 7		7.778	2.887
Second Hour	Pretest - 7	25	4.680	2.393
	Posttest - 7		7.920	2.548
Total	Pretest 7	52	5.250	2.520
	Posttest - 7		7.846	2.704
Second Hour	Pretest - 8	27	5.852	3.483
	Posttest - 8		11.185	5.314
Seventh Hour	Pretest - 8	25	6.200	3.175
	Posttest - 8		9.480	5.285
Total	Pretest - 8	52	6.019	3.311
	Posttest - 8		10.365	5.317

TABLE III

UNADJUSTED AND ADJUSTED MEANS FOR STUDENTS' POSTTESTS BY CLASS HOUR AND TREATMENT GROUP

	Chapter 7 - Plants	Chapter 8 - Rocks and Ores
2 Hour Class		
Unadjusted Mean	7.741*	11.85
Adjusted Mean	7.601	11.282
N	27	27
7 Hour Class		
Unadjusted Mean	7.920	9.480*
Adjusted Mean	8.071	9.375
N	25	25

*Treatment group

TABLE IV

ANALYSIS OF COVARIANCE SUMMARY TABLE FOR STUDENT POSTTEST--CHAPTER 7-PLANTS

Source of Variation	Sum of Squares	df	Mean Squares	F	Significance of F
Treatment	2.737	1	2.737	.375	1.00
Residual	337.306	49	7.292		
Total	360.043	50			

N = 52

TABLE V

ANALYSIS OF COVARIANCE SUMMARY TABLE
FOR STUDENT POSTTEST-CHAPTER 8-
ROCKS AND ORES

Source of Variation	Sum of Squares	df	Mean Squares	F	Significance of F
Treatment	47.080	1	47.080	1.896	.172
Residual	1216.75	49	24.832		
Total	1263.831	50			

N = 52

TABLE VI

CHI SQUARE GOODNESS OF FIT AFFECTIVE
PREFERENCE FOR ADAPTIVE MATERIAL

Material	Number of "Like" Responses	Number of "Dislike" Responses	Chi-Square
Tape	28	24	.173
Advanced Organizer	31	21	1.558
Study Guide	42	10	18.481*
Activities	41	11	16.173*
Reading	31	21	1.558

*$p < .05$

in affective preference for the study guides and the activities (χ^2 = 18.481, df = 1, p <.05; χ^2 = 16.173, df = 1, p <.05); however, no significant difference in preference for the tape recording, advanced organizer of the reading (χ^2 = .173, df = 1. p >.05, χ^2 = 1.558, df = 1, p > .05; χ^2 = 1.558, df = 1, p >.05). Therefore, null hypothesis three was rejected as it applied to the tape, advanced organizer and the reading, while the null hypothesis as it applies to the study guide and the activities was not rejected.

The data were then further analyzed to determine the affective preference of the students by treatment and are presented in Table VII. The analysis showed that the students who received treatment one, covering plants, significantly preferred the activity more than any of the other adaptive materials (χ^2 = 7.259, df = 1, p <.05). In contrast, the students involved in treatment two, covering rocks and ores, significantly preferred a wider range of adaptive materials. The analysis showed they affectively preferred the study guide, the activity and the reading (χ^2 = 14.815, df = 1. p <.05; χ^2 = 9.481, df = a, p <.05; χ^2 = 9.481, df = 1, p <.05), more than the tape and the advanced organizer.

HO_4: There is no significant difference in the proportion of students who scored above and below the median

TABLE VII

CHI SQUARE GOODNESS OF FIT AFFECTIVE PREFERENCE FOR ADAPTIVE MATERIAL BY CLASS AND TREATMENT

Class Treatment	Material	Number of "Like" Responses	Number of "Dislike" Responses	Chi Square
Second Plants	Tape	10	17	1.333
	Advanced Organizer	12	15	.148
	Study Guide	20	7	5.333
	Activitiy	21	6	7.259*
	Reading	11	16	.593
Seventh	Tape	11	6	.941
	Advanced Organizer	11	6	.941
	Study Guide	24	3	14.815*
	Activitiy	22	5	9.481*
	Reading	22	5	9.481*

* = $p < .05$

of the Survey of Study Habits and Attitude, Student Attitude subscale, in terms of their preference to use or not to use the adaptive materials as part of their instruction.

The results of the Chi Square Test of Independence are presented in Table VIII. It is determined from analysis of the data that there is no significant difference in the affective preference for certain adaptive material between students who score above and below the median on the Study Attitude subscale of the SSHA (χ^2 = 0.00, df = 1, p >.05; χ^2 = 0.00, df = 1, p >.05; v^2 = .193, df = 1, p >.05; χ^2 = 424. df = 1. p >.05; χ^2 = .404, df = 1, p > .05). Therefore null hypothesis four is not rejected. Whereby the data were not included, the results were analyzed to determine if there were differences in preferred activities by hour. There were no significant differences found.

HO_5: There is no significant relationship between academic success as measured by the posttest for Chapter Seven, Plants-Structure, Function and Behavior, and the students' study habits and attitudes.

HO_6: There is no significant relationship between academic success as measured by the posttest for Chapter Eight, Rocks and Ores, and the students' study habits and attitudes.

The results of the Spearman Rank Order Correlations, comparing the posttest scores for Chapters Seven and Eight to the posttest scores of the Survey of Study Habits and

TABLE VIII

CHI SQUARE TEST OF INDEPENDENCE AFFECTIVE PREFERENCE ABOVE AND BELOW THE MEDIAN SSHA STUDY ATTITUDE SUBSCALE

Material		Obesrved Like	Expected	Observed Dislike	Expected	χ^2
Tape	Above	9	8.615	7	7.385	
	Below	19	19.385	17	16.615	0.000
Advanced Organizer	Above	9	9.538	7	6.462	
	Below	22	21.462	14	14.538	0.000
Study Guide	Above	14	12.923	2	3.077	
	Below	28	29.077	8	6.923	.193
Activity	Above	14	12.615	2	3.385	
	Below	27	28.385	9	7.615	.424
Reading	Above	8	9.538	8	6.462	
	Below	23	21.462	13	14.538	.404

N = 52
$p < .05$

Attitudes are presented in Tables IX and X. It is concluded from an analysis of the data that there is a significant relationship between academic success and the students' study habits and attitudes ($r = .283$, $N = 52$, $p < .05$; $r = .441$, $N = 52$, $p < .05$). Therefore the null hypotheses five and six are rejected.

Summary

This chapter has presented the statistical results yielded through the analysis of the data. Four separate statistical procedures were utilized to test six hypotheses regarding the effectiveness of the introduction of adaptive materials in a seventh grade science class. Of the six hypotheses, only three were found to be significant: hypotheses three, five and six. The statistical analysis for hypothesis three showed that the students did affectively prefer the study guide and the activities over the other adaptive materials placed in the classroom for their use. The analysis of the data for hypotheses five and six determined that there was a significant relationship between the students academic posttest scores and their attitudes. The data showed that adaptive materials do not effect performance on content-related posttests, and that there is no difference in the affective preference for the adaptive materials by those students who scored below the median on the Student Attitudes subscale, and those who scored above.

TABLE IX

SPEARMAN RANK ORDER CORRELATION POSTTEST CHAPTER SEVEN AND POSTTEST SURVEY STUDY HABITS AND ATTITUDES

Sum of Squares	16771
Correction for ties - Chapter 7	25.5
Correction for ties - SSHA	20
Sum of Squares - Chapter 7	16687.5
Sum of Squares - SSHA	11693
Spearman Rho	.283

N = 52
*p < .05

TABLE X

SPEARMAN RANK ORDER CORRELATION POSTTEST CHAPTER EIGHT SURVEY OF STUDY HABITS AND ATTITUDES

Sum of D squares	13065.5
Correction for ties for Chapter 8	25.5
Correction for ties for SSHA	21.5
Sum of Squares Chapter 8	11687.5
Sum of Squares SSHA	11691.5
Spearman Rho	.441*

*N = 52
p < .05

CHAPTER V

SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was designed primarily to determine whether academic achievement and student attitudes would be improved by the use of adaptive materials, and if the students would exhibit an effective preference for the materials. The adaptive materials used in this study were limited to the modification of reading materials and the development of learning modules.

Over a six week period the students were pretested on both attitudinal and content-related measures, allowed to use the adaptive materials, then posttested. An instrument was also administered to determine if the students' effectively preferred any of the materials introduced. The data was then subjected to a variety of statistical procedures.

Discussion

For purposes of discussion, the findings will be presented individually as they relate to the hypotheses stated in Chapter One.

Academic Gains

In this study it became evident that the adaptive materials used did not cause an increase in test scores. There was no significant difference found when the posttest scores were compared using the analysis of covariance.

Attitudes

In this study it became evident that the use of adaptive materials did have a positive effect on the attitudes of the students involved. A comparison of the means of the pretest and the posttest of the SSHA showed a positive increase. The statistical analysis also showed a positive correlation between academic achievement and student attitude.

Affective Preference

The analysis of the data collected in this area showed that the students did have significant affective preferences for specific materials. The students' preferred the study guides and the activities over the advanced organizers, the tape recordings of the chapters, and the articles.

The study also showed that there was no difference in the affective preference of those students who scored above and below the median of the Study Attitudes subscale of the Survey of Study Habits and Attitudes.

Conclusions

The study was based upon the premise that the use of adaptive materials is an effective method for teachers who desire to individualize instruction. Previous research in this area has been restricted to the elementary school level. The research found the use of learning centers, learning activity packets, and the modification of reading materials to be affective (Cheyney and Strichart, 1981; Thompson, 1981, Armstrong, 1971; Piechowiak and Cook, 1976.) The present study was conducted to discover if these methods would be as effective at the secondary level. The current study failed to find that the use of adaptive materials brings about an increase in the students academic test scores, but the use of the materials on the other hand did not cause any decline in the test scores. The failure to find the expected increase could be attributed to the time of the school year in which the study was conducted, May, and the fact that the length of exposure to the treatment was restricted to six weeks.

The data collected in the current study does show that students do affectively prefer certain types of educational materials over the other. Research supports the idea that students will work longer and harder on materials that they like to use (Penick and Yager, 1985). The students in this particular study preferred the study guides and the activities over the other materials included in the adaptive materials. Teachers can employ the same methods used in this

study to determine what types of materials their students affectively prefer, and incorporate them into the regular classroom situation.

Previous research indicates the use of adaptive materials will affect how the student remembers and uses their educational experience by giving them a more positive attitude toward the educational process (Warman, Wang, Anderson and Walberg, 1985; Penick and Yager, 1985; Page, 1968). The current study does indicate that adaptive materials influence students' attitudes in a positive manner. The study failed to show, however, that this increase in positive attitude influenced academic gains. This failure could be attributed to the short length of time the students were involved with the adaptive material treatment.

Recommendations

Future studies are needed in the use of adaptive materials on the secondary school level. The researcher makes the following recommendations for future studies:

1. Research has indicated that increased positive attitude influences academic gains; therefore, future studies of a longer time frame are needed to verify this assumption.

2. Research to determine what type of materials are affectively preferred by the majority of the students.

3. Research to determine which of the adaptive materials affectively preferred by the students produce the largest academic gains.

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APPENDIX A

CHAPTERS SEVEN AND EIGHT

PRE AND POSTTESTS

TEST B Chapter 7 Plants—Structure, Function, and Behavior

PART I

Circle the letter of the best answer.

1. Which of the following kinds of algae can make their own food?
   a. Red algae
   b. Brown algae
   c. Green algae
   d. All the answers are correct.

2. Tropisms are responses of plants that involve
   a. the release of spores.
   b. growth movements.
   c. changes in the speed of photosynthesis.
   d. the amount of oxygen used during respiration.

3. Respiration in plants
   a. produces sugar and oxygen.
   b. occurs only during light hours.
   c. gives off oxygen.
   d. occurs during both the day and the night.

4. Ferns are similar to mosses because ferns
   a. need a moist environment for reproduction.
   b. produce naked seeds.
   c. are monocots.
   d. lack chlorophyll.

5. In a vascular plant, phloem cells are found in the
   a. stem.
   b. leaves.
   c. root.
   d. All the answers are correct.

6. Angiosperms
   a. produce "naked seeds."
   b. are conifers.
   c. produce seeds within flowers.
   d. reproduce by spores.

7. The phloem cells in stems transport
   a. food down to the roots.
   b. water and minerals to the leaves.
   c. chlorophyll to the leaves.
   d. oxygen to the roots.

8. During the day, stomates are usually open so that
   a. carbon dioxide can leave the leaf.
   b. water can enter the leaf.
   c. oxygen can leave the leaf.
   d. None of the answers are correct.

9. Which of the following are produced in photosynthesis?
   a. Oxygen and minerals
   b. Carbon dioxide and sugar
   c. Oxygen and carbon dioxide
   d. Sugar and oxygen

10. An example of thigmotropism in plants is
    a. a plant bending toward sunlight.
    b. a plant growing around a tree.
    c. a root growing with the pull of gravity.
    d. a leaf turning orange in the autumn.

Fill in the blanks with the correct word.

11. _____ cells open and close a stomate.

12. Mosses and _____ belong to the group of plants called mosses.

13. Auxins are a group of plant _____ that affect growth.

14. Most of the food produced by a plant is made in the _____ of the plant.

15. _____ is the process that releases energy from food.

TEST A Chapter 8 Rocks and Ores

PART I

Circle the letter of the best answer.

1. Rocks that form from magma or lava are
   a. sedimentary rocks.
   b. igneous rocks.
   c. metamorphic rocks.
   d. coquina rocks.

2. Diamonds and gold are often found
   a. in salt deposits.
   b. with natural gas.
   c. on the bottom of a stream.
   d. in sedimentary rocks.

3. Which of the following rocks would probably not be found deep under the earth's surface?
   a. Granite
   b. Sandstone
   c. Marble
   d. Schist

4. Because of the rock cycle, when one type of rock is destroyed
   a. granite and basalt are formed.
   b. marble is formed.
   c. another type of rock forms.
   d. None of the answers are correct.

5. Oil usually
   a. passes through the pores in permeable rock and fills the rock.
   b. does not penetrate sandstone.
   c. is formed below the water level in sandstone.
   d. forms from animal and plant remains in just a few years.

6. Which of the following pairs of rocks does not represent a rock and its metamorphic form?
   a. Basalt and obsidian
   b. Granite and gneiss
   c. Shale and slate
   d. Limestone and marble

7. The most widely used energy source is
   a. coal.
   b. natural gas.
   c. wood.
   d. oil.

8. When mud and clay are pressed together, they form
   a. shale.
   b. sandstone.
   c. conglomerate.
   d. coal.

9. Deposits that contain large amounts of metallic minerals are called
   a. oil pools.
   b. mineral deposits.
   c. ores.
   d. None of the answers are correct.

10. When a large body of water evaporates, two common sedimentary rocks that may form are
    a. gypsum and granite.
    b. granite and salt.
    c. basalt and gypsum.
    d. salt and gypsum.

Match the lettered words with definitions 11–15. Write two correct letters on the line provided.

a. gabbro	g. large crystals
b. pebbles	h. sand
c. chalk	i. granite
d. small crystals	j. gneiss
e. schist	k. cools quickly
f. cools slowly	l. coquina

_____ 11. sediments that commonly form sedimentary rocks

_____ 12. characteristics of extrusive igneous rocks

_____ 13. examples of metamorphic rocks

_____ 14. two types of limestone

_____ 15. examples of intrusive igneous rocks

APPENDIX B

SMILEY FACE QUESTIONNAIRE

STUDENT ATTITUDES TOWARD MATERIALS SURVEY

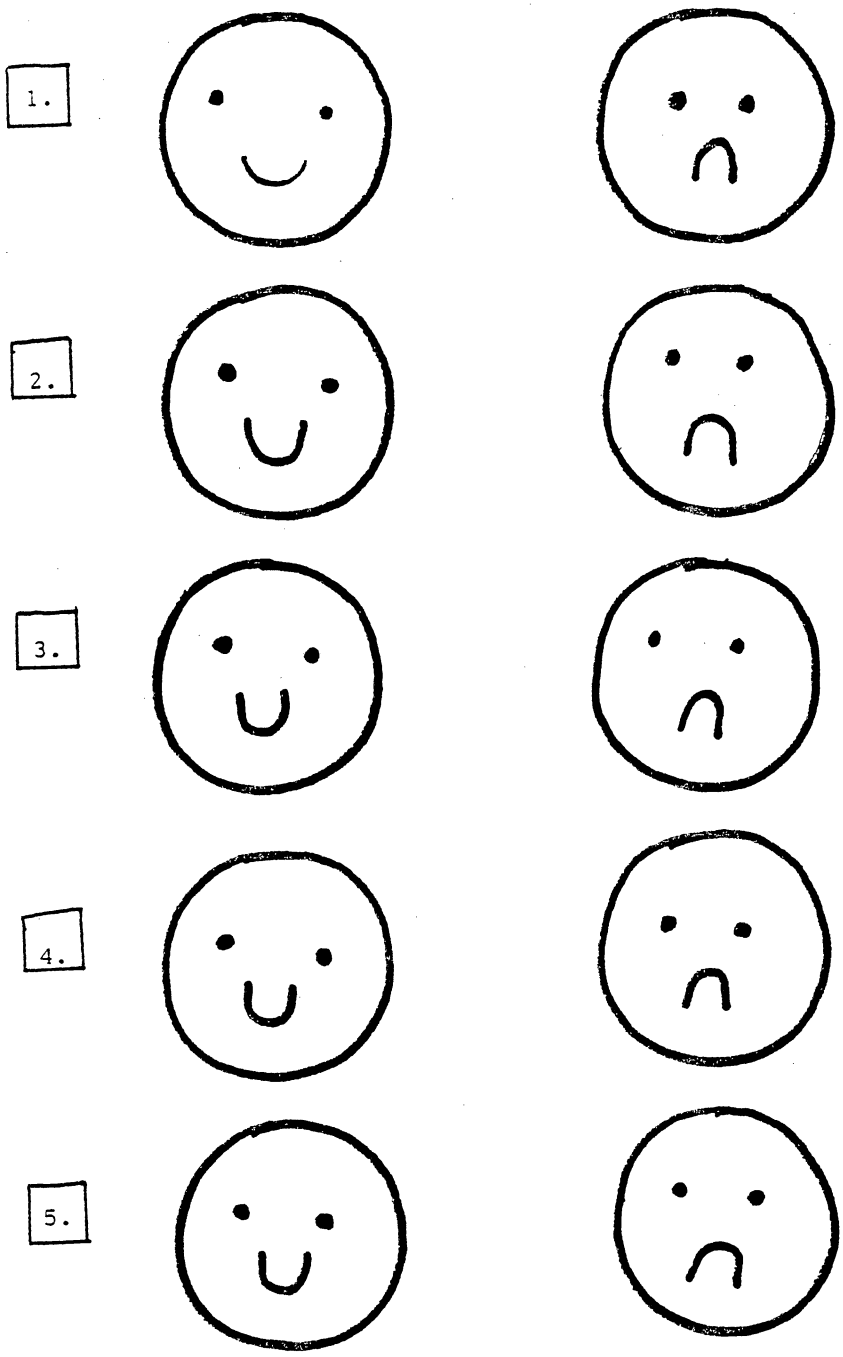
TEACHER INSTRUCTIONS

TEACHER READS: I am going to show you some books and materials which you have worked with this semester. For each material mark your answer sheet to show if you liked it or if you did not like it. If you liked the material put an "X" on the smiley face. If you did not like the material put an "X" on the sad face. Put your finger on the box with the number on in it. Now, look at the material I am showing you. Put an "X" on the face that shows how you feel about this material.

Repeat the underlined portion of the instructions above for each material you show the students.

(NOTE: The teacher must provide the coding for each sheet indicating the level of the material and the subject mater area for which the material was used. Also the response sheets can be coded for the type of student: 1-Student with I.E.P., list classification; 2-Regular student; and 3-Students in the Gifted/Talented program.)

STUDENT RESPONSE SHEET



APPENDIX C

EXAMPLES ADAPTIVE MATERIALS-

CHAPTER SEVEN

STUDY GUIDE: CHAPTER SEVEN

DIRECTIONS: AS YOU READ THE TEXTBOOK MATERIAL OVER PLANTS, THEIR STRUCTURE, FUNCTION AND BEHAVIOR, TRY TO ANSWER THE QUESTIONS ON THE STUDY GUIDE.

SECTION ONE: HOW PLANTS ARE CLASSIFIED INTO FIVE MAIN GROUPS.

1. How are the three main kinds of algae alike?

   a._____

   b._____

2. What keeps mosses and liverworts from growing larger?

   _____

   _____

3. How are ferns more complex than algae and mosses?

   a._____

   b._____

4. How do conifers produce seeds?_____

   _____

5. How are angeosperms important to humans?_____

   _____

6. What are the two main kinds of flowering plants?

   _____and_____

   How are they different?

   Monocots_____

   Diocots_____

SECTION TWO: ROOTS STEMS AND LEAVES ARE PLANT ORGANS

1. What are three functions of plant roots?

   a._____

   b._____

   c._____

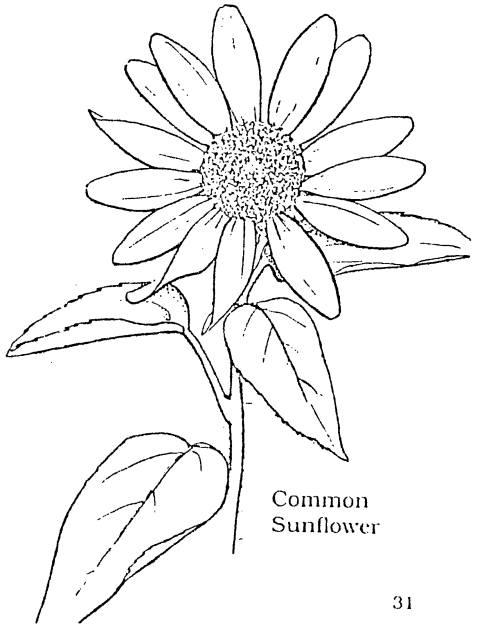
MAKE YOUR OWN WILDFLOWER GUIDE INSTRUCTIONS

1. Select pictures of ten wildflowers you wish to include in your guide from those provided for you in the kit.

2. Using either A Guide to Wildflowers Coloring Book or Rocky Mountain Wildflower Guide to help you color each correctly.

3. Place your pictures in some type of cover with your name on it and turn it in for a grade

The **Common Sunflower** may grow as tall as 12 feet (but is usually shorter). It has a large brown disk surrounded by yellow petals (rays). (71)



Common Sunflower

Although it looks like a smaller version of the western desert plant, the **Yucca, or Spanish Bayonet**, actually grows along the Atlantic coastal plain, in sterile sandy soil. The very tall stem rises from a rosette of stiff, spiky leaves, each about 2½ feet long. The flowers are greenish white. (68)

Yucca

APPENDIX D

EXAMPLES ADAPTIVE MATERIALS-

CHAPTER EIGHT

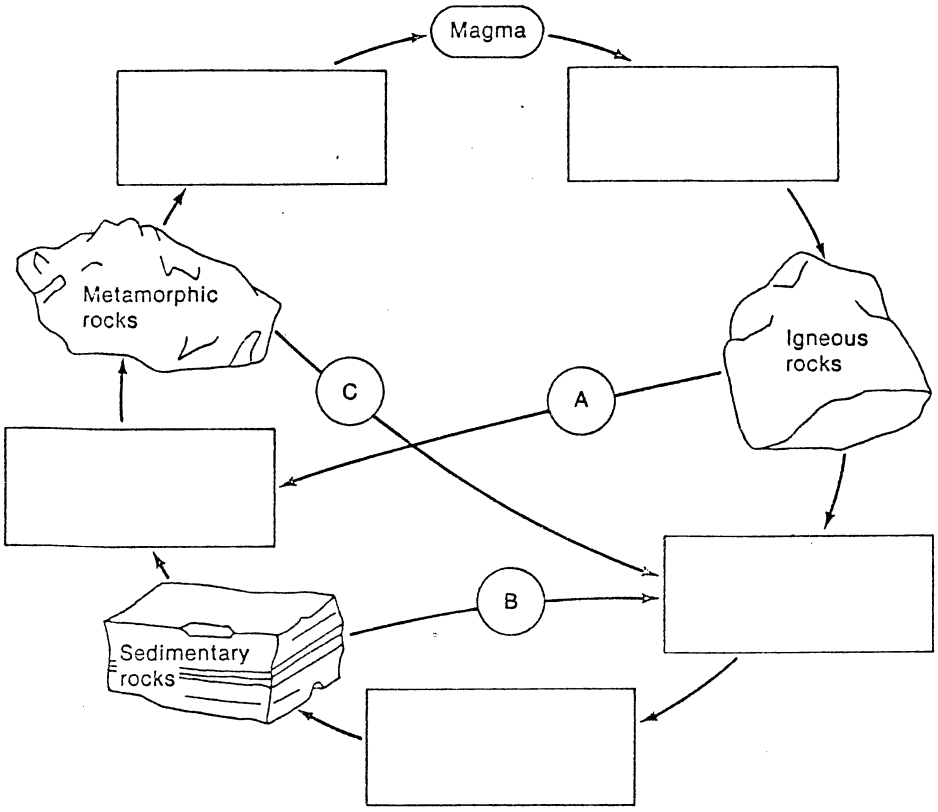
STUDY GUIDE: Chapter Eight

Directions: Complete the rock cycle diagram below by inserting the description of the process that froms each rock type select the description from the following list:

magma or lava that hardens and cools addition of more heat

cemented together breaks into sediments

heat, pressure, and /or chemical actions



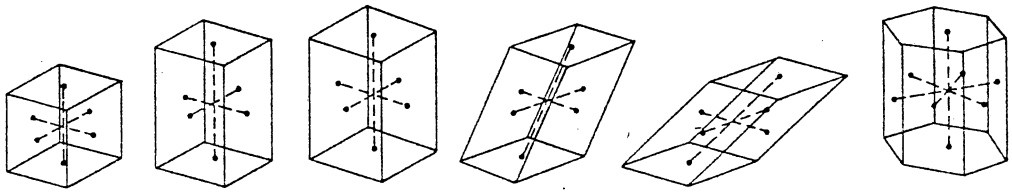
Look at arrows A,B,C. How might the rock cycle be broken?

_____

_____

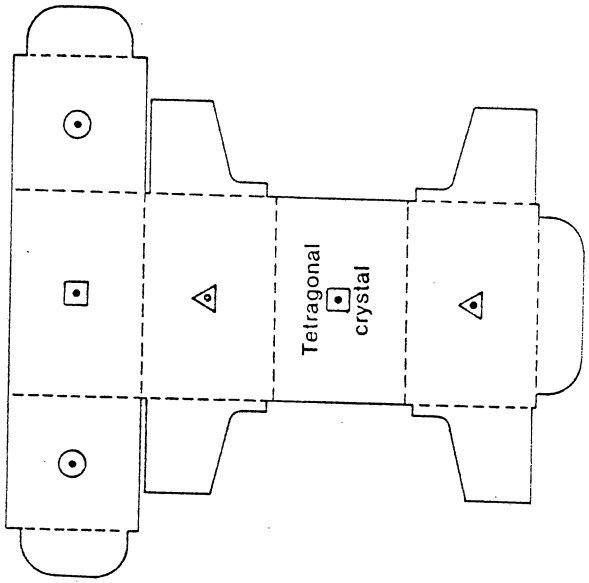
_____

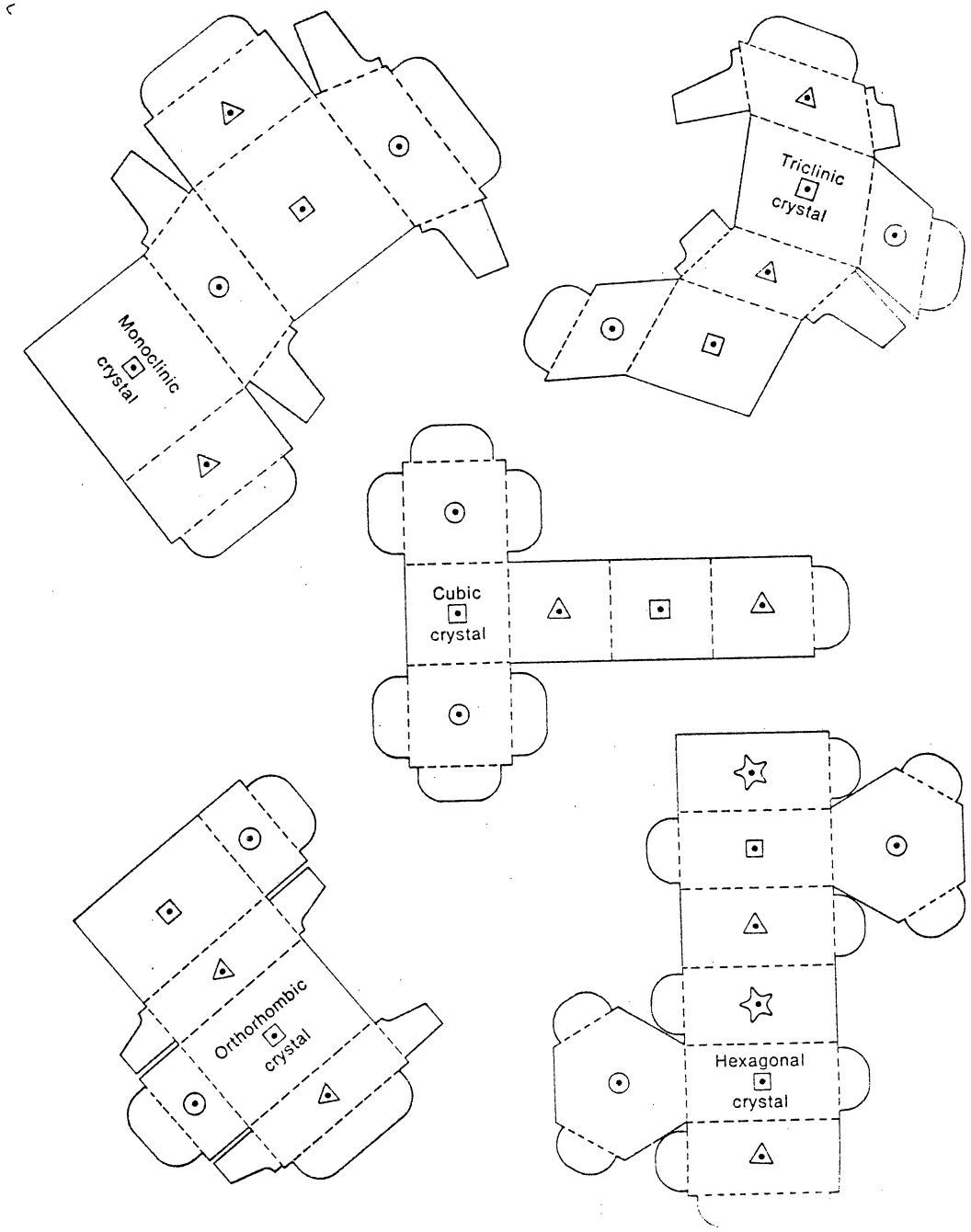
CRYSTAL WORKSHEET



Cubic Tetragonal Orthorhombic Monoclinic Triclinic Hexagonal

1. Cut out the paper models on the solid lines.
2. Form a hole by carefully pushing a pin point through the tiny points marked on the faces of each crystal.
3. Fold the papers along the dotted lines.
4. Glue or tape the tabs on the inside of each model to form the illustrated crystal shapes.
5. Insert one toothpick through both holes marked with a circle to make a holder for the model. This toothpick represents one axis of the crystal. An axis is the imaginary straight line about which the crystal turns.
6. Pick up the cubic crystal and hold it by the ends of the toothpick. Slowly rotate it until the label "one face of a cubic crystal" faces you. Rotate the cube one quarter turn, then stop. Look at the crystal face now facing you. Repeat this step until you return to the label "one face of a cubic crystal."
7. In the chart below, record how many crystal faces you see in one complete turn. The cubic crystal has a square face which is repeated four times along one axis.
8. Remove the toothpick and insert it through the holes marked with a triangle. This is another axis of a cubic crystal. Now the label "one face of a cubic crystal" is in a different position. Repeat Procedures 6 and 7.
9. Remove the toothpick and insert it through the holes marked with a rectangle. Repeat Procedures 6 and 7.
10. Repeat Procedures 5–9 with the other five crystal models. Be sure to insert the toothpicks through the matching symbols. Complete the chart below.




Monoclinic
crystal
Triclinic
crystal
Cubic
crystal
Orthorhombic
crystal
Hexagonal
crystal

VITA

Patricia Ann Gundersen

Candidate for the Degree of

Master of Science

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