THE UNIVERSITY OF MANITOBA

A STUDY OF THE EFFECT OF PROJECT REPORTING TECHNIQUE AND COMMUNICATION MEDIA EXPOSURE UPON THE VALUE ORIENTATIONS AND BIOLOGY INTERESTS OF HIGH SCHOOL BIOLOGY STUDENTS

by

JAMES A. FIELDING

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A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

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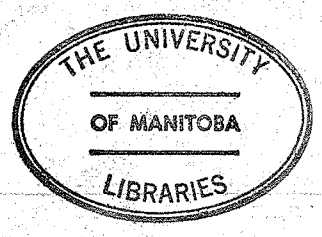

ABSTRACT

A STUDY OF THE EFFECT OF PROJECT REPORTING TECHNIQUE AND COMMUNICATION MEDIA EXPOSURE UPON THE VALUE ORIENTATIONS AND BIOLOGY INTERESTS OF HIGH SCHOOL BIOLOGY STUDENTS

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Several authors who have observed the attitude of contemporary students have claimed that theoretically-oriented high school science courses are responsible for the lack of student interest and enthusiasm in these courses. They recommended that educators could rekindle positive attitudes and interest by stressing the humanistic applications of science which are most valued by students.

This study measured and compared the value orientations and biology interests of students who made audio-visual presentation reports of independent study projects with those who made written reports. It further determined the effect of varying levels of mass communication media exposure upon students' value orientations and biology interests. A determination of differential effects of combinations of project reporting technique and communication media exposure level was performed. Finally, the separate value orientations of male and female biology students were compared.

A Reading-Television Survey instrument consisting of fifty items designed to measure the students' exposure to biology-related

television programs and reading materials was constructed and administered to students participating in the study. The results were used to identify students who demonstrated high and low exposure levels of television viewing and reading of biology-related topics.

One hundred and twelve students from Sisler High School in the Winnipeg School Division participated in a two-month independent study project in biology. At the completion of the project, reports were made by one group with an audio-visual presentation technique and by the other group with a written report.

A Value Orientation Survey instrument consisting of twenty-six sets of alternative statements was developed and administered to measure the students' preference for the humanistic, technological, and theoretical aspects of biological phenomena or facts. A Student Interest Survey instrument consisting of fifty biology-related topics was developed and administered to measure the students' biology interests.

The differences in the means of scores obtained on the Value Orientation Survey instrument indicated that biology students prefer the humanistic aspects of biology to a significantly greater extent than either the theoretical or technological aspects. The theoretical aspects were also preferred to the technological aspects. Male biology students preferred the technological aspects to a significantly greater extent than did female students.

Project reporting technique and reading exposure were not

significant in their effect upon value orientations of biology students. Television exposure was not significant in producing an effect upon value orientations of students but did prove significant in producing an effect upon biology interests. Combinations of reporting technique and either television exposure or reading exposure were not differentially significant in producing an effect upon value orientations or biology interests of biology students.

DEDICATION

This study is dedicated to my wife, Sharon, whose understanding, encouragement, and assistance made possible its completion. It is dedicated also to Kelly and Scott, from whom my attention was all too frequently diverted. May their learning experiences in high school be interesting, meaningful, and applicable to their lives.

ACKNOWLEDGEMENTS

I would like to express my gratitude to the many students and teachers whose cooperation made this research possible. Most particularly, I would sincerely like to thank Dr. H. Grunau who gave so graciously of his time in providing understanding, kindly encouragement, and constructive advice in the development of this study.

My thanks also to members of the guidance committee, Mr. B. Klassen and Mr. J. Welsh for their assistance and advice.

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CHAPTER I

INTRODUCTION

I. THE PURPOSE OF THE STUDY

The purpose of this study was to compare the value orientations and biology interests of students who make audio-visual presentation reports of independent study projects with those who make written reports. Another purpose was to determine the effect of varying degrees of mass communication media exposure upon students' value orientations and biology interests. A third purpose was to determine whether project reporting technique differentially affected value orientations and biology interests according to communication media exposure level. A fourth purpose was to determine whether significant differences existed between the value orientations of biology students. A fifth purpose was to determine whether differences existed between the value orientations and biology interests of male and female students.

The biology instructor faces students with a wide diversity of backgrounds and interests including differences in mass communication media exposure and preference. Moreover, the instructor has a continuing responsibility to develop the teaching strategies which best suit the needs and characteristics of his students.

This study provides the biology instructor with some of the information required to make better decisions about some alternatives in approaches to teaching biology topics.

II. QUESTIONS AND OBJECTIVES

The following questions reflect the objectives of the study:

1. Do male and female students exhibit different biological value orientations and biology interests when measured by the Student Interest Survey and the Value Orientation Survey instruments?[1,2]
2. Does student participation in an audio-visual presentation of a biology project produce different results than participation in a written report when compared by value orientation and biology interest scores?
3. Do students with high television exposure achieve different results than students with low television exposure when compared by value orientation and biology interest scores regardless of project reporting technique?[3]
4. Do students with high reading exposure achieve different results than students with low reading exposure when compared by value orientation and biology interest scores regardless of project reporting technique?
5. Do combinations of reporting technique and communication media exposure which are significant in differentially affecting value orientations and biology interests exist?
6. Do biology students demonstrate different levels of humanistic, theoretical, and technological value orientations?

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[1] Student Interest Survey - Appendix A

[2] Value Orientation Survey - Appendix B

[3] Reading-Television Survey - Appendix C

III. DEFINITION OF TERMS

The following are definitions of terms as they are used in this study:

Audio-Visual Presentation, as used in this study, refers to the students' use of audio-visual aids, created and utilized to present finds of the independent study projects to other members of the class.

Biology Interests, as used in this study, refers to the interest exhibited by students in biology topics tested in the student interest survey of appendix A.

Biology-Related Topic, as used in this study, refers to some topic that is indirectly related to some concept or body of theory listed in the curriculum guide for senior biology patterned after the Biological Science Curriculum Study (B.S.C.S.). Reference to this term indicated a favourable connotation due to its wide applicability to everyday occurences in the students' lives.

Humanistic Value Orientation refers to the students' preference for some statement or activity which involves a concern for human nature and improvement in human condition.

Independent Study Project, as used in this study, refers to a two-month biology research project which was voluntarily selected, planned, researched, and reported to other members of the class by small groups of students. Approximately twelve per cent of class time was devoted to independent study during which students assumed responsibility for their own self-direction.

Instructional Emphasis, as used in this study, refers to the theoretical, humanistic, or technological description of biological phenomena or facts by the instructor or by instructional materials.

Mass Communication Media, as used in this study, refers to:

A. Commercial television and radio programs which the student voluntarily observes.

B. Reading materials which the student voluntarily selects. e.g., newspapers
magazines
books and paperbacks
pamphlets

Reading Exposure, as used in this study, refers to the students' attitude toward voluntary selection of reading materials for pleasure, interests, or self-edification. It may be classified as:

A. High - favourably inclined toward reading biology-related topics as indicated by interest scores above the median when measured with the student interest survey related to reading items.

B. Low - unfavourably inclined toward reading biology-related topics as indicated by interest scores below the median when measured with the student interest survey related to reading items.

Technological Value Orientation refers to the students' preference for some statement or activity which involves the commercial application of knowledge for production and utilization of material goods.

Television Exposure, as used in this study, refers to the students' attitude toward voluntary selection and observation of commercial television programs for pleasure, interest, or self-edification. It may be classified as:

A. High - favourably inclined to television viewing of biology-related topics as indicated by interest scores above the median when measured with the student interest survey related to television items.

B. Low - unfavourably inclined to television viewing of biology-related topics as indicated by interest scores below the median, when measured with the student interest survey related to television items.

Theoretical Value Orientation refers to the students' preference for some statement or activity which involves the systemization of knowledge. (i.e., principles, definitions, functions, and hypotheses of biological science).

Value Orientation, as used in this study, refers to the students' preference for some statement or activity related to biology which he/she considers most worthwhile.

Written Report, as used in this study, refers to the written compilation of results of findings of the independent study project.

IV. IMPORTANCE OF THE STUDY

The remarkable growth of scientific knowledge during the past three decades has been reflected in revised high school science curricula which place great emphasis on the abstract, theoretical aspects of science. This approach has lacked appeal for many students who appear to be more receptive to applications of science for the improvement of human living conditions.[4,5] Butts has claimed:

> Students must feel that they are studying something of value and not merely executing intellectual minuets.

Thus, the relative importance attributed by an individual to subject matter emphasis is a function of the individual's values. Few attempts have been made to assess the values which students hold with regard to the high school science subjects currently taught.

Peter H. Huston has measured the value orientations of chemistry students as they relate to the humanistic, technological,

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[4]Derek A. Davenport, "Elevate Them Guns A Little Lower", The Journal of Chemical Education, Vol. 45, April, 1968, p. 246.

[5]Ronald S. Ratney, "Two Views", The Journal of Chemical Education, Vol. 45, April, 1968, p. 246.

[6]David P. Butts, "Opening the World to the Student", Designs for Progress in Science Education, Washington, National Science Teachers' Association, 1969, p. 32.

and theoretical emphasis of chemical phenomena and facts.[7] His findings demonstrated that chemistry students value humanistic and technological statements more than the theoretical aspects of the subject. A similar type of study in the field of biology is required to determine the values held by students toward biology instructional emphasis.

The practical advantage of such study is to provide biology teachers with information regarding value orientations of grade twelve biology students so that they might critically examine their teaching methods to determine whether the instructional emphasis parallels the values held by students. Lee J. Cronbach has stated that the optimal learning situation occurs when instructional variables can be matched with individual learning characteristics.[8] Consequently, instructors might modify their instructional emphasis to relate more meaningfully to the value orientations of the students.

Various investigators have found that the instructional method of independent study has resulted in producing affective

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[7]Peter H. Huston, A Study of Value Orientations As A Characteristic of Secondary School Students and Teachers of Chemistry And As A Factor In Learning, 1971, University Microfilms, Ann Arbor, Michigan, p. 4.

[8]Lee J. Cronbach, "The Two Disciplines of Scientific Psychology", The American Psychologist, Vol. 2, November, 1957, p. 681.

gains in attitude to science in high school students.[9,10] Other findings related to project reporting technique in independent study presented conflicting evidence that affective gains occur only in thirty per cent of students.[11] A study is required to provide additional evidence to assess this conflict of findings.

The mass communication media has provided varying degrees of exposure to biology-related topics for high school students. Billie G. Poteet has indicated that television programs increased subject preference and thus, values for science.[12] Eleanor E. Maccoby stated that television creates interests in students.[13]

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[9]William E. Hug, "Independent Study Evokes Good Student Attitudes", Science Education, Vol. 54, April, 1970, pp. 115-118.

[10]Harry F. Fulton, "A Comparative Study of Student Attitudes Toward Science and the Ability of the Teacher to Make Material Understandable in Individualized and Group Approaches to B.S.C.S. Biology", School Science and Mathematics, Vol. 71, March, 1971, pp. 198-202.

[11]J. Wilmut, "The Effect of Project Work on the Attitudes to Science Held by Sixth Form Pupils", Educational Research, Vol. 15, No. 2, February, 1973, pp. 128-133.

[12]Billie G. Poteet, The Effect of Casual Viewing of Filmed Television Programs on Subject Preference and Achievement in Science, University Microfilms, Ann Arbor, Michigan, 1972, pp. 1-94.

[13]Eleanor E. Maccoby, "Why Do Children Watch T.V.?", Public Opinion Quarterly, Vol. 18, No. 3, 1954, pp. 239-244.

George Norvell has reported that interests and values are formed in students as a result of reading.[14] A study is required to compare the effect of television and reading exposure upon formation of values and interests in students.

V. ASSUMPTIONS

Several basic assumptions were made in view of the nature of the study, the procedures, and the instruments used.

1. Paper and pencil inventories of the type used in this study can be used to make valid assessments of attitudes, interests, and orientations of students.
2. Treatments and treatment procedures used were sufficiently self-directed so that production of significant differences between treatment groups due to differences in the instructor variable were avoided.
3. The method of random selection of groups for treatments would not affect the outcome of the study.
4. Random computer assignment of students to classes would not affect the outcome of the study.
5. Students involved in the study demonstrate a variety of combinations of television and reading exposure.

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[14] George Norvell, The Reading Interests Of Young People, Michigan State University Press, 1973, pp. 10-14.

6. Increased exposure to biology-related topics through the media of communication will result in development of biology interests.
7. The audio-visual method of reporting projects is beneficial to some students in that it offers them an activity to develop and practice a variety of skills.
8. Students exhibit definite degrees of the three dimensions of value orientation namely, humanistic value, technological value, and theoretical value.
9. The results of surveys made by students may be accepted as valid as all respondents answered questions frankly and honestly.
10. The groups from St. John's High School who participated in the reliability checks were comparable to students involved in the experiment.
11. The teachers involved in the validity check of instruments were competent and answered questions frankly.

VI. LIMITATIONS OF THE STUDY

The study was limited to value orientations determined in the field of biology.

The study was limited in that the values and biology interests were assessed in the context of a single project assignment lasting only two months.

The study was limited in that no norms could be found for communication media exposure. Thus, the results relating to the effect of media orientation cannot be generalized to other groups.

VII. DELIMITATIONS OF THE STUDY

Only the students enroled in the grade 12 B.S.C.S. biology program at Sisler High School participated in the study.

The only value orientations measured were described as the humanistic, technological, and theoretical.

The only interests measured were in relation to curriculum topics found in the B.S.C.S. blue version biology text and non-curriculum biology-related topics which had appeared during the past two years in magazines, newspapers, or on commercial television programs. The study did not include an analysis of other variables which might possibly have partially contributed to the outcome of the study. Some of these variables would include the following:

A. Socioeconomic status of students.

B. Reading abilities.

C. Extra-curricular demands on time.

D. Emotional problems of students.

E. Dexterity of students.

F. I. Q.

G. Attitude to work.

H. Achievement in biology.

I. Achievement in school.

J. Influence of peer group.

K. Attitude to teachers involved.

L. Ability of students to interpret directions.

This study did not attempt to evaluate the value orientations of biology instructors.

VIII. TREATMENT OF THE PROBLEM

This study was designed to determine the effectiveness of the independent study project for inducing values and biology interests in participating students with varied media exposure.

Four classes of grade 12 students enrolled in P.S.C.S. biology at Sisler High School and taught by two teachers were randomly assigned to one or the other of two treatment groups. One of the groups was designated as an independent study audio-visual presentation group and the other as an independent study written report group. Each teacher in the study supervised both types of groups in the two classes assigned to his program.

Students were informed that a portion of their program of studies was to be devoted to independent group study in which they were to select, independently research, and present evidence of the results of their cooperative effort. Written directions were issued to students and explained by the investigator to all classes of both groups.[15]

A librarian from Sisler High School was enlisted as a resource speaker for the purpose of describing the method of performing library research. Students were made aware of the facilities and resources available for their use at the school.

The students voluntarily formed groups and selected biology related topics of mutual interest to each group. Students then independently proceeded to gather data for their specific project.

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[15]Directions for audio-visual presentations - Appendix D.

A media exposure survey was given to students to determine how students obtain exposure to biology related topics. Students were classified into four groups corresponding to:

High television exposure

Low television exposure

High reading exposure

Low reading exposure

A two-month period for preparation was allotted to the audio-visual project followed by a period of presentation of projects to other members of the class. A similar pattern of events was followed by the written report groups. Although no presentations were made, other members of the class were allowed to read any or all written reports.

All classes were then tested with:

(a) Value Orientation Survey

(b) Biology Interest Survey

Hypotheses pertaining to the effect of project reporting technique and the effect of communication media exposure on value orientations and biology interests were tested using t-tests of significance.

A two-way analysis of variance was used to test for the presence of interactions between project reporting technique and communication media exposure with respect to value orientations and biology interests of students.

IX. HYPOTHESES

The hypotheses which were tested were the following:

1. There are no significant differences in mean scores of humanistic, technological, and theoretical value orientations and biology interests of male and female biology students regardless of project reporting technique or communication media exposure level.
2. There are no significant differences in mean scores of value orientations and biology interests between the two treatment groups regardless of reading or television exposure levels of students.
3. There are no significant differences in mean scores of value orientations and biology interests between groups demonstrating high or low television exposure regardless of reading exposure level or project reporting technique.
4. There are no significant differences in mean scores of value orientations and biology interests between groups demonstrating high or low reading exposure regardless of television exposure level or project reporting technique.
5. There are no combinations of reporting technique and communication media exposure which are significant in differentially affecting value orientations and biology interests of biology students.
6. There are no significant differences between the mean scores of humanistic, technological, and theoretical value orientations of biology students.

Chapter I includes a statement of the purpose of the study. It also includes a list of questions which reflect objectives of the study, along with a delineation of the need for the study. Definition of terms, assumptions, limitations, and delimitations, as well as a description of the overall treatment of the problem are presented. A list of hypotheses is included.

Chapter II includes an overview of the current related literature, the literature review, and a summary of literature pertinent to the study.

Chapter III includes a description of the methods and techniques to be used in the study. Specifically, selection and description of the sample, description of the treatments and instruments, the research design, and procedures of investigation are presented, as well as the methods of analysis of the data and the research hypotheses.

An Analysis of the data and the findings related to the hypotheses are reported in Chapter IV.

Finally, Chapter V consists of a summary of the findings, conclusions from the study, a discussion of implications for educational practice, and recommendations for future research.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

I. OVERVIEW OF THE LITERATURE

The current literature related to the independent variables, treatments, and dependent variables which appear in the present study is included in the literature review.

Independent study is presented as a desirable instructional technique utilized by schools to achieve important goals of instruction, including motivation. An independent study activity which presents an opportunity to attain this goal was found to be the development and reporting of some independently researched topic. Two methods of reporting results of projects are the written report and the audio-visual presentation. These reporting techniques constitute the treatments of the present study, and consequently, the literature concerning project reporting is next reviewed. The outcomes of independent study via projects are examined to determine whether or not there are important affective results which have been reported to be achieved through this technique. Specific affective components used as dependent variables in this study are values and interests. The measurement of these factors is described with particular reference to a study which described value orientations of chemistry students and their teachers.

Finally, the role of the mass communication media is examined in relation to value and interest formation.

II. INDEPENDENT STUDY PROJECTS

The nature of our society, and nature of science in society, and the nature of the individual make independent study in science desirable.[1] The Education Policies Commission of the National Education Association states that the average high school graduate will have to be retrained at least three times during his lifetime just to keep pace with the acceleration of knowledge and technology.[2] Students require the development of responsibility for their own learning, all in accordance with their individual learning styles. If a prime objective of education is the development of self-reliant adults who can think and work independently, then this might be realized by giving students an opportunity to plan, execute, and evaluate their curriculum and its objectives.[3]

Independent study involves the pursuit and acquisition of knowledge and skills by students with limited assistance from their classroom teachers.[4] Some research findings suggest that learning is best accomplished when the teacher creates situations wherein the student can discover knowledge for himself.[5]

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[1]Carol Cole, "Independent Study in Science", School Science and Mathematics, Vol. 71, March, 1971, p. 236.

[2]James Howard, "Independent Study for Today's Schools", Journal of Secondary Education, Vol. 46, No. 1, January, 1971, p. 26.

[3]John B. Simmons, W. J. Davis, G. C. Ramseyers and J. J. Johnson "INdependent Study Methods and the Gifted Biology Student", American Biology Teacher, Vol. 33, October, 1971, p. 416.

[4]Howard, Loc. Cit.

[5]Loc. Cit.

White proposed an "effectance theory" of intrinsic motivation, maintaining that there is an urge within the person which stimulates him toward making accomplishment on his own and that successful accomplishment generates feelings of competence which push him toward learning behaviour.[6]

Various experimenters have implemented different plans of independent study.[7,8,9] Most of the plans shared the provision that the student be allowed to select a subject for investigation within the specified field of study, develop his own procedures, pursue the investigation independently, and participate in the evaluation of his work. The student is made aware that he must select, direct, and pace his activities, and has thus become the central figure in the learning process.[10] Two objectives are served by active student participation.[11]

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[6]Pauline S. Sears, "Implications of Motivation Theory for Independent Learning", The Theory and Nature of Independent Learning, edited by G. T. Gleason, International Textbook Co., Scranton, Pennsylvania, 1967, pp. 37-38 (citing "Motivation Reconsidered: The Concept of Competence", Psychological Review, Vol. 66, pp. 297-333, by R. W. White, 1959.).

[7]L. W. Glass and R. E. Yager, "Individualized Instruction as a Spur to Understanding the Scientific Enterprise," American Biology Teacher, Vol. 32, No. 6, September 1970, pp 359-361.

[8]O'Toole, R. J., "The Effectiveness of Individualized Elementary School Science", Science Education, Vol. 52, 1968, pp 381-384.

[9]R. G. Rainey, "The Effects of Directed Versus Non-directed Laboratory Work on High School Chemistry Achievement", Journal of Research in Science Teaching, Vol. 3, No. 4, 1965, pp 286-292.

[10]J. B. Simmons et al., Loc. Cit.

[11]Joseph J. Schwab, Biology Teachers' Handbook, John Wiley and Sons, Inc., New York and London, 1963, p. 31

First, the student can discover through the kinds of problems posed, and through his ability to contribute toward their solution, that science is something more than merely learning from others. Second, through the process of participating in such activities, the quality of the activity may be shaped and improved. The student may develop skill in the interpretation of data and the understanding of scientific knowledge.

R. M. Bingman and P. G. Koutnik cited studies by J. S. Parakh which demonstrate that seventy-five per cent of student verbal interaction in biology class comes from as few as eight students.[12] Koutnik reasoned that student team participation in projects would raise the total student participation.

Bingman suggested that learning could be enhanced by dividing the class into teams of four students, each person having a definite role responsibility.[13] Thus, students would work individually, in small groups, and finally in whole class discussion at the culmination of the project to share the results of their individual findings. Carol Cole, Dean Jernigan and Robert M. Gagné have suggested that the student should be able to communicate the nature of his investigation to others for the purpose of refining opinions via group interaction

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[12] R. M. Bingman, P. G. Koutnik, "Small Group Study Approach for Biology Based Inquiry Objectives", American Biology Teacher, Vol. 32, December 1972, p. 548.

[13] Loc. Cit.

and discussion.[14,15,16]

Jernigan indicated that it is important that the groups be self-selected to assure cooperative efforts in planning.[17] James De Rose reported that he excused students from formal classes to pursue the study of their selected independent project.[18]

Marion E. Cornelius reported that groups of students can make good decisions and properly select what and when to study if given the opportunity.[19]

According to Hans O. Anderson

> ...students will not get a feeling for what science really is unless they are given an opportunity to inquire. This means that they must be permitted to make decisions and for that matter, to suffer the consequences of their decisions.[20]

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[14]Cole, Ibid., p. 238

[15]Dean Jernigan, "A Research Approach to Inquiry in High School Biology", American Biology Teacher, Vol. 34, No. (8), November, 1972, p. 466.

[16]Robert M. Gagné, "Learning Research and Its Implications for Independent Learning", The Theory and Nature of Independent Learning, Editor G. T. Gleason, International Textbook Co., Scranton, Pennsylvania, 1967, p. 30.

[17]Jernigan, Ibid, p. 469.

[18]James V. De Rose, "The Independent Study Science Program at Marple Newton High School", The Science Teacher, Vol. 35, No. (5), May, 1968, pp 48-49.

[19]Marion E. Cornelius, "Student Involvement in the Systems Approach to Biology", American Biology Teacher, Vol. 35, March, 1973, p. 16.

[20]Hans O. Anderson, "Developing Favourable Attitudes Toward Science", Science Teacher, Vol. 38, No. (8), November, 1971, p. 43.

Some inquiry objectives described by P. Hurd for use in biology projects included the following:[21]

1. The involvement of students in library research
2. The understanding and awareness of past research
3. The examination of current issues related to science, to analyze opposing viewpoints and to exercise the right to form individual opinions
4. The individualization of matters of personal interest within the framework of science
5. The basic use of students' questions and "interest areas" to conduct class
6. The development of analytic skills
7. The practice of reasoning so that decisions will be more skillfully made
8. The exercise of analyzing materials to separate fact and opinion and to increase critical thinking
9. The basic use of student-student interaction to develop learning and tutoring situations
10. The stress on individualism for creativity

Howard suggested the following steps for project procedures:[22]

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[21]Paul Hurd, "Inquiry Objectives for the Teaching of Biology in the 1970's", American Biology Teacher, Vol. 32, No. (9), September, 1970, pp 553-554.

[22]Howard, Op. Cit., p. 27.

Students may have a choice of projects for study over an extended period of time. After the project is selected the student is assigned free time to do the reading, viewing, listening, and compilation of data necessary to complete the project. Often the quest for information will lead the student outside the confines of the school. Interviews with experts in his field may be arranged by the student or his advisor.

III. PROJECT REPORTING TECHNIQUE

Students may report the results of their work in independent study projects through a variety of techniques. Popular methods include video tapes, cassette recordings, films, oral reports, or conventional themes and reports.[23]

Howard reported that since some students learn best by viewing, some by listening, and some by reading, the sharing of information might best be accomplished through the varied use of mediated materials by students.[24]

Norman Linck has performed a study which illuminated the role of the educational media in independent study.[25] His findings revealed that when students pursue independent study there is a great deal of activity on the part of students in the production of instructional media. The strong implication here is that the production

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[23]Joe W. Wilson, Terry Armstrong, "Independent Study", The Clearing House, Vol. 47, No. (9), May, 1973, p. 527.

[24]Howard, Loc. Cit.

[25]Norman Linck, "Educational Media and Independent Study", A.V. Instruction, Vol. 15, No. (2), February, 1970, pp 36-37.

of educational media is a natural activity in the student involvement process. Three other interesting findings showed first, that every kind of audio-visual medium along with the appropriate equipment was made available to students. Secondly, many kinds of non-print media was reported to be produced by students working independently. Materials included, in order of frequency mentioned, were:

reel to reel audio-tape recordings
overhead projectuals
graphics (posters, graphs)
slides
8 mm. films
16 mm. films
videotape

Finally, ninety percent of the schools in the study identified the library as the major location for materials, and eighty-eight percent reported that the school librarian was the most frequently named media resource staff member serving students working independently. Consequently, the library was pre-eminent as a support facility for independent study projects undertaken by students.

With regard to another aspect of independent study project reporting, H. E. Schlichting and R. V. Brown have performed a study to show that background music played during lectures to biology students and in an examination resulted in significantly higher achievement in grades regardless of a student's scholastic aptitude.[26]

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[26]H. E. Schlichting Jr. and R. V. Brown, "Effect of Background Music on Student Performance", American Biology Teachers, Vol. 32, No. 7, October, 1970, pp 427-429.

Student responses to questionnaires further revealed that background music caused them to experience heightened enjoyment of lectures, made them more attentive, and helped them relax.

Daisy Arredondo recommended that music be incorporated into student projects. She described the role of the audio and visual portions as being effective in setting the mood:

> It is difficult to explain the total effect of slides, lights, music, and readings. The blend holds the attention of nearly anyone. The desire to talk during the display is reduced to nothing, while a sort of total environment of watching and listening holds the student entranced.[27]

This presentation phase of independent study projects provided the opportunity for the student to be very creative and somewhat self-directive in completing the project.[28]

No literature pertaining to development of interest and values as a result of written reports nor a comparison of written reports and audio-visual presentations could be found.

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[27]Daisy Arredondo and Sam Throm, "Utilizing Multi-Media In Teaching For Attitude Changes", A. V. Guide, Vol. 51, May, 1972, p.11

[28]Howard, Op. Cit., p. 27.

IV. OUTCOMES OF INDEPENDENT STUDY

James De Rose and H. F. Fulton have indicated that the achievement of students in a particular class may depend to a large extent on the development of a favourable student attitude toward a subject.[29,30] J. B. Davis and L. A. Mahan conducted studies in the development of attitudes by varying the approach used in teaching science.[31,32] Their results supported the idea that student attitudes are influenced by the approach used in teaching science.

Other studies by P. W. Richard and R. Zeschke revealed that students exposed to individualized instruction in science developed a

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[29] De Rose, Op. Cit., p. 49

[30] Harry F. Fulton, "A Comparative Study of Student Attitudes Toward Science and the Ability of the Teacher to Make Material Understandable in Individualized and Group Approaches to B.S.C.S. Biology", School Science and Mathematics, Vol. 71, March, 1971, pp. 198-201.

[31] Jerry B. Davis, "Attitude Changes on Fallout and Race Associated with Special Instruction in Biology", Science Education, Vol. 47, March, 1963, pp. 178-183.

[32] Luther A. Mahan, The Effect of Problem-Solving and Lecture-Discussion Methods of Teaching General Science in Developing Student Growth in Basic Understandings, Problem-Solving Skills, Attitudes, Interests, and Personal Adjustment, University Microfilms, Ann Arbor, Michigan, 1963.

favourable attitude toward science after experiencing this approach to teaching science.[33,34]

H. Fulton and W. E. Hug have each performed studies which reveal significant affective gains by students who have been engaged in independent study.[35,36] Hug's study compared the effect of independent study, small group discussion, large group presentation, and a combination of the above practices in producing cognitive and affective gains in high school biology students. The study indicated that students were able to meet cognitive objectives equally well through all of the above practices. Other important findings related to the independent study group are the following.[37] Eighty-five per cent of the students

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[33]Paul W. Richard, "Experimental Individualized B.S.C.S. Biology", The Science Teacher, Vol. 36, No. 2, February, 1969, pp 53-54.

[34]Richard Zeschke, "Using Programmed Instruction in a High School Biology Course", The American Biology Teacher, Vol. 28, No.10 December, 1966, pp 15-17.

[35]Fulton, Ibid, pp 198-201.

[36]William E. Hug, "Comparison of Cognitive and Affective Gains Between Independent Study, Small Group Discussion, and Large Group Presentation in High School Biology", Science Education, Vol. 55, No. 2, November, 1971, pp 241-247.

[37]William E. Hug, "Independent Study Evokes Good Student Attitudes", Science Education, Vol. 54, April, 1970, pp 115-118.

believed they learned more than in other classes. Sixty-eight per cent of students believed that their work in independent study was more interesting than other classes they had attended in biology. Fifty-six per cent of the students in the independent study group felt that they spent their class time more wisely than in other biology classes. Fifty-three per cent believed they developed their ability to think more than they did in other classes It is noteworthy that although students believed they learned more in independent study than in other classes, and found their work more interesting, they did not find the work particularly challenging. Thirty-two per cent of the students believed their work was more challenging than other classes, whereas forty-four per cent of the students found the work less challenging. This indicated that students may not necessarily equate difficulty with value. An analysis of positive and negative comments regarding independent study revealed that students participating in this practice made the greatest number of positive comments and the least number of negative comments when compared with other experimental groups.

John R. Olsen conducted a study to determine the type and amount of learning that took place with varying techniques and amounts of media stimulation. The results indicated that the learning of cognitive material can be accomplished using only one sense modality. While multi-sensory modalities and/or multiple amounts of related stimuli do not detract from cognitive learning, they contribute no

significant gains.[38] Olsen further stated that when a multitude of related stimuli are present, the student seems to be able to select those portions which are useful to him and reject those which are not.

Although most investigators have reported significant affective gains attributed to independent study, J. Wilmut has reported results of a study which are less conclusive: "...in some cases (about thirty per cent of all pupils) the project has the effect of changing attitudes by a significant amount."[39] He further claimed that

> ...so little is known about project work which is very different in character from other approaches to learning of science that one can only guess at its effectiveness. Instead it is more likely that the initial attitude of the student would determine the outcome of the project.[40]

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[38]John R. Olsen, The Effect of Multi-Stimuli Presentations on Learning Gain, University Microfilms, Ann Arbor, Michigan, December, 1969.

[39]J. Wilmut, "The Effect of Project Work On The Attitudes To Science Held By Sixth-Form Pupils", Educational Research, Vol. 15, No. 2, February, 1973, pp 128-133.

[40]Ibid., p. 133.

V. AFFECTIVE COMPONENTS: INTERESTS AND VALUES

DEFINITION

The affective domain was described by David R. Krathwohl, Benjamin S. Bloom, and Bertram B. Masia with the aid of a taxonomy which provided a means of ordering and relating different kinds of affective behaviour.[41] According to these authors the taxonomy consisted of several categories of behaviour exhibited by an individual in response to various stimuli. Those categories which demonstrated increasing personal involvement with stimuli were described as receiving, responding, valuing, organizing, and forming a value complex.[42]

Two commonly used affective terms, interest and value, may be defined as having a variety of meanings related to the behaviour categories.

INTEREST

The lowest category of interest, namely "receiving", was described as consisting of an awareness level in which the individual merely has his attention attracted to some stimuli.[43] A higher level of receiving termed "willingness to receive" referred to a willingness of the individual to give attention to the stimuli or to tolerate the

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[41] David R. Krathwohl, Benjamin S. Bloom, Bertram B. Masia, Taxonomy of Educational Objectives. The Classification of Educational Goals. Handbook II: Affective Domain, David McKay Co., Inc., New York, 1970, p. 24.

[42] Ibid., p. 35

[43] Ibid., p. 34

stimuli.[44] The highest level of receiving was described as "controlled or selected attention" where the individual favoured some stimulus over competing and distracting stimuli."[45]

A higher category of interest called "responding" demonstrated some activity by the individual brought on by the awareness of the stimuli.[46] A primary level called "acquiescence in responding" referred to a passive compliance to a call for initiation of behaviour.[47] A second level termed "willingness to respond" indicated that the individual voluntarily exhibits behaviour due to some inner compulsion.[48] The highest level of responding was that of finding satisfaction in response in which the individual derives an emotional feeling of pleasure as a result of the behaviour.[49]

The final category of interest involved "valuing" which was described as the process by which the individual acquires a value.[50] The lowest level of valuing involved the individuals "acceptance of a value" by the ascription of worthiness to the stimuli.[51] The final level of valuing was termed"preference for a value" and implied that an individual was sufficiently committed to a value to pursue it.[52]

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[44] Ibid.

[45] Ibid.

[46] Ibid.

[47] Ibid.

[48] Ibid.

[49] Ibid

[50] Ibid., p. 35

[51] Ibid.

[52] Ibid.

VALUE

The term value was described by the taxonomy categories of affective behaviour designated as "responding", "valuing", and "organization". It was similar to interest in that it included behaviour levels designated as "willingness to respond", "satisfaction in response", "acceptance of a value", and "preference for a value". Value was different from interest in that it included the highest level of "value".[53] It also included the category of "organization" in which the individual organized many values into a system. The lowest level of organization, namely, the "conceptualization of a value" was also used to describe a value.[54]

The following diagram which is relatively similar to that used to describe the taxonomy of affective behaviour was useful in visualizing similarities and differences in behaviour characteristics of interest and value.[55]

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[53] Ibid. [54] Ibid. [55] Ibid., p. 37.

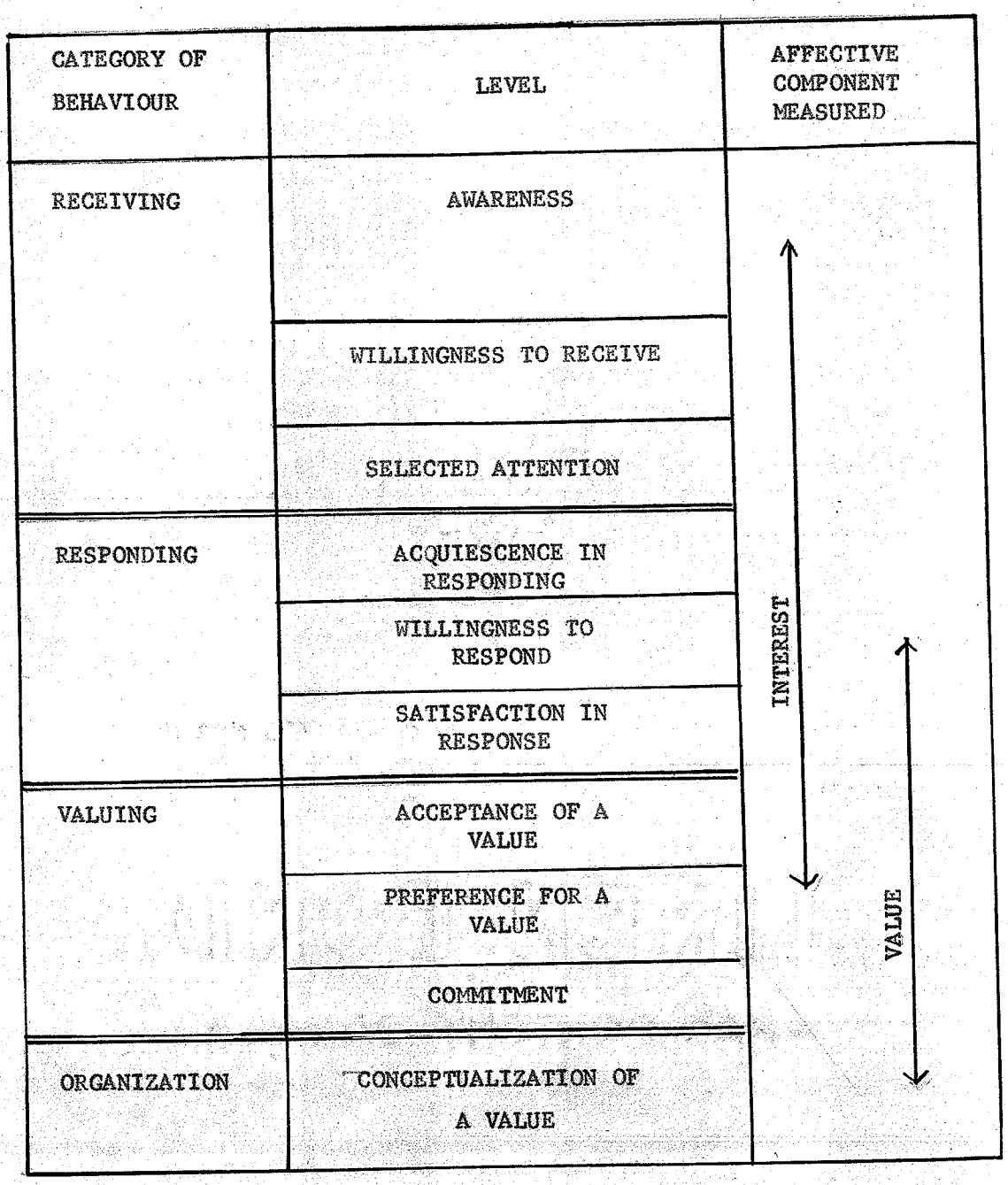

FIGURE 2.1

COMPARISON OF VALUE AND INTEREST BEHAVIOUR

The length of the arrows which refer to interest or value as affective components indicate the category of behaviour and level which that term encompasses.

VALUES IN SCIENCE

A value has been defined by Milton Rokeach as "an enduring belief that a specific mode of conduct or end-state of existence is personally and socially preferable to alternative modes of conduct or end-states of existence".[56] Evelyn H. Wilson has stated that modern education is often at variance with the values that present-day students hold important.[57] She further expressed concern that science should become more humanistic and reflect the feelings of contemporary students for human needs.

Merrett E. Kimball performed a study which showed that seventy-two per cent of secondary teachers surveyed disagreed that emphasis on applied science was an important part of the scientific enterprise.[58] This attitude was evident in secondary curricula developed in the United States during the nineteen-fifties and early sixties. Derek A. Davenport described them as being "more logical, more rigorous, and more abstract" than previous curricula.[59] Stephen Hopkins also observed that "Currently the de-

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[56]Peter H. Huston, A Study of Value Orientations as a Characteristic of Secondary School Students and Teachers of Chemistry and as a Factor in Learning, University Microfilms, Ann Arbor, Michigan, 1971, p. 8 (citing Journal of Social Issues, p. 16, by Milton Rokeach, 1968.)

[57]Ibid. (citing The Journal of Chemical Education, p. 484, by Evelyn H. Wilson, August, 1969.)

[58]Ibid., p. 9, (citing The Journal of Research in Science Teaching, Vol. 3, pp 110-120, by Merritt E. Kimball, 1967-1968).

[59]Ibid., (citing The Journal of Chemical Education, Vol. 45, p. 419, by Derek A. Davenport, June, 1968).

veloping curricula in science show a rapid movement away from the technical to the theoretical bases of the science."[60]

The theoretical aspects of science are important in the systemization and structuring of scientific facts.[61] However, maximal emphasis on theoretical aspects of science result in teaching science as authoritative facts and dogma.[62] This has had bad effects on student attitudes toward science and scientists because they learn that science is unrelated to reality. Elite science curricula were "essentially irrelevant to the needs of the major portion of the students".[63] Science seemed to lack relevence for many students because it did not seem to supply solutions to social and other problems in the real world and because science appeared mechanized and dehumanized in contrast to their studies in the humanities.[64] This difference between science

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[60]Stephen Hopkins, "Science-Technology: An Introduction to Technology for High School Students", The Science Teacher, Vol. 35, May, 1968, p. 39.

[61]Huston, Op. Cit., p. 10, (citing The Value of Science, by Henry Poincoré, 1958).

[62]Schwab, Op. Cit., p. 45

[63]Claude Gatewood, "The Science Curriculum Viewed Nationally", The Science Teacher, Vol. 35, November, 1968, p.19.

[64]Huston, Op. Cit., p. 11, (citing Phi Kappa Phi Journal, by William F. Henry, Fall, 1969).

and the humanities could be reduced by stressing the humanistic aspects of science.[65]

Waly and Cook maintain that students would find increased emphasis on the humanistic and technological aspects of science both interesting and stimulating.[66] The emphasis of teaching upon the humanistic values of students could assist them in finding "a sense of unity of science with life as a whole".[67] Such humanistic emphasis could be achieved through a demonstration of the role of science in solving problems related to famine, disease, and pollution.[68]

THE MEASUREMENT OF VALUES AND INTEREST

The attitude held by students towards an object is affected not only by one or more values which may have been supportive or competing, but also by the individual's perception of the object.[69]

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[65] Op. Cit., (citing The Sciences and the Humanities, p. 10, by W. T. Jones, 1965).

[66] Op. Cit., p. 15, (citing Journal of Personality and Social Psychology, Vol. 4, pp 280-288, by P. Waly and S. W. Cook, 1966).

[67] Harry S. Browdy, "Science and Human Values", The Science Teacher, Vol. 36, March, 1969, p. 27.

[68] Huston, Op. Cit., p. 12, (citing Science: The Center of Culture, p. 58, by I. I. Rabi, 1970).

[69] A. N. Oppenheim, Questionnaire Design and Attitude Measurement, Basic Books Inc., New York, 1966, p. 109.

Lee J. Cronbach has referred to Spranger's six basic types of men for a description of values. They are:

> theoretical, economic, social, aesthetic, political, and religious.[70]

The theoretical, economic, and social values listed are parallel to those recently selected for study by Peter Huston, namely the theoretical, technological, and humanistic value orientations.[71]

Since an individual holds many values simultaneously, the mere presence or absence of values is of less consequences than the relative strength of the values. Thus, a forced choice to rank-order three alternatives, each corresponding to a theoretical, humanistic, or technological value, would indicate the relative strength of these values.[72] Use of a forced choice method produced an ipsative relationship, (i.e. one decreases as others increase) among the value scores but appears more intimately related to the definition of a value than a system which would attempt to measure the intensity of particular values on separate scales and then assume equal values on these separate scales for the purpose of comparison.[73] A study of values by Allport,

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[70] Lee J. Cronbach, Essentials of Psychological Testing, New York, Harper and Row Publishers, Second edition, 1960, p. 323.

[71] Huston, Op. Cit., p. 13.

[72] Abraham K. Maslow, The Psychology of Science, Harper and Rowe Publishers, New York, 1966, p. 124.

[73] Huston, Op. Cit., p. 27, (citing "The Development of a Test To Measure the Intensity of Values", Journal of Educational Psychology, pp 266-274, by Joseph E. Shaw, May, 1952).

Vernon, and Lindzey employed such a forced choice response.[74]

Huston also employed a forced choice value orientation instrument. An analysis of the results following the administration of his instrument to 120 grade twelve chemistry students in London, Ontario, indicated that students demonstrate differing levels of value orientation with a general tendency to favour humanistic items over both technological and theoretical items.[75]

Huston's research indicated also that there was no correlation between humanistic, technological, or theoretical value with measured intelligence, students' academic grade, or chemistry grades.[76] Thus, these factors could not be used to infer student value orientations.

Finally, results indicated that male students demonstrated higher technological value orientations, whereas female students indicated a greater preference for humanistic items.[77]

Frank Fazio has performed a study utilizing a forced choice instrument, similar to that of the Huston study, for the purpose of assessing the value preferences of college non-science majors with respect to certain aspects of environmental chemistry.

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[74]Gordon W. Allport, Philip E. Vernon, and Gardner Lindzey, Study of Values: A Scale for Measuring the Dominant Interests in Personality, third edition, Boston: Houghton Mifflin Co., 1965.

[75]Huston, Op. Cit., p. 57.

[76]Op. Cit., p. 35

[77]Op. Cit., p. 36

His findings indicated that biology majors demonstrated significantly higher humanistic and theoretical scores than technological scores.[78]

Anne Anastasi has indicated that "it would seem that the most expedient and direct way of determining an individual's interests...would be simply to ask him."[79] She warns, however, that data has been collected which shows that answers to direct questions about interests are often unreliable, superficial, and unrealistic. A Likert-type scale was described as one of many instruments which could be used to measure attitudes and their components, one of which is interest.[80] The Likert-type scale calls for a graded response to each item. The response was described as being expressed in terms of five categories ranging from an unfavourable to a favourable reaction to the stimulus item. Alternative responses were credited with point values from one to five, respectively, from the most unfavourable to the most favourable response. The sum of item points represented the individual's score.

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[78]Frank Fazio, An Assessment of Value Preferences of College Students with Reference to Environmental Chemistry, paper presented at the 48th Annual Convention of the National Research in Science Teaching, March, 1975, pp 1-9.

[79]Anne Anatasi, Psychological Testing, Second Edition, The Macmillan Company, New York, 1966, p. 529.

[80]Ibid., p. 551

A relatively similar technique for measuring interest was reported by George W. Norvell.[81] He utilized a Likert Scale to measure the reading interests of young people. Although the instrument consisted of only three response categories consisting of those designated as "uninteresting, fairly interesting, and very interesting", he reported that five categories of response would prove statistically sound.[82]

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[81] George W. Norvell, The Reading Interests of Young People, Michigan State University Press, 1973, pp 10-14.

[82] Ibid.

VI. COMMUNICATION MEDIA AND VALUES

Television and printed materials have given contemporary students the opportunity to be exposed to recent advances in science and technology. Roger Manvell described the role of television in education:

> The new opportunity in the 20th century is broadcasting in sound and vision combined with recording on film and tape. This form of communication has arrived at a time when the whole pattern of civilization is changing and when the thinking that goes with this needs the widest possible dissemination. The 20th century represents a new educational era in human history.[83]

Caleb Gattegno stated that most television shows teach us something, or are educational in some way. "Learning from books is much more time consuming than watching the unfolding of a process on the screen. Television is so much more vivid that it is more easily retained and recalled".[84]

Eleanor E. Maccoby stated that "if it is interesting, it strikes a responsive chord in him--it satisfies a particular need, supplies some wanted information or perhaps offers a release from general tension".[85]

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[83]Roger Manvell, "Education Through T.V." Television: The Creative Experience, Hastings House Publishers Inc., New York, 1967, p. 222.

[84]Caleb Gattegno, Towards A Visual Culture, Outerbridge and Dienstfrey, New York, 1969, pp 37-38.

[85]Eleanor E. Maccoby, "Why Do Children Watch T.V.?" Public Opinion Quarterly, Vol. 18, No. 3, 1954, pp 239-244

Whatever the reason for watching television, the population is exposed to many science related topics indirectly through stimulating programs. B. G. Poteet conducted a study to determine the effect of exposure to science-related television programs on children and concluded that viewing the television programs did increase subject preference for science.[86] A preference for some activity is defined by Rokeach as a value.[87]

Hilde Himmelweit states that television has its maximum psychological effect on children with respect to value development when the following conditions are met:[88]

1. The values or viewpoints must recur from program to program.
2. The values must be presented in dramatic form so that they evoke emotional reactions.
3. The values must link with the child's immediate needs and interests.
4. The child must be uncritical of and attached to the medium.
5. The viewer is not already supplied with a set of values which would provide a standard against which to assess the views offered on television.

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[86]Billie G. Poteet, The Effect of Casual Viewing of Filmed Television Programs on Subject Preferences and Achievement in Science, University Microfilms, Ann Arbor, Michigan, 1972, pp 1-94.

[87]Milton Rokeach, " A Theory of Organization and Change Within Value-Attitude Systems", Journal of Social Issues, Vol. 24, 1968, p. 16.

[88]Hilde Himmelweit, A. N. Oppenheim, and Pamela Vince, Television and The Child: An Empirical Study of the Effects of Television on the Young, Neuffield Foundation, Oxford University Press, 1958, p. 522.

Wilbur Schramm indicated that there is ample opportunity for viewers to develop these values asjunior high school and high school students aged thirteen to sixteen watch an average of two hours of television per day in the United States.[89]

Leiland W. Strzelecki has determined from the results of a survey that many teachers have indicated that television stimulated motivation, interest, understanding, reading, and research in high school students.[90] Robert E. Gilligan designed a study to determine teacher and student use of the four elements of mass media as applied to education.[91] These included commercial television, motion pictures, daily newspapers, and magazines. He concluded from his results that students preferred entertaining rather than informative media content. Although students utilized the four elements extensively, the teachers did not incorporate them into their teaching. It was, therefore, concluded that the educational potentials of the media were being overlooked or ignored and therefore wasted.

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[89]Wilbur Schramm, Jack and Parker Lyle, B. Edwin, Television in the Lives of our Children, Stanford Conneticut, Stanford University Press, 1961, p. 324.

[90]Leiland W. Strzelecki, An Investigation to Determine the Availability and Utilization of Television in the Instructional Activities of Public School Teachers in the State of Oregon, University Microfilms, Ann Arbor, Michigan, 1973.

[91]Robert E. Gilligan, A Survey of Teacher and Student Instructional Uses of Mass Media in Eleventh Grade English Classes, University Microfilms, Ann Arbor, Michigan, 1974, pp 1-75.

Reading materials also contribute to the acquisition of knowledge and the development of interests and values in students.

Charles L. Koelsche and Ruth H. Adams conducted independent studies to determine what newspapers and the most widely read magazines publish in reference to biology-related topics.[92,93] The results of their findings indicated respectively that 175 and 195 basic principles of biology appeared in the public press.

Dr. Charles Berryman of the University of Georgia College of Education researched the effectiveness of the newspaper as a learning tool. He created an instructional program using three Georgia daily papers and found after fifty consecutive classes that students gained significantly in newspaper reading skills as well as general reading skills.[94] Consequently, he surmised that the newspaper can be a practical tool for teaching basic skills and bringing relevance and immediacy to the classroom.

M. Maskowski reported the use of newspapers in the development of student interest in current events.[95] The American

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[92]Charles L. Koelsche, "Science Literacy As Related To The Media of Mass Communication", School Science and Mathematics, Vol. 65, No. 8, November, 1965, pp.719-725.

[93]Ruth H. Adams, Determination and Comparison of Biological Principles in the Public Press and in B.S.C.S. Biology Texts, University Microfilms, Ann Arbor, Michigan, 1971, pp. 1-83.

[94]M. Maskowski, "Newspapers Wow Classroom", American Education, U.S. Department of Health, Education, and Welfare, Office of Education, January, 1972, p. 141.

[95]Ibid., p. 152

Newspaper Publishers Association initiated a "Newspaper In The Classroom Program", in which three million students taught by 48,000 teachers at 17,600 schools participated in the daily reading of 322 local newspapers. Basically the program was perceived as being a move away from tedious memorization of textbook facts to an emphasis on an examination and interpretation of events that the individual sees as impacting directly on his life.

Garfield Continuation High School in Santa Monica, California replaced texts with newspapers, paperbacks, and periodicals for one semester. The results of this action indicated that class attitudes improved and students were stimulated to higher levels of interest in reading. It credits these benefits to the students' perception of a demonstrable connection of learnings with daily events in their lives.

Lawrence R. Campbell made a study of the reading habits of teenagers from which he concluded that teenagers read the newspaper almost as much as adults.[96] He also found that there is little evidence that schools are stimulating students to become discerning and discriminating users of newspapers.

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[96] L. R. Campbell, What Teenagers Read in the Hometown Daily Newspaper, Quill and Scroll Foundation, Iowa City, Iowa, September, 1969.

Dr. R. S. Berman claims:

> We have been neglecting one of the most potentially potent mediums of mass education at our disposal. That medium is the American newspaper.[97]

George Norvell has conducted a study of the reading interests of young people to determine factors which affect reading preferences.[98] His results indicated that these factors were I.Q., sex, interests, and age. The literature indicated that reading may cause interests to develop, and subsequently values, but the type of reading must be consistent with the demonstrable effect of practical application of principles to the students' lives.

VII. SUMMARY

The literature review initially examined independent study which was reported to be effective in producing affective gains in regard to interest and value formation. The independent study project enabled students to participate in independent activities designed to provide opportunities for the development of individuals capable of directing their own learning.

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[97]Dr. R. S. Berman, "Teaching of College Level Courses by Newspaper", Intellect, January, 1973.

[98]George W. Norvell, The Reading Interests of Young People, Michigan State University Press, 1973, pp. 27-46.

The provisions for project procedures included offering the student the choice of project studied, freedom to pursue his individual research technique, and method of reporting his findings. The use of audio-visual materials prepared by students was recommended as a creative activity which might assist in the reporting of research findings.

The literature related to outcomes of independent study revealed that although no cognitive gains can be expected, there were significant affective gains in students experiencing this instructional approach.

Interests and values, two components of affective behaviour, were next examined. Interest was described as being a continuum of positive affective behaviours designated by the levels of receiving, responding to, and valuing of specific stimuli. Interests were described as being best measured by an instrument offering a variety of choices corresponding to various intensities of interest. Value components attributed to instructional emphasis were described as being humanistic, technological, and theoretical. An individual holds these values simultaneously so an instrument incorporating rank-ordered preferences was described as appropriate to the measurement of their relative strengths. A form of this instrument was used by two authors who concluded that high school students and college students place greater value emphasis upon humanistic rather than theoretical aspects of instruction.

The mass communication media, particularly newspapers and magazines, was shown to be efficient in the dissemination of biology principles. Thus, television and the printed word are often responsible for the initial exposure of ideas and discoveries to the receptive minds of an education conscious public. The interests and values assumed by individuals were shown to be somewhat dependent upon their exposure to television and the printed word. Television and reading materials were shown to be influential in the development of preferences for specific content and thus reflected their partial role in interest and value formation.

CHAPTER III

PROCEDURE AND IMPLEMENTATION OF THE STUDY

I. SELECTION AND DESCRIPTION OF SAMPLE

Students involved in the study included those enrolled in four coeducational classes of grade 12 university entrance biology at Sisler High School in the Winnipeg School Division during the fall term, 1974. The school is situated in an urban setting drawing students from predominantly low to middle socio-economic levels. The sample was comprised of 112 students consisting of sixty-seven girls and forty-five boys who ranged in age from sixteen to nineteen years. Both the mean and median ages were seventeen years. All students had completed at least one year of general science at the high school level and the majority had been previously enrolled in a grade eleven biology course. The grade eleven and twelve biology course is based on the curricular materials developed by the Biological Science Curriculum Study in Colorado, U. S. A. Students had been assigned by computer to the four classes. The mode of assignment to a class was dictated in part by students choice of other subjects within their program of studies.

It was decided that two of the four participating classes would be assigned to one of the treatment groups and the other two classes would be assigned to the second treatment group. A list of

numbers was prepared to represent each class and a table of random numbers was consulted to randomly assign each class to one or another of the treatment groups.

II. INDEPENDENT VARIABLES

DESCRIPTION OF TREATMENTS

The treatments consisted of reporting techniques of students who had been assigned an independent study project. The reporting techniques used by alternate treatment groups were designated as an audio-visual presentation and a written report. Treatments may be viewed diagramatically as in figure 1.

SIMILARITIES	DIFFERENCES
- Independent Study - Preparatory Research Instruction - 12.5% Free Time - 2 Month Project - Choice of Research Materials - Choice of Topic - Report Documented with Footnotes and Bibliography	AUDIO-VISUAL REPORT - Use of Communication Media - One half-hour Report - 5-7 Minute Individual Report - Class Question and Answer Period WRITTEN GROUP REPORT - Twenty Pages Length - Correct: grammar spelling form - Submitted for Evaluation

Figure 3.1

DIAGRAMATIC REPRESENTATION OF EXPERIMENTAL TREATMENTS

The diagram indicates similarity of experiences shared by treatment groups but indicates how they differ with respect to the variable under study, namely reporting technique.

1. AUDIO-VISUAL PRESENTATION PROJECT

The criteria for project procedures and evaluation were contained in the instructions distributed to students and are found in Appendix D. These procedures and instructions were discussed with particular reference to the following points, namely that the research and presentation be:

a) informative and accurate
b) interesting
c) current--mass media was recommended as an information source
d) documented as to source
e) practical or applicable to their lives
f) presented by the group using a minimum of five audio-visual aids

The stipulation that the project findings must be current helped insure that students would use materials and/or ideas presented by the elements of mass communication media (ie., television, newspapers, magazines, books and paperbacks, etc.). Thus, there was a directive that students examine critically the mass communication media for information regarding their project. In this way the student was indirectly exposed to the multitude of practical biology-related topics which are constantly appearing in the media.

The stipulation that the research be practical or applicable provided additional stimulus for perusal of the mass communication

media. Articles and television programs which accentuated the practical aspect of biological concepts were suggested as a source of research material to supply facts and anecdotal records for the audio-visual presentation.

Students within groups were requested to avoid a formal write-up of the results of their inquiry. Instead they were to individually present evidence of their findings to the entire treatment group. Students were requested to arrange presented findings according to a sequential development of ideas pertinent to the research project. All individuals who presented their findings in this manner were directed to manufacture materials and use audio-visual aids of their own choice to expedite the most favourable presentation of their research report. A resource center technician was available for consultation with students regarding advice pertaining to the manufacture of audio-visual aids and use of any equipment. Students were requested to present an outline of presentation format and required materials at least two weeks prior to their presentation date. The instructor acted in an advisory capacity during the entire two-month preparation period. Students were informed that they were responsible for audio-visual equipment arrangements and for familiarization with handling of equipment prior to and following the presentation. Each student group was requested to utilize appropriate music to create a mood suitable for their project presentation.

Presentations were to range in length from twenty to thirty minutes, each student having a five to seven-minute time allotment for his contribution. This was to be followed by a class question and answer period ranging from five to fifteen minutes.

2. WRITTEN REPORT PROJECT

The criteria for project procedures and evaluation were contained in the instructions distributed to students and are found in Appendix F. Students were informed that their research and presentation would be evaluated in accordance with the following criteria. The written report must be:

a) interesting
b) informative and accurate
c) current
d) documented as to source
e) practical or applicable to their lives
f) written or typed demonstrating all principles of correct grammar, spelling and suggested form.
g) at least twenty pages in length (ie., a minimum of five typewritten pages per student in the group.)

The absence of direction for students to critically examine and document the mass communication media (ie., television, radio, newspapers and magazines) helped insure that they would not be exposed to biology related topics over and above their natural tendencies. The librarian, acting in a resource capacity, recommended that students use encyclopedias, books and school vertical files to obtain information pertaining to their project. This was all in accordance with the procedures found in Appendix F. Students were further requested to compile written results in a logical sequential order. Reports were to be submitted for grading and perusal by other members of the treatment group.

COMMUNICATION MEDIA EXPOSURE

Development of the Instrument

In order to determine students' exposure to biology-related topics via the mass communication media an instrument to measure this variable was developed. It was decided that the two components of exposure that would be measured were reading and commercial television viewing.

A survey instrument was constructed to include twenty-five items related to the measurement of reading exposure to biology related topics and a similar number of items for television exposure.

A list of television programs known to contain biology- related topics was drawn up following consultation with other biology teachers. The programs were selected to form part of the measurement instrument by meeting a criterion, determined by the author of this study, of demonstrating some biology-related topic at least one time for every three viewings.

Similarly, a list of magazines known to contain biology related topics was compiled and used to form part of the reading exposure measurement instrument. Questions related to newspaper reading were included to measure student exposure to that component of the mass communication media. The complete instrument is included in Appendix C.

The instrument was scored by employing a Likert-scale in which point values were assigned to the range of student responses. Increasingly higher levels of exposure generated increasingly higher point values.

The following is an example of the scoring method.

I have read popular science magazine.

STUDENT CHOICE	ASSIGNED POINT VALUE
a) Never	0
b) Seldom	1
c) Occasionally	2
d) Often	3
e) Regularly	4

The survey when scored generated two separate measurement totals representing reading and television orientation.

Scores for each orientation were rank ordered and a median calculated for each. Students demonstrating scores above the medians were designated as having high reading or television orientation. Those students having scores fall below the medians were designated as having low orientation.

Thus, there were two independent variables each with two levels related to mass communication media exposure. These are depicted below in figure 3.2.

HIGH TELEVISION		LOW TELEVISION	
High Reading	Low Reading	High Reading	Low Reading

FIGURE 3.2

DIAGRAMATIC REPRESENTATION OF LEVELS OF COMMUNICATION MEDIA EXPOSURE

The diagram shows that students with high or low television exposure may also demonstrate either a high or low reading exposure.

VALIDITY OF THE INSTRUMENT

Face validity was established by a conscientious effort to include only items which the author had pre-determined would demonstrate measurement of media exposure to biology-related topics.

Content validity relative to the suitability of items to measure exposure to biology related topics was established by submitting the statements to a panel for approval.[1] The panel consisted of five experienced biology teachers each teaching a similar course in biology to that studied by students involved in the study. Panel members were asked to determine whether items of the instrument would provide a measure of student exposure to biology-related topics. Only items for which at least eighty per cent of the panel agreed would measure exposure were retained.

RELIABILITY OF THE INSTRUMENT

Reliability was statistically determined by employing a test-retest technique. The instrument was administered to the experimental group and subsequently scored. Students were assigned numbers and a table of random numbers was consulted to select a group consisting of approximately twenty per cent of the sample. These twenty students were retested two months following the first administration of the instrument. Results were scored and the two sets of data were correlated for reading and television orientations. The formula used for the calculation of the correlation coefficient from ungrouped data

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[1] Appendix G

using raw scores was the following:[2]

$$\gamma = \frac{N \Sigma XY - \Sigma X \Sigma Y}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

in which:

N = number of subjects

ΣX = sum of first set of scores

ΣY = sum of second set of scores

ΣX^2 = sum of squares of first set of scores

ΣY^2 = sum of squares of second set of scores

ΣXY = sum of products of first and second sets of scores

Since the administration of the instrument produced two scores, a reliability coefficient was required for each score. The reliability coefficients obtained for the sub-sample of twenty students were:

ORIENTATION	RELIABILITY COEFFICIENT
Reading	0.84
Television	0.87

Both coefficients were statistically significant at the .01 confidence levels.

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[2] George A. Ferguson, Statistical Analysis in Psychology and Education, McGraw Hill Inc., New York, 1966, p. 111.

III. DEPENDENT VARIABLES

1. VALUE ORIENTATION SURVEY

Development of the Instrument

The value orientation survey was designed to determine an individual's preference for the humanistic, theoretical and technological aspects of biology. A list of biology-related topics was formulated from a collection of current magazine and newspaper articles. Topics which incorporated principles or concepts related to the biology course were selected to comprise the subject matter from which items were designed.

Each item consisted of three option statements. One statement was designed to reflect the humanistic value, a concern for improvement of the human condition. A second statement pertained to the technological value for application of biology concepts in the industrial processes used to produce material goods. The third option statement delineated a theoretical value for the ordering and systemization of biological knowledge. The following is an example taken from the value orientation survey.

(A) Newborn babies achieve better blood clotting ability if vitamin K were given to their mothers prior to the birth.

(B) The function of vitamin K is to stimulate the production of prothrombin, a plasma enzyme necessary to catalyze the calcium-thromboplastin reaction.

(C) Vitamin K can be produced by isolation from alfalfa or from fish meal subjected to bacterial putrefaction.

This item was designed to present:

Option (A) Humanistic Value

Option (B) Theoretical Value

Option (C) Technological Value

The three statements were randomly assigned to option choices throughout the instrument.

Thirty items were constructed and administered to a grade twelve biology class similar to that of the study group but not involved in the experiment at Sisler High School. Four items were eliminated because they proved inadequate for measurement purposes. Thus, the complete instrument consisted of twenty-six items.

Students were not informed of value association attributed to the statements. The directions specified that they were to consider all three statements as being equally correct. They were further instructed to rank order their preference for the statements.

The instrument was scored by assigning two points for a first choice and one point for a second choice. Three scores were generated for each individual representing a measure of his orientation toward humanistic, theoretical, and technological values in biology.

VALIDITY

Face validity was established by a conscientious effort to include pre-determined biological concepts pertinent to all phases

of the course content. A panel of five experienced biology teachers was consulted for verification.

Content validity was established by submitting the option statements to a panel for categorization. The panel consisted of five experienced biology teachers presently teaching a similar course as that studied by students involved in the study. The panel members were asked to categorize alternative statements of each item as humanistic, theoretical, technological, or none of these according to the definitions provided them.[3] Only items for which at least eighty per cent of the panel had agreed were retained.

RELIABILITY

The statistical reliability was determined following an administration of the instrument to a class of students at St. John's High School which was similar to that of the experimental group. An odd-even split halves technique was employed. First, all odd-numbered item scores were totalled for each of the three option categories followed by the same procedure for the even-numbered items. Next, the formula described by Ferguson and previously used in the media exposure survey was employed to derive a correlation coefficient for half the instrument (ie., thirteen items).

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[3] Appendix C

The Spearman-Brown Prophecy formula was then employed to predict the reliability of the entire test consisting of twenty-six items. This formula is depicted as follows:[4]

$$\text{Estimated Spearman-Brown reliability of total instrument} = \frac{2 \times \text{actual correlation between halves of the instrument}}{1 + \text{actual correlation between halves of the instrument}}$$

Since the administration of the instrument generated three measurement scores, a reliability coefficient was required for each. The reliability coefficients obtained for the sample of students were:

Value Preference	Corrected Spearman-Brown Reliability Estimate
Humanistic	.80
Technological	.60
Theoretical	.82

All coefficients were statistically significant at the .01 confidence level.

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[4] David J. Fox, The Research Process in Education, Holt Rinehart and Winston, Inc., New York, 1969, P. 358.

2. STUDENT INTEREST SURVEY

Development of the Instrument

The Student Interest Survey was designed to provide a measure of students' interests in biology-related topics. The biology text book recommended by the curriculum guide was consulted to identify the biological principles and concepts studied in the course.[5] A second list of biology-related topics was compiled from current publications of newspapers and magazines as well as recent presentations of biology topics by television programs. Those topics which demonstrated application of principles or concepts found in the first list were selected for use in the interest measurement instrument. Care was taken in numerically selecting the proportion of topics that corresponded to designated emphasis of subject matter as outlined by the text. Thus, a list of topics was drawn up to proportionately correspond to each phase of the course. Fifty biology-related topics formed the completed instrument and are found in appendix A.

Students were instructed to indicate the extent of their interest in all topics. A Likert-scale was employed for student response and point values were assigned corresponding to the range of student responses. Increasingly higher levels of interest generated a proportionate point value. The following is an example taken from the instrument.

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[5] Biological Science Curriculum Study, Biological Science: Molecules to Man - Blue Version, 2nd Edition , Houghton Mifflin Co., Boston, 1968.

TOPIC: Stress: Cause of Diseases

STUDENT CHOICE	POINT VALUE
(a) No interest	0
(b) Little interest	1
(c) Moderate interest	2
(d) Very interested	3
(e) Intense interest	4

VALIDITY OF THE INSTRUMENT

Face validity was established by a conscientious effort to represent all phases of the recommended curriculum in the proportion designated by the text book. This was checked by submitting the instrument to a panel of five experienced biology teachers. Content validity was also established. The panel members were asked to determine the items which represented a reflection of subject matter content as it appeared in the text.[6] Only items for which at least eighty per cent of the panel had agreed were related to the course content were retained.

RELIABILITY OF THE INSTRUMENT

The instrument was pre-administered to a group of biology students at the 1974 Summer School session held at St. John's High School. The students were drawn from most of the Winnipeg

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[6] Appendix G

Division high schools and were similar to the sample of students involved in the study. The instrument was scored and a mark generated to represent an estimate of student interest in biology-related topics.

A split-halves technique was employed to statistically determine reliability. All odd item scores were totalled separately to provide one set of scores and a similar procedure using even items generated a second set of scores for each student. The correlation and Spearman-Brown Prophecy formulae described earlier in this chapter were used to predict the reliability of the entire instrument. The reliability coefficient obtained for the student interest survey was .94. This coefficient was statistically significant at the .01 level of confidence.

IV. EXPERIMENTAL DESIGN

STATISTICAL MODEL

The study was conducted using a Posttest-Only Control Group design similar to that described by Campbell and Stanley.[7] Symbolically the design may be depicted as:

$$\begin{matrix} XO_1 \\ O_2 \end{matrix}$$

[7] Donald T. Campbell and I. C. Stanley, Experimental and Quasi-Experimental Designs for Research, Rand McNally and Company, Chicago, 1966, P. 26.

in which:

X represents exposure of a group to an experimental variable or event, the effects of which are to be measured.

O represents some process of observation or measurement.

The X's and O's in a given row are representative of the same specific group. The left to right dimension indicates temporal order and X's and O's vertical to one another are simultaneous occurring events.

Figure 3.3 illustrates the design of the study.

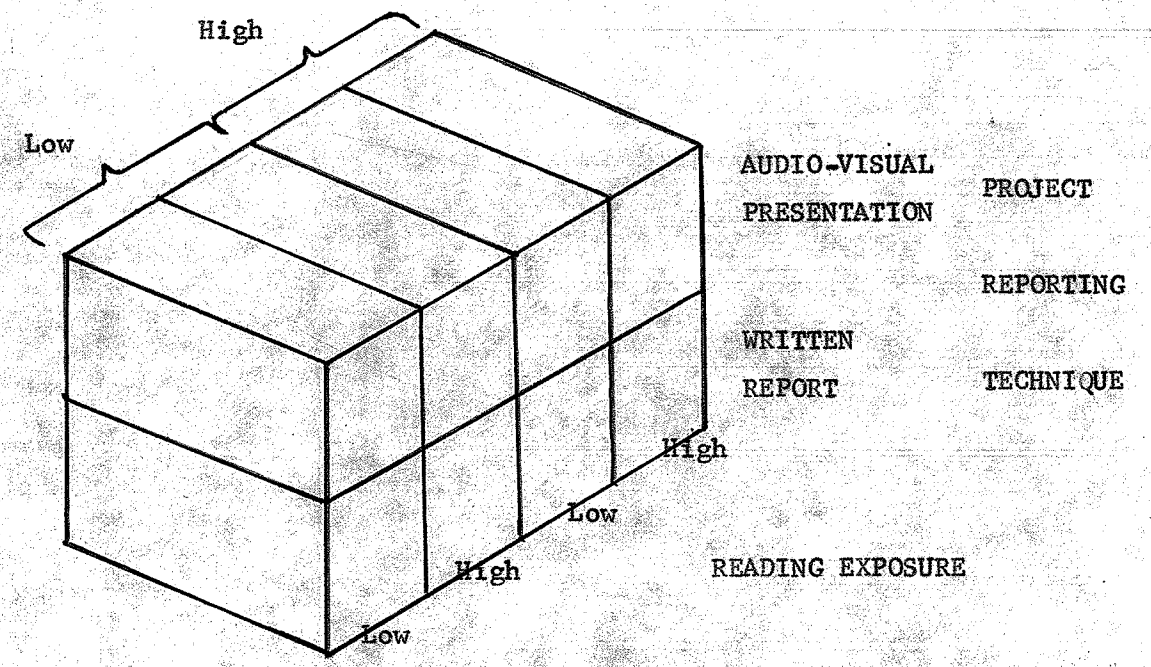

FIGURE 3.3
MODEL OF EXPERIMENTAL DESIGN

The diagram shows two treatment groups (audio-visual presentation and written report). Each treatment group contains two levels of television exposure (low and high) each having two levels designated as reading exposure (low and high). These six independent variables generate eight experimental cells. This model allowed significant tests for all main effects and all interactions.

The dependent variables were:

(a) total score on humanistic value orientation

(b) total score on technological value orientation

(c) total score on theoretical value orientation

(d) total score on biology-topic interest survey

Pretest designs were avoided to minimize negative bias which might have occurred as a result of excessive testing. Some subjects might have been sensitized to the treatment by exposure to pretests involving interest surveys.

ANALYSIS OF THE DATA

Instruments administered to students for measurement of value orientations and biology interests were scored. The appropriate analysis was then applied.

Hypotheses associated with value orientations and interests were tested by a series of t-tests. The hypotheses were then rejected or not rejected at the .01 level of significance. The hypothesis con-

cerning interactions of project reporting technique with communication media exposure was rejected or not rejected at the .01 level of significance. The cell means were examined and graphed to facilitate interpretation. Differences were assessed for the effects of project treatment and media exposure.

HYPOTHESES

The following null experimental hypotheses were tested at $\alpha = .01$.

HYPOTHESIS 1

There are no significant differences in mean scores of humanistic, technological, and theoretical value orientations and biology interests of male and female biology students regardless of project reporting technique or communication media exposure level.

Symbolically

Ho: $u_1 = u_1'$

H_1: $u_1 \neq u_1'$

Legend: u_1 = mean scores of value orientations of female students.

u_1' = mean scores of value orientations of male students.

HYPOTHESIS 2

There are no significant differences in mean scores of value orientations and biology interests between the two treatment groups regardless of reading or television exposure of students.

Symbolically

Ho: $u_2 = u_2'$

Ho: $u_2 \neq u_2'$

Legend: u_2 = mean scores of value orientations and biology interests for Audio-Visual Presentation treatment group.

u_2' = mean scores of value orientations and biology interests for Written Report group.

HYPOTHESIS 3

There are no significant differences in mean scores of value orientation and biology interests between groups demonstrating high or low television exposure regardless of reading exposure level or project reporting technique.

Symbolically:

Ho: $u_3 = u_3'$

H_1: $u_3 \neq u_3'$

Legend: u_3 = mean scores of value orientations and biology interests for groups having high television exposure.

u_3' = mean scores of value orientations and biology interests for groups having low television exposure.

HYPOTHESIS 4

There are no significant differences in mean scores of the humanistic, technological, and theoretical value orientations and biology interests between groups demonstrating high or low reading exposure regardless of television exposure level or project reporting technique.

Symbolically:

Ho: $u_4 = u_4'$

H_1: $u_4 \neq u_4'$

Legend: u_4 = mean scores of value orientations and biology interests for groups demonstrating high reading exposure.

u_4' = mean scores of value orientations and biology interests for groups demonstrating low reading exposure.

HYPOTHESIS 5

There are no combinations of reporting technique and communication media exposure which are significant in differentially affecting humanistic, technological, and theoretical value orientations and biology interests of biology students.

Symbolically:

H_o: $u_5 = u_5'$

H_1: $u_5 \neq u_5'$

Legend: u_5 = mean score of value orientations and biology interests for groups who have experienced interactions between audio-visual presentations of projects and television exposure.

u_5' = mean scores of value orientations and biology interests for groups who have experienced interactions between written reports of projects and television exposure.

Ho: $u_5'' = u_5'''$

Hi: $u_5'' \neq u_5'''$

Legend: u_5'' = mean score of value orientations and biology interests for groups who have experienced interactions between audio-visual presentations of projects and reading exposure.

u_5''' = mean score of value orientations and biology interests for groups who have experienced interactions between written reports of projects and reading exposure.

HYPOTHESES 6

There are no significant differences between mean scores of humanistic, technological, and theoretical value orientations of biology students.

Symbolically

Ho: $u_6 = u_6' = u_6''$

Ho: $u_6 \neq u_6' \neq u_6''$

Legend: u_6 = mean scores of humanistic value orientation.

u_6' = mean scores of technological value orientation.

u_6'' = mean scores of theoretical value orientation.

V. PROCEDURES OF THE STUDY

Permission was obtained from the administrators of the St. John's Summer School during July, 1974 to test members of the grade 12 biology class. A student interest survey was constructed and administered to the class of students. The survey was scored and reliability determinations performed. Permission was obtained from the administrator of Sisler High School in September, 1974 to perform the study.

The four classes of grade 12 biology students at Sisler High School were assigned at random to one or the other of two treatment groups designated as the audio-visual presentation project group and the written report project group. Procedures were described to students and distributed in printed form in early October, 1974. Briefly, the procedures directed students involved in each of the two treatment types to work in groups of three or four to voluntarily select, independently research, and report findings or solutions to some biology-related problem of practical and mutual interest to the group. A list of suggested topics included in the procedural instructions was compiled by making a study of topics selected for research by students in former years and by producing a list of biology-related topics which had appeared in the mass communication media over the preceding three years. Students were not required to pursue topics on this suggested list but there was provision that a topic they did select must be related indirectly to some curriculum

topic as outlined by the text used in the course.[8] A library resource consultant was invited to discuss research techniques with the students. Possible sources of information were described and instructions for library use were issued.[9]

A definite time allotment was designated, namely one period per cycle of eight periods, or 12.5% of scheduled time for groups and individuals to research and/or discuss problems pertaining to their research. The remaining time was utilized for theory, discussion, laboratory work, films, and tests. Although the proportion of scheduled time assigned to independent study projects appeared disproportionately small compared with that for regular class routine, students spent a considerable amount of their unassigned time devoted to these projects.

Voluntary selection of problem studied, research technique, use of unassigned school time, partners selected, and reporting technique provided the maximum freedom required to achieve goals of the inquiry process.

Both treatment groups were allowed two months for completion of their research endeavour.

A Reading-Television survey was constructed and administered to all groups in the study in October and was later checked for re-

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[8] B.S.C.S., Biological Science: Molecules to Man-Blue Version, Houghton Mifflin Co., Boston, 1968.

[9] Appendix E.

liability in a retest procedure during January, 1975. Students' scores for reading and television exposure to biology-related topics were rank-ordered and a median determined for each. Students who achieved scores above the median were categorized as being highly exposed to reading or television and those with scores below the medians were categorized as having low reading or television exposure. Thus, four possible combinations of student media exposures were generated within the audio-visual and written groups resulting in eight possible independent variable cell groups.

Students performed their research during the months of October to December, 1974.

A Value Orientation Survey instrument was constructed and administered to a class of grade twelve biology students at St. John's High School during early January, 1975. Biology students involved in the testing were similar to the study group. The surveys were scored and reliability was determined.

Face and content validity was established in January, 1975 by submitting all three instruments to a panel of five experienced biology teachers.

The students presented their audio-visual projects during the latter part of December, 1974, and early January, 1975. Written reports were also submitted for evaluation at this time. The Value Orientation Survey and Student Interest Survey were then administered to all groups. The surveys were scored and results were then analyzed using a two-way analysis of variance technique. Hypotheses were either rejected or not rejected at the .01 level of confidence.

VI. SUMMARY

This chapter included the method of assignment of groups to treatment types. An instrument used to determine communication media exposure was described. Instruments for determination of the dependent variables, namely value orientations and biology interests, were described. Research design, hypotheses, and procedures of the investigation were described.

CHAPTER IV

ANALYSIS OF THE DATA

I. PROCEDURE

Separate t-tests for significance were employed to test hypotheses involving the effects of one variable upon two groups of students. A two-way analysis of variance incorporating two reporting techniques and four combinations of communication media exposure was used to test hypotheses concerned with interactions. Dependent variables included scores representing the humanistic, technological, and theoretical value orientations of biology students. A score representative of students interest in biology-related topics was also used as a dependent variable.

The analysis of hypotheses one to four included a separate t-test for each of the three value orientations (i.e., humanistic, technological, and theoretical) and the biology interest score within each hypothesis.

An analysis of the dependent variables produced the results summarized in Table 4.1.

TABLE 4.1

MEAN SCORES OF DEPENDENT VARIABLES (N = 112)

DEPENDENT VARIABLE	MEAN SCORE
Value Orientations	
Humanistic	35.7
Technological	17.4
Theoretical	24.9
Biology Interest	121.3

II. RESULTS

HYPOTHESIS 1.

There are no significant differences in mean scores of humanistic, technological, and theoretical value orientations and biology interests of male and female biology students regardless of project reporting technique or communication media exposure level.

HUMANISTIC VALUE

The mean humanistic value orientation was 35.6 for male students and 35.8 for female students which produced a $t = 0.133$ with 110 degrees of freedom. The obtained t was less than the

critical t = 2.624 required for significance. Therefore the hypothesis was not rejected at the .01 level of confidence. This was interpreted to mean that male and female biology students do not differ significantly in their preference for humanistic values

TECHNOLOGICAL VALUE

The mean technological value orientation was 19.6 for male students and 15.9 for female students which produced a t = 3.13 with 110 degrees of freedom. The obtained t was greater than the critical t = 2.624 required for significance. Therefore the hypothesis was rejected at the .01 level of confidence. This was interpreted to mean that male biology students demonstrated a significantly greater preference for the technological aspects of biology than did female students.

THEORETICAL VALUE

The mean theoretical value orientation was 22.8 for male students and 26.3 for female students which produced a t = 1.994 with 110 degrees of freedom. The obtained t was less than the critical t = 2.624 required for significance. Therefore the hypothesis was not rejected at the .01 level of confidence. This was interpreted to mean that male and female biology students did not differ significantly in their preference for theoretical values.

The value orientation comparisons may be depicted as in figure 4.1 and are summarized in table 4.2.

BIOLOGY INTEREST

The biology interest mean score was 117.3 for male students and 124.1 for female students with $t = 1.370$ and 110 degrees of freedom. The obtained t was less than the critical $t = 2.624$ required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that female students did not find biology-related topics more interesting than did male students. The results may be depicted as in figure 4.2 and are summarized in table 4.1.

TABLE 4.2

TESTS OF SIGNIFICANCE:

VALUE ORIENTATIONS AND BIOLOGY INTEREST ACCORDING TO SEX

ORIENTATION	SEX	MEANS	VARIANCE	df	OBTAINED t
Humanistic	male	35.6	60.96	110	0.133
	female	35.8			
Technological	male	19.6	37.65	110	3.131 *
	female	15.9			
Theoretical	male	22.8	83.41	110	1.994
	female	26.3			
Biology interest	male	117.3	666.62	110	1.370
	female	124.1			

critical t(.01) = 2.624

* significant result

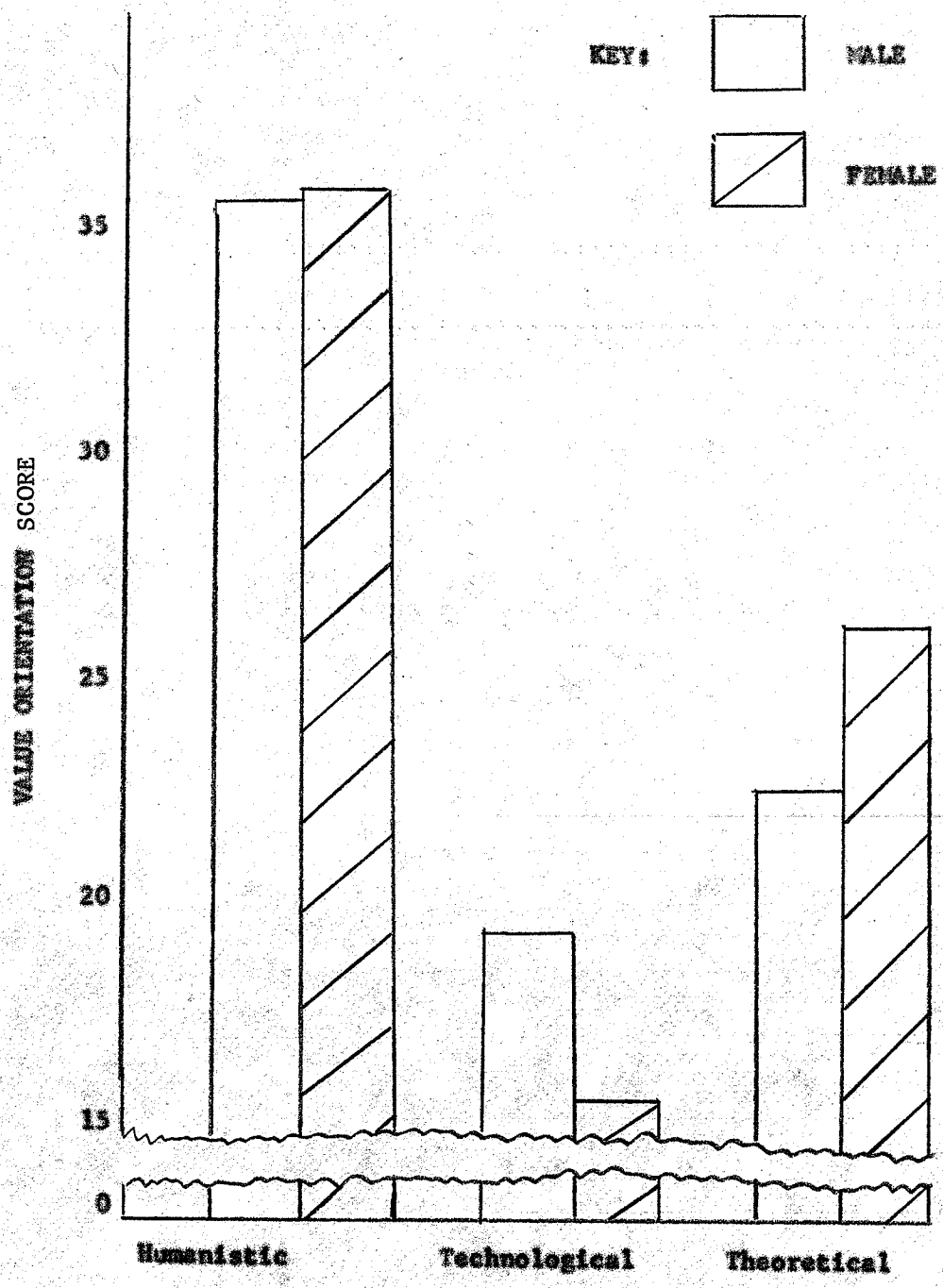

FIGURE 4.1

A COMPARISON OF VALUE ORIENTATIONS

EXHIBITED BY MALE AND FEMALE BIOLOGY STUDENTS

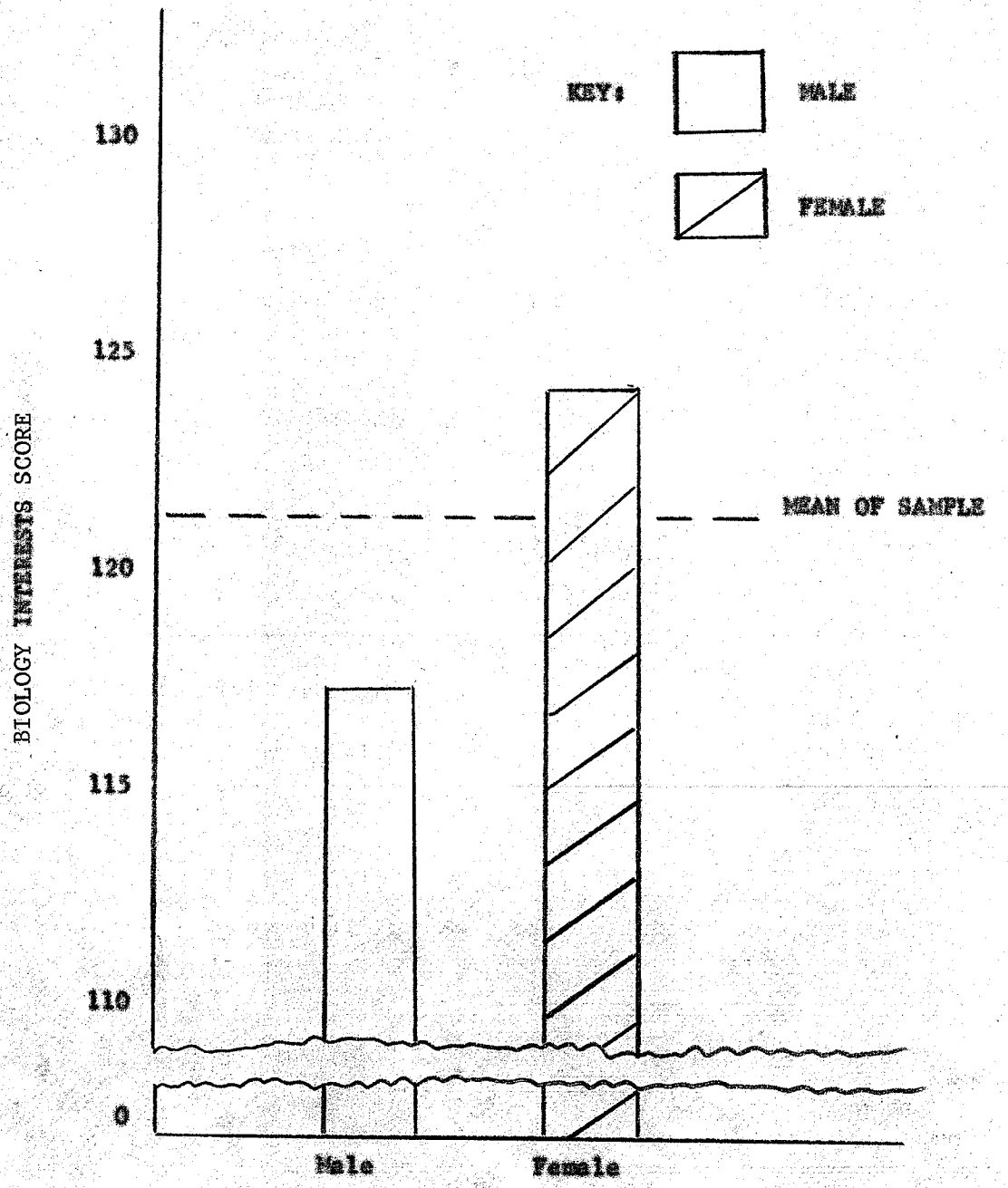

FIGURE 4.2

COMPARISON OF BIOLOGY INTERESTS

EXHIBITED BY MALE AND FEMALE STUDENTS

HYPOTHESIS 2

There are no significant differences in mean scores of the humanistic, technological, and theoretical value orientations and biology interests between two treatment groups regardless of reading or television exposure levels of students.

HUMANISTIC VALUE

The mean humanistic value score was 35.5 for the audio-visual presentation group and 35.9 for the written report group. A t-test of significance produced a $t = 0.295$ with 110 degrees of freedom. The obtained t-value was less than the critical $t = 2.624$ required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that project reporting technique was not significant in influencing preference for humanistic value.

TECHNOLOGICAL VALUE

The mean technological value score was 16.3 for the audio-visual presentation group and 18.3 for the written report group. The t-test of significance produced a $t = 1.746$ with 110 degrees of freedom. The obtained t was less than the critical $t = 2.624$ required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted

to mean that project reporting technique was not significant in determining preference for technological value.

THEORETICAL VALUE

The mean theoretical value score was 26.3 for the audio-visual presentation group and 23.7 for the written report group. The t-test of significance produced a t = 1.574 with 110 degrees of freedom. The obtained t was less than the critical t = 2.624 required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that project reporting technique was not significant in determining preference for the theoretical value.

BIOLOGY INTEREST

The mean biology interest score was 118.8 for the audio-visual presentation group and 123.5 for the written report group. The t-test of significance produced a t = 0.955 with 110 degrees of freedom. The obtained t was less than the critical t = 2.624 necessary for significance at the.01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that project reporting technique was not significant in producing interest in biology related topics. The result may be depicted as in figure 4.3 and in figure 4.4 and are summarized in table 4.3.

TABLE 4.3

TESTS OF SIGNIFICANCE:

VALUE ORIENTATIONS AND BIOLOGY INTEREST

ACCORDING TO PROJECT REPORTING TECHNIQUE

DEPENDENT VARIABLE	REPORTING TECHNIQUE	MEAN SCORE	VARIANCE	DEGREES OF FREEDOM	OBTAINED t
Humanistic	A.V.	35.5	61.91	110	0.295
Value	W	35.9			
Technological	A.V.	16.3	39.81	110	1.746
Value	W	18.3			
Theoretical	A.V.	26.3	71.73	110	1.574
Value	W	23.7			
Biology	A.V.	118.8	672.59	110	0.953
Interest	W	123.5			

critical t(.01) = 2.624

Reporting technique key:

A.V. = Audio-Visual Presentation

W = Written Report

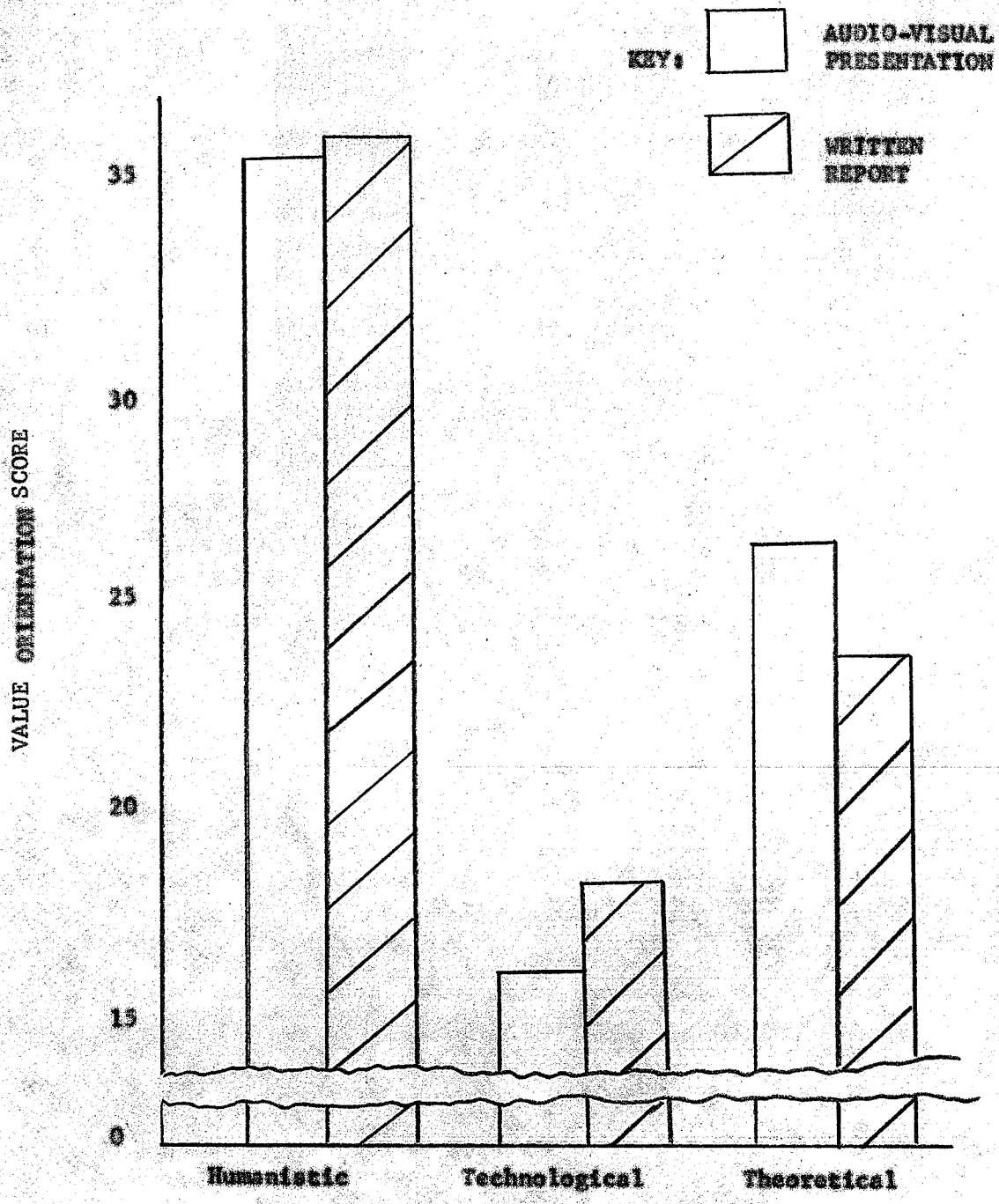

FIGURE 4.3

A COMPARISON OF VALUE ORIENTATIONS
HELD BY STUDENTS EXPERIENCING
TWO PROJECT REPORTING TECHNIQUES

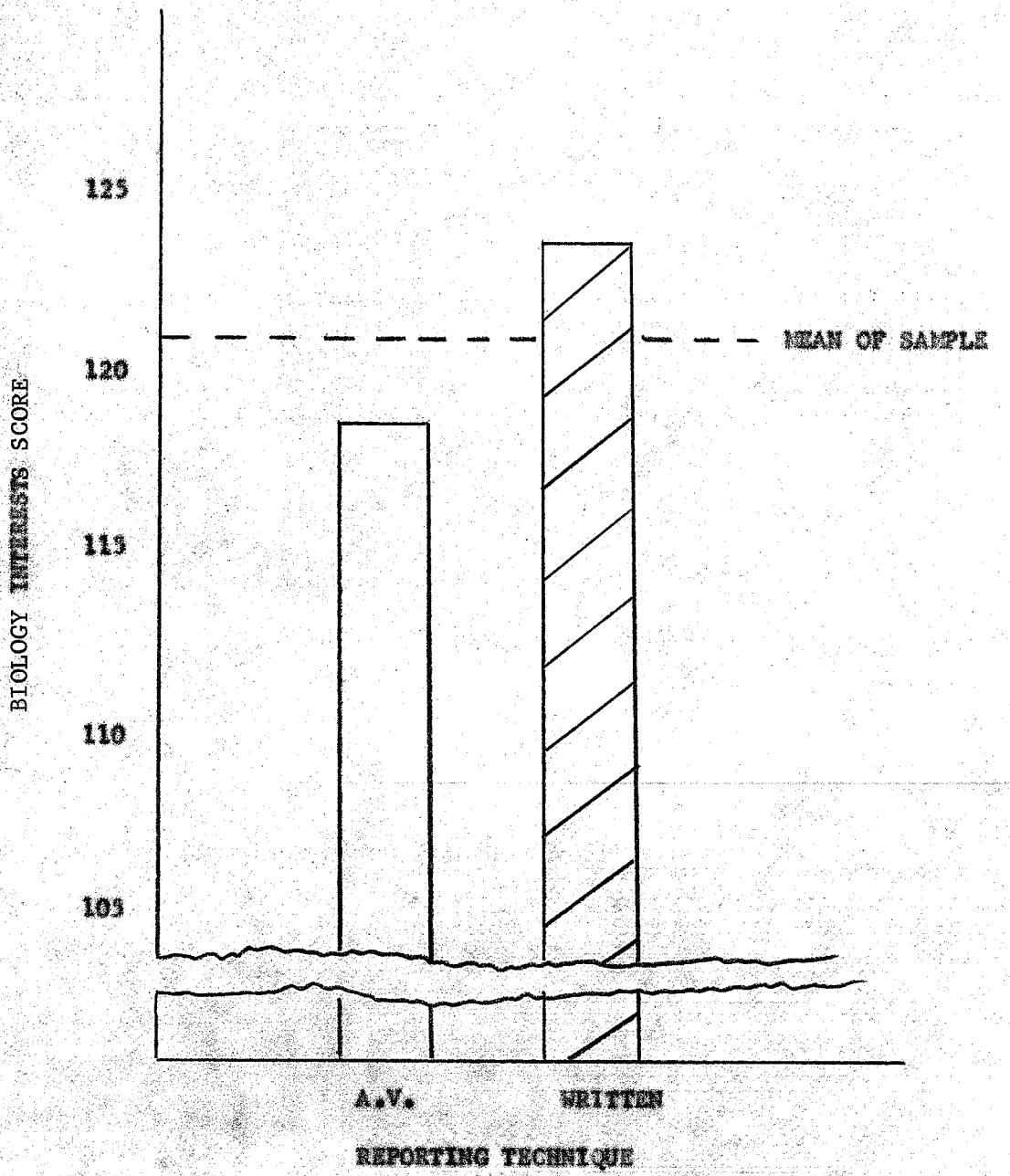

FIGURE 4.4

A COMPARISON OF BIOLOGY INTERESTS EXHIBITED BY STUDENTS WHO HAVE EXPERIENCED TWO PROJECT REPORTING TECHNIQUES

HYPOTHESIS 3

There are no significant differences in mean scores of the humanistic, technological, and theoretical value orientations and biology interests between groups demonstrating high or low television exposure regardless of reading exposure.

HUMANISTIC VALUE

The humanistic value mean score was 37.0 for the high television exposure group and 34.5 for the low television exposure group. A t-test of significance produced a $t = 1.823$ with 110 degrees of freedom. The obtained t-value was less than the $t = 2.624$ required for significance at the .01 level of confidence Consequently, the hypothesis was not rejected. This was interpreted to mean that high television exposure was not significant in influencing preference for humanistic value.

TECHNOLOGICAL VALUE

The technological value mean score was 17.1 for the high television exposure group and 17.7 for the low television exposure group. The t-test of significance produced a $t = 0.43$ with 110 degrees of freedom. The obtained t was less than the $t = 2.624$ required for significance at the .01 level of confidence. Consequently the hypothesis was not rejected. This was interpreted to mean that high television exposure was not significant in influencing preference for technological value.

THEORETICAL VALUE

The theoretical value mean score was 23.9 for the high television exposure group and 25.8 for the low television exposure group. The t-test of significance produced a $t = 1.128$ with 110 degrees of freedom. The obtained t-value was less than the $t = 2.624$ required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that high television exposure was not significant in influencing preference for theoretical value.

BIOLOGY INTEREST

The biology interest mean score was 129.5 for the high television exposure group and 113.5 for the low television exposure group. The t-test of significance produced a $t = 3.445$ with 110 degrees of freedom. The obtained t-value was greater than the critical $t = 2.624$ necessary for significance at the .01 level of confidence. Consequently, the hypothesis was rejected. This was interpreted to mean that high television exposure may be influential in producing biology interests.

The results are depicted in figure 4.5 and 4.6 and are summarized in table 4.4.

TABLE 4.4

TESTS OF SIGNIFICANCE:

VALUE ORIENTATIONS AND BIOLOGY INTEREST

ACCORDING TO TELEVISION EXPOSURE

DEPENDENT VARIABLE	TELEVISION EXPOSURE	MEAN SCORE	VARIANCE	df	OBTAINED t
Humanistic	high	37.0	52.20	110	1.823
Value	low	34.5			
Technological	high	17.1	40.85	110	0.430
Value	low	17.7			
Theoretical	high	23.9	85.43	110	1.128
Value	low	25.8			
Biology	high	129.5	611.99	110	3.445*
Interest	low	113.4			

critical t(.01) = 2.624

* SIGNIFICANT RESULT

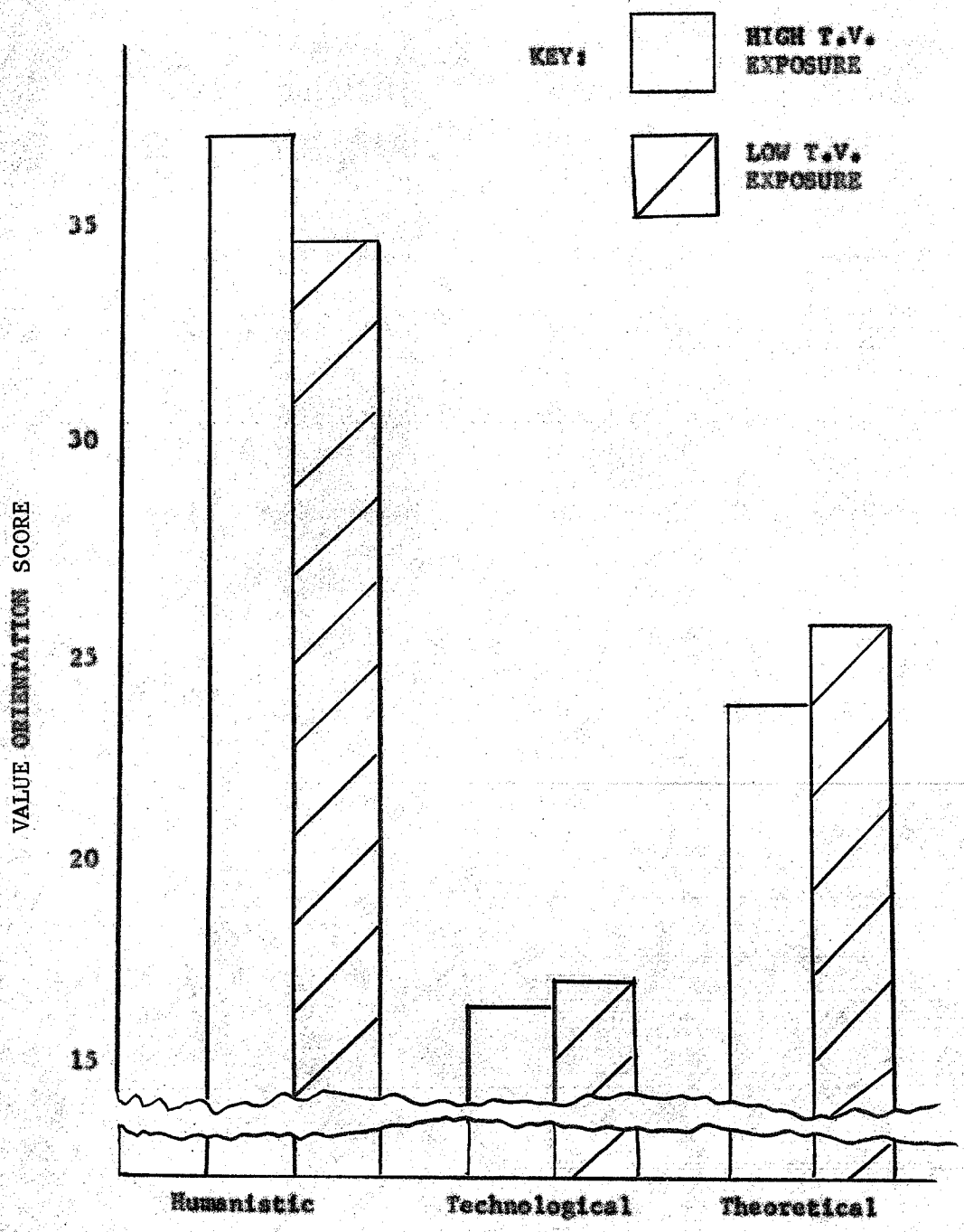

FIGURE 4.5

A COMPARISON OF VALUE ORIENTATIONS EXHIBITED BY BIOLOGY STUDENTS DEMONSTRATING LOW AND HIGH T.V. EXPOSURE

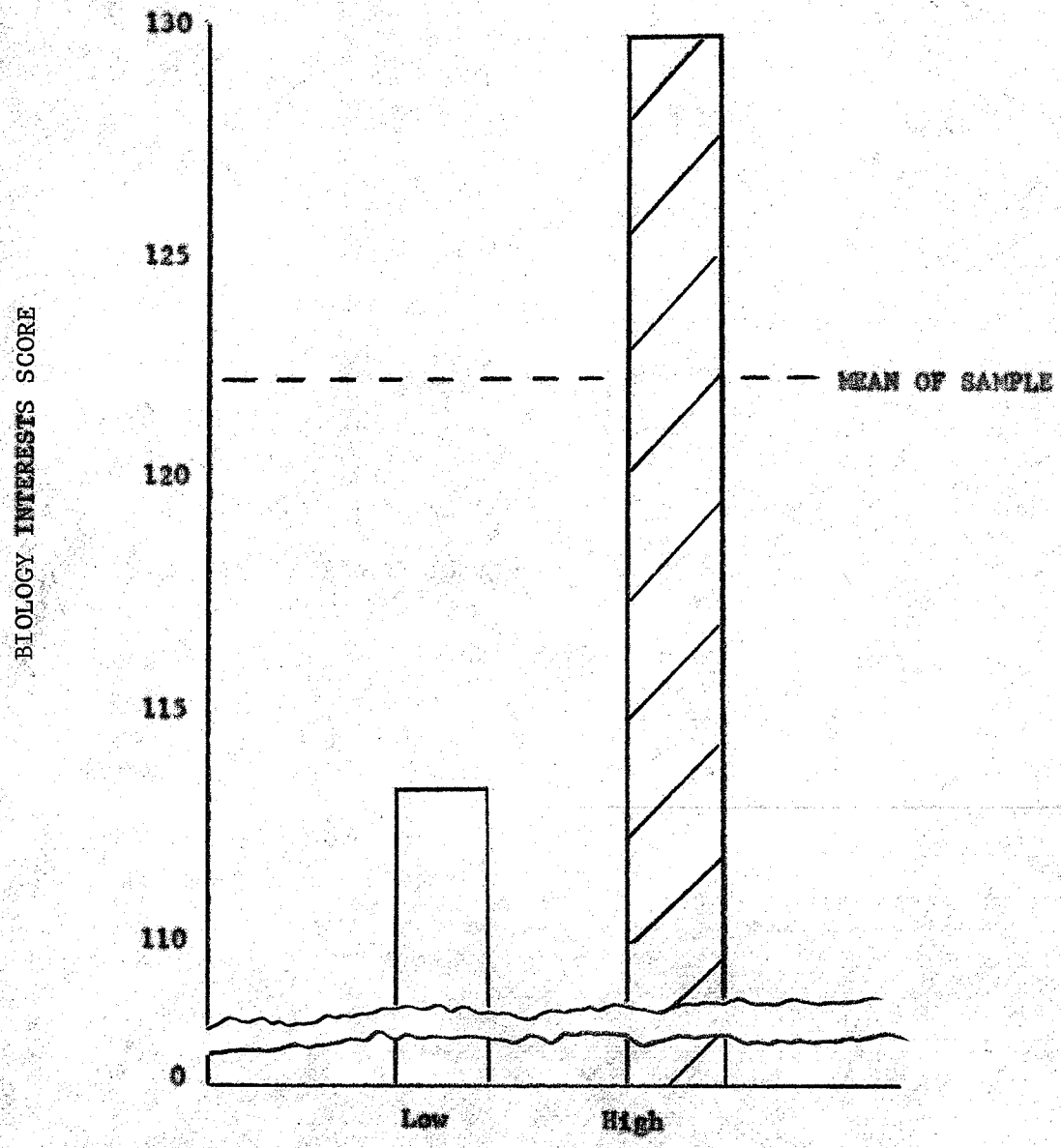

FIGURE 4.6

A COMPARISON OF BIOLOGY INTERESTS EXHIBITED BY BIOLOGY STUDENTS DEMONSTRATING LOW AND HIGH TELEVISION EXPOSURE

HYPOTHESIS 4

There are no significant differences in mean scores of humanistic, technological, and theoretical value orientations and biology interests between groups demonstrating high or low reading exposure regardless of television exposure level or project reporting technique.

HUMANISTIC VALUE

The humanistic value mean score was 35.2 for the high reading exposure group and 36.2 for the low reading exposure group. The t-test of significance produced a $t = 0.753$ with 110 degrees of freedom. The obtained t-value was less than the critical $t = 2.624$ required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that high reading exposure was not significant in influencing preference for humanistic value.

TECHNOLOGICAL VALUE

The technological value mean score was 17.3 for the high reading exposure group and 17.5 for the low reading exposure group. The t-test of significance produced a $t = 0.165$ with 110 degrees of freedom. The obtained t-value was less than the critical

t = 2.624 required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that high reading exposure was not significant in influencing preference for technological value.

THEORETICAL VALUE

The theoretical value mean score was 25.5 for the high reading exposure group and 24.3 for the low reading exposure group. The t-test of significance produced a t = 0.713 with 110 degrees of freedom. The obtained t-value was less than the critical t = 2.624 required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that high reading exposure was not significant in influencing preference for theoretical value.

BIOLOGY INTEREST

The mean biology interest score was 124.4 for the high reading exposure group and 118.4 for the low reading exposure group. The t-test of significance produced a t = 1.234 with 110 degrees of freedom. The obtained t-value was less than the critical t = 2.624 required for significance at the .01 level of confidence. Consequently, the hypothesis was not rejected. This was interpreted to mean that high reading exposure is not significant in producing biology interest.

The result may be depicted as in figures 4.7 and 4.8 and are summarized in table 4.5.

TABLE 4.5

TESTS OF SIGNIFICANCE:

VALUE ORIENTATION AND BIOLOGY INTEREST

ACCORDING TO READING EXPOSURE

DEPENDENT VARIABLE	READING EXPOSURE	MEAN SCORE	VARIANCE	df	OBTAINED t
Humanistic	high	35.2	53.50	110	0.753
Value	low	36.2			
Technological	high	17.3	40.91	110	0.165
Value	low	17.5			
Theoretical	high	25.5	86.03	110	0.713
Value	low	24.3			
Biology	high	124.4	668.75	110	1.234
Interest	low	118.4			

critical t (.01) = 2.624

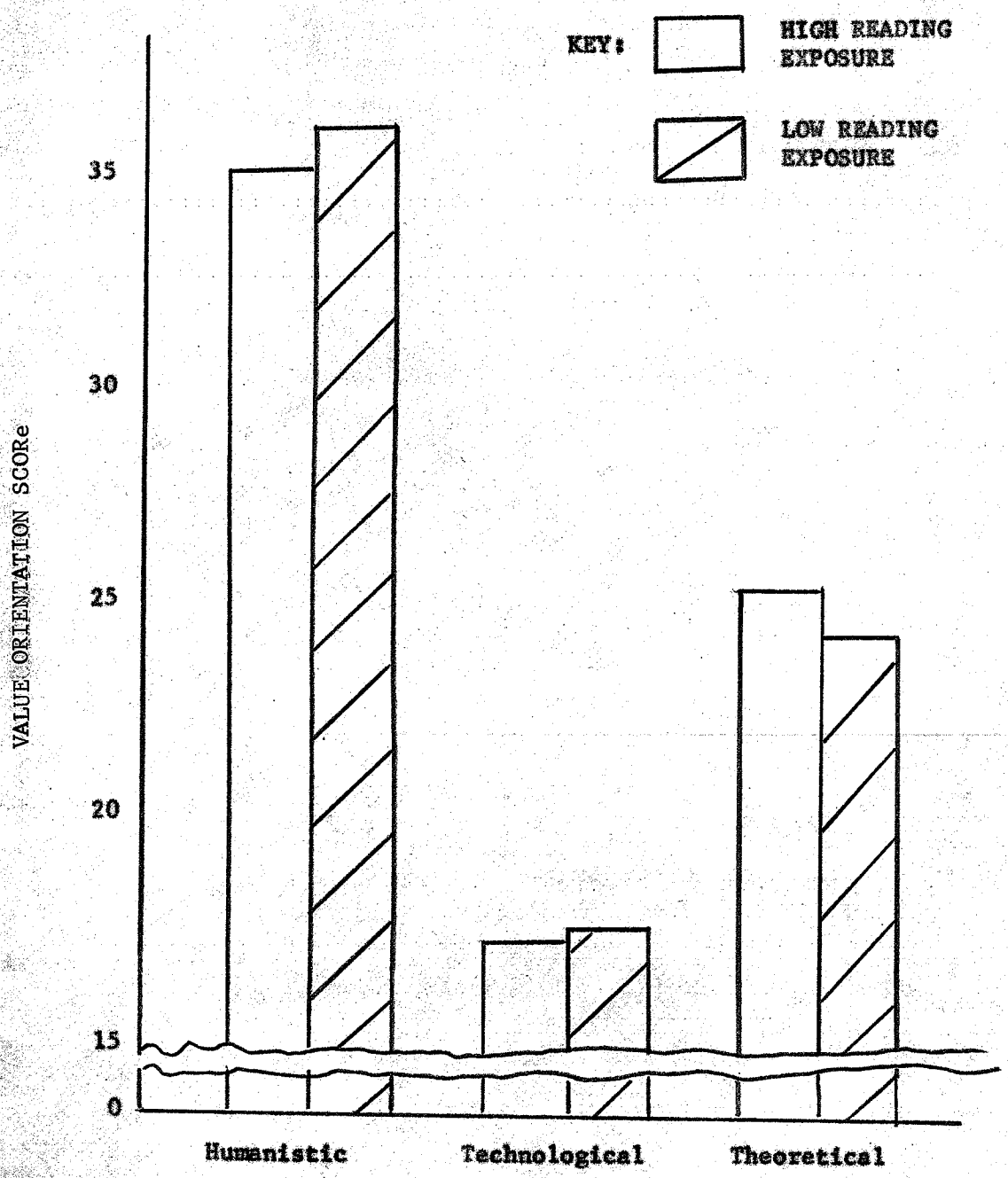

FIGURE 4.7

A COMPARISON OF VALUE ORIENTATIONS EXHIBITED BY BIOLOGY STUDENTS WHO EXPERIENCED LOW AND HIGH READING EXPOSURE

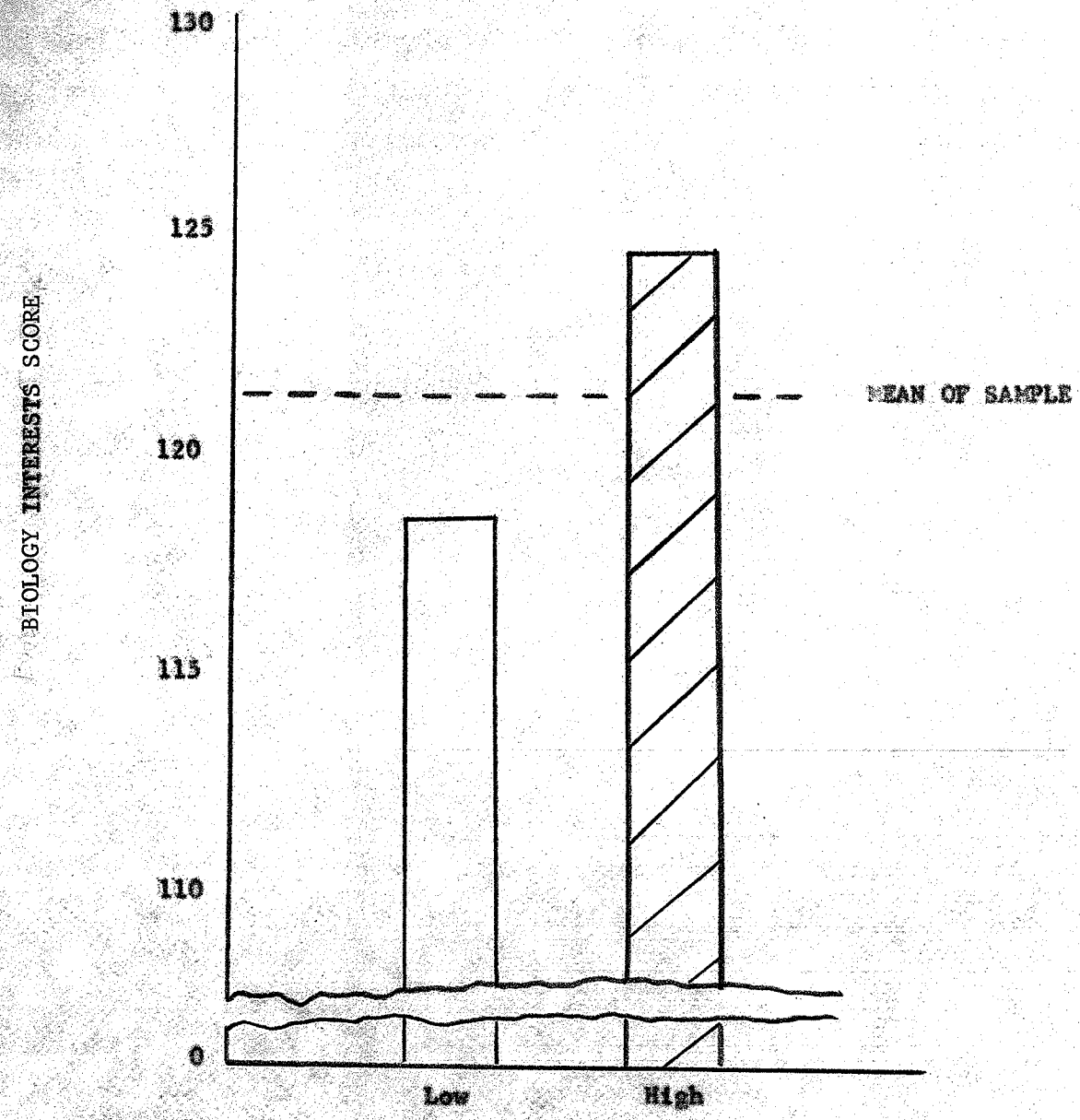

FIGURE 4.8

COMPARISON OF BIOLOGY INTEREST EXHIBITED BY ALL BIOLOGY STUDENTS WHO EXPERIENCED LOW AND HIGH READING EXPOSURE

HYPOTHESIS 5

There are no combinations of reporting technique and communication media exposure which are significant in differentially affecting humanistic, technological, and theoretical value orientations and biology interests of biology students.

All combinations of interactions between project reporting technique and either television exposure or reading exposure were tested for significance using a two-way analysis of variance. All interactions were not significant at the .01 level of confidence. This was interpreted to mean that the various combinations of project reporting technique and communication media exposure were not differentially significant in influencing either value orientation of biology interest. The results may be depicted as in figures 4.9 to 4.12 are are summarized in tables 4.6 and 4.7.

TABLE 4.6

ANOVA TABLE

INTERACTION: TELEVISION EXPOSURE AND PROJECT REPORTING TECHNIQUE

DEPENDENT VARIABLE	SOURCE OF VARIATION	SS	df	VARIANCE	F-RATIO
Humanistic	Between Groups				
Value	T.V.	173.55	1	173.55	2.748
	Reporting	5.38	1	5.38	0.085
	Interaction	44.61	1	44.61	0.706
	Within Groups	6820.48	108	63.15	
Technological	Between Groups				
Value	T.V.	7.51	1	7.51	0.169
	Reporting	121.33	1	121.33	2.728
	Interaction	1.28	1	1.28	0.029
	Within Groups	4803.22	108	44.47	
Theoretical	Between Groups				
Value	T.V.	108.64	1	108.64	1.24
	Reporting	177.8	1	177.8	2.03
	Interaction	109.03	1	109.03	1.25
	Within Groups	9456.32	108	87.55	
Biology	Between Groups				
Interest	T.V.	7264.12	1	7264.12	9.502 *
	Reporting	595.3	1	595.3	0.779
	Interaction	381.05	1	381.05	0.499
	Within Groups	82561.28	108	764.46	

critical F (.01) = 6.87 required for significance

* Significant Result

TABLE 4.7

ANOVA TABLE

INTERACTION: READING EXPOSURE AND PROJECT REPORTING TECHNIQUE

DEPENDENT VARIABLE	SOURCE OF VARIATION	SS	df	VARIANCE	F-RATIO
Humanistic	Between Groups				
Value	Reading	30.28	1	30.28	0.479
	Reporting	5.38	1	5.38	0.085
	Interaction	26.93	1	26.93	0.426
	Within Groups	6820.48	108	63.15	
Technological	Between Groups				
Value	Reading	1.02	1	1.02	0.023
	Reporting	121.33	1	121.33	2.728
	Interaction	2.92	1	2.92	0.066
	Within Groups	4803.22	108	44.47	
Theoretical	Between Groups				
Value	Reading	43.05	1	43.05	0.492
	Reporting	177.8	1	177.8	2.031
	Interaction	24.0	1	24.0	0.274
	Within Groups	9456.32	108	87.55	
Biology	Between Groups				
Interest	Reading	1017.42	1	1017.42	1.331
	Reporting	595.3	1	595.3	0.779
	Interaction	751.74	1	751.74	0.983
	Within Groups	82,561.28	108	764.46	

CRITICAL F (.01) = 6.87 required for significance

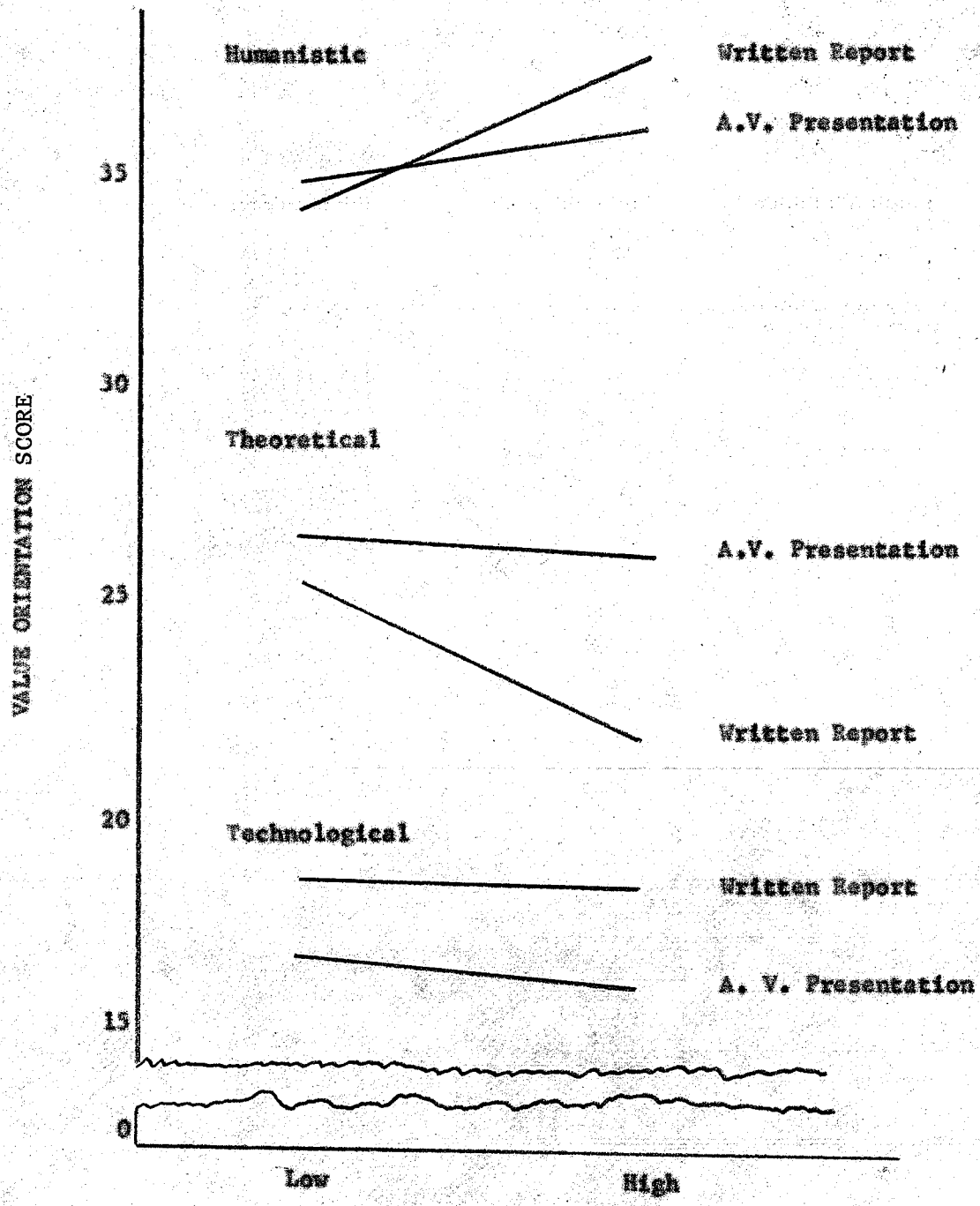

FIGURE 4.9

THE EFFECTS OF TELEVISION EXPOSURE AND PROJECT REPORTING TECHNIQUE UPON VALUE ORIENTATIONS OF BIOLOGY STUDENTS.

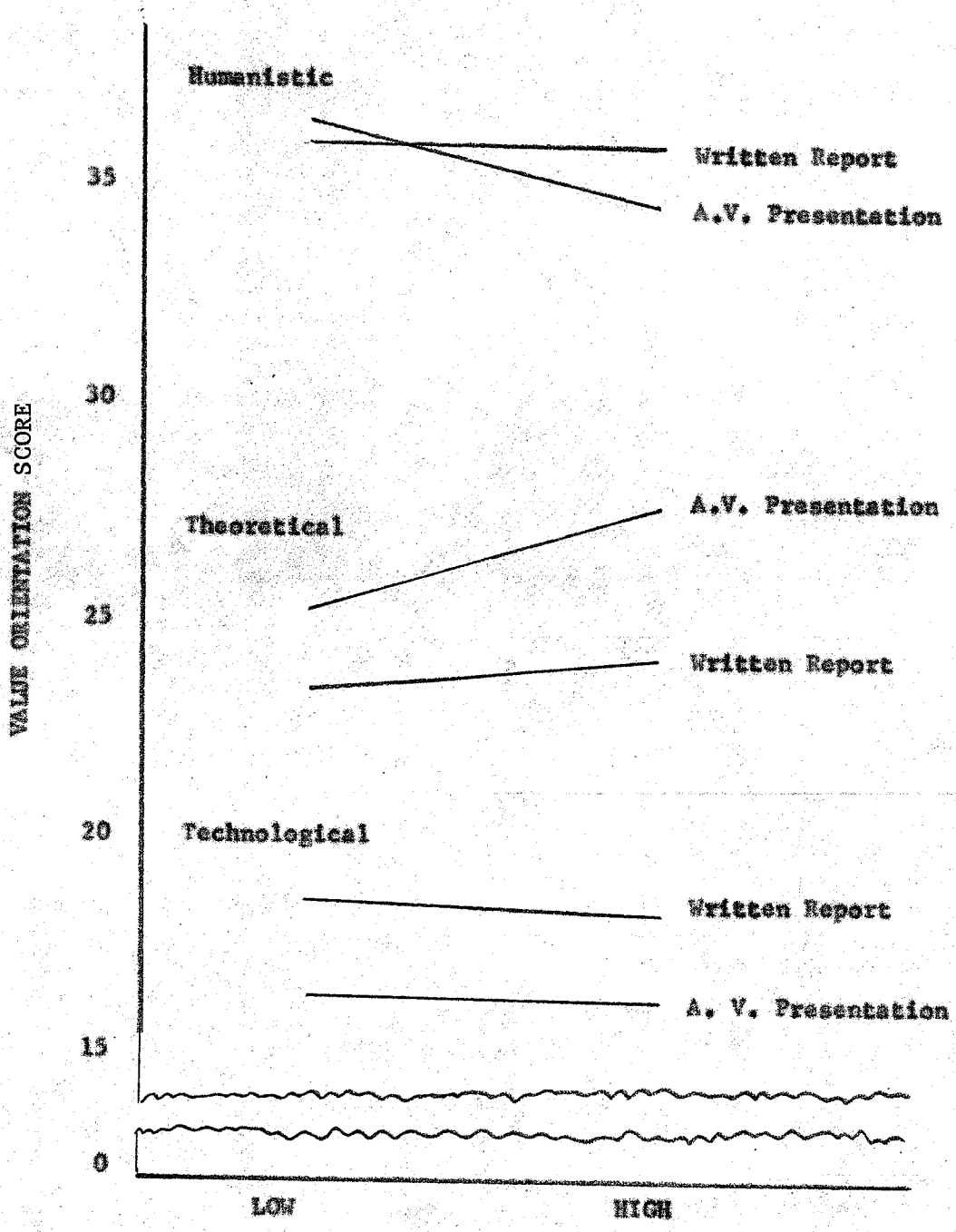

FIGURE 4.10

THE EFFECTS OF READING EXPOSURE AND PROJECT REPORTING TECHNIQUE UPON VALUE ORIENTATIONS OF BIOLOGY STUDENTS.

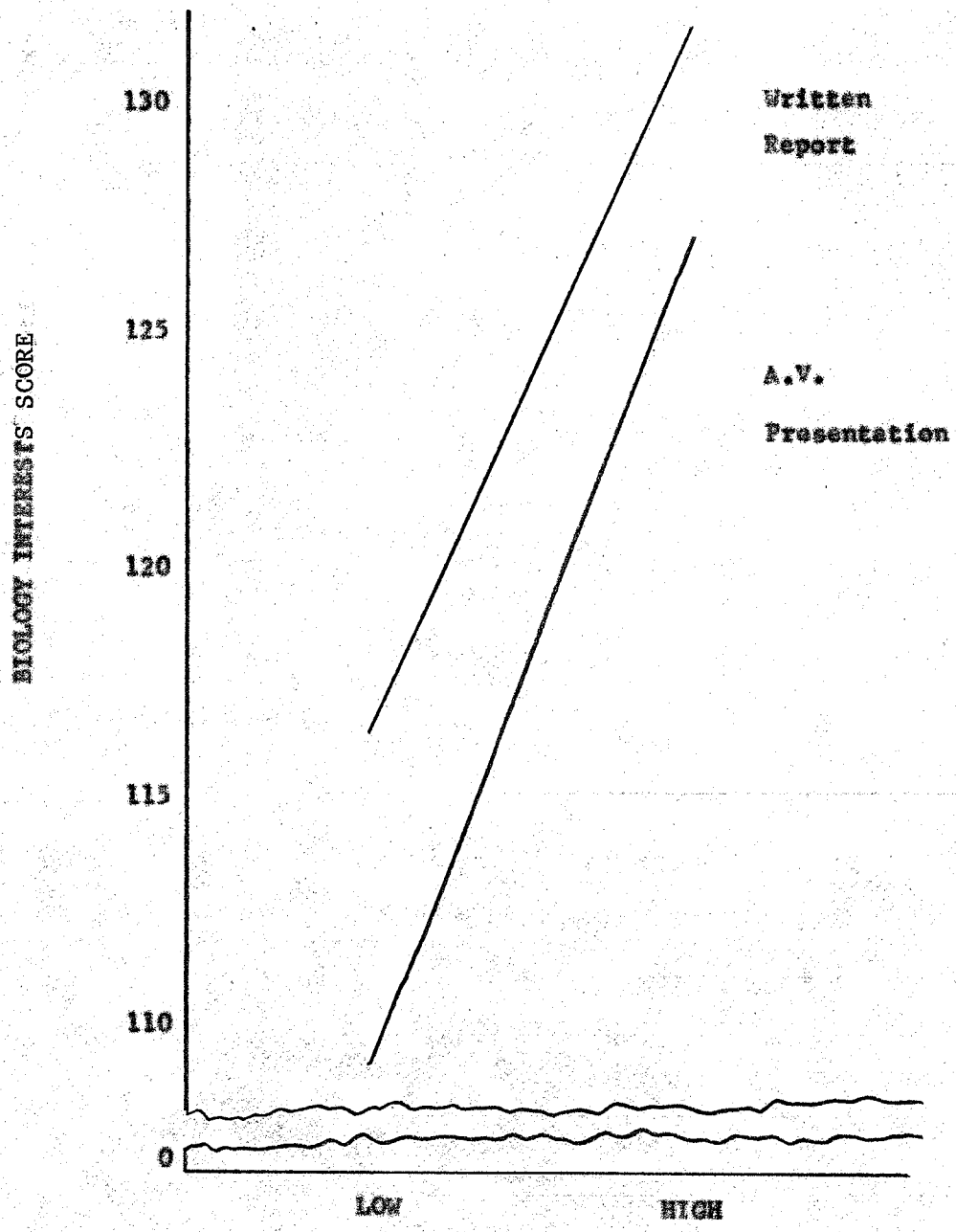

FIGURE 4.11

THE EFFECTS OF TELEVISION EXPOSURE AND PROJECT REPORTING TECHNIQUE UPON BIOLOGY INTEREST OF BIOLOGY STUDENTS.

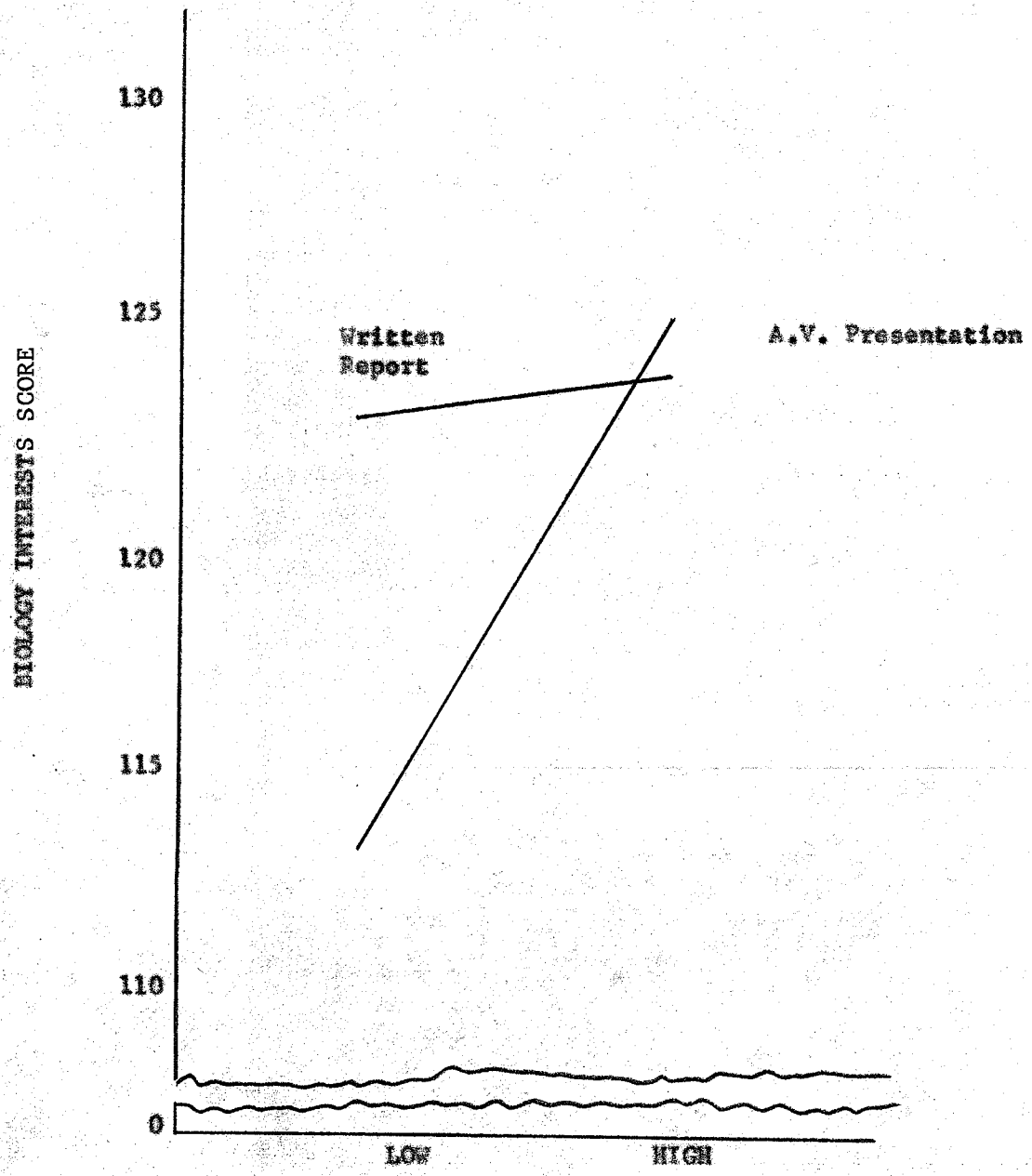

FIGURE 4.12

THE EFFECTS OF READING EXPOSURE AND PROJECT REPORTING TECHNIQUE UPON THE BIOLOGY INTERESTS OF BIOLOGY STUDENTS.

HYPOTHESIS 6

There are no significant differences between the mean scores of humanistic, technological, and theoretical value orientations of biology students.

HUMANISTIC-TECHNOLOGICAL VALUE COMPARISON

The humanistic value mean score was 35.73 and the technological value mean score was 17.39. A t-test of significance produced a $t = 19.346$ with 222 degrees of freedom. The obtained t was greater than the critical $t = 2.60$ required for significance at the .01 level of confidence. Consequently, the null hypothesis was rejected. This was interpreted to mean that biology students preferred humanistic value to a significantly greater extent than technological value.

HUMANISTIC-THEORETICAL VALUE COMPARISON

The humanistic value mean score was 35.73 and the theoretical value mean score was 24.88. A t-test of significance produced a $t = 9.52$ with 222 degrees of freedom. The obtained t was greater than the critical $t = 2.60$ required for significance at the .01 level of confidence. Consequently, the null hypothesis was rejected. This was interpreted to mean that biology students preferred humanistic value to a significantly greater extent than theoretical value.

THEORETICAL-TECHNOLOGICAL VALUE COMPARISON

The theoretical value mean score was 24.88 and the technological value mean score was 17.39. A t-test of significance produced a $t = 7.05$ with 222 degrees of freedom. The obtained t was greater than the critical $t = 2.60$ required for significance at the .01 level of confidence. Consequently, the null hypothesis was rejected. This was interpreted to mean that biology students preferred theoretical value to a significantly greater extent than technological value.

III. SUMMARY

Biology students' value orientations were measured with the Value Orientation Survey instrument and biology interests were measured with the Student Interest Survey instrument. Hypotheses involving the effects of one variable upon two groups of students were tested for significance using t-tests. Interactions involving the effects of two independent variables upon value orientations and biology interests of students were tested for significance using a two-way analysis of variance. The humanistic, technological, and theoretical value orientations mean scores of biology students were tested for significant differences using t-tests.

The results indicated that male students preferred the technological aspects of biology to a significantly greater extent than did females.

The results further indicated that project reporting technique, television exposure, and reading exposure were not significant in influencing the humanistic, technological, and theoretical values of biology students. Project reporting technique and reading exposure was not significant in influencing biology interests of biology students.

Television exposure to biology related programs was found to be significant in producing interest in biology-related topics.

The interaction of project reporting technique with levels of exposure to television and reading was not significant in influencing significant differential effects with respect to either value orientations or biology interests of biology students.

The humanistic value orientation of biology students was significantly different from both the technological and theoretical value orientations. The technological value orientation was significantly different from the theoretical value orientation.

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSIONS, RECOMMENDATIONS AND IMPLICATIONS FOR EDUCATIONAL PRACTICE

I. SUMMARY

The remarkable growth of scientific knowledge during the past three decades and the demands of society for advanced courses in education has been reflected in revised high school science curricula which place great emphasis on the abstract, theoretical aspects of science. This approach has lacked appeal for many students who appear more receptive to applications of science for the improvement of human living conditions. This apparent lack of relevance has resulted in decreased interest and generated an attitude that science was unimportant. The relative importance placed by an individual on an occurrence was a function of that individual's values. Three components of value related to teaching are the preferences for humanistic, technological, and theoretical aspects of instruction. A major purpose of the study was to measure the value orientations of students to these three aspects of biology.

Many investigators have found that the instructional technique of independent study via projects appeared to produce affective gains in attitude which includes interests and values. It was decided to determine whether project reporting technique, a facet of the independent study project, could influence the values and interests of biology students.

Many investigators have found that elements of the communication media, particularly television and the printed word, were influential in the development of interests and subsequently, values. It was decided to measure exposure of biology students to television and reading materials which contained many descriptive applications of biological concepts for the purpose of determining whether varied amounts of exposure could influence the values and interests of biology students. A Student Interest Survey instrument consisting of fifty biology-related topics designed to measure students' interest in practical applications of theory was constructed and administered.

A Reading-Television Survey instrument consisting of twenty-five items related to the measurement of reading exposure and a similar number of items for the measurement of television exposure was constructed. Face and content validity was established. This instrument was then administered to four classes of grade twelve biology students at Sisler High School in October, 1974. Scores were generated and used to determine groups of students demonstrating four combinations of reading and television exposure to biology related topics.

The classes of students were assigned to one or another of two treatment groups. The treatments consisted of having classes which were involved in independent study projects report results by means of either an audio-visual presentation or a written report.

Scores generated by the Student Interest Survey and the Value Orientation Survey were used as dependent variables to test hypotheses. A series of t-tests of significance were employed to test the effects of one variable upon two groups of students. A two-way analysis of variance was utilized to determine whether significant interactions existed between project reporting technique and the various communication media exposure types and levels. Additional t-tests were used to determine whether significant differences existed between humanistic, theoretical, and technological value orientations of students.

II. CONCLUSIONS

The analysis of the data resulted in the following conclusions.

1. Male and female students do not differ significantly with regard to their preference for humanistic value, theoretical value, or biology interests. However, male biology students demonstrate significantly greater preference for technological value than do female biology students.

2. The audio-visual presentation and the written report techniques of independent study project reporting do not differ in effect on value orientations and biology interests of students.

3. Students with high initial television exposure do not differ from students with low initial television ex-

posure in that exposure does not affect value orientations. However, students with high initial television exposure differ from students with low initial television exposure in that they demonstrate significantly higher biology interests.

4. Students with high initial reading exposure do not differ from students with low initial reading exposure in that exposure does not affect value orientations or biology interests of students.

5. There is no evidence of a differential effect such that either reporting technique affects the value orientations or biology interests of:
   (A) one television exposure level more than another.
   (B) one reading exposure level more than another.

6. The humansitic value orientation of students is significantly greater than the theoretical and technological value orientations. The theoretical value orientation of students is significantly greater than the technological value orientation.

III. DISCUSSION

METHODOLOGY

Students assigned to one or the other of the two reporting technique groups were informed that they would participate in the alternate reporting technique of a second project assigned during the following term. This was included in the verbal directions to ensure student acceptance of their assigned reporting technique which may have differed from those of friends who were participating in the alternate reporting technique. In fact, students may have had positive or negative attitudes toward participation in the group to which they were assigned from the time of such assignment.

The direction to the audio-visual presentation group to critically examine the mass communication media was included to determine whether an increased exposure would result in significantly greater value orientation or biology interest. An inherent weakness in the technique was the lack of control in having students adequately follow this direction. Results of some student reports indicated that not all students followed the direction.

The scoring technique used to assess value orientations produced an ipsative relationship among the three scores of humanistic, technological, and theoretical value orientations. Thus, in some cases, an extremely high score for one variable produced a low score for either or both of the other two variables.

The analysis involved a considerable number of t-tests, the use of which increased the probability of significant results due to

chance. The use of the .01 level of confidence, a more conservative level chosen to compensate for the multiple t-tests, does depart from the most common practice and might have affected some of the results and conclusions. Thus, this increased rigour might have resulted in a failure to reject a null hypothesis when, in fact, there was a difference between two groups.

RESULTS

The higher orientation of male students to the technological aspects of biology were consistent with previous findings by Huston which demonstrated higher male technological orientation to chemistry. This conforms to one of the common stereotypes of sex differences. Greater female preference for the theoretical aspects of biology was suggested, but not demonstrated by a .049 level of significance for the hypothesis test conducted.

Although the project reporting technique did not prove significant in influencing value orientations or biology interests, observation of students' behaviour during the preparatory period and during presentations gave the impression that students involved in audio-visual presentations appeared more enthusiastic in their approach than those involved in the written report project. This might be explained in part by the novelty of the active use by students of mediated materials. Students who viewed classmates' audio-visual presentations appeared extremely interested, whereas

those offered the opportunity to read the written reports of classmates appeared reluctant to do so. Similarly, students involved in audio-visual presentations appeared more anxious to do so. It would appear that this indirect observation substantiates the views of White who described the effectance theory of intrinsic motivation by maintaining that there is an urge within the person which stimulates him toward making accomplishment on his own. The successful accomplishment generated feelings of competence which push him toward learning behaviour.

Television exposure was found significant only in regard to biology interest. Students who exhibited high television exposure to biology-related topics also demonstrated significantly higher interest scores. This finding must be interpreted with caution, however, because it is possible that their pre-existing interest in biology-related topics was influential in their choice of viewing biology-related television programs.

A separate series of t-tests, beyond the scope of the study, and using a sample of only sixteen subjects, was performed to determine whether combinations of reading and television exposure were jointly responsible for the significant result. The results suggested that those students exhibiting high television and high reading exposures demonstrated significantly greater interest scores than those having low television and high reading exposures. This would suggest that television exposure was primarily responsible

for the significant finding with regard to interest which was reported earlier.

Using similar additional tests those students who exhibited high television and low reading exposure demonstrated significantly greater interest scores than students having low television but high reading exposure. This would suggest therefore, that there is a correlation between interest and television exposure regardless of reading exposure of students.

Whatever the cause of this finding, it may be viewed as a method used to identify students having a strong biological interest.

With respect to the next two conclusions, the literature neither supported or was at variance with the findings of the study.

Reading exposure was not found to be significant with regard to value orientation or biology interests. This would seem to suggest that other factors must be responsible for the development of values and interest.

Combinations of project reporting technique and communication media exposure levels did not differentially affect the value orientations and biology interests of students. This was not surprising as no interaction effects were expected.

The measurement of student preference for the values of the humanistic, technological, and theoretical aspects of instruction was similar in technique to studies done by Huston and Fazio,

but differed in that this study measured these values in relation to biology rather than chemistry. The results concerning humanistic value agreed with those earlier findings of maximal student preference for this aspect of instruction. Theoretical value for biology was ranked second in preference by biology students. This was in agreement with findings by Fazio which showed that biology students ranked theoretical preference for chemistry second to humanistic preference. Technological preference for biological aspects proved minimal. This finding was also in agreement with those of Fazio but differed from the findings of Huston which indicated that chemistry students preferred the technological aspects of chemistry more than the theoretical aspects.

IV. RECOMMENDATIONS

The validity and reliability data, as well as facility of administration and scoring, indicate that the Value Orientation Survey and the Student Interest Survey instruments are valid, reliable, and efficient modes of assessing the value preferences and biology interests of high school students with respect to biological concepts. These instruments were satisfactory for this study and are recommended for future studies regarding measurement of values and interests of biology students. These instruments should be tested with larger groups to obtain normative data for use in comparative studies. The value orientations of biology instructors might also be studied to ascertain whether they agree with instruc-

tional emphasis and the value orientations of their students. The Value Orientation instrument might be refined by increasing the number of items to adequately represent phases of a course not represented by this study. The construction of alternative forms of the instrument are recommended for use in studies which might attempt to determine types of factors which could produce changes in value orientations.

The audio-visual reporting technique is recommended for further study as an educational practice which could be adapted by instructors to enable students to refine techniques of independent learning. The method of evaluation requires study. Reasons for student preference for one or the other of the two reporting techniques also merit study.

Biology instructors are advised to be cognizant of biology-related television programs so that they might utilize current television application of biological concepts in their daily lessons to add interest and appeal to the subject. A study which should be undertaken is that of a determination of precedence of biology interest or television exposure as a causative factor for the significant result noted in this study.

Reluctance of students to read their peers' independent study reports warrants study. It is recommended that educational authorities examine the reading skills of high school students. Similarly, the levels of reading material regarding scientific literature should be examined as a possible factor in depressing

interest in biology-related topics. Reading preferences might be compared with television preference as a technique of data accumulation for all phases of the independent study project.

V. IMPLICATIONS FOR EDUCATIONAL PRACTICE

Teachers might change the emphasis of biology instruction to correlate more closely with the observed value orientations of students. The humanistic aspects of biology instruction warrant maximal emphasis. Results of findings in this study indicate also that male students find technological instructional emphasis to be of greater value than do female students. Thus, instructors might utilize this knowledge to alter their approach to instruction where appropriate situations exist with respect to population of students by sex. It also is pertinent to the approach utilized in individualized instruction whereby groups of students of one sex are involved. The interest survey might also enable teachers to utilize information regarding the students' interest background to adequately formulate educational activities which are meaningful and motivating.

The conclusions do not demonstrate significant gains in interests and values by students involved in either audio-visual presentations or written reports of independent study projects. However, the audio-visual independent study project described in this study might be introduced into biology programs for the purpose of adding variety and creativity to the teaching process.

Teachers must be made aware that television has become a stronger factor in producing interest and exposure to biology-related topics in the contemporary student population than has reading. Therefore, anecdotal reference to application of biology principles as presented on television is an effective method teachers could utilize to increase interest in the theoretical aspects of subject matter.

The value orientations data have demonstrated that contemporary biology students demonstrate strong humanistic value preference. Curriculum committee members, textbook authors, communication media producers and editors, and biology instructors might consider the fact that relevant, meaningful course material is the best means of assuring intrinsic behavioural motivation for learning. Biology instructors must have the freedom to select appropriate currucular materials and to design effective curricular experiences in accordance with the interests and value orientations of their students. This could be achieved in part by incorporating value-related aspects, particularly humanistic aspects of instruction into biology course objectives.

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APPENDICES

APPENDIX A

STUDENT INTEREST SURVEY

APPENDIX A

STUDENT INTEREST SURVEY

DIRECTIONS

Read the following list of biology-related topics and indicate on the answer sheet the level of your interest in each item.

Key: (A) No interest
(B) Little interest
(C) Moderate interest
(D) Very interested
(E) Intense interest

Example:

51. Carnivorous Plants

No Interest	Little Interest	Moderate Interest	Very Interested	Intense Interest
A	B	C	D	E
‖	‖	▌	‖	‖

Note: There are no right or wrong answers, so please respond to each item as honestly as you can.

1. Types of Diets
2. Megavitamin Therapy: Large Dose Administration for Disease Prevention
3. Obesity, By-Pass Operation
4. Malnutrition: Causes and Prevention
5. Cystic Fibrosis
6. Open Heart Surgery
7. High Blood Pressure
8. Stress: Cause of Disease
9. Heart Transplants
10. Stroke
11. Artificial Pacemakers - Electronic Device Used for Regulation of Heart Beat
12. Emphysema, Bronchitis, Asthma
13. Kidney Stones
14. Sleep, Insomnia
15. Intelligence, Memory, Amnesia
16. Lie Detector Test, Truth Serum
17. Mental Diseases, Shock Treatment
18. Hypnosis: Medical Use
19. Psychosomatic Illness, Hypochondria
20. Electrode Implants in Brain, Pleasure Center
21. Headache: Causes and Treatment
22. Extra-Sensory Perception
23. Baldness: Causes and Treatment
24. Plastic Surgery, Skin Grafts
25. Orthotherapy: Relief from Aches and Pains

26. Venereal Diseases
27. Contraception, Vasectomy
28. Test Tube Babies
29. Amniocentesis: Medical Prediction of Child's Sex
30. Abortion
31. Acupuncture
32. Cryobiology: Freezing of The Dead
33. Cancer
34. Arthritis
35. Radiation Therapy
36. Skin Diseases: Psoriasis, Acne
37. Muscular Dystrophy
38. Cause of Aging - Life Expectancy
39. Biological Superiority: Male vs Female
40. Effects of Smoking
41. Effects of Alcohol on Body
42. Effects of Non-Medical Use of Drugs
43. Lead and Mercury Pollution
44. Effects of D.D.T., Pesticides, Phosphates
45. Noise Pollution
46. Bioluminescence: Organisms Which Glow in Dark
47. Endangered Species of Animals
48. Chromosomes: A Cause of Crime?
49. Cloning: Making Duplicate Organisms
50. Gene Manipulation: Production of Superhumans

APPENDIX B

VALUE ORIENTATION SURVEY

APPENDIX B

VALUE ORIENTATION SURVEY

DIRECTIONS:

Each item contains three true statements regarding some aspect of biology.

Indicate your preference for each statement in order of your choice - i.e.

1st choice, most preferred statement

2nd choice

3rd choice, least preferred statement

e.g. 1. (A) The human heart is divided into two halves by a thick muscular wall called a septum.

(B) Heart patients may lead normal lives following open heart surgery to repair faulty heart valves.

(C) The electronics industry produces blood pressure sensors and heart rate monitoring devices linked to computer analysis in biomonitor systems.

Note: If you prefer statement C as your 1st choice,

statement B as your 2nd choice, and

statement A as your 3rd choice,

mark your answer sheet as follows:

(A) 3 (B) 2 (C) 1

1. (A) Insulin is a protein consisting of two polypeptide chains of amino acids held together by two disulfide linkages.

   (B) Insulin may be prepared commercially be grinding animal pancreases and extraction of hormone fractions.

   (C) Some mental patients achieve improvement in their condition when given repeated administration of large doses of insulin.

2. (A) Newborn babies achieve better blood clotting ability if vitamin K was given to their mothers prior to the birth.

   (B) The function of vitamin K is to stimulate the production of prothrombin, a plasma enzyme necessary to catalyze the calcium-thromboplastin reaction.

   (C) Vitamin K can be produced by isolation from alfalfa or from fish meal subjected to bacterial putrefaction.

3. The pacemaker of the heart controls heart beat rate.

   (A) The electronics industry has used a nickel-cadmium battery powered timing device to simulate electrical stimulation.

   (B) Defective pacemaker patients may be kept alive through the use of artificial pacemakers implanted in the thoracic cavity.

   (C) The normal pacemaker consists of a small volume of specialized tissue which stimulates the heart muscle to contract in a definite rhythmical pattern.

4. The Rh blood disorder erythroblastosis fetalis results in the clotting of babies' blood.

   (A) This condition is caused by the agglutination or rejection of the child's blood by the mother's plasma when the two dissimilar blood types accidently mix.

   (B) The survival rate of Rh^+ newborn infants is increased by replacing their Rh^+ blood with Rh^- blood similar to that of the mother.

(C) Test serum to determine the incidence of Rh^+ blood factor may be commercially extracted from animal plasma.

5. (A) Victims of high blood pressure may show improvement by following a low salt diet.

(B) High blood pressure may be expressed as a ratio of systolic pressure to diastolic pressure when measured with a sphygmomanometer.

(C) The pharmaceutical industry produces tranquilizers by extraction of chemical substances from organisms such as the rauwolfia plant.

6. (A) Industrial uses of animal intestines require stringent sanitary refrigeration procedures and chemical treatment.

(B) Grossly overweight individuals may achieve significant weight loss by submitting to an intestinal bypass operation.

(C) The intestine moves food along its length by an involuntary series of contractions of the circular and longitudinal muscles located in the intestinal wall.

7. (A) Patients suffering kidney failure may experience prolonged life by the successful transplant of a favourable tissue-typed organ.

(B) The chemical industry used the kidney's principle of dialysis for the chemical separation of colloids.

(C) The kidney is an organ which separates nitrogenous waste from the liquid component of the blood through the use of hydrostatic and osmotic blood pressures.

8. (A) The pharmaceutical industry extracts useful compounds from equine urine by utilizing the process of fractional crystalization.

(B) Urine consists of urea, uric acid, creatinine, inorganic salts, and water.

(C) People with heart conditions may survive for longer periods in good health when given an anticoagulent component of urine.

9. (A) The pharmaceutical industry extracts sheep pituitary glands for the production of a wide range of hormonal products.

(B) Patients suffering from a lack of thyroxine may develop improved speech and mental alertness when given thyroid pills.

(C) Thyroxine hormone consists of a combination of amino acids and iodine which has the function of accelerating metabolism.

10. (A) Persons in stressful situations often release adrenalin which results in increased strength to perform seemingly super-human feats.

(B) Adrenalin is produced in the colloidal tissue of endocrine glands and transported to the target organ by the blood stream.

(C) The pharmaceutical industry determines optimum dosages of adrenalin by recording physiological response reactions of test subjects.

11. Liquid nitrogen at -200°C is used as a refrigerant

(A) Low temperatures provided by liquid nitrogen inhibits enzyme action by solidifying the reacting watery medium.

(B) Industrial liquid nitrogen refrigeration is utilized by the transportation industry in the protection and storage of wide range of perishable products.

(C) Terminal cancer patients might be frozen with liquid nitrogen immediately following death and revived in the future when re-thaw technology and cancer cures have been achieved.

12. (A) The eye may be classified as a teleceptor in that it receives visual impulses from a distance to inform the organism of occurences in the environment.

(B) The optical industry has developed a soft unbreakable glass for use in the manufacture of contact lens.

(C) Semi-blind induviduals may regain sight through the removal and replacement of the diseased cornea with one obtained from a cadaver.

13. (A) Industrial radioactive materials may be manipulated by mechanical claw instrumentation which replicate hand movements.

(B) War amputees have gained some degree of independence through the use of the artificial Boston limb.

(C) Divergence, generally associated with the weight bearing function of the hand is achieved by extension at the metacarpophalongeal joints.

14. (A) Partially deaf persons achieve improved hearing through the use of amplified vibrations via hearing aids.

(B) The vibrations of the ear drum are transmitted to pitch-sensitive hair cells of the cochlea via movements of the maleus, incus and stapes bones of the middle ear.

(C) An industrial application of ultra-sonic vibration is the production of dog whistles, capable of producing a frequency of 30,000 vibrations per second.

15. (A) Radiation creates damaging lethal effects or mutations due to disruption of the D.N.A. material resulting in deletion of specific heriditary coding.

(B) Cancer victims may be cured by the use of radioactive cobalt 60 treatment which selectively destroys malignant cells.

(C) Industry uses radiation to prevent bacterial decomposition of perishable products.

16. (A) Alcohol, an organic compound consisting of carbon, hydrogen and oxygen, is derived from the anaerobic fermentation of carbohydrates.

(B) The pharmaceutical industry uses alcohol in the formulation of many of its products.

(C) Alcoholics may avoid cirhosis of the liver by eliminating consumption of alcohol.

17. (A) Thermography is a technique used in the metallurgical industry to locate flaws in machinery or sheet metal.

(B) Thermography is a technique of determining localized heat concentrations by the use of infra-red scanning devices.

(C) Breast cancer victims may achieve greater longevity through early diagnosis using thermographic techniques.

18. Antibiotics

(A) Persons with severe infection may achieve significant improvement by the use of antibiotics.

(B) The pharmaceutical industry uses many varieties of fungi to produce antibiotics.

(C) An antibiotic is a protein substance released from a fungus to inhibit or retard growth of competitor organisms.

19. (A) D.D.T., a contact poison available as powder and oil solvent sprays, kills insects by producing a paralytic effect on the nervous system.

(B) The chemical industry previously produced vast quantities of this nondegradable product which is now being rendered harmless.

(C) Mankind may save many aestheically beautiful birds by effecting a ban on D.D.T. spraying programs.

20. D.N.A.

(A) Synthetic D.N.A. molecules have been manufactured under experimental conditions in research laboratories.

(B) D.N.A. is the molecule containing adenine, guarine, cytosine and thymine combined in definite sequences which form a code of information controlling hereditary characteristics.

(C) Synthetic D.N.A. molecules offer mankind the opportunity of correcting the defective genes which cause diseases such as sickle cell anemia.

21. Estrogen is a female hormone.

(A) Certain types of male cancer victims may be cured following injections of estrogen.

(B) Equine urine may be utilized in the pharmaceutical industry for the commercial production of estrogen.

(C) Estrogen is a protein compound released from the ovary for the purpose of controlling development of secondary sex characteristics.

22. Salk Vaccine

(A) Salk vaccine is a dead virus product which when injected into the body will stimulate the production of antibodies to provide immunity.

(B) Populations of urban centers have been protected from the incidence of polio by the widespread use of Salk Vaccine.

(C) Salk vaccine is prepared in the pharmaceutical industry by the application of formaldehyde to live virus.

23. Osmosis refers to the diffusion of molecules of a solution through a membrane.

(A) The leather industry utilizes the principle of osmosis in placing rock salt on animal hides for the purpose of tanning preparation.

(B) Cold sufferers may alleviate the effects of a sore throat by gargling with salt water.

(C) Osmosis is the diffusion of water through a semi-permeable membrane from a region of greater concentration to a region of lesser concentration to establish equilibrium.

24. (A) Outbreeding or hybridization is the crossing of two different plant or animal varieties to obtain a new one.

(B) Researchers in the agricultural industry have produced hybrid corn by the process of dusting pollen from one species upon the stigmas of another plant species in controlled test plots.

(C) Population food requirements may be satisfied through the production of new strains of hybrid crops.

25. (A) Future human food requirements may be met by utilizing algae harvested from the ocean.

(B) Marine algae produce vast amounts of carbohydrate and oxygen in the aquatic environment through the combination of carbon dioxide with water by the photosynthetic process.

(C) The agricultural industry utilizes marine algae which is rich in inorganic salts for the production of fertilizer.

26. (A) Scientists from the agricultural industry innoculate fungae spores into forest soils around tree rootlets in a process of heightening soil fertility.

(B) The world lumber requirements may be achieved by using fungi to increase forest productivity in barren soils.

(C) Fungi may be considered saprophytic plants because although they rob moisture from the rootlets of forest trees, they provide mineral substances vital to the growth of the trees.

1. (A) _____ (B) _____ (C) _____
2. (A) _____ (B) _____ (C) _____
3. (A) _____ (B) _____ (C) _____
4. (A) _____ (B) _____ (C) _____
5. (A) _____ (B) _____ (C) _____
6. (A) _____ (B) _____ (C) _____
7. (A) _____ (B) _____ (C) _____
8. (A) _____ (B) _____ (C) _____
9. (A) _____ (B) _____ (C) _____
10. (A) _____ (B) _____ (C) _____
11. (A) _____ (B) _____ (C) _____
12. (A) _____ (B) _____ (C) _____
13. (A) _____ (B) _____ (C) _____
14. (A) _____ (B) _____ (C) _____
15. (A) _____ (B) _____ (C) _____
16. (A) _____ (B) _____ (C) _____
17. (A) _____ (B) _____ (C) _____
18. (A) _____ (B) _____ (C) _____
19. (A) _____ (B) _____ (C) _____
20. (A) _____ (B) _____ (C) _____
21. (A) _____ (B) _____ (C) _____
22. (A) _____ (B) _____ (C) _____
23. (A) _____ (B) _____ (C) _____
24. (A) _____ (B) _____ (C) _____
25. (A) _____ (B) _____ (C) _____
26. (A) _____ (B) _____ (C) _____
27. (A) _____ (B) _____ (C) _____
28. (A) _____ (B) _____ (C) _____
29. (A) _____ (B) _____ (C) _____
30. (A) _____ (B) _____ (C) _____

APPENDIX C

READING - TELEVISION SURVEY

APPENDIX C

READING - TELEVISION SURVEY

Directions:

Read the following list of questions and indicate on the answer sheet the extent to which you have done the following activities over the past few years.

KEY:

a) NEVER - HAVE NEVER DONE THIS
b) SELDOM - ONCE OR TWICE
c) OCCASIONALLY - MORE THAN 10 TIMES
d) OFTEN - MORE THAN 20 TIMES
e) REGULARLY - MISSED IT ONLY ONCE OR TWICE

EXAMPLE:

I have read popular science magazine.

NEVER	SELDOM	OCCASIONALLY	OFTEN	REGULARLY
A)	B	C	D	E

NOTE: There are no right or wrong answers so please respond to each item as honestly as you can.

1) I read the newspaper(s).

2) The average time I spend reading the newspaper is approximately:

a) 0 - 5 minutes
b) less than/or 15 minutes
c) less than/or 30 minutes
d) less than/or 45 minutes
e) up to an hour or more

3. I read newspages other than the front page.

4. I read the family section/womens news.

5. I have read Readers Digest magazine.

6) I have read Time magazine or Newsweek magazine.

7) I have read National Geographic magazine.

8) I have read McLeans magazine.

FOR QUESTIONS 9 - 20, INDICATE HOW OFTEN YOU HAVE CHOSEN TO READ A NEWSPAPER OR MAGAZINE ARTICLE CONCERNING THE FOLLOWING TOPICS.

9) Alcohol or Smoking

10) Plants

11) Animals

12) Disease or Disease cures

13) Drug usuage

14) Ecology, wildlife

15) Pollution

16) Nutrition and/or diets

17) Medical-legal problems

18) Discoveries/innovations/therapy

19) Mental disorders

20) Abortion/birthcontrol/Venereal Disease

LIST FOR QUESTION 21

FICTION NON-FICTION SCIENCE RELATED TOPICS SPORTS NEWS - OTHER THAN SCIENCE

21) Given the previous list of categories of reading material, I would choose science - related topics.

a) 5th
b) 4th
c) 3rd
d) 2nd
e) 1st

FOR QUESTIONS 22 - 25 INDICATE WHETHER YOU

A) STRONG DISAGREE B) DISAGREE C) FEEL YOU ARE AVERAGE D) AGREE E) STRONGLY AGREE

22) I consider my reading speed as being very fast.

23) I consider my reading comprehension as being very good.

24) I consider myself a well-informed newspaper and magazine reader.

25) The average time I feel I spend reading in my leisure time per week is closest to:

a) 0 hours
b) 0.1 -3 hours
c) 3.1 -6 hours
d) 6.1 -9 hours
e) 9.1 -12 hours

FOR QUESTIONS 26 - 45 INDICATE THE EXTENT TO WHICH YOU HAVE VIEWED THE FOLLOWING PROGRAMS OVER THE PAST FEW YEARS.

eg.,

	NEVER	SELDOM	OCCASIONALLY	OFTEN	REGULARLY
	A	B	C	D	E
1) STAR TREK	//	//	//	//	//
2) M.A.S.H.	//	//	//	//	//
3) WORLD OF MAN	//	//	//	//	//

26) Target the Impossible

27) The Nature of Things

28) Bold Ones

29) Marcus Welby M.D.

30) Untamed World

31) National Geographic

32) The Collaborators

33) Jaques Cousteau

34) Here Come The 70's

35) Audobon

36) The Interns

37) Take 30

38) Medical Center

39) 24 Hours

40) W5

41) Animal World

42) Newsmagazine

43) This Hour Has 7 Days

44) Klahanie

45) News

FOR QUESTIONS 46-50 INDICATE THE EXTENT TO WHICH YOU

a) STRONGLY DISAGREE
b) DISAGREE
c) FEEL YOU ARE AVERAGE
d) AGREE
e) STRONGLY AGREE

46) I watch more informative T.V. programs than entertaining programs.

47) I have watched several hour-long specials concerning scientific topics.

48) I have developed a broad scientific background indirectly through the media of T.V.

49) I think I watch more science-related T.V. than my friends do.

50) The average amount of T.V.-viewing hours/week I think I watch is closest to:

a) 0
b) 0.1- 5 hours
c) 5.1-10 hours
d) 10.1-15 hours
e) 15.1-20 hours

APPENDIX D

INSTRUCTIONS: AUDIO-VISUAL PRESENTATION PROJECT

BIOLOGY

AUDIO-VISUAL PRESENTATION PROJECT

PURPOSE: The audio-visual presentation project offers the student the opportunity to acquire and develop skills, attitudes and interests by actively participating in group projeet work pertaining to biology.

Topics which are related to the present biology program but not normally studied during the course of the year will be researched by groups of students and presented to the class. the practical nature of the topics presented should provide a stimulus for the development of interest in inherent Biology principles and concepts.

OBJECTIVES:

(a) development of responsibility to the group
(b) practice in problem solving ability
(c) development of critical thinking ability
(d) creative invclvement - students may use their own initiative for presentations.
e.g. T.V. production - made in Sisler T.V.studio
tape recordings - music to set mood
photograph displays
picture charts
graphs
overhead or opaque projectors
interviews
panel discussion
audience participation
oral reports
demonstrations
home made films
slide presentations
special lighting
sound effects
(e) practice using research techniques
(f) practice in developing organizational skills
(g) practice in data gathering
(h) practice in data analysis and generalization
(i) development in cooperative social skills
(j) communication of knowledge in an orderly and interesting manner
(k) practice in developing manipulative skills using a variety of audio-visual aids

PROCEDURE:

Students will work cooperatively in groups of 3 - 4 persons to research some topic which is of mutual interest to all participants. The following suggestions are listed to facilitate initial organization.

1. Meet to select a group leader/secretary
   - this person shall be responsible for coordination of the project and communication with the instructor.

2. Examine the list of suggested topics (last page) and select one for research.
   NOTE: All members must agree upon this topic to insure maximum wholehearted participation.

3. Meet to discuss:
   (a) possible research sources
   (b) anticipated problems
   (c) solution to problems
   (d) organization of the study
   (e) individual responsibilities
   (f) deadlines or time schedule
   (g) presentation techniques

4. Write up a one page proposal of
   (a) topic
   (b) students involved
   (c) outline of research topics
       e.g. Muscular Dystrophy
       - cause
       - symptoms
       - effects
       - current literature/research
       - treatment
       - prospects for future
   (d) time schedule
       i.e. deadlines for:
       i) survey of available information sources
       ii) final date of research - data collection, reading, interviewing etc.
       iii) final date for meetings - to correlate data
       iv) final date for preparation - presentation equipment rehearsal
   (e) presentation technique
       i) aids used i.e. machines, lighting, etc.
       ii) procedures followed - definite order

continued . . .

PROCEDURE - continued

5. Submit proposal to instructor for approval

6. Do research - suggested areas of information retrieval are the following:

student questionnaires (must be approved by instructor)
libraries
school resource center
newspapers
magazines - e.g. Readers' Digest
Time
National Geographic
Popular Science
Science Digest
Newsweek
Information Canada
Department of Health
Canadian Cancer Society
interviews with knowledgeable persons
mail requests to organizations
films - see library
microfilm viewers - William Library
University
phone book - yellow pages
television programs related to medicine

Research technique will vary depending upon the project and presentation.

DOCUMENTATION OF CURRENT INFORMATION

7. Documentation of the current practical nature of the research is required. It is suggested that students may find this information using either
newspapers
paperbacks or books and magazines
OR
anecdotal accounts of television programs, radio programs

This may be in the form of:

(a) newspaper article - underline pertinent information with red pen. Indicate date of publication and source - Free Press or Tribune

(b) magazine article - list magazine and date of publication e.g. Time, June 1974, (page 63)
- include a brief outline of pertinent information

(c) anecdotal account of television or radio program.
- write a brief account of some television or radio program which you have observed recently. Indicate the pertinent information by listing:

continued . . .

PROCEDURE - continued - 4 -

7. (c) continued

(1) date of presentation
(2) Channel
(3) program title
(4) brief account of content of program

A file folder including these items and bibliography of other sources used are the only written portions of the assignment which must be submitted for evaluation upon due date.

8. Critically evaluate data collected.

- eliminate superfluous material
- correlate

9. Compile a bibliography of sources, personnel contacted, materials used. Submit to instructor upon due date.

10. Organize presentation

- arrange for use of audio-visual aids
- practice using machines
- perform rehearsal of presentation
- suggest questions which class members might investigate

11. PRESENT STUDY TO CLASS (date to be assigned by instructor)

TIME SEQUENCE

5 minutes - preparation
25 minutes - presentation
7 minutes - questions from class

AUDIO VISUAL REQUIREMENT

Students are advised that projects must include at least a minimum of five audio-visual aids in their presentation. These might include:

music - tape recorder	models
video tape recorder	picture displays
overhead projector	movie projector
camera	T.V.
filmstrip or slide projector	demonstration
opaque projector	panel discussion
special lighting	posters

SUGGESTED TOPICS

1. Abortion
2. Acupuncture
3. Aging - Life Expectancy
4. Alcohol - effects
5. Allergies
6. Artificial Pacemakers
7. Baldness
8. Biofeedback - learning to control involuntary action
9. Biological Superiority? Male vs. Female
10. Bioluminescence
11. Biorhythms
12. Blood - diseases - Anemia
    - Leukemia
    - Hemophelia
    - Polycythemia
13. Breathing under water
14. Burns
15. Carnivorous plants
16. Chromosomes and Disease
17. Cloning - making duplicate organisms
18. Cryobiology - Freezing and Revival of Dead
19. Definition of Death - A medical-legal problem
20. Diets
21. D.D.T. - Use and abuse of pesticides
22. Drugs - Medical and Non-medical uses
23. Electrode implants in brain
24. Endangered species of animals
25. Extra-Sensory perception
26. Extra-terrestrial life
27. Eye disorders
28. Fear
29. First Aid
30. Germ Warfare
31. Headache
32. Hibernation - suspended animation
33. Hypnosis
34. Hypochondria
35. Human diseases
    - cystic fibrosis
    - cerebral palsy
    - muscular dystrophy
    - multiple sclerosis
    - malaria
    - Parkinson's Disease
    - Hodgkin's Disease
    - Huntington's Chorea
    - Diabetes
    - Cancer
    - Arthritis
    - Rheumatism
    - Psoriasis
    - Acne
    - Seborrea
    - Influenza
    - Common Cold

continued ....

SUGGESTED TOPICS - continued

36. Intelligence
37. Lie Detector Test - Truth serum
38. Malnutrition
39. Megavitamin therapy - Vitamin E
    - Vitamin C
    - Vitamin B
40. Mental disease
41. Memory, amnesia
42. Migration
43. Mutation
44. Obesity
45. Open Heart Surgery
46. Organ transplants - heart
    - lung
    - bone
    - skin grafts
    - artery
47. Orthotheraphy - relief from aches and pains
48. Pain
49. Placebo effect
50. Plastic surgery
51. Pollution - lead - water
    - mercury - air
    - noise - soil
52. Psychosomatic illness
53. Radiation therapy
54. Rejection reaction - human body
55. Respiratory diseases - Emphysema
    - Bronchitis
    - Asthma
    - Pneumonia
    - T.B.
    - Black lung
56. Sleep - Insomnia Somnambulism
57. Smoking
58. Stress - a cause of disease
59. Test tube babies
60. Thalidomide babies
61. Twins
62. Ulcers
63. Zero population growth

PARTICIPATING STUDENTS

TOPIC _____

SECTION _____

EVALUATION CRITERIA

	VALUES
PREPARATION:	
Data gathering	
Effort	
Machine usage	
Meets deadlines	
Responsibility for A.V. arrangements	
Responsibility to group	
Problem solving	
RESEARCH:	
Bibliography	
Data analysis and selection	
Documentation of current material	
Informative nature of material	
Knowledge of material - answers, questions	
Quality/depth of information	
Variety of sources - written	
Variety of sources - other than written	
PRESENTATION:	
Attitude to presentation/audience	
Follows specified procedures	
Interesting/audience reaction	
Organization/pacing	
Voice - can be heard	
USE OF AUDIO VISUAL AIDS:	
1. Mood/background music	
2. Aid 2 _____ usage	
3. Aid 3 _____ usage	
4. Aid 4 _____ usage	
5. Aid 5 _____ usage	
TOTAL	

KEY

4 ..... Excellent

3 ..... Very good

2 ..... Good/satisfactory

1 ..... Fair

0 ..... Unacceptable

APPENDIX E

LIBRARY USE DIRECTIONS

APPENDIX E

LIBRARY USE INSTRUCTIONS

When you have been assigned a list of topics from which to begin a project, a number of considerations should affect your choice. You should choose a topic which will be of interest to you, and you should also choose a topic on which sufficient information may be found to complete the project.

The topic you decide to investigate should not be too new, or too technical, or too regional. Because of the nature of our library, to serve a junior and senior high school, the material tends to be oriented toward subjects taught in the school. Thus, if the topic is too new, it may not have had enough time to get into book and magazine form. Material which is too technical requires that you have a background of the terminology to understand the subject. Also, technical material is usually to be found only in specialized journals and text books or in specialized libraries.

Regional material will be no problem if you are studying a topic involving Manitoba. However, it might be difficult to find material on the incidence of sheep raising for the manufacture of steel wool if the sheep are only found in Shreveport, Louisiana.

Once you have selected a topic your next job is to find out what material on your subject is available in the school library or in the Winnipeg Public Library. The tools for this will be: the

card catalogue, periodical index, and reference books such as encyclopedia and dictionaries.

The card catalog lists, in alphabetical order, all the books in the library, by author, title and subject. Each card in the catalog points out the location of the book by means of a call number or classification number. Our library uses the Dewey Classification System, which divides knowledge into ten classes numbered from 000 to 999. The classification numbers in the 500's indicates science books, with 570 being the books on biology. The 600's include technology, medical sciences, engineering, etc.

To find books on the topic you have chosen, look in the card catalog for subject cards, where all books on your topic should be recorded. To be able to use the subject headings in the card catalog you should have a general knowledge of your topic. The most authoritative and objective introduction will be found in an encyclopedia. Also, at the end of the article, or in a separate volume, will be a bibliography of the most important books on the subject. By using the general information in the encyclopedia you should be able to find subject headings in the card catalog that will have information about your topic. The better general encyclopedia in our library inclued Collier's and Britannica. We have a number of specialized science encyclopedia - McGraw Hill Encyclopedia of Science and Technology, Harper Encyclopedia of Science, and Von Nostrand's Scientific Encyclopedia.

Because the terminology used in science and technology is often restricted to this subject field, it is necessary to find the meaning of many words. Our library has a number of scientific, medical and biological dictionaries which will provide easy-to-understand definitions.

An important source of information is magazines or periodicals. In order to find the information you require, it is necessary to use a periodical index. Periodical indexes point out the location of topics discussed in magazines. The location of the article is given by name of periodical, page and date of issue. Our library subscribes to two periodical indexes - Readers' Guide to Periodical Literature, which indexes American magazines, and Canadian Periodical Index, which indexes most Canadian periodicals.

The vertical file, or pamphlet file, often contains information which is not available in other sources in the library. There is a small vertical file in the Science Resource Centre, while the main file is in the library.

APPENDIX F

INSTRUCTIONS: WRITTEN REPORT PROJECT

APPENDIX F

WRITTEN REPORT PROJECT

PURPOSE: The Written Report offers the student the opportunity to acquire and develop skills, attitudes, and interests by actively participating in group project work pertaining to biology.

Topics which are related to the present biology program but not normally studied during the course of the year will be researched by groups of students and compiled in a written or typed report. The practical nature of the topics studied should provide a stimulus for the development of interest in inherent biology principles and concepts.

OBJECTIVES:

(a) development of responsibility to the group

(b) practice in problem solving ability

(c) development of critical thinking ability

(d) practice in research techniques

(e) practice in developing organizational skills

(f) practice in data gathering

(g) practice in data analysis and generalization

(h) development of cooperative social skills

(i) development of written skills

(j) communication of knowledge in an orderly and interesting manner.

PROCEDURE:

Students will work cooperatively in groups of 3-4 persons to research some topic which is of mutual interest to all participants. The following suggestions are listed to facilitate initial organization.

1. Meet to select a group leader/secretary
   - this person shall be responsible for coordination of the project and communication with the instructor.
2. Examine the list of suggested topics (last page) and select one for research.
   Note: All members must agree upon this topic to insure maximum wholehearted participation.
3. Meet to discuss:
   (a) possible research sources
   (b) anticipated problems
   (c) solution to problems
   (d) organization of the study
   (e) individual responsibilities
   (f) deadlines or time schedule

4. Write up a one page proposal of

   (a) topic

   (b) students involved

   (c) outline of research topics

      e.g. Muscular Dystrophy

         - cause

         - symptoms

         - effects

         - current literature/research

         - treatment

         - prospects for future

   (d) time schedule

      i.e. deadlines for:

         i) survey of available information sources

         ii) final date of research - data collection, reading, interviewing, etc.

         iii) final date for meetings - to correlate data

         iv) final date for preparation - typing

5. Submit proposal to instructor for approval

6. Do research - suggested areas of information retrieval are the following:

   student questionnaires (must be approved by instructor)

   libraries

   school resource center

   newspapers

magazines - e.g. Readers' Digest
Time
National Geographic
Popular Science
Science Digest
Newsweek

Information Canada

Department of Health

Canadian Cancer Society

interviews with knowledgeable persons

mail requests to organizations

films - see library

microfilm viewers - William Library
University

phone book - yellow pages

television programs related to medicine

Research technique will vary depending upon the project.

7. Critically evaluate data collected
   - eliminate superfluous material
   - organize data into meaningful patterns
8. Compile a bibliography.
9. Submit written or typed report
   - a mark will then be awarded
   - all reports will be available for reading by other class members.

EVALUATION CRITERIA:

Students are advised to follow the guidelines for writing term papers which were distributed in English 300 classes. Term papers are to be written or typed demonstrating all principles of correct grammar, spelling, and suggested form. In addition, the written report must be:

(a) interesting

(b) informative and scientifically accurate

(c) current - written within the past 7 years

(d) documented as to source

(e) practical or applicable

(f) at least twenty pages in length

i.e. a minimum of five typewritten pages per student in the group

SUGGESTED TOPICS

1. Abortion
2. Acupuncture
3. Aging - Life Expectancy
4. Alcohol - effects
5. Allergies
6. Artificial Pacemakers
7. Baldness
8. Biofeedback - learning to control involuntary action
9. Biological Superiority? Male vs. Female
10. Bioluminescence
11. Biorhythms
12. Blood - diseases - Anemia
    - Leukemia
    - Hemophelia
    - Polycythemia
13. Breathing under water
14. Burns
15. Carnivorous plants
16. Chromosomes and Disease
17. Cloning - making duplicate organisms
18. Cryobiology - Freezing and Revival of Dead
19. Definition of Death - A medical-legal problem
20. Diets
21. D.D.T. - Use and abuse of pesticides
22. Drugs - Medical and Non-medical uses
23. Electrode implants in brain
24. Endangered species of animals
25. Extra-Sensory perception
26. Extra-terrestrial life
27. Eye disorders
28. Fear
29. First Aid
30. Germ Warfare
31. Headache
32. Hibernation - suspended animation
33. Hypnosis
34. Hypochondria
35. Human diseases
    - cystic fibrosis
    - cerebral palsy
    - muscular dystrophy
    - multiple sclerosis
    - malaria
    - Parkinson's Disease
    - Hodgkin's Disease
    - Huntington's Chorea
    - Diabetes
    - Cancer
    - Arthritis
    - Rheumatism
    - Psoriasis
    - Acne
    - Seborrea
    - Influenza
    - Common Cold

continued ....

SUGGESTED TOPICS - continued

36. Intelligence
37. Lie Detector Test - Truth serum
38. Malnutrition
39. Megavitamin therapy - Vitamin E
    - Vitamin C
    - Vitamin B
40. Mental disease
41. Memory, amnesia
42. Migration
43. Mutation
44. Obesity
45. Open Heart Surgery
46. Organ transplants - heart
    - lung
    - bone
    - skin grafts
    - artery
47. Orthotheraphy - relief from aches and pains
48. Pain
49. Placebo effect
50. Plastic surgery
51. Pollution - lead - water
    - mercury - air
    - noise - soil
52. Psychosomatic illness
53. Radiation therapy
54. Rejection reaction - human body
55. Respiratory diseases - Emphysema
    - Bronchitis
    - Asthma
    - Pneumonia
    - T.B.
    - Black lung
56. Sleep - Insomnia Somnambulism
57. Smoking
58. Stress - a cause of disease
59. Test tube babies
60. Thalidomide babies
61. Twins
62. Ulcers
63. Zero population growth

APPENDIX G

PANEL MEMBERS, DIRECTIONS FOR VALIDATION OF INSTRUMENTS

APPENDIX G

PANEL MEMBERS, DIRECTIONS FOR VALIDATION OF INSTRUMENTS

PANEL MEMBERS

Mr. Brian Burdy
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Mr. Len Rosolovich
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Winnipeg, Manitoba, Canada

Mrs. Catherine Thexton
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St. John's High School
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DIRECTIONS FOR VALIDATION PROCEDURE

I. READING-T.V. SURVEY

All items were designed to measure the students' exposure to biology-related topics via the medium of television or reading materials.

Please read each item and indicate beside it whether or not you agree that it is appropriate for this purpose. If you should disagree with any item, please indicate your reason for disagreement.

II. STUDENT INTEREST SURVEY

All items were designed to measure the intensity of students' interest in biology topics which reflect applied principles and concepts found in the B.S.C.S. blue version biology text. Please read each item and indicate beside it whether or not you agree that it is appropriate for this purpose. If you should disagree with any item, please indicate your reason for disagreement.

III. VALUE ORIENTATION SURVEY

The enclosed set of statements has been developed as part of a research study to determine the preferences of grade twelve biology students for various aspects of biology. Each item consists of three true statements which may be classified as being dominated by the following values:

HUMANISTIC VALUE - demonstrates a concern for human nature, improvement in the human condition, or some benefit to mankind.

TECHNOLOGICAL VALUE - demonstrates an application of knowledge in industry for the production of material goods.

THEORETICAL VALUE - demonstrates a concern for the ordering and systematization of knowledge (i.e. definition or functional concept of theory).

For purposes of validation of the instrument I would like to request your kind assistance to classify the three statements of each item according to the above definitions.

Please read the statements and decide which of the three values is represented by that statement. Please indicate on the answer sheet provided which item is in your opinion:

Humanistic ..... use symbol "H"

Technological ..... use symbol "P"

Theoretical ..... use symbol "T"

If, in your opinion, a statement is not dominated by one of these three values, please leave the answer sheet blank.

For example, the hypothetical question 27 might be categorized as follows:

27. (A) H (B) T (C) P

I would appreciate your hasty reply. Please feel free to contact me regarding any query or comments you might wish to make regarding these statements. All information will be kept confidential.