

TEACHERS' PERCEPTION OF STUDENTS' ATTITUDES
AND PERFORMANCE ON COMPUTER SOFTWARE
PROGRAMS IN BIOLOGY

By

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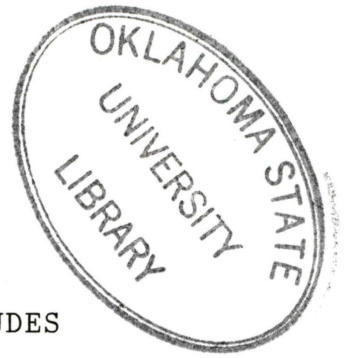
Oklahoma University

Norman, Oklahoma

1959

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
May, 1986

Thesis
1986
C692E
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PREFACE

I wish to express my sincere gratitude to all of the people who have assisted me in this work. In particular, I am especially indebted to my major adviser, Dr. Terence J. Mills, for his intelligent guidance, concern and invaluable help.

I am also thankful to the other committee members Dr. Joyce S. Friske and Dr. Russell Dobson for their advisement in the course of study. Many thanks are due to my Biology students at Hale High School, John Roller, Terry Bridgewater, George Fowler, Glen Chowins and Arliss Olds for their kind help in providing pertinent data and support. A special thanks goes to Bob McCormick for his timely assistance.

The help of my colleagues, Don Johnson, Monte Alexander, Harold McCord, Tim O'Halloran, Charles Lonechief, Brenda Brothers, Don Cupps, Paul Paulson, Annette Sorensen and Tomala Howard, is greatly appreciated. I am thankful to the assistance, friendship and encouragement of Carol A. Cowan.

My mother and father, Gladys and Kermit McKinney, my two sons, Ray and Scott, my two daughters, Chris Ann and Rhonda, each deserve my deepest appreciation for their constant support, moral encouragement and understanding.

My dear, sweet Mother passed away on March 14, 1986, before I could complete this writing.

TABLE OF CONTENTS

| Chapter | Page |
|--|------|
| I. INTRODUCTION | 1 |
| Statement of the Problem. | 2 |
| Objectives. | 2 |
| Rationale | 2 |
| Limitations | 3 |
| Definition of Terms | 3 |
| II. REVIEW OF REFERENCE LITERATURE | 5 |
| Introduction. | 5 |
| Computers in the Classroom. | 5 |
| Computers and Television. | 10 |
| Software Evaluation | 13 |
| Summary | 15 |
| III. METHODS AND PROCEDURES | 16 |
| Population Studied. | 21 |
| IV. RESULTS AND DISCUSSION | 22 |
| Teachers' Perception of Students' Attitudes Versus Student Attitudes. | 22 |
| Teachers' Perception of Students' Performance Versus Actual Students' Performance | 31 |
| Teachers' Evaluation on DIET, HEART, and WORMS | 35 |
| Teacher Attitude Toward Computers | 37 |
| V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS. | 40 |
| Summary | 40 |
| Conclusions | 43 |
| Recommendations | 43 |
| SELECTED BIBLIOGRAPHY. | 45 |

| Chapter | Page |
|----------------------|------|
| APPENDIX A | .48 |
| APPENDIX B | .59 |

LIST OF TABLES

| Tables | Page |
|--|------|
| I. Comparison of Teacher and Student Responses to Level of Enjoyment | .23 |
| II. Students' Frequency Response to Question 6 by Programs. | .23 |
| III. Students' Responses in Percentages to Question 6 by Programs | .24 |
| IV. Teacher Response to Question 6 by Program | .25 |
| V. Comparing Teacher Question 7 with Student Question 7 | .26 |
| VI. Comparing Teacher Question 10 with Student Question 10 | .27 |
| VII. Comparing Teacher Question 15 with Student Question 14 | .28 |
| VIII. Comparing Teacher Question 17 with Student Question 16 | .30 |
| IX. Comparing Teacher Question 11 with Student Question 11 | .31 |
| X. Comparing Teacher Question 12 with Student Question 11 | .32 |
| XI. Comparing Teacher Question 13 with Student Question 10 | .33 |
| XII. Comparing Teacher Question 14 with Student Question 13 | .34 |
| XIII. Teachers' Perception of Students' Test Results. | .35 |
| XIV. Average of Three Programs | .36 |
| XV. Teachers Who Would Use the Programs In Biology. | .37 |

| Tables | Page |
|--|------|
| XVI. Teachers Who Enjoyed the Programs | 38 |
| XVII. Material Taught From a Book, a Lecture, or a Discovery Lesson | 39 |

CHAPTER I

INTRODUCTION

Computers have been used in education since the late 1950s; in the early 1960s large mainframe computers filled huge rooms. In 1984, over 325,000 microcomputers were in use in the United States schools; 86% of high schools, 77% of the junior high schools, and 61% of the elementary schools have at least one microcomputer for use in education (Market Data Retrieval, 1983-84). Becker (1986) states that along with a quadrupling of the number of computers in schools in the last two years, there has been a tripling of the number of students using computers and a tripling of the number of teachers supervising students in their use.

Computer literacy is rapidly becoming one of the basic skills required for full participation in the emerging information society. Automation and robots may replace as many as 45 million workers during the next 20 years (Ellis, 1984).

Living in a revolution is exciting and frustrating. The excitement of the Computer Revolution stems from all of the new capabilities and insights that are possible. This study was initiated to study teachers' and students' acceptance of software as teaching aids in the classroom, on the recommendation of Dr. Terence J. Mills at Oklahoma State University.

Statement of the Problem

Using four computer software programs in Biology, how does teacher attitude and evaluation of the computer software compare with student attitude and content acquisition?

Objectives

- A 1. To compare teachers' perception of students' attitudes with actual students' attitudes toward each of four computer software programs in Biology.
- A 2. To compare male teachers' perception with female teachers' perception of students' attitudes toward each of four computer programs in Biology.
- B 1. To compare teachers' perception of students' performance with actual student performance on each of four computer software programs in Biology.
- B 2. To compare male teachers' perception with female teachers' perception of students' performance on each of four software programs in Biology.
- C. To assess teachers' attitude toward the use of computers in the science classroom as an educational aid.
- D. To assess students' attitude and achievement level.

Rationale

Educational computer software is best evaluated in the context of real school with real teachers. While a great

deal has been written about the software and software evaluation, very little has been written about the acceptance or appropriateness of the computer as a learning tool.

Limitations

- A. Eighty-six tenth grade students were assigned to the researcher. Assignment was not random.
- B. During the students' Biology class each student was permitted to spend no more than one hour on this project.
- C. The computer software programs investigated were limited to those programs that could be used on the TRS-80 Radio Shack Model IV.
- D. The number of science teachers was limited to ten.

Definition of Terms

1. Teachers' perception of students' attitudes--teachers' insight or awareness of students' feelings as they expressed them on opinion items 6 through 16 (APPENDIX A).
2. Students' attitudes--students' feelings as they expressed them on opinion items 6 through 16 (APPENDIX B).
3. Teachers' perception of students' performance--teachers' prediction of students' level of achievement on examination questions 17 through 27 on the DIET program, 17 through 23 on the HEART program, and 17 through 26 on the WORM program.
4. Students' performance--the percent of correct answers for each of the computer software programs.

5. Visual material--material graphically displayed on the computer screen.

CHAPTER II

REVIEW OF REFERENCE LITERATURE

Introduction

A review of the literature was accomplished from the years of 1979 until 1986, using an ERIC search. The following is a list of the descriptors which were used: BIOLOGICAL-SCIENCES, BIOLOGY, COMPUTER-PROGRAMS, COMPUTER-ASSISTED-INSTRUCTION, EVALUATION, STUDENT-ATTITUDES, and TEACHER-ATTITUDES. An extensive look at the card catalog and the current stacks of recent magazines was accomplished. In addition the researcher made a number of telephone calls to IBM, Apple, and some other companies, including Radio Shack, to obtain any knowledge about pilot studies on the subject of teacher attitudes and student attitudes.

Computers in the Classroom

The rationale for using computers in the classroom is based on increasing dependence on the creation, use, and communication of information for economic and social well-being. As a result, computing is being recognized as the fourth basic skill, along with reading, writing and arithmetic (National Science Foundation 1979). Ensuring that all students have opportunities to develop computer literacy,

regardless of gender, race, or creed, will promote equal access to the many new careers in the information society.

Presently, computer literacy is more easily attained by affluent males. Equality of opportunity is a political rather, than an educational issue. However, equality of opportunity has been one of the principal goals of federal involvement in education (Ellis, 1984). Women are grossly underrepresented in the fields of math, science, and engineering. The U. S. is failing to utilize fully one of its most valuable resources for the future. With the current and predicted shortage in science- and math-related fields, such underutilization of women is disturbing. The greatest immediate potential pool of workers to fill the employment needs of the information society is women. It is suggested by Ellis (1984) that the public schools share the responsibility for ameliorating this inequity among women.

A look at a summary of the research on how girls lose interest shows that elementary school boys and girls generally like computers equally well (Beyers, 1984). In the sixth grade (and usually before), there are no sex differences in self-confidence about, attitude toward or perceived utility of computers (Lockheed, 1984).

The key difference between boys and girls crops up most noticeably in their voluntary use of the machines. Boys sign up for elective computer classes. They seek out and use computers outside of school more than girls do. They take extra courses and they "play" with the computer in their

spare time.

Around high school age, girls have less confidence than boys do in their ability to learn computer skills (Cole, 1983). There is little difference in achievement among teenage girls and boys who take required computer courses (Beyers, 1984). After one course, 52% of girls are interested in taking more word processing or business applications courses; 59 percent of boys want more programming courses (Miura, 1983). Elective programming courses in high school have a two-to-one ratio of boys to girls (National Assessment in Science, 1982). Among teenage girls, 7 percent use computers outside of class; 40 percent of boys do (Beyers, 1984). There are three times more boys than girls in summer computer camps (Hess, 1982).

There are several plausible explanations. More boys than girls are coming home to computers. (Parents seem more willing to spend money on computers for boys than for girls). Through ads, role models and sex-segregated school activities, society suggests to kids that the computer is a male machine. But, perhaps the most significant factor is the lack of appealing software for women (Brady, 1985).

In education an environment must be created in which any youngster--male or female--feels free to explore his or her interests without being influenced by stereo-typical notions of "girls' activities" and "boys' activities." These students need an equal opportunity--and similar enticements--to become involved with technology (Brady, 1985).

Moskowitz (1985) raises the concern that some of the anxiety expressed about female and minority access to

microcomputer technology may be based on current participation in high school programming courses, which themselves may become obsolete. The rapid move toward universal computer literacy could limit equity problems.

Educational computing cannot be considered without describing other probable impediments. The fear of educational computing is that after a great investment it will fail. That is a realistic concern. The success of educational computing depends on the extent of the acceptance by students, teachers, administrators, and parents. The barriers to the acceptance of educational computing in the schools are numerous. Students, perhaps, represent the least significant barrier to implementation. They are already very comfortable with computers in the form of video games. Preliminary research indicates that students can be motivated to learn using the computer.

Teachers and administrators are wary of educational innovation and are apprehensive about committing large amounts of time and funds to new goals and methodologies. Possibly the most significant barrier to implementation of any educational innovation is teacher resistance to change. However, if educators are to fulfill their responsibilities, they will not only have to adapt to requirements of the information society, but also assist all citizens in making the transition.

Much of teacher reluctance to get involved with computers can be traced to two factors: ignorance and fear. The fear of making a fool of oneself is a major obstacle in acceptance of computers in the classroom. Not wanting to appear like a

total fool may be a big consideration, but teacher ignorance of the enormous possibilities that computer use in education holds is the primary stumbling block to widespread use of the machines in the classroom. Gary (1985) feels that teacher ignorance concerning what software is available to help them in their own disciplines is probably another major reason more teachers aren't using microcomputers. Most teachers are simply unaware of the kinds of programs that they could be using in their classrooms.

Restricting computers to classes in computer literacy removes the skill from the application. That is similar to restricting reading just to reading class. The skill obtains relevance in its use in a realistic problem situation.

The computer is too costly to use to provide instruction that can be provided more effectively by a book or other methods, and the ease of writing drill and practice programs does not alone justify their use. A 1984 study by Fortner and Mayer detected no difference in attitudes toward the use of computers versus workbooks, but did find that students using computers exhibited a more stable attitude toward them over time. This suggests that such use provides students with a realistic attitude toward the value of computers in learning. The most important factor in determining the level of implementation of educational computing will likely be the degree of acceptance by teachers.

While some researchers have argued that computer and allied technologies are just the latest in a long line of educational fads of unfulfilled promise, there are indications

to the contrary. A substantial body of evidence now supports the effectiveness of computer assisted learning (CAL). Solid research shows that CAL improves students' attitudes and works as well as or better than traditional pedagogical methods in less time (Bracey, 1982), (Forman, 1982), (Kulik, 1983), and (Becker, 1986).

Schrock (1984) suggests the present mixed state of affairs is where computers are being both used and abused in the science classroom. The first error is the misuse of computers as a "gimmick." Secondly, the space for computers is taking the place of what once was the science laboratory space. Computers are bought on lab money and take up lab time. Indeed, Schrock believes there is sufficient experience indicating that computers inserted into the current curricula will not help students develop values drawn from reality, but will be an additional step in isolating students from real value-producing experiences! Schrock goes on to state, "Nevertheless, there are those who would move with great haste to convert our laboratories to textbook arcades."

Computers and Television

Gollan (1984) makes a case against the classroom computer by stating that computerized education relies mainly on stimulus-response learning, much like the controversial and discarded "teaching machine" developed for the schools after World War II by B. F. Skinner of behavior modification fame. Computer "input" by the student is limited to brief responses, registered by touching a keyboard. For formulation of written

essays by students, a task traditionally seen as a training of the thought process, does not exist in computer assisted instruction. Nor, to any appreciable extent, does reading.

But reading and formulated writing--the reproduction of thought and language in printed, symbolic form--allow what is only fractionally possible in other communication formats. The development of thought and the ability to reason are essential tools of liberty. No democratic society can afford an educational system without the objectives of thought and reason.

The human brain is the site of learning, thought, and reason. Most educators do agree that rapidly expanding knowledge of the brain can assist in the refinement of teaching techniques. The brain's activity is altered in dismaying ways by the mere act of viewing television. The place where intellectualization occurs in the brain has the greatest ramifications for education; the huge cerebrum, which is divided into left and right hemispheres, is the seat of language, and is the part of the brain that does elaborate intellectual processing. It is this part of the brain that educators are primarily concerned with in relation to academic learning or complex kind of intentional behavior. The development of language in the cerebrum may be viewed as learned sequences of action that result in the storing of huge numbers of programs in the brain. Learning in school can be defined as the acquisition of useful programs. Language alone requires many tens of thousands of programs to utter, or write, or type, or listen to syllables, words,

phrases, sentences. The most fundamental concern of education is the development of reasoning abilities, and reading and writing are essential to that process.

Reading cannot take place unless the student can perform the operations of observation, classification, seriation, and spatial relationships. Writing requires reasoning on a more advanced level, which becomes more formal as students prepare written presentations. But the behavior modification of the stimulus-response approach to education rejects the development of reason.

Gollan (1984) points out that many school districts install classroom television monitors simply because video appears a convenient way to provide instruction for large numbers of students. Gollan continues by stating that Dr. Anthony W. Bates, an education technologist with Great Britain's famed Open University and whose sole teaching method is televised lessons to students in their homes. The Open University, when it began operations, excited the imaginations of American education technologists, who saw it as a bold step into the future. And yet despite his deep involvement in televised education, Bates acknowledges that very little empirical work has been done to identify and validate the mental processes stimulated by the modes of representation and symbol systems generic to educational television.

Bates admits that not much is known of whether television, by its very nature, is capable of stimulating and developing the process of thought. He feels that much more evidence is required to determine whether or not certain

levels or elements of thinking are particularly stimulated or developed by the unique features of television communication.

Gollan writes of Merrelyn and Fred Emery from Australia who conducted a study involving the future of cable television in that country. During the course of their inquiry, they encountered two separate research projects which, based on studies of subjects' brain waves while viewing television, indicated that the brain's capacity for analytical processing had been interrupted. The Emerys reported that the data led to the left hemisphere of the frontal cortex (of the brain) and in particular the left angular gyrus, that area where all types of sensations are integrated to determine a common meaning.

Gollan (1984, p. 21) states that in assessing the activity of the brain, scientists can determine the presence of what is called a "phasic state," dominated by the activity of alpha waves--which as the Emerys point out, "are a sign not of a simple unideterminant function but of a complex pattern or micro- and macro-behaviors which center about the lack of attention or directed attention." Dominated by alpha waves, the phasic state does not permit "organized thought." In the researcher's point of view there is no relationship between television and computers.

Software Evaluation

Crovello (1982) points out that computer software should be evaluated by teachers, students, and administrators before

and after purchase, and that reliable evaluations are performed only in the educational context in which students will be using the computer.

Software evaluation is a multistage decision process. It is not a simple, one-step process that always can be done by one person, such as an educator. Yet the teacher of the course is the major evaluator because he/she is most familiar with the pedagogic goals. Students should be important software evaluators. The students rarely are included in the earliest stages, i.e. before a specific program is created or purchased. Computer software is not a success because educators like it. It is successful only if our students benefit from it.

The more common role of students as software evaluators is by actual use of the program, followed either by their own assessment or by the assessment of the program by others in terms of changes in their grasp of the subject matter. The student has the possibility of a dual role: as evaluator and as evaluatee (Crovello, 1982). Other potential evaluators include other teachers in the department as well as colleagues from other institutions who teach the same subject.

Software obviously should be evaluated before purchase. It is necessary to have both a short- and long-range perspective in the program evaluations. The most reliable evaluations are those performed in the educational context in which students will be using the computer.

The software sets the tone of the computer session. It

conveys the personality of the computer for that assignment. This occurs through a combination of many factors, including the program's interactive strategy; the psychological tone of the program as evidenced by its "user friendliness;" the content and phrasing of its replies to a user's incorrect or correct choices; and the program's use of color and graphics. The status of these and many other software traits determine whether it will have a positive educational effect, just as a teachers' personality and attitude toward students determines his or her effectiveness. The educational effect of software that teaches children to type by having them shoot at and kill letters, probably teaches more about killing than about typing. Sexual and racial discrimination in software is often more subtle. These aspects of software are morally degrading and teach youngsters false and terrible moral values.

In software evaluation, as in all serious educational work, judgment, and sensitivity are central because what is taught ultimately affects how people live and how they perceive the world. And the teacher is a key to the process of evaluation, and a key to determining the quality of what students will have an opportunity to learn (Kohl, 1984).

Summary

Very little quantitative research is available about teachers' attitudes and perception of students' attitudes and performance on computer software; therefore, the researcher chose to include some of the most interesting philosophical readings that were found.

CHAPTER III

METHODS AND PROCEDURES

The general goals of this study were to examine the perception of high school students and teachers toward the instructional use of computers in the classroom. In addition the study was to analyze student/teacher and male and female teachers' responses for congruence.

In selecting four computer programs for use in this study a total of nine current catalogues (six dated 1985 and three dated 1984-85) were surveyed. The selection by the researcher was based on (1) variety, such as one word clues, statement and questions, and games; (2) subject material: familiar and unfamiliar; (3) user friendliness; (4) length of material and testing time; (5) availability, time and price; (6) compatibility with available equipment; and (7) material designed for high schools.

The availability of equipment was checked by the researcher. Three TRS-80 Radio Shack Model IV computers were borrowed from the Computer Mathematics Department and moved to the Biology classroom. The fourth TRS-80 computer was obtained from the Chemistry Department. With the computers in the classroom four students were able to use the equipment at one time. When the students used certain

software, two students had to interacted together at the computer. The total data gathering process took place over a twelve day period.

The first program used was called DIET, which was written by Creative Computing in Morristown, New Jersey. Each student completed a list of all of the food and beverages that they had consumed on a typical day. In order to coordinate the foods with the list of the foods in the software, which is given in the instructions at the beginning, a printed copy of the 102 available foods and beverages were given to each student so that they were able to match up the foods they had consumed with the appropriate number which represented the food on the computer.

After the student completed the program of DIET, a print out was given to the student which stated that if you stayed on that diet, you will lose or gain so many pounds a week. At the completion of the program each student answered an evaluation sheet by placing the answers to each question on a computer card. These cards were read and tabulated. The time that each student spent on the computer was at least 10 to 15 minutes depending upon the previous experience of the student.

The second program called HEART was written by Dennis Kurtz of Educational Activities, Inc. This is a drill and practice piece of software with only one graphic showing the flow of the blood through the vessels and chambers of the heart. There are eight statements regarding the flow of

the blood with each statement on the screen less than a minute. When the student felt that the statements had been internalized, a quiz was given by the computer. Each student used this program for at least 15 minutes, but no longer than 20 minutes. Then they answered the evaluation sheet by placing their answers on a computer card.

The third program entitled RATS is from Creative Computing, also. It is a simulation game where there was a population of rats in either a city or an apartment house. The students controlled the conditions of growth and set the points at which the computer program printed the reports. The rat population was controlled by variables including garbage levels selected for the site, and the types and quantities of poison applied. At the conclusion of the simulation, the program printed details concerning the nature of the rat population, the dollar value of damage done by the rats, costs of the poison, and the amount of poison left uneaten. With 15 minutes on this program each student was able to manipulate the RATS a number of different ways to see just how the population was affected. After completion of this program, the student answered an evaluation form on a computer card.

The last program, WORMS, is a Focus Media, Inc., of the Tandy Corporation. The game is designed to aid the development of vocabulary, spelling, and work recognition skills of the students in Biology. The software distributor states that the game "offers students an exciting and educationally valuable

tool in using, learning, and associating subject area terminology."

In addition to the vocabulary building benefits of this word game other benefits were to result from the use of this game: these include (1) spelling--game players must spell words correctly to receive game points (2) patterning--game players must discover and identify patterns that emerge as clues and letters of keywords are exposed, and (3) abstract thinking--game players must use inductive and deductive reasoning skills to utilize clues that describe the keyword.

As stated by the manufacturer of WORMS, "INVERTEBRATE BIOLOGY KEYWORD can be employed for vocabulary review of course content drill, either as a means of engaging the interest of more advanced students or for remediation. Whether in the classroom setting or in the computer lab, INVERTEBRATE BIOLOGY KEYWORD will prove to be a stimulating, interactive means of utilizing your students' reasoning powers in reviewing, testing, or challenging their knowledge of specific areas of invertebrate biology."

Two students were allowed to play the game at one time in order to give each student more points to get the keyword before the other student could. Each pair of students was given between 15 to 20 minutes to work on this program. At the end each student took an examination to evaluate how much they learned and just what that student thought about WORMS. The students had no previous instructions on any of the above subjects included in any of the four software packages.

The late receipt of the Release Forms From the Parents caused a few students not to be able to participate in the programs since the computers were used for only a total of twelve days. Therefore, more students were involved in the first program (see Population Studied).

After viewing each of the four computer programs, the researcher wrote the questions to evaluate both the students and the teachers (see APPENDIX A and B). The STUDENTS' EVALUATION for each of the four programs had sixteen general questions or statements about the programs individually. The evaluation for DIET had eleven questions to test the students' knowledge after running the program. The HEART program had seven questions to test the students. The RATS program only had the sixteen general questions or statements. The RATS program did not lend itself to test questions as did the other three programs. Therefore, RATS was not used in the findings or performance. The WORMS program had a total of ten questions to test the students' knowledge.

The teachers each viewed two software programs and then responded to the teachers' perception of students' attitudes and teachers' perception of students' performance instruments (see APPENDIX A).

The data was collected on computer cards from both the teachers and the students. The total results of all four computer programs from the ten teachers were added and divided by four to gain the average responses from all of the programs. The same procedure was followed for the students' responses to gain an average by dividing the total responses by the total of students who used the programs.

Corresponding questions were asked of both the teachers and students. These answers were compared and analyzed to get the percentages of how each group responded to the particular question.

Population Studied

All of the teacher participants in the study are science teachers from Tulsa high schools. These ten teachers viewed two of the software programs and completed an evaluation of each one. Therefore, each program was evaluated five times by teachers. The individual teachers spent no less than 30 minutes and no more than 45 minutes at this task.

The student population was from the researcher's five classes, three were Basic Biology and two classes were Biology. The 10th grade counselor told the researcher that one criterion for Basic Biology was a ranking below the 30 percentile on the SRA (Science Research Associates).

The number of 10th grade students who took part in the study were as follows: DIET 86, HEART 81, RATE 80, WORMS 76. This variance was due to students dropping out of the class, absences of students, and students bringing in their signed Release Forms From the Parents late. At the time of this study there were 449 tenth grade students enrolled in the high school.

CHAPTER IV

RESULTS AND DISCUSSION

Teachers' Perception of Students' Attitudes Versus Student Attitudes*

Teacher Question 6. What percent of 10th graders do you think will enjoy this program? (A) 0 to 15% (B) 16% to 30% (C) 31% to 45% (D) 46% to 60% (E) 61% to 75% (F) 76% to 90% (G) 91% to 100%.

Student Question 6. Did you, as a student, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.

* See Teacher Questions 6, 7, 10, 15, and 17. Also, see Student Question 6, 10, 14, and 16.

TABLE I
COMPARISON OF TEACHER AND STUDENT
RESPONSES TO LEVEL OF
ENJOYMENT*

| ANSWERS | | ALL TEACHERS | | MALES | FEMALES |
|---------|---------|--------------|---|-------|---------|
| A. | 0-15% | 10% | 2 | 7% | 17% |
| B. | 16-30% | 5% | 1 | 7% | - |
| C. | 31-45% | 20% | 4 | 21% | 17% |
| D. | 46-60% | 10% | 2 | 7% | 17% |
| E. | 61-75% | 45% | 9 | 43% | 50% |
| F. | 76-90% | 10% | 2 | 14% | - |
| G. | 91-100% | - | 0 | - | - |

| STUDENTS' RESPONSES | | |
|---------------------|-----|------------|
| A. | 72% | Yes |
| B. | 12% | Maybe |
| C. | 3% | Don't know |
| D. | 11% | No |
| | 2% | Left blank |

TABLE II
STUDENTS' FREQUENCY RESPONSE TO QUESTION 6 BY PROGRAMS*

| | DIET | HEART | RATS | WORMS |
|--------|------|-------|------|-------|
| A | 75 | 53 | 58 | 47 |
| B | 5 | 10 | 13 | 11 |
| C | 2 | 6 | 1 | 3 |
| D | 4 | 11 | 8 | 11 |
| BLANK | - | 1 | - | 4 |
| TOTALS | 86 | 81 | 80 | 76 |

* Average of all four programs.

TABLE III
STUDENTS' RESPONSES IN PERCENTAGES
TO QUESTION 6 BY PROGRAMS*

| | DIET | HEART | RATS | WORMS |
|-------|------|-------|------|-------|
| A | 87% | 65% | 73% | 62% |
| B | 6% | 12% | 16% | 14% |
| C | 2% | 7% | - | 4% |
| D | 5% | 5% | 10% | 14% |
| BLANK | - | 1% | 1% | 6% |

A 1. Forty-five percent of the teachers thought that 61% to 75% of the students would enjoy the programs (Table I). In fact 72% of the students did enjoy the programs. Less than 50% of the teachers accurately predicted the exact proportion of students who indicated they did enjoy the program.

A 2. A majority of both male and female teachers were of the same opinion that 61% to 75% of the students would enjoy the programs. Two out of three female teachers felt that the students would not enjoy the programs. Fourteen percent of the male teachers versus none of the female teachers thought that 76% to 90% of the students would enjoy the programs.

* Average of all four programs.

TABLE IV
TEACHER RESPONSE TO QUESTION 6 BY PROGRAM*

| PROGRAM | MALE | FEMALE | RESPONSE |
|---------|------|--------|----------|
| DIET | - | - | A |
| | 1 | - | B |
| | 1 | - | C |
| | 1 | 1 | D |
| | 1 | - | E |
| | - | - | F |
| | - | - | G |
| HEART | - | - | A |
| | - | - | B |
| | 1 | - | C |
| | - | - | D |
| | 3 | 1 | E |
| | - | - | F |
| | - | - | G |
| RATS | - | - | A |
| | - | - | B |
| | 1 | - | C |
| | - | - | D |
| | 1 | 2 | E |
| | 1 | - | F |
| - | - | G | |
| WORMS | 1 | 1 | A |
| | - | - | B |
| | - | 1 | C |
| | - | - | D |
| | 1 | - | E |
| | 1 | - | F |
| | - | - | G |

* See Teacher Question 6 for the responses A through G in APPENDIX A.

Teacher Question 7. Do you think that 10th graders will want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.

Student Question 7. Would you want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.

TABLE V
COMPARING TEACHER QUESTION 7 WITH
STUDENT QUESTION 7*

| ANSWERS | STUDENTS | TEACHERS | | |
|---------------|----------|--------------|------|--------|
| | | ALL TEACHERS | MALE | FEMALE |
| A. Yes | 45% | 30% | 29% | 33% |
| B. Maybe | 29% | 25% | 21% | 33% |
| C. Don't know | 9% | 35% | 43% | 17% |
| D. No | 15% | 10% | 7% | 17% |
| Left blank | 2% | - | - | - |

A 1. Thirty percent of all teachers believed the students would want to share the information with a friend, versus 45% of the students who answered yes they want to share this information with a friend.

A 2. By the same percentages as in Question 6 (17% versus 7%), female teachers perceived the students attitudes towards the programs to be more negative than did the male teachers.

* Averages of all four programs.

Teacher Question 10. What grade level is this material appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.

Student Question 10. What grade level is this material appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.

TABLE VI
COMPARING TEACHER QUESTION 10 WITH
STUDENT QUESTION 10*

| ANSWERS | STUDENTS | ALL TEACHERS | TEACHERS | |
|-----------------|----------|-----------------|----------|--------|
| | | | MALE | FEMALE |
| A. 4th-5th | 7% | - | - | - |
| B. 6th-7th | 14% | 10% | 14% | - |
| C. 8th-9th | 21% | 15% | 21% | - |
| D. 10th-11th | 55% | 70% | 57% | 100% |
| E. 12th or more | 3% | 5% | 7% | - |

A 1. Forty-two percent of the students thought the material was appropriate for grades 4th through 9th (includes 3 different categories). Seventy percent of the teachers thought that the students would think that the material was appropriate for the 10th and 11th grades. Fifty-five percent of the students chose the grade level of 10th and 11th. This is the greatest percentage of students in any one category.

* Averages of all four programs.

The largest percentage of teachers selected the same grade level as the largest percentage of students.

A 2. One hundred percent of the female teachers picked the grade level that the highest percentage of the students picked. Fifty-seven percent of the male teachers were in agreement with the highest percentage pick of the students choice of 10th and 11th grades. Thirty-five percent of the male teachers thought students would pick grades lower than the 10th.

Teacher Question 15. The students believe that this material is directed to the students of the highest scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

Student Question 14. The material is directed to the students of the high scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

TABLE VII
COMPARING TEACHER QUESTION 15 WITH
STUDENT QUESTION 14*

| ANSWERS | STUDENT | ALL TEACHERS | TEACHERS | |
|----------------------|---------|-----------------|----------|--------|
| | | | MALE | FEMALE |
| A. Strongly agree | 16% | 20% | 21% | 17% |
| B. Agree | 35% | 25% | 29% | 17% |
| C. Neutral | 28% | 25% | 29% | 17% |
| D. Disagree | 17% | 25% | 21% | 33% |
| E. Strongly disagree | - | 5% | - | 17% |

* Averages of all four programs.

A 1. Forty-five percent of the teachers believe the students think that the programs are for the highest scholastic level and 51% of the students agree. This included A and B (strongly agree and agree).

A 2. Fifty percent of the female teachers thought the students would think it is not for the highest scholastic level with 21% of the male teachers agreeing, and 17% of the students who felt the material was not directed to the students of the highest scholastic level. Fifty percent of the male teachers felt the students would think the programs were directed to the students of the highest scholastic level. Fifty-one percent of the students gave this response and only 34% of the female teachers responded that way.

Teacher Question 17. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

Student Question 16. As a student, I find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

TABLE VIII
 COMPARING TEACHER QUESTION 17 WITH
 STUDENT QUESTION 16*

| ANSWERS | STUDENT | ALL TEACHERS | TEACHERS | |
|----------------------|---------|-----------------|----------|--------|
| | | | MALE | FEMALE |
| A. Strongly agree | 28% | 5% | - | 17% |
| B. Agree | 38% | 55% | 64% | 34% |
| C. Neutral | 21% | 10% | 7% | 17% |
| D. Disagree | 9% | 10% | 7% | 17% |
| E. Strongly disagree | 5% | 20% | 21% | 17% |

A 1. Sixty percent of the teachers thought that the students would find the programs exciting versus 66% of the students who found them exciting. The highest percentage of teachers selected the categories that the highest percentage of students did.

A 2. Seventeen percent of the female teachers felt that the students would strongly agree that the programs were exciting and no male teachers were of the same opinion. However, 51% of the female teachers versus 64% of the male teachers felt that the students would find the programs exciting. Fifty percent of the female teachers versus 35% of the male teachers picked categories C, D, and E. It is interesting to note that the male teachers' response in these categories (35%) was identical to the students' response (35%) versus the female teachers' response of 51%.

* Averages of all four programs.

Teachers' Perception of Students'
Performance Versus Actual
Students' Performance*

Teacher Question 11. I think the male student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

Teacher Question 12. I think the female student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

Student Question 11. There was enough material for me. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

TABLE IX

COMPARING TEACHER QUESTION 11 WITH
STUDENT QUESTION 11**

| ANSWERS | MALE STUDENT | ALL TEACHERS | TEACHERS | |
|----------------------|-----------------|-----------------|----------|--------|
| | | | MALE | FEMALE |
| A. Strongly agree | 20% | 5% | 7% | - |
| B. Agree | 43% | 25% | 21% | 33% |
| C. Neutral | 23% | 50% | 57% | 33% |
| D. Disagree | 8% | 20% | 14% | 33% |
| E. Strongly disagree | 6% | - | - | - |

* This section includes Teacher Questions 11, 12, 13, and 14. Also Student Questions 11, 12, and 13.

** Averages of all four programs.

TABLE X
 COMPARING TEACHER QUESTION 12 WITH
 STUDENT QUESTION 11*

| ANSWERS | FEMALE STUDENT | TEACHERS | TEACHERS | |
|----------------------|-------------------|----------|----------|--------|
| | | | MALE | FEMALE |
| A. Strongly agree | 32% | 5% | 17% | - |
| B. Agree | 36% | 25% | 21% | 33% |
| C. Neutral | 16% | 45% | 50% | 33% |
| D. Disagree | 13% | 25% | 21% | 33% |
| E. Strongly disagree | 3% | - | - | - |

A 1. Thirty percent of all teachers felt the students would think the visual material was adequate versus 63% of the male students and 68% of the female students who felt there was enough visual material. Twenty percent of all teachers felt that the male students would disagree versus 14% of the male students who felt accordingly. Twenty-five percent of all teachers felt the female students would think the visual material was inadequate versus 16% of the female students who felt that it was inadequate.

A 2. Twenty-eight percent of the male teachers and 33% of the female teachers thought that there was enough visual material for the male students versus 63% of the male students who felt that it was adequate. Thirty-eight percent of the male teachers and 33% of the female teachers thought there was enough visual material for the female students versus 68% of the female students who felt that way.

* Averages of all four programs.

Teacher Question 13. I believe the student will find it easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

Student Question 12. It was easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

TABLE XI
COMPARING TEACHER QUESTION 13 WITH
STUDENT QUESTION 10*

| ANSWERS | STUDENT | ALL TEACHERS | TEACHERS | |
|----------------------|---------|-----------------|----------|--------|
| | | | MALE | FEMALE |
| A. Strongly agree | 42% | 40% | 57% | - |
| B. Agree | 37% | 50% | 36% | 50% |
| C. Neutral | 10% | 5% | - | 50% |
| D. Disagree | 10% | 5% | 7% | - |
| E. Strongly disagree | 1% | - | - | - |

A 1. Forty percent of all teachers thought that the students would strongly agree that the program was easy to start and in fact 42% of the students did choose A.

A 2. Ninety-three percent of the male teachers and 50% of the female teachers thought the students would chose either A or B versus 79% of the students who chose A or B.

* Averages of all four programs.

Teacher Question 14. I believe the student will find that the feedback was adequate when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

Student Question 13. There was enough feedback when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

TABLE XII
COMPARING TEACHER QUESTION 14 WITH
STUDENT QUESTION 13*

| ANSWERS | STUDENT | ALL TEACHERS | TEACHERS | |
|----------------------|---------|-----------------|----------|--------|
| | | | MALE | FEMALE |
| A. Strongly agree | 26% | 20% | 28% | - |
| B. Agree | 34% | 45% | 36% | 67% |
| C. Neutral | 21% | 30% | 28% | 33% |
| D. Disagree | 10% | 5% | 7% | - |
| E. Strongly disagree | 9% | - | - | - |

A 1. Sixty-five percent of all teachers thought the students would feel that the feedback was adequate, versus 60% of the students that did feel that way.

A 2. Twenty-eight of the male teachers and 0% of the female teachers strongly agreed that the students would pick A, versus 26% of the students who strongly agreed.

* Averages of all four programs.

Teachers' Evaluation's on DIET,
HEART and WORMS

The Teachers' Evaluations on DIET, HEART, and WORMS (See Appendix A) asked the foregoing question. "What percent of the 10th graders do you believe will get the question correct?"

- | | |
|---------------|----------------|
| A. 0 to 15% | E. 61% to 75% |
| B. 16% to 30% | F. 76% to 90% |
| C. 31% to 45% | G. 90% to 100% |
| D. 46% to 60% | |

TABLE XIII
TEACHERS' PERCEPTION OF STUDENTS'
TEST RESULTS

| PROGRAM | SEX OF TEACHER | % OF TOTAL TEACHERS | % OF TIMES TEACHERS PERCEPTION WAS CORRECT | % OF TIMES ALL TEACHERS WERE CORRECT |
|---------|-------------------|---------------------------|---|--|
| DIET | 4 Males | 80% | 34% | |
| | 1 Female | 20% | 27% | 33% |
| HEART | 4 Males | 80% | 7% | |
| | 1 Female | 20% | 14% | 9% |
| WORMS | 3 Males | 60% | 3% | |
| | 2 Females | 40% | 20% | 10% |

TABLE XIV
AVERAGE OF THREE PROGRAMS

| TEACHERS | % OF TIMES PERCEPTION WAS CORRECT |
|-------------------|--------------------------------------|
| Males (7) | 18% |
| Females (3) | 21% |
| ALL TEACHERS (10) | 19% |

A 1. Teachers correctly predicted the percent of students who would answer each test item correctly 19% of the time.

A 2. The male teachers were correct only 18% of the time while the female teachers were correct 21% of the time.

On an average 69% (not grade average) of the students answered all of the content questions on DIET correctly, 40% of the students answered all of the content questions on HEART correctly, and 28% of the students answered all of the content questions on WORMS correctly.

Teacher Attitude Toward Computers*

Teacher Question 8. Would you use this program if you were teaching Biology? (A) yes (B) maybe (C) don't know (D) no.

TABLE XV
TEACHERS WHO WOULD USE THE PROGRAMS
IN BIOLOGY**

| ANSWER | ALL TEACHERS | MALES | FEMALES |
|---------------|-----------------|-------|---------|
| A. Yes | 60% | 57% | 67% |
| B. Maybe | 30% | 36% | 17% |
| C. Don't know | - | - | - |
| D. No | 10% | 7% | 17% |

A 1. Sixty percent of all teachers would use the programs if he or she were teaching Biology. Ten percent of all teachers would not use the programs.

A 2. Fifty-seven percent of the male teachers would use the programs; 67% of the female teachers would use the programs. Seven percent of the male teachers and 17% of the female teachers would not use the programs.

* Includes Teacher Questions 8, 9, and 16; and Student Question 15).

** Averages of all four programs.

Teacher Question 9. Did you, as a teacher, enjoy the program?
 (A) yes (B) maybe (C) don't know (D) no.

TABLE XVI
 TEACHERS WHO ENJOYED THE PROGRAMS*

| ANSWER | ALL TEACHERS | MALES | FEMALES |
|---------------|-----------------|-------|---------|
| A. Yes | 70% | 64% | 83% |
| B. Maybe | 20% | 29% | - |
| C. Don't know | - | - | - |
| D. No | 10% | 7% | 17% |

A 1. Seventy percent of all of the teachers enjoyed the programs. Ten percent of all of the teachers did not enjoy the programs.

A 2. Eighty-three of the female teachers enjoyed the programs versus 64% of the male teachers who enjoyed the programs.

Teachers Question 16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

* Averages of all four programs.

TABLE XVII
 MATERIAL TAUGHT FROM A BOOK, A LECTURE,
 OR A DISCOVERY LESSON*

| ANSWERS | ALL TEACHERS | MALES | FEMALES |
|----------------------|-----------------|-------|---------|
| A. Strongly agree | 10% | 7% | 17% |
| B. Agree | 10% | 14% | - |
| C. Neutral | 40% | 43% | 33% |
| D. Disagree | 30% | 36% | 17% |
| E. Strongly disagree | 10% | - | 33% |

A 2. Twenty percent of the teachers thought that this material would be better taught from a book, a lecture, or a discovery lesson. Seventeen percent of the female teachers strongly agreed it would. No male teachers strongly disagreed that the material would be better taught from a book, a lecture, or a discovery lesson versus 33% of the female teachers, who strongly felt the material would be better taught using the computer software programs. Thirty-six percent of the male teachers favored the use of the computer software programs versus 50% of the female teachers.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

In general the teachers underestimated the students' responses to the questions concerning their enjoyment (Q-6), excitement (TQ-17 and SQ-16), willingness to share the information with a friend (Q-7). The male teachers were more attuned to the students and had a clearer perception of the students attitudes than the female teachers. The majority of the teachers were correct in the perception of the students' attitudes concerning the appropriate grade level (Q-10) and scholastic level (TQ-15 and SQ-14) for the material with both favoring the tenth and eleventh grades and the high scholastic level fo the material. Less than half of the students felt that the material was appropriate for the fourth through the nineth grades.

The female teachers' perception of the students' choice of grade level was more accurate than that of the male teachers. The male teachers were more in agreement with the students as to scholastic level while the female teachers believed the material was easier than what the students perceived it to be. The female teachers, more than male teachers, responded that the students would feel that the material

was for the lower scholastic levels. This possibly explains the female teachers' disparity with other student attitude questions. The pattern of lower percentages of the female teachers' perception could indicate a divergence of opinion of what constitutes a good learning atmosphere.

The teachers did not perceive that the students would feel that there was adequate visual material (SQ-11), while more than twice as many students than teachers on a percentage basis, felt the visual material was adequate. The teachers were accurate in their perception of the students' attitudes concerning the ease with which to begin the program (SQ-12) and with the feedback question (SQ-13).

The teachers showed a number of differences in their compared perception of the students' performance. As a group the teachers positively overestimated the students' test results. The male teachers' perception of the students' performance was more optimistic than the female teachers, but both were high. The students test scores were very low.

With such a dramatic difference between the expected performance and the actual performance, it must be concluded that the teachers overestimated the knowledge of the students (as stated in Chapter II, Methods and Procedure there had been no prior instruction on any of the subjects), or underestimated the difficulty of the test. Actually, the students could have suffered from both. However, a majority of the teachers in the study found the programs enjoyable and would use the programs as instructional aids in Biology. By a margin of two to one the teachers believed the material was

better taught using the computer programs than using a book, a lecture, or a discovery lesson.

The researcher feels that the teachers' negative perception may cause them to place a low value on the computer as a teaching aid, while a media that gains the students' enthusiasm and generates an enjoyable and exciting learning environment is of great potential value particularly in this time of short attention span, high-tech, visually enhanced information gathering.

The female teachers had a decidedly more favorable opinion and a higher level of acceptance of the programs and their use than the male teachers. This is interesting because in the areas concerning students' attitudes, the female teachers displayed a more negative perception.

On the last objective of assessing the students' attitudes and achievement level, a great majority of the students did enjoy the programs; about half of them wanted to share the information with a friend; over half of the students felt that the material was appropriate for 10th and 11th grades; half of the students strongly agreed or agreed that the material was directed to the students of the highest scholastic level, about two-thirds of the students found the programs "exciting;" well over half of the students believed there was enough visual material; over three-quarters of the students thought that the program was easy to start; well over half of the students thought that the feedback was adequate; and most of the students did very poorly on the test.

CONCLUSIONS

Teachers were unable to accurately predict the attitudes and performance levels of the students on four computer programs in Biology. Teachers though aware of the limitations of the students in the subject group were unable to translate that awareness into realistic appraisals or expectations.

From the researcher's observations and data, the programs had too much cognitive memory learning with sophisticated vocabulary words. Many of the students became frustrated when they were unable to recognize unfamiliar terms. Some gave up by leaving the questions blank. A large number of students complained about the vocabulary and wanted to know what to study so that they could be prepared for the software programs.

RECOMMENDATIONS

Obviously from the research observed, the use of computer software has the potential to create an excellent learning environment. This opportunity of such an environment where the students enthusiastically wish to participate and learn should not be ignored. However, all of the programs studied here could not be used to impart information without modifications. For example, the manufacturer of the WORMS program stated in its recommendations that the software was for both junior high and high schools. It is the opinion of the researcher that the junior high school level should not be considered in using that particular program due to the

difficulty of the vocabulary.

Since the teachers were unable to perceive the attitudes and performance levels of the students, more studies are needed to ascertain more realistic benefits that both the students and teachers might gain from the use of software for computers and to determine the appropriate software to be used in the Biology classes. These studies should be conducted within the classroom with students and teachers.

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APPENDIX A

TEACHERS' EVALUATION ON DIET

DIRECTIONS: Please answer the following questions and statements by marking the appropriate letter on the computer card.

1. My age range is (A) 21 to 30 (B) 31 to 40 (C) 41 to 50 (D) 51 to 60.
2. I am a (A) male (B) female.
3. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
6. What percent of 10th graders do you think will enjoy this program? (A) 0 to 15% (B) 16% to 30% (C) 31% to 45% (D) 46% to 60% (E) 61% to 75% (F) 76% to 90% (G) 91% to 100%.
7. Do you think that 10th graders will want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no,
8. Would you use this program if you were teaching Biology? (A) yes (B) maybe (C) don't know (D) no.
9. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level do you think the students will think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. I think the male student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. I think the female student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
13. I believe the student will find it easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

14. I believe the student will find that the feedback was adequate when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
15. The students believe that this material is directed to the students of the highest scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
17. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

DIRECTIONS: Please answer the question "What percent of the 10th graders you believe will get the question correct?" by using the following:

- | | |
|---------------|----------------|
| A. 0 to 15% | E. 61% to 75% |
| B. 16% to 30% | F. 76% to 90% |
| C. 31% to 45% | G. 90% to 100% |
| D. 46% to 60% | |

18. Your body needs energy from food for (A) activities (B) repairs (C) growth (D) all of the above. _____%
19. Too many calories from food (A) add water to your body (B) add fat to your body (C) help you lose weight (D) help you to stay the same weight. _____%
20. Protein is found in all of the following foods except (A) fish (B) chicken (C) ham (D) tomatoes. _____%
21. Lipids mean fats and oils. These are very concentrated sources of energy and should probably (A) be avoided by dieters (B) be eaten in large amounts by dieters (C) make no difference to the dieter (D) help the dieter lose weight. _____%
22. The main food source of energy is (A) fats (B) carbohydrates (C) proteins (D) all of the above. _____%
23. All of the following foods are examples of fats except (A) butter (B) margarine (C) skimmed milk (D) whipped cream. _____%
24. Sugar and starch are examples of (A) proteins (B) fats (C) carbohydrates (D) vitamins and minerals. _____%

25. When figuring the number of calories a person needs daily, the following must be taken into account (A) age (B) amount of exercise a person does (C) sex (male or female) (D) all of the above. _____%
26. A person who has a job of sitting for 8 hours per day needs more calories than a person who works at heavy labor. (A) strongly agree (B) strongly disagree. _____%
27. All food and drink must be taken into account when figuring how many calories a person consumes in one day. (A) strongly agree (B) strongly disagree. _____%
28. A person should select a large variety of foods in order to get the proper nutrients. (A) strongly agree (B) strongly disagree. _____%

TEACHERS' EVALUATION ON HEART

DIRECTIONS: Please answer the following questions and statements by marking the appropriate letter on the computer card.

1. My age range is (A) 21 to 30 (B) 31 to 40 (C) 41 to 50 (D) 51 to 60.
2. I am a (A) male (B) female.
3. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
6. What percent of 10th graders do you think will enjoy this program? (A) 0 to 15% (B) 16% to 30% (C) 31% to 45% (D) 46% to 60% (E) 61% to 75% (F) 76% to 90% (G) 91% to 100%.
7. Do you think that 10th graders will want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.
8. Would you use this program if you were teaching Biology? (A) yes (B) maybe (C) don't know (D) no.
9. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level do you think the students will think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. I think the male student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. I think the female student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
13. I believe the student will find it easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

14. I believe the student will find that the feedback was adequate when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
15. The students believe that this material is directed to the students of the highest scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
17. Students will find the program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

DIRECTIONS: Please answer the question "What percent of the 10th graders you believe will get the question correct?" by using the following:

- | | |
|---------------|----------------|
| A. 0 to 15% | E. 61% to 75% |
| B. 16% to 30% | F. 76% to 90% |
| C. 31% to 45% | G. 90% to 100% |
| D. 46% to 60% | |

18. Blood returns from the body through the vena cava to the (A) left atrium (B) right atrium (C) left ventricle (D) right ventricle. _____%
19. The arteries which carry the blood to the lungs are (A) the coronary arteries (B) aorta (C) pulmonary arteries (D) pulmonary veins. _____%
20. How many chambers are there in the human heart? (A) one (B) two (C) three (D) four. _____%
21. The receiving chambers are called (A) aorta (B) atria (C) ventricles (D) septum. _____%
22. From the left ventricle the oxygenated blood is pumped through the aorta to the (A) body (B) lungs (C) right atrium (D) left atrium. _____%
23. The blood from the body goes from the right atrium to (A) the left ventricle (B) the lungs (C) left atrium (D) right ventricle. _____%
24. The blood from the pulmonary vein returns to the heart by the (A) right atrium (B) right ventricle (C) left atrium (D) left ventricle. _____%

TEACHERS' EVALUATION ON RATS

DIRECTIONS: Please answer the following questions and statements by marking the appropriate letter on the computer card.

1. My age range is (A) 21 to 30 (B) 31 to 40 (C) 41 to 50 (D) 51 to 60.
2. I am a (A) male (B) female.
3. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
6. What percent of 10th graders do you think will enjoy this program? (A) 0 to 15% (B) 16% to 30% (C) 31% to 45% (D) 46% to 60% (E) 61% to 75% (F) 76% to 90% (G) 91% to 100%.
7. Do you think that 10th graders will want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.
8. Would you use this program if you were teaching Biology? (A) yes (B) maybe (C) don't know (D) no.
9. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level do you think the students will think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. I think the male student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. I think the female student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
13. I believe the student will find it easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

14. I believe the student will find that the feedback was adequate when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
15. The students believe that this material is directed to the students of the highest scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
17. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

TEACHERS' EVALUATION ON WORMS

DIRECTIONS: Please answer the following questions and statements by marking the appropriate letter on the computer card.

1. My age range is (A) 21 to 30 (B) 31 to 40 (C) 41 to 50 (D) 51 to 60.
2. I am a (A) male (B) female.
3. I have taught science from (A) 0 to 2 years (B) 3 to 5 years (C) 6 to 8 years (D) 9 to 11 years (E) over 12 years.
4. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
5. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
6. What percent of 10th graders do you think will enjoy this program? (A) 0 to 15% (B) 16% to 30% (C) 31% to 45% (D) 46% to 60% (E) 61% to 75% (F) 76% to 90% (G) 91% to 100%.
7. Do you think that 10th graders will want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.
8. Would you use this program if you were teaching Biology? (A) yes (B) maybe (C) don't know (D) no.
9. Did you, as a teacher, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level do you think the students will think this material is appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. I think the male student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. I think the female student believes there is enough visual material. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

13. I believe the student will find it easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
14. I believe the student will find that the feedback was adequate when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
15. The students believe that this material is directed to the students of the highest scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
17. Students will find this program "exciting." (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

DIRECTIONS: Please answer the question "What percent of the high school age student you believe will get this correct?" by using the following:

- | | |
|---------------|----------------|
| A. 0 to 15% | E. 61% to 75% |
| B. 16% to 30% | F. 76% to 90% |
| C. 31% to 45% | G. 90% to 100% |
| D. 46% to 60% | |

18. Setae are (A) the bristles on an earthworm (Annelid) used for moving the worm through the soil (B) the body sections of a tapeworm (C) a thick nonliving layer on the outside of certain worms which protect them from being digested (D) the area for temporarily storing food in an earthworm. _____%
19. Aortic arches are (A) involved in the worm's reproduction (B) used to suck in the soil containing food (C) large muscular tubes which keep the blood flowing in the earthworm (D) for reproduction in the earthworm. _____%
20. Eyespots are (A) light sensitive, pigmented receptors in a flatworm (B) in roundworms to enable them to see where they are going (C) found in tapeworms (D) found in earthworms. _____%
21. The crop is (A) a very muscular organ where food is ground up (B) where food is digested in the earthworm (C) a long tube where food particles and soil go through (D) a round organ that stores the food temporarily. _____%

22. The mesoderm is the (A) thick outer nonliving layer of a worm which is secreted by the epidermis (B) middle layer that makes up the tissue in flatworms (C) place where sperm are stored (D) tube where nitrogen is removed as waste material. _____%
23. The scolex is (A) the opening from the intestine in a roundworm where waste comes out (B) the head of a tapeworm which has hooks and suckers (C) a tube in a female fluke where eggs are stored (D) the ventral feed tube of a planaria. _____%
24. The proglottids are (A) sections of a parasite which look like ribbon and have the reproductive organs (B) the swollen segments used in the reproduction of earthworms (C) cysts which form in muscles of pigs (D) organisms with only ectoderm and no organs and no organ systems. _____%
25. A hermaphrodite is (A) where each individual animal has both the male and female reproductive organs in its body (B) where each animal is a male (C) where each animal is a female (D) where each animal is neither a male nor a female. _____%
26. A leech is (A) a parasite which has part of its life cycle in the liver of a sheep (B) a parasite or blood sucker whose salivary glands secrete a substance that prevents blood from clotting while it feeds (C) a worm that enters the body by boring through the skin of the feet (D) one of the most dangerous parasitic worms that spends the first part of its life as a cyst in the muscles of pigs, dogs, cats or rats. _____%
27. The gizzard is (A) an organ in humans which helps to break down food (B) a round organ that stores the food temporarily (C) a very muscular organ where food is ground up (D) a long tube where food particles and soil go through. _____%

APPENDIXES

STUDENT'S EVALUATION ON DIET

DIRECTIONS: Please answer the following questions by marking the appropriate letter on the computer card.

1. The computer software that I am working with is on
(A) RATS (B) DIET (C) HEART (D) WORMS.
2. My grade level is (A) 10th (B) 11th (C) 12th.
3. My hour for Biology is (A) 1st (B) 2nd (C) 3rd (D) 5th
(E) 6th.
4. I am a (A) male (B) female.
5. My previous experience on a computer is (A) 0 to 20
hours (B) 21 to 40 hours (C) 41 to 60 hours (E) over
81 hours.
6. Did you, as a student, enjoy the program? (A) yes
(B) maybe (C) don't know (D) no.
7. Would you want to share this information with a friend?
(A) yes (B) maybe (C) don't know (D) no.
8. Do you think a teacher of Biology would use this pro-
gram? (A) yes (B) maybe (C) don't know (D) no.
9. Do you think science teachers would enjoy the program?
(A) yes (B) maybe (C) don't know (D) no.
10. What grade level is this material appropriate for?
(A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th
and 11th (E) 12th or more.
11. There was enough visual material for me. (A) strongly
agree (B) agree (C) neutral (D) disagree (E) strongly
disagree.
12. It was easy to begin the program. (A) strongly agree
(B) agree (C) neutral (D) disagree (E) strongly disagree.
13. There was enough feedback when a mistake was made.
(A) strongly agree (B) agree (C) neutral (D) disagree
(E) strongly agree.
14. The material is directed to the students of the high
scholastic level. (A) strongly agree (B) agree (C) neu-
tral (D) disagree (E) strongly disagree.
15. This material would be better taught from a book, lecture
or discovery. (A) strongly agree (B) agree (C) neutral

- (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
 17. Your body needs energy from food for (A) activities (B) repairs (C) growth (D) all of the above.
 18. Too many calories from food (A) add water to your body (B) add fat to your body (C) help you lose weight (D) help you to stay the same weight.
 19. Protein is found in all of the following foods except (A) fish (B) chicken (C) ham (D) tomatoes.
 20. Lipids mean fats and oils. These are very concentrated sources of energy and should probably (A) be avoided by dieters (B) be eaten in large amounts by dieters (C) make no difference to the dieter (A) help the dieter lose weight.
 21. The main food source of energy is (A) fats (B) carbohydrates (C) proteins (D) all of the above..
 22. All of the following foods are examples of fats except (A) butter (B) margarine (C) skimmed milk (D) whipped cream.
 23. Sugar and starch are examples of (A) proteins (B) fats (C) carbohydrates (D) vitamins and minerals.
 24. When figuring the number of calories a person needs daily, the following must be taken into account (A) age (B) amount of exercise a person does (C) sex (male or female) (D) all of the above.
 25. A person who has a job of sitting for 8 hours per day needs more calories than a person who works at heavy labor. (A) strongly agree (B) strongly disagree.
 26. All food and drink must be taken into account when figuring how many calories a person consumes in one day. (A) strongly agree (B) strongly disagree.
 27. A person should select a large variety of foods in order to get the proper nutrients. (A) strongly agree (B) strongly disagree.

STUDENTS' EVALUATION ON HEART

DIRECTIONS: Please answer the following questions by marking the appropriate letter on the computer card.

1. The computer software that I am working with is on (A) RATS (B) DIET (C) HEART (D) WORMS.
2. My grade level is (A) 10th (B) 11th (C) 12th.
3. My hour for Biology is (A) 1st (B) 2nd (C) 3rd (D) 5th (E) 6th.
4. I am a (A) male (B) female.
5. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
6. Did you, as a student, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
7. Would you want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.
8. Do you think a teacher of Biology would use this program? (A) yes (B) maybe (C) don't know (D) no.
9. Do you think science teachers would enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level is this material appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. There was enough visual material for me. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. It was easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
13. There was enough feedback when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
14. The material is directed to the students of the high scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

15. This material would be better taught from a book, lecture or discovery. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
17. blood returns from the body through the vena cava to the (A) left atrium (B) right atrium (C) left ventricle (D) right ventricle.
18. The arteries which carry the blood to the lungs are (A) the coronary arteries (B) aorta (C) pulmonary arteries (D) pulmonary veins.
19. How many chambers are there in the human heart? (A) one (B) two (C) three (D) four.
20. The receiving chambers are called (A) aorta (B) atria (C) ventricles (D) septum.
21. From the left ventricle the oxygenated blood is pumped through the aorta to the (A) body (B) lungs (C) right atrium (D) left atrium.
22. The blood from the body goes from the right atrium to (A) the left ventricle (B) the lungs (C) left atrium (D) right ventricle.
23. The blood from the pulmonary vein returns to the heart by the (A) right atrium (B) right ventricle (C) left atrium (D) left ventricle.

STUDENTS' EVALUATION ON RATS

DIRECTIONS: Please answer the following questions by marking the appropriate letter of the computer card.

1. The computer software that I am working with is on (A) RATS (B) DIET (C) HEART (D) WORMS.
2. My grade level is (A) 10th grade (B) 11th grade (C) 12th grade.
3. My hour for Biology is (A) 1st (B) 2nd (C) 3rd (D) 5th (E) 6th.
4. I am a (A) male (B) female.
5. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
6. Did you, as a student, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
7. Would you want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.
8. Do you think a teacher of Biology would use this program? (A) yes (B) maybe (C) don't know (D) no.
9. Do you think science teachers would enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level is this material appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. There was enough visual material for me. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. It was easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
13. There was enough feedback when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
14. The material is directed to the students of the high scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

15. This material would be better taught from a book, lecture or discovery. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

STUDENTS' EVALUATION ON WORMS

DIRECTIONS: Please answer the following questions by marking the appropriate letter on the computer card.

1. The computer software that I am working with is on (A) RATS (B) DIET (C) HEART (D) WORMS.
2. My grade level is (A) 10th grade (B) 11th grade (C) 12th grade.
3. My hour for Biology is (A) 1st (B) 2nd (C) 3rd (D) 5th (E) 6th.
4. I am a (A) male (B) female.
5. My previous experience on a computer is (A) 0 to 20 hours (B) 21 to 40 hours (C) 41 to 60 hours (D) 61 to 80 hours (E) over 81 hours.
6. Did you, as a student, enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
7. Would you want to share this information with a friend? (A) yes (B) maybe (C) don't know (D) no.
8. Do you think a teacher of Biology would use this program? (A) yes (B) maybe (C) don't know (D) no.
9. Do you think science teachers would enjoy the program? (A) yes (B) maybe (C) don't know (D) no.
10. What grade level is this material appropriate for? (A) 4th and 5th (B) 6th and 7th (C) 8th and 9th (D) 10th and 11th (E) 12th or more.
11. There was enough visual material for me. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
12. It was easy to begin the program. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
13. There was enough feedback when a mistake was made. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strgonly disagree.
14. The material is directed to the students of the high scholastic level. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.

15. This material would be better taught from a book, lecture or discovery. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
16. This material would be better taught from a book, a lecture, or a discovery lesson. (A) strongly agree (B) agree (C) neutral (D) disagree (E) strongly disagree.
17. Setae are (A) the bristles on an earthworm (Annelid) used for moving the worm through the soil (B) the body sections of a tapeworm (C) a thick nonliving layer on the outside of certain worms which protect them from being digested (D) the area for temporarily storing food in an earthworm.
18. Aortic arches are (A) involved in the worm's reproduction (B) used to such in the soil containing food (C) large muscular tubes which keep the blood flowing in the earthworm (D) for reproduction in the earthworm.
19. Eyespots are (A) light sensitive, pigmented receptors in a flatworm (B) in roundworms to enable them to see where they are going (C) found in tapeworms (D) found in earthworms.
20. The crop is (A) a very muscular organ where food is ground up (B) where food is digested in the earthworm (C) a long tube where food particles and soil go (D) a round organ that stores the food temporarily.
21. The mesoderm is the (A) thick outer nonliving layer of a worm which is secreted by the epidermis (B) middle layer that makes up the tissue in flatworms (C) place where sperm are stored (D) tube where nitrogen is removed as waste material.
22. The scolex is (A) the opening from the intestine in a roundworm where waste comes out (B) the head of a tapeworm which has hooks and suckers (C) a tube in a female fluke where eggs are stored (D) the ventral feed tube of a planaria.
23. The proglottids are (A) sections of a parasite which look like ribbon and have the reproductive organs (B) the swollen segments used in the reproduction of earthworms (C) cysts which form in muscles of pigs (D) organisms with only ectoderm and no organs and no organ systems.
24. A hermaphrodite is (A) an individual animal having both male and female reproductive organs in its body (B) each animal is a male (C) each animal is a female (D) each animal is neither male nor female.

25. A leech is (A) a parasite which has part of its life cycle in the liver of a sheep (B) a parasite or blood sucker whose salivary glands secrete a substance that prevents blood from clotting while it feeds (C) a worm that enters the body by boring through the skin of the feet (D) one of the most dangerous parasitic worms that spends the first part of its life as a cyst in the muscles of pigs, dogs, cats or rats.
26. The gizzard is (A) an organ in humans which helps to break down food (B) a round organ that stores the food temporarily (C) a very muscular organ where food is ground up (D) a long tube where food particles and soil go through.

2
VITA

Patty McKinney Coleman
Candidate for the Degree of
Master of Science

Thesis: TEACHERS' PRECEPTION OF STUDENTS' ATTITUDES AND
PERFORMANCE ON COMPUTER SOFTWARE PROGRAMS IN
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1936, the daughter of Kermit and Gladys McKinney;
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Education: Graduated from Bixby High School, Bixby,
Oklahoma, in May, 1954; received Bachelor of
Science degree in Home Economics Education and
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sity in January, 1959; completed requirements
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Professional Experience: Teacher of Social Studies
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