

A PROPOSED METHOD FOR INCREASING READING COMPREHENSION
SKILLS OF COLLEGE STUDENTS

By

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Bluffton, Ohio

1960

Submitted to the faculty of the Graduate School
of the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
May, 1963

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ACKNOWLEDGEMENTS

The writer wishes to express her thanks to Mrs. Mavis Martin and Dr. Bernard R. Belden for their guidance and encouragement throughout this study and to Mrs. Idella Lohmann, who served as a member of the committee.

Special appreciation is expressed to Mrs. Carol Snelson for her part in the development of the exercises and to Mrs. JoAnn Wilbanks for her able preparation of the manuscript.

This study is dedicated to my little morale booster, Rick, and to my niece, Connie, and my husband, Stan, for their continuous forbearance and encouragement.

B. J. B.

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CHAPTER I

PRESENTATION OF THE PROBLEM

Introduction

Reported gains in comprehension skills for enrollees of college reading programs are seldom as great as gains in reading rate. Research has shown that a typical college student increases his rate of reading between 50 and 200 per cent in a training program, whereas his comprehension level usually remains constant or increases only slightly during the same period.

Improvement of reading rate appears to be easier to achieve because slow reading is frequently a result of inadequate mechanical skills. Comprehension deficiencies are more difficult to remedy because they involve such complex factors as intelligence, personality development, and poor study skills.

Preliminary to this study, an examination of twelve college reading workbooks was made. This appraisal showed that many of the workbooks failed to consider the complexity of comprehension. The analysis indicated that materials should be developed for training as many facets of comprehension as possible.

Statement of the Problem

The purpose of this study was two-fold in nature: (1) to establish rationale and criteria for the development of reading exercises which spe-

cifically emphasize comprehension skills and (2) to develop reading exercises designed to improve the student's ability to comprehend written selections such as are found in both textbook and general reading materials.

Significance of the Problem

The necessity of comprehending what one reads is of utmost importance. Getting meaning from the printed page is a major goal of all reading and improvement of other aspects of the process should lend themselves to promoting better comprehension.

The need for special materials to improve comprehension was early recognized by Jacobson (1932). Realizing that students in high school often had to rely upon incidental practice as a means of increasing reading abilities, he developed exercises for formal practice in work-type reading.

Since that time authors have been continuously concerned with the teaching of reading skills, but most of this concern has been at the elementary school level. The problem still remains at the college level where fewer attempts have been made to provide formal reading materials.

The dearth of work-type reading materials suggests the usefulness of criteria for guidance in the development of reading exercises. Further, there is a need for the developing of reading exercises designed to meet the requirements set by established criteria.

Definition of Comprehension

Traxler (Perry and Whitlock, 1952) suggested that no really adequate definition of reading comprehension had been offered up until that time. Writers in the field of reading still tend to think of reading as anything

from a set of more or less mechanical habits to something related to the "thinking" process itself.

A basic definition is given by Anderson (1958). He says that "comprehension is the act of understanding the meaning of the printed language as contrasted with the ability to perceive and pronounce words without reference to their meaning." Nila B. Smith (1961) makes a further contribution with her concept of comprehension as "a welter of processes, abilities, attitudes, and purposes which one brings to bear upon any situation in which he wishes to derive meanings from language symbols..."

As used throughout this study, the term comprehension will refer to the complex act in which the reader involves the sum total of his past learnings and experiences in interpreting the language symbols in their current context.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Students encounter increasing demands upon their reading skills as they climb each step of the educational ladder. Many educators have recognized a need for sequential development and have established reading improvement programs in their colleges. The reading skills emphasized in these programs may be improvement of rate, comprehension, and/or study-skills.

Results of College Reading Programs

A summary of nineteen studies reviewed by Ray (1962) showed that only eight programs reported gains in comprehension. These gains ranged from "... tended to improve" as reported by Witty, Stolarz, and Copper (1952) to Burfield's (1949) reported gain of fifteen standard score points. Most of the gains were small or no levels of significance were reported. Six studies reported no change at all in performance regarding comprehension skills.

Students in a study conducted at the Oklahoma State University (Ray, 1962) made significant gains in comprehension during the training period; however, comprehension was the only aspect of reading measured which did not show continued growth when students were retested at later dates. Further, the findings showed no real differences in the gains made by

students falling below the median and those falling above the median. This latter finding contrasts what might have been expected from earlier research.

Kingston and George (1957) found that both experimental and control groups made significant gains in reading rate, whereas only those who had participated in a college reading improvement program made significant increases in comprehension. Their results indicate that students make little or no gain in reading comprehension between their freshman and junior year unless they receive special training designed to develop this skill.

Abilities of College Students

Various estimates have been made of the ability of college students to meet the demands of their college assignments. Hadley (1957) estimated that 95% of college entrants lack adequate study skills. He further noted that "a relatively small percentage have reading speeds and comprehension skills adequate for handling all college assignments."

Carter (1959) made a study of 1029 students completing the freshman year of college. Of the students reporting, 68 per cent felt that they had never been taught how to read a chapter effectively, 70 per cent indicated that they have not been taught to concentrate upon a reading activity, 64 per cent had not been shown how to develop an awareness of problems and 70 per cent had not been taught how to critically evaluate a writer's bias.

Such findings suggest that college students generally need specific help in developing their reading skills. Eller (1955) reported a particular need for reading training among college students in the Southwest. A

study conducted over a five year period revealed that students in this locality are on the average inferior to the average college students throughout the country in the matter of reading ability. At the University of Oklahoma, 63 per cent of the freshmen fell below the national median and at the Oklahoma Agricultural and Mechanical College, 78 per cent fell below the median score.

Factors in Comprehension Difficulty

Hill (1959) undertook to verify the existence of factors which combine to produce a "general and more basic deficiency." Results of his study show that the significant components of this "basic deficiency" are limited intelligence, lower socio-economic home environment, and a personality orientation which leaned toward masculine interests and anti-social attitudes.

In discussing types of comprehension skills, Davis (1956) made the following comment:

Underlying all . . . skills are two general mental abilities: ability to remember word meanings and ability to reason with verbal concepts. Basically, neither of these general abilities lends itself to specific teaching; they are probably part of the pupil's native endowment. However, the gradual building up of an experiential background and of association with words tends to augment an individual's store of usable word meaning; and conscious attention to methods of attack on problems and to logical steps in reasoning tends to improve an individual's ability to think.

His statement implies that certain limitations are imposed upon training in comprehension and that comprehension skills can be developed only within the existing potential.

Limited intelligence was also cited by DeBoer and Dallman (1960) as one of the factors causing poorer comprehension skills. The ability to comprehend reading material is limited by the "conceptual load" that a student's mental ability enables him to carry. DeBoer and Dallman feel

that if the student were able to acquire mechanical skills he still would not be able to read materials involving abstractions beyond his mental development.

Betts (1957) stated that part of the blame for comprehension deficiencies can be given to failure to gain control of the "mechanics" of reading. Since most high school and college students do not have adequate control over the mere mechanics of the reading process, they find themselves unable to achieve their possible maximum comprehension. However, he did warn that in developing reading comprehension the "mechanics" of reading must be relegated to their proper, subordinate position.

In addition to intellectual level and inadequate reading "mechanics," Heilman (1961) pointed to the student's academic background and past experiences as factors determining the level at which a student can comprehend. The important factor in comprehension is the manner in which the reader uses his past experiences in meeting new reading materials.

Betts (1936) summarized the factors contributing to deficient comprehension as follows: 1) meager vocabulary; 2) word-by-word reading; 3) inaccurate perception; 4) failure to note punctuation; 5) low intelligence; 6) lack of interest; 7) reading materials too difficult; and 8) inadequate mechanical habits. Bond and Bond (1941) add two other factors, a lack of differentiated attack and excessive speed or speed unadjusted to the purpose for reading.

Components of Comprehension

As Hunt (1957) reported, logical analysis and thoughtful speculation has led many interested students of the reading process to describe read-

ing comprehension in terms of several skills and functions. There now appears to be wide-spread agreement among reading specialists that reading comprehension can best be described in terms of multiple skills and abilities, rather than as a single function or skill.

Davis (1944) undertook an exhaustive study of comprehension components. The following are components of reading comprehension according to his analysis: 1) memory for isolated word meanings; 2) ability to manipulate concepts and ideas in relation to one another; 3) ability to understand the writer's specific statements; 4) ability to infer the writer's intent, purpose, or point of view; 5) ability to select appropriate meanings from contextual settings; 6) ability to follow the organization of a passage; 7) ability to grasp detailed statements; 8) specific knowledge concerning literary devices and techniques; and 9) ability to synthesize the main ideas of a passage.

Later Davis (1956) defined comprehension as a weighed composite of five skills. One skill is the ability to answer questions that are explicitly given in a passage. The second skill is that of weaving together ideas, in grasping a central thought, and in answering questions that are not explicitly stated. The third and fourth skills are those of following the structure of a passage and drawing inferences about the content, the author's purpose, and the author's point of view. The fifth skill is recognition of the literary devices used by an author to identify the tone and mood of a passage. The weight to be attached to any one of the skills varies with the nature of the material read and with the purpose and maturity of the reader.

Fischer (1959) has divided the comprehension skills into those of a

higher order and those of a lower order for convenience in instructional procedures. Those which are included in a list of higher order skills are of intellectual kinds; drawing inferences and conclusions, predicting outcomes, recognizing the tone and intent of the author, recognizing the purpose of the author, understanding semantic devices, and becoming aware of one's personal bias. Those which are included in the lower order skills are of a mechanical nature; choosing main ideas, recognizing significant details, summarizing skills, direction following, vocabulary improvement, and skimming. One is not to assume that the word mechanical implies that one can learn the lower order skills without thinking. They are also intellectual skills, but of a lesser nature and degree.

Helen K. Smith (1960) examined the components of each of the comprehension skills and suggested a potential hierarchy or a time order in which they may be taught so that one ability can be built upon another. This was done with the knowledge that research had not been able yet to determine a definite sequential order for development of comprehension abilities and the proposal is open for examination when research provides new information.

Rate and Comprehension

Numerous studies have considered the relationship of rate and comprehension. The purpose of the present study was not to investigate the matter in detail, but some attention was necessary to make this review as complete as possible.

Preston and Botel (1951) concluded that there is little relationship between rate and comprehension. They found a statistically significant coefficient of .48 between rate and timed comprehension, whereas, the

correlation between rate and untimed comprehension yielded a not significant coefficient of .20. Since the untimed comprehension score is the "purer" score, they felt that timed procedures for measuring comprehension are unacceptable.

Stroud (1956), one of the leading investigators of the relationship between comprehension and rate, decided that the magnitude of the correlation coefficient should be a function of the extent to which rate and comprehension measurements invade one another. Examples of such encroachments are the timed tests for measuring comprehension which put a premium upon reading and answering questions quickly and the reading rate tests which ask a student to answer questions as he reads.

Brown (1959) contended that neither speed nor comprehension is adequate in itself and that the two must be combined to give a meaningful picture of reading performance. From her study, she concluded that improvement is obtained in the area emphasized, whether speed or comprehension, and that speed and comprehension must be equated when making evaluations of reading improvement.

Summary

This review demonstrated the need for continued development of reading skills at a college level. Although few studies of reading improvement programs have reported gains in improvement of comprehension, indications have been that more specific training in this area would increase gains.

In general, college students possess reading skills insufficient to the demands of their assignments. While intellectual capacity delimits the degree of comprehension, other factors which may be improved through

training contribute to comprehension deficiencies. Comprehension is composed of a number of abilities which have been named by investigators and research will probably identify others not yet recognized.

CHAPTER III

DEVELOPMENT OF CRITERIA

Reading Materials to be Selected

Difficulty of the Materials

The difficulty of the materials is important in developmental or remedial training for comprehension. Useful improvement in comprehension cannot be made in situations where the reading materials are not within the range of reading ability of the student.

Ideally, the difficulty level of materials for reading improvement programs should be determined by the reading levels of individual students; however, instructors with large college groups find practical considerations force them to forsake an individualized approach. Even then, however, there must be an attempt made to match the materials to the abilities of the students with some accuracy. Such materials will be the most appropriate vehicles for developing skills in a reading improvement program.

Content Fields for Selection

Authorities generally agree that reading skills are specific in nature and should be taught within the framework of content areas at the high school and college levels. Shores (1943) conducted a study of the relationship of general and subject-area reading skills. He found that the subject skills of history and science were not significantly related

to general reading skills. His conclusion was that "by the time students have reached the ninth grade, reading proficiency is to a considerable extent specific to the content field in which the reading is done." To speak of general reading ability of the student without description of the content field in which the reading is done is inappropriate.

Intercorrelations between comprehension accuracy scores on art, geology, fiction, Canadian History, and Russian History showed great variability as found by Robinson and Hall (1941). They concluded that it is particularly dangerous to predict comprehension achievement from one subject to another.

Artley (1948) concluded that both general and specific reading instruction have a place in the functional program. There may be fewer differences in the reading abilities than in the different ways students transfer these abilities from one content area to another. Consequently each teacher is accountable for making the necessary application of this "generalized" ability to his particular area.

Indications would then be that reading is a specific skill to be developed with content materials. Reading abilities must be developed in the areas where they are to be used and the materials must be provided in these areas.

Proposed Organization of the Exercises

Stauffer (1959) attacked the type of "round-the-robin comprehension" procedures used in some elementary schools. He pointed out that the teacher usually asks the questions and the pupil's only role is to answer questions based on verbatim knowledge of the text. Few attempts are made to adjust

to the abilities, purposes, skills, experiences, and needs of the pupils. The same situation often exists at the high school and college level.

Certain conditions seem to assist in turning reading into a thinking and comprehending process. (Strang, 1961). First, the reader should have a mind-set to read in a thoughtful, purposeful way, with a problem to solve, a story to interpret, or questions to answer. Secondly, the reader needs time to review what he already knows about the problem and to think while he is reading. Lastly, the evaluation questions should be answerable only by thoughtful reading.

McCullough (1959) compared the conditions favorable to comprehension to conditions favorable to cooking a good steak on a hibachi. First, the ashes must be cleared away, that is, the deficiencies in the student's equipment which makes it impossible for him to profit by his reading. Second, the fuel must be provided. The body of knowledge with which the student will be dealing must be presented to him. Third, draft is a necessary ingredient. This is the assistance which is given the student in meanings and pronunciations of difficult or technical words and in the setting of purposes. The last condition is sparks or motivation within the student. Included in this is past experience, familiarity with the topic, and curiosity.

Appraising the Background of Experience

Heilman (1961) pointed out that the best job of preparing the learner for reading is probably provided by the primary teacher. This preparation is equally important at the higher grades where reading materials often deal with concepts which are beyond the present knowledge of some students.

A lack of an experience background essential to the understanding of the printed page is a frequent cause of poor comprehension. McAllister (1960) reported that students must be provided with time and opportunity to review what they already know about a problem or topic and to associate past experiences with new ideas. Learning requires time for reflection both before and after reading.

Reading is a "taking-to" process. An individual's understanding of the reading selection is influenced by the experience he takes to the materials. This experience can be of two types, experience with language and experience with the facts set forth in that language. Both are essential to full comprehension. One of the most important functions of a teacher is to provide situations which give experiences of both types.

Language includes two types of technical vocabulary. One is the common word with a specialized meaning. The teacher must develop a new concept as it is used in the content area. The second type is the word which is new to the student in form as well as meaning. (DeBoer and Whipple, 1961).

Previewing the Selection

"Pre-reading" or previewing helps the reader understand the general content and organization before he begins to read thoroughly. (Judson and Baldrige, 1954). The higher the difficulty level of the materials, the more likely that previewing will aid comprehension. A preview also provides an advance sampling of the author's style and the content of the selection, thus making it easier in subsequent thorough reading to maintain efficient reading comprehension.

In a study with college subjects, Robinson and Hall (1941) found that the average college student does not take advantage of headings and sub-headings when studying textbooks. This implies a definite need for instructional emphasis of this and other organizational cues.

Some students try rereading their lessons to raise the level of comprehension accuracy and to retard forgetting. Simply rereading a lesson several times in one session does not effectively aid comprehension accuracy according to English, Welborn, and Killian (1934). In their study, they found the average reader achieved 69 per cent accuracy on an easy test immediately following one reading and was only able to raise his accuracy to 75 per cent after three more readings. Such results show that comprehension is not aided to any significant extent by successive rereadings.

Raising Questions to Answer

Carter and McGinnis (1957) stated that most things worth remembering are answers to some sort of questioning. Questions can implement learning because they help the student identify what he wants to learn from his reading. Questions give purpose to the student's reading and learning. Carter and McGinnis suggest that the reader change headings and sub-headings into questions to provide a study guide.

Questions formulated immediately after prereading and before thorough reading aid the reader by fixing the theme and organization of the selection in the reader's mind. Four main questions which should be asked immediately after pre-reading a selection are listed by Judson and Baldridge (1954):

1. What is the thesis or problem of the selection?
2. What is the purpose of the selection?
3. What limitations are imposed on the discussion?
4. What particular information or ideas do you, the reader, want from the selection?

There are usually some purposes for assigned reading, but too often the teacher fails to share them with the readers. McAllister (1960) feels that it is not sufficient merely to provide students with teacher-made purposes, rather each student must be directed in learning to make purpose-setting a part of his own thinking activity.

Preceding a reading activity, time is well spent by the student in developing reading purposes that appeal to him. The reader's purposes will influence not only his degree of comprehension but also his method of attack, his rate of reading, and the skills he employs in his reading. Purposes also assist in furnishing the force needed for sustained reading and studying. (DeBoer and Whipple, 1961).

Reading the Selection

Vernon (1956) expressed the view that the reader cannot just back off and let his reading soak into his mind as a piece of blotting paper soaks up ink. If the reader is to grasp the full implications of what he reads he must approach the materials with active intention to understand and learn. He cited the results of an unpublished thesis by Gomulicki, University of Oxford, England. Gomulicki found that when readers were asked to recall the content of short narrative and descriptive passages, those who did it best were the students who remembered the general outline and the key phrases. Whenever a reader attempted to reproduce the material verbatim, he omitted much of what was important.

Generally, authorities agree that there is little need for outlining in most of the student's reading. There are some occasions, however, where total mastery of the details is required. At such times, outlining can be worth the time it takes. The aims in outlining are to summarize the organization of a selection and to differentiate the order and rank of topics and details. (Judson and Baldrige, 1954).

Reviewing the Selection

Review is one of the most effective and simple devices to delay forgetting. Few students make use of the process and when they do, it is seldom at the best time. (Robinson, 1962). Self-recitation and review acts to insure the reader that he understands the material and serves to reinforce the fixing of the material in the mind. Recitation or review should be used immediately after reading a selection to retard forgetting.

Students should be shown how to test themselves on recall of ideas during a review period. Such testing may be done by answering the questions the student raised earlier. They may also reread certain portions of the selection for clarification of important points. Reviewing an outline of the major points can make the whole lesson more meaningful.

Evaluating Comprehension

If a student knows that he may be called upon to reproduce what he has read, his quality of reading will be higher. The student needs to be given a chance to express his understanding in various ways so that he has an effective way of learning how accurately he has comprehended. (Gates, 1947).

Spitzer (1939) found in his studies of retention that immediate recall in the form of a test was an effective method of aiding the retention of the learner. He warns, however, that since recall can aid in the fixing of erroneous ideas, all tests or examinations should be corrected immediately and each pupil allowed to check his mistakes.

Since comprehension is not a clearly defined factor, test-writers have found it difficult to build good evaluation measures. Some authors feel that mere recognition of details, recall of information, and recall of isolated facts is a suitable check on comprehension. They equate comprehension with memory. A few writers have attempted to evaluate such higher mental processes as understanding various principles, seeing the implications of complex data, and application of what has been read. (Kingston, 1955).

In evaluation of reading comprehension, Nila B. Smith (1960) called for questions which test the student's literal comprehension and questions which require interpretation of meanings not stated directly in the text. Since the students need to get important implications from their reading in order to draw conclusions, teachers should ask questions which stimulate cause and effect reasoning and which require students to make comparisons, draw inferences, arrive at conclusions, and make generalizations.

Summary

The types of materials to be used play an important role in the development of comprehension skills. Difficulty level of the material should match the reading level of the students as closely as possible. Since reading skills at the college level are often quite specific in nature, materials should be selected from the various content areas.

Reading exercises should enrich the reading experience and be meaningful for the student. Before thorough reading, time should be spent in orienting the student to the reading selection. The student should consider the previous experience he has had with the subject of the selection. A quick preview will help him fix an organizational outline for the details he will gather later. A questioning period will help the student set purposes in light of what he himself hopes to obtain from his reading.

During thorough reading, the student must take an active part in the interpretation of the context. After reading the selection, the student should review the selection to ascertain his understanding of the ideas presented and to aid in the retention of the material. Short tests provide a check on the understanding and help the student evaluate his learning experience.

CHAPTER IV

APPLICATION OF CRITERIA

The criteria for selection of material and for the pattern of organization established in the preceding chapter was used in the development of reading exercises to improve comprehension. This chapter discusses procedures followed in building the exercises and illustrates sequential steps to be used in training for increased comprehension.

Reading Materials Selected

Content Area of Selections

The review of the literature substantiated the belief that the reading selections should be chosen from various subject areas. Since more emphasis is placed on the three basic content areas of Humanities, Social Sciences, and Natural Sciences in the college curriculum, four selections from each of these areas were used. Four selections were included under a classification of General to aid in building general comprehension skills applicable to recreational-type reading. Appendix A gives a distribution of the content of the reading selections according to subject areas. The publication references of the reading selections are also given.

Difficulty Level of Selections

The difficulty level is one of the most important considerations in selecting reading materials and must be comparable to the reading abilities of the students using them. Examination of test performances of students who have been enrolled in the Reading Improvement Program at the Oklahoma State University showed that a majority of students read at an eleventh and twelfth grade level. For this reason, a predominant number of the reading selections were selected from within this range. Materials of a ninth and tenth grade level and from the thirteenth through fifteenth grade level were also included to provide a generous range.

Appendix A gives a distribution of the content according to the readability level of the reading selections. The readability levels of the selections were determined by the Dale-Chall Formula for Predicting Readability. (Dale-Chall, 1948).

To best aid the students participating in a developmental program, units were arranged according to difficulty level. Since the General Unit and the Humanities Unit each contained three selections of a ninth and tenth grade reading level, they were placed in beginning positions.

Some reading specialists have suggested that a student will want to remedy a weakness in one content area and/or develop a reading strength in another area. This viewpoint suggests a possible alternative in procedure for using the reading exercises. The student could begin with the unit most familiar to him and proceed through the exercises in a systematic way until he reached the kind of materials with which he had the least experience.

Organization of the Exercises

Following the pattern suggested by the criteria, six basic steps were included in each individual exercise. To summarize, the six steps are: 1) Appraising the Background of Experience; 2) Previewing the Selection; 3) Raising Questions to Answer; 4) Reading the Selection; 5) Reviewing the Selection; and 6) Evaluating Comprehension.

Each example used to illustrate the previous steps was taken from the developmental exercise constructed for use with the reading selection "The Nature of Matter and Its Changes." (Appendix B).

Each step of the reading exercise includes certain procedures not pertinent to this particular study. These procedures were a part of a companion study (Snelson, 1962) and were designed to develop flexibility in the reading of college students.

Appraising the Background of Experience

The goal of this section was to prepare the students for the reading experience. This motivation step so often used by teachers in the elementary school, but neglected quite often by teachers at higher levels, was felt to be important for these exercises.

The pattern followed in this step requires the student to apply his previous store of knowledge to pave the way for better comprehension of the particular reading selection. Such a step allows the student time to become aware of the experiences and concepts he "takes-to" the reading situation.

In half of the reading exercises, objective questions were given so that the student could analyze his general knowledge of the subject to be

presented. While the questions provide a check on the amount of present knowledge, they also serve to present new and basic information to the reader, thus promoting later comprehension. The other half of the exercises ask the reader to make his own analysis of general knowledge and to write a sentence or paragraph demonstrating this knowledge.

Technical vocabulary questions were included in the exercises to check the student's knowledge of concepts necessary for the comprehension of a certain reading selection. If the concepts are unfamiliar, a check of the meaning before the actual reading helps the reader understand when he does locate the word in context.

The following example illustrates the procedure that students are to follow in Step I.

APPRAISING THE BACKGROUND OF EXPERIENCE

The following questions will help you decide how familiar you are with the material to be presented in this reading selection. Such questioning will aid you in deciding what type of approach you should use in reading this selection.

General Knowledge

1. All matter is composed of exceedingly small particles which are called 1) grams 2) colloids 3) molecules
2. Molecules in liquids and solids are much more scattered than they are in gases.
True _____ False _____
3. An increase in temperature increases the rate at which molecules move.
True _____ False _____
4. Small as molecules are, they are made up of still smaller particles which are called 1) hydrogens 2) atoms 3) isotopes
5. A formula is used by chemists to
 - 1) set down a prescribed method.
 - 2) express in algebraic terms the chemical principles.
 - 3) represent the composition of a substance.

6. A formula shows
- 1) what atoms are present in each molecule and the number of each.
 - 2) the relative weight of an element.
 - 3) the molecular weight of a substance.
7. A chemical change in matter occurs when the identity of the original substances is lost.
 True _____ False _____
8. A chemist can use several agents to bring about a chemical change, but cannot hasten one that has already started.
 True _____ False _____
9. A physical change in matter occurs when
- 1) the identity of the substance is destroyed.
 - 2) the identity of the substance is not destroyed or the characteristic properties do not change.
 - 3) the characteristic properties change.
10. Some of the agents, such as heat, light, and electricity, which aid in producing chemical changes are often produced themselves as a result of chemical changes.
 True _____ False _____

Technical Vocabulary

1. Chemistry
 - 1) the science which includes a study of elements and compounds.
 - 2) the process of analyzing drugs.
 - 3) branch of applied science devoted to industrial utilization of chemical substances.
2. Endothermic
 - 1) Pertaining to a reaction which absorbs light.
 - 2) Pertaining to a reaction which liberates heat.
 - 3) Pertaining to a reaction which absorbs heat.
3. Exothermic
 - 1) Pertaining to a reaction which absorbs heat.
 - 2) Pertaining to a reaction which liberates heat.
 - 3) Pertaining to a reaction which liberates light.
4. Kinetic Theory
 - 1) Theory of matter which assumes that all molecules are always in motion.
 - 2) Theory of matter which assumes that some molecules are in motion while others are inactive.
 - 3) Theory of matter which assumes that all molecules are always inactive.
5. Molecule
 - 1) The smallest particle of matter that exists.
 - 2) Makes up the composition of an atom.
 - 3) The smallest particle of matter that can exist and still retain the properties of the mass.

6. Precipitate 1) A substance which condenses into vapor.
 2) A substance which mixes rapidly with the solution.
 3) A substance which separates from a solution as a result of some physical or chemical change which has taken place.

Evaluation:

I am _____ with the materials in this selection.

Comprehension:

Unfamiliar (1-3) Familiar (4-7) Adept (8-10)

Vocabulary:

Unfamiliar (1-2) Familiar (3-5) Adept (6)

Previewing the Selection

This section was designed to provide the reader with a general impression of the reading selection. Through this preview, the reader should obtain an over-all picture into which he can fit the details of his later thorough reading. The student is trained to take advantage of textbook cues provided for his use.

In each exercise the student surveys the reading selection by noting titles, introductory paragraphs, key words, heading and sub-headings, and summaries. Sometimes the student is asked also to determine the author's purpose so that a mind-set can be established.

The following example illustrates the procedure the students are to follow in Step II.

PREVIEWING THE SELECTION

A preview will help you get the best possible over-all picture of what you are going to read before you begin to read in any detail. Such a perspective is important in study for the same reason that people consult maps before they drive unfamiliar roads. The reader needs to know the general picture before he can make intelligent decisions about the details. When previewing, use the headings as a guide; they have been planned by the author to help you. Reading the summary will give you the most important points of the chapter

before the details begin to clutter up the picture.

1. Give the title of this selection here.
2. Read the summary. List some of the key words used in the summary.
3. Read the headings and sub-headings.

By surveying the reading selection, you have been able to organize your thoughts. This preview should enable you to realize the points to look for while reading. This step should have helped you decide what YOU want to get out of the article. As you read, you should also have received some idea of the difficulty level of the materials for YOU.

Evaluation:

I expect the reading in this selection to be _____ for me.

- 1) Most difficult
- 2) difficult
- 3) average
- 4) fairly easy
- 5) simple

Raising Questions to Answer

The major purpose of this section was to guide the student in asking questions which would aid in developing real purposes for reading. Together these questions and purposes should influence the degree of comprehension favorably. The questioning also furnishes the force needed for sustained reading and studying of the selection.

The procedure in this section is for the student to ask himself a number of questions which identify the information he hopes to obtain from his reading. In textbook selections, it is suggested that the student change the headings into questions as an aid in knowing what to look for as he reads.

The questions then are to be used as a guide by the student in determining his own purpose or purposes for reading the selection. A list of possible purposes for reading are made available for the student's use. (Appendix C). He is also given an opportunity to formulate purposes

other than those found on the list.

The following example illustrates the procedure the students are to follow in Step III.

RAISING QUESTIONS TO ANSWER

These questions may be obtained from a rapid skimming and by changing headings to questions, as, for example, a heading Matter into What is Matter? Each question should be written out and used to test one's knowledge of each question after reading the selection. In this selection there are two main headings. Develop your own questions for these headings and the sub-headings under them. Some of them might already be stated as questions. If so, make these questions more specific and detailed.

Evaluation:

Considering the questions I have asked myself, I would expect to read for the purpose or purposes of _____.

Reading the Selection

The importance of active participation on the part of the student during thorough reading must be stressed. The abilities and skills of the student will be effective only to the extent that he concentrates on understanding the materials.

In most cases, the student is asked to read the selection without any interruptions. However, in a few selections he is to take notes as he reads. Note-taking is used with selections which require complete understanding of details, as in science materials. The suggested methods of note-taking are jotting down words and phrases in the margins and outlining of major and minor points to be remembered.

The following example illustrates the procedure the students are to follow in Step IV.

READING THE SELECTION

Much reading material in science is concerned with the pattern in which the writer gives the reader detailed facts by a method of simply stating these facts directly. Reading such selections should be done by reading for details. It is often advisable to take notes when studying such a selection and to organize your notes in the form of an outline as you go along. This helps you to see the details in their right relationships.

Begin your note-taking by writing one heading for each of the two main divisions. Continue reading the text for the purpose of finding major and minor details. Write these major details in your outline opposite capital letters and your minor details (if any) under Arabic numerals.

Now read "The Nature of Matter and its Changes." Note your starting and finishing time so that you will be able to determine your reading rate.

Reviewing the Selection

Review was included in the development of these exercises as an important means of reinforcement. The step also serves to increase the reader's understanding and interpretation of the information presented.

The reader is asked to answer the questions he himself raised in Step III and to answer any new questions which might have come to mind. By comparing and applying ideas and noting relationships between what he reads and personal experiences, the student adds to his level of comprehension. The use of headings and sub-headings is suggested as further aid in reviewing. The student might also reread any part that he did not understand in the first reading.

The following example illustrates the procedure the students are to follow in Step V.

REVIEWING THE SELECTION

Review the questions you asked yourself earlier. Were you able to answer the questions from your reading and note-taking? List any

questions you were not able to answer.

Now scan the article again to be certain that you did not miss the answers in your reading.

Evaluating Comprehension

This section was included to give the student an opportunity to demonstrate his understanding of the reading selection. Two types of questioning were used, literal and interpretative. Questions of literal comprehension are objective in nature and test the student's understanding of main ideas and supporting details. The objective questions are varied in nature so as to diminish the element of guess.

Questions involving interpretation ask the student to write short paragraphs in response to the questioning. The student is asked to summarize, to state opinions and views, to make comparisons, to give cause and effect relationships, to make distinctions, and to apply principles.

The following example illustrates the procedure the students are to follow in Step VI.

EVALUATING COMPREHENSION

Supporting Details Answer these questions without looking back at the selection.

1. A molecule is
 - 1) large enough to be seen by the human eye.
 - 2) about three pin-heads in diameter.
 - 3) extremely small.
2. It is considered impossible to subdivide the _____ by ordinary chemical means, but other methods may be used.
3. In the formula for water, H₂O, the symbols show that a molecule of water contains one atom of hydrogen and two atoms of oxygen.
True _____ False _____
4. The changing of water into steam is an example of _____ change.

5. Chemical change occurs when
 1) sugar dissolves water.
 2) starch is made by plants.
 3) a glass breaks into pieces.
6. An increase in temperature of 10 C° just about doubles the speed of a chemical reaction.
 True _____ False _____
7. Green plants utilize _____ energy to make starch from carbon dioxide and water.
8. Mechanical energy is produced when
 1) we open the shutter of a camera.
 2) dynamite explodes.
 3) water is added to baking powder.
9. Exothermic reaction is illustrated by the necessity to apply the intense heat of an electric furnace all the time that calcium carbide is being manufactured.
 True _____ False _____
10. In the burning of coal, which of these forms of energy is not set free?
 1) light energy
 2) electrical energy
 3) heat energy

Vocabulary Check your knowledge of word-meanings by finding a word in the paragraph (indicated in parenthesis) which means the same as the word or group of words given below.

1. One thousandth of a meter (3)
2. Enlarged (3)
3. A drawing into the lungs (3)
4. A thin, soft, pliable layer (6)
5. A volatile, crystalline substance (6)
6. To attract (10)
7. Dulling of a luster (11)
8. Capable of being made compact (5)
9. Ignite (14)
10. That which cannot be dissolved (22)

11. Decomposed (17)
12. Separated into basic components or parts (16)
13. Frees from combination in a compound (18)
14. Process of development (19)
15. Wholly engulfed (23)

Other Questions for You to Answer Check your general understanding of this selection by answering the following questions with a sentence or short paragraph.

1. What is the difference between an atom and a molecule?
2. Distinguish between a symbol and a formula.
3. What is the difference between a physical change and a chemical change?
4. What is the significance of a chemical formula and what can a chemist learn from a correctly written formula?

Summary

Developmental exercises following this organizational pattern were constructed for use with sixteen reading selections. These exercises were designed to be used with students in the Reading Improvement Program at Oklahoma State University and for further study may be found at the Reading Center, Oklahoma State University.

CHAPTER V

SUMMARY

The present study involved the production of materials for college reading improvement classes. The purposes of this study were two in number: 1) to establish criteria for the development of reading exercises which would specifically emphasize comprehension skills and 2) to develop reading exercises designed to improve the student's ability to comprehend written materials.

Chapter I presented a statement of the problem and its significance. The term comprehension was defined as the complex act in which the reader involves the sum total of his past learnings and experiences in interpreting the language symbols in their current context.

Chapter II, a review of the literature, emphasized the need for continued development of reading skills at a college level. Although few studies of reading improvement programs have reported gains in improvement of comprehension, indications have been that specific training would be beneficial for students.

Results of most studies indicate that college students, in general, possess reading skills inadequate to meet the demands of their assignments. Many factors contribute to comprehension deficiencies, some of which can be improved through training. Comprehension is described as a composite of many skills, some not yet identified by research.

In Chapter III criteria are established by reference to relevant research and discussion. An attempt is made to develop materials appropriate to the abilities and interests of college students. The following steps were discovered to aid the student in understanding written materials. 1) Prior to reading, a consideration of the reader's previous experience with the subject promotes comprehension. 2) A preview of the selection helps the reader organize a general outline for the details he will read later. 3) Questioning helps the student set purposes in terms of what he hopes to obtain from his reading. 4) After reading, a review aids in ascertaining the student's understanding of ideas presented and 5) a recall check reinforces his understanding.

In Chapter IV the criteria are applied by describing the procedures to be followed by students. Classifications for the reading materials are General, Humanities, Natural Science, and Social Science. The selections range in difficulty from ninth through fifteenth grade levels. The comprehension exercises were developed according to the following organizational outline.

- I. Appraising the Background of Experience.
- II. Previewing the Selection.
- III. Raising Questions to Answer.
- IV. Reading the Selection.
- V. Reviewing the Selection.
- VI. Evaluating Comprehension.

The potential usefulness of these exercises should be tested in a college reading improvement program to determine their effectiveness in improving the comprehension skills of college students.

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APPENDIX A

A LIST OF THE READING SELECTIONS ACCORDING TO AREA,
PUBLICATION SOURCE, AND READABILITY LEVEL

**A LIST OF THE READING SELECTIONS ACCORDING TO AREA,
PUBLICATION SOURCE, AND READABILITY LEVEL**

Area and Title of Selection	Book Source	Author	Publisher	Place	Date	Pages	Readability
<u>General</u>							
"Dr. America"-Tom Dooley	<u>Freedom, America's Choice</u>	Tom Dooley	Reader's Digest Educational Division	Pleasantville, New York	1962	133-141	9-10
I Was a "Student" at Moscow State	<u>Communism, Menace to Freedom</u>	Everest Mulekezi	Reader's Digest Educational Division	Pleasantville, New York	1962	132-138	9-10
Rocket Shoot at White Sands	<u>Man Against Nature</u>	Jonathan Norton Leonard	Random House	New York City	1953	9-17	9-10
College Athletics: Education or Snow Business?	<u>Ideas for Writing</u>	Kenneth L. Knickerbocker	Henry Holt and Company	New York City	1956	196-204	11-12
<u>Humanities</u>							
The Great Stone Face	<u>High School Reading, Book Two</u>	Nathaniel Hawthorne	American Book Company	New York City	1961	439-450	9-10
The Nature of Materials	<u>Writings and Buildings</u>	Frank Lloyd Wright	Horizon Press	Spring Green, Wisconsin	1960	222-227	9-10
Folk Music In America	<u>All About Music</u>	Fredric Swift, Willard Musser	Etmar Publishing Company	New York City	1960	125-135	9-10
The Philosophical Concept of Duty	<u>Types and Problems of Philosophy</u>	Hunter Mead	Henry Holt and Company	New York City	1959	284-290	11-12

LIST CONTINUED

Natural Science

What Good is the Atom?	<u>Literature for Life</u>	David Lilienthal	Houghton, Mifflin Company	Boston	1958	245-251	9-10
Learning to Name Plants	<u>Textbook of Botany</u>	E. N. Transeau H. C. Sampson L. H. Tiffany	Harper and Brothers	New York City	1953	18-25	11-12
Close Relatives: The Solar System	<u>Historical Geology</u>	Carl G. Dunbar	John Wiley and Sons	New York City	1949	68-76	11-12
The Nature of Matter and Its Changes	<u>Modern Chemistry</u>	Charles Dull William Brooks Clark Metcalf	Henry Holt and Company	New York City	1954	19-24	11-12

Social Science

Technology and Industry in The Young Republic	<u>American History, A Survey</u>	Richard Current T. Harry Williams Frank Freidel	Alfred A. Knopf	New York City	1960	161-170	11-12
Primary Emotions	<u>Elements of Psychology</u>	David Kretch Richard Crutchfield	Alfred A. Knopf	New York City	1958	235-239	11-12
Marriage: The Various Forms it May Take	<u>Cultural Anthropology</u>	Felix M. Kessing	Rinehart and Company, Inc.	New York City	1958	255-265	13-15
Employment and Unemployment	<u>Steel's Competitive Challenge</u>	American Iron and Steel Institute	American Iron and Steel	New York City	1961	25-30	13-15

APPENDIX B

THE READING SELECTION WHICH ACCOMPANIES THE
DEVELOPMENTAL EXERCISE ILLUSTRATION

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THE NATURE OF MATTER AND ITS CHANGES

Chemistry is the science dealing with the composition of materials, and the changes in composition which these materials undergo. Matter is anything which occupies space and has weight. Substances may be found either as solids, as liquids, or in the gaseous state. The state of a substance depends largely on its temperature, but pressure affects it, too. Matter has weight and occupies volume. The weight of a unit volume of a material is its density. We describe substances by their properties, and these properties determine their uses. A substance has both physical and chemical properties.

Part I. The Nature of Matter

What is the Nature of Matter?

We may break a piece of chalk into tiny pieces, but each one will still have the properties of chalk. Even if we grind the chalk to a very fine powder, each little speck will still be chalk. If we open a gas jet, the odor of gas will soon be detected in the room. No particles of gas can be seen in the air of the room even if we use the best of microscopes. But our noses tell us that gas is escaping! We may dissolve some sugar in water and examine the solution for the sugar particles with a microscope. Such particles are too tiny to be seen, but our sense of taste tells us that the solution contains sugar.

Many other similar experiments can be performed. All of them convince us that all matter is composed of exceedingly small particles

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of a substance that retains the properties of the material. 2

How Large Are Molecules?

Different molecules vary greatly in size. It has been estimated, however, that it would take one million average molecules laid side by side to make a line one millimeter long (approximately $1/25$ inch long). It is estimated that if a drop of water were magnified until it became as large as the earth, its molecules, if correspondingly magnified, would be about three feet in diameter. 3

Molecules Are Not Closely Crowded

From the number of molecules in a liter of gas, we might infer that they must be closely crowded. Such is not the case, for they are quite far apart at ordinary air pressure, which is 14.7 pounds per square inch at sea level. Suppose we pump up a tire to a pressure of 60 pounds per square inch. We are putting into that tire more than four times as many molecules as it contained before. What we are really doing is crowding the molecules more closely together. Hence we infer that the space between adjacent molecules of a gas is actually greater than the space occupied by the molecules themselves. 4

Liquids and solids are not so easily compressible. Therefore we believe that the molecules in liquids and solids are much closer together than they are in gases. 5

The Kinetic Theory of Matter

Several facts show fairly conclusively that the molecules of

matter are always in motion. A gas escapes from a bottle when the stopper is removed. Both liquids and gases pass through a membrane by osmosis, as you may have learned in biology. Water and other liquids evaporate because molecules continually escape from their surfaces. The decided odor of camphor, perfume, and moth ball is further proof that the molecules of matter are in motion. Because we cannot see the molecules of matter in motion, or prove with absolute certainty that they are moving, we speak of molecular motion as a theory. Chemists call it the kinetic theory.

When water is heated, it evaporates faster. An increase in temperature increases the rate at which molecules move. The melting of solids when they are heated is further proof of the increase in the rate of molecular motion with an increase in temperature.

Molecules are Composed of Atoms

Small as molecules are, they are made up of still smaller particles which are called atoms. The atom is the chemist's unit out of which he builds compounds. Atoms are the ultimate particles of the individual elements. It is considered impossible to subdivide the atom by ordinary chemical means, but other means may be used to break up atoms. A single bacterium is more than 100 times as large in diameter as an atom.

How Do We Write Formulas for Compounds?

The numbers and kinds of atoms which make up molecules are very important. Therefore, chemists have developed a shorthand method of

combining the symbols for the elements in such a way that they show the composition of molecules. The formula for water is H_2O . It represents one molecule of water, and it shows that a molecule of water contains two atoms of hydrogen and one atom of oxygen. A small subscript figure written after a symbol shows the number of atoms of that element which are present in one molecule of the substance. The formula for water is read H-two O. The expression $2 \text{H}_2\text{O}$ represents two molecules of water, each containing two atoms of hydrogen and one atom of oxygen. The formula for sulfuric acid is H_2SO_4 . It is read H-two S O-four. It indicates that each molecule of sulfuric acid contains two atoms of hydrogen, one atom of sulfur, and four atoms of oxygen. $3 \text{H}_2\text{SO}_4$ means three molecules of sulfuric acid. When no number is used before the formula, the number one is always understood. A subscript number is never used after a symbol when only one atom of an element is represented.

Part II. Changes Which Occur in Matter

What is a Physical Change?

Ice melts, water changes to steam, liquids freeze, glass breaks, and sugar dissolves in water. We may magnetize a piece of steel, or heat a piece of platinum wire until it glows. In all these cases the matter undergoes some change. Its form may be different, or its state may have changed. But in no case has the matter lost its identity. No new substance is formed in any of these cases. These are examples of physical changes, because in no case is the molecule broken up. Any change in matter which does not destroy the identity

of a substance, or change its characteristic properties, is a physical change.

What is a Chemical Change?

Wood burns, iron rusts, copper tarnishes, milk sours, plants decay, and acids react with metals. In each of these changes, the identity of the original substance is lost. They are chemical changes, and new substances with new properties are produced. In some cases the original molecule is broken up into simpler molecules or into its atoms. In other cases, the atoms of two elements may have united to form a compound. In some chemical changes, too, the atoms rearrange themselves in the molecules, and form a new substance with decidedly different properties. 11

Now we are ready to give a completely scientific definition of chemistry. Chemistry is defined as that science which deals with chemical changes in matter; it also includes a study of elements and compounds. 12

How We Bring About Chemical Changes

The chemist uses several agents to bring about a chemical change or to hasten one that has already started. Some type of energy is often used. 13

1. Heat energy. We kindle a match by rubbing it over some rough substance to warm it by friction. If we apply the lighted match to a piece of paper, the paper begins to burn. The heat from the burning match is used to start this chemical change. We are 14

familiar with the chemical changes caused by heat energy during the baking of bread or in the cooking of other foods. As a rule, increasing the temperature hastens the speed of chemical changes. An increase in temperature of 10 C° . just about doubles the speed of a chemical reaction.

2. Light energy. When we open the shutter of our camera for only a fraction of a second, light enters. This starts a chemical change on the plate or film. The colors of rugs, draperies, or clothing sometimes fade in sunlight. If you have studied biology, you remember that in sunlight, green plants can make starch from carbon dioxide and water. But they cannot make starch in the dark.

3. Electrical energy. If we pass an electric current through water which contains a little acid, the water will be decomposed by the electric current into hydrogen and oxygen. We make use of electrical energy to produce a chemical change when we charge a storage battery. Electricity is also used commercially to produce chemical changes. It is used in the plating of one metal or another one, in the extraction of aluminum and other metals from their ores, and in the purifying of some metals.

4. Solution in water. Baking powder is a mixture of two or more compounds. No chemical action occurs as long as the powder is kept dry. But when you add baking powder to water, chemical action begins immediately and a gas bubbles off. Many chemicals which do not react in the dry state begin to react as soon as they are dissolved in water.

Some Proofs of Chemical Action

Several of the forms of energy which bring about chemical changes are also evident during the change. For example, external heat must be used to start a coal fire, but heat energy is set free as long as the coal continues to burn. Any chemical reaction which liberates heat as it proceeds is called an exothermic (giving out heat) reaction. 18

In the burning of coal, light energy is set free, too. From these two examples, we conclude that the evolution of heat energy and light energy are proofs that chemical action is taking place. 19
Many other examples may be given.

The mechanical energy which is produced when dynamite explodes is evidence of chemical action. The explosion of gunpowder and of gasoline vapor mixed with air in a gas engine are further examples. 20

In a dry cell, the zinc cylinder which is used as the negative plate of the cell, is acted on chemically. As a result of such action and as proof that it is taking place, we get electrical energy from such a cell. In this case, chemical energy is used to produce electrical energy. 21

When water is added to baking powder, the gas, carbon dioxide, is set free. The evolution of a gas is often used as evidence that chemical action is taking place. In many cases, an insoluble solid is formed by adding one solution to another one. The formation of such an insoluble solid, which is called a precipitate, furnishes evidence that a chemical change is taking place. 22

During certain chemical changes, heat is absorbed all the time

that the reaction is taking place. Any reaction which absorbs heat as it progresses is called an endothermic (taking in heat) reaction. 23 For example, it is necessary to apply the intense heat of an electric furnace all the time that calcium carbide is being manufactured.

Summary

Matter is composed of exceedingly small particles which are called molecules. In gases, molecules are not closely crowded together, but the intervening spaces are much larger than the spaces occupied by the molecules themselves. In liquids and solids the molecules are more closely packed. We believe that molecules of matter are always in motion. This belief is called the kinetic theory. Molecules are composed of atoms. 24

A formula is used by chemists to represent the composition of a substance. The formula shows what atoms are present in each molecule, and the number of each. 25

Changes in matter may be physical or chemical. In a physical change the characteristic properties of a substance are not lost. 26 In a chemical change a new substance with new properties is formed. More than one new substance may be formed.

Chemistry is defined as that science which deals with chemical changes in matter; it also includes a study of elements and compounds. 27

Heat, light, electricity, and solution in water are agents which aid in producing chemical changes. The various forms of energy--- heat, light, and electricity--- are often produced as a result of chemical changes. 28

APPENDIX C

A LIST OF POSSIBLE PURPOSES
FOR READING

PURPOSES FOR READING

1. Understanding the main thought.
2. Locating specific facts and details.
3. Appreciating the author's style of writing.
4. Increasing general knowledge.
5. Forming an opinion.
6. Determining the logic and consistency of the author.
7. Evaluating and/or criticizing the selection.
8. Identifying the author's purpose.
9. Deriving personal enjoyment.
10. Others (explain).

Use this list as a guide to determine your purpose(s) in Step III.

VITA

Barbara JoAnn Brauen

Candidate for the Degree of

Master of Science

Thesis: A PROPOSED METHOD FOR INCREASING READING COMPREHENSION SKILLS
OF COLLEGE STUDENTS

Major Field: Elementary Education

Biographical:

Personal Data: Born at Bluffton, Ohio, February 27, 1936, the
daughter of Otis and Mildred Fett.

Education: Attended grade school at Beaverdam, Ohio; graduated
from Beaverdam High School in 1954; received the Bachelor
of Science in Education degree from Bluffton College,
Bluffton, Ohio, in June, 1960; completed requirements for
the Master of Science degree in May, 1963.

Professional Experience: Taught second grade at Gahanna, Ohio,
1956 to 1959; taught first grade at Upper Arlington, Ohio,
1960; served as graduate assistant in the Department of
Education, the Oklahoma State University, 1961-1962.