

A SURVEY OF THE LITERATURE RELATING TO
PHYSICAL SCIENCE FOR THE SLOW LEARNER

by 2214

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CHAPTER I

INTRODUCTION

Occasionally a teacher is asked to assist in developing a course of study in physical science for slow learners and disinterested students in the secondary school. Sometimes the course of study has been developed and the teacher is asked to teach this class--often with no previous teaching experience. This teacher needs to know what factors will enhance the learning for these young people who are often not interested in science or school.

The problem of the disinterested student has been receiving national attention during recent years because of such outward symptoms as drug abuse and violence. Although the slow learner and the disadvantaged child have always been present, the problem of educating them has become more urgent recently for several reasons. Automation and advanced technology have eliminated many of the menial tasks. Equality of job opportunity requires also an equal opportunity for developing intellectually.¹ The racial disturbances and high population concentration in urban areas have caused educators

¹J. McVicker Hunt, "The Implications of the Changing Ideas on How Children Develop Intellectually," The Disadvantaged Child: Issues and Innovations, Joe L. Frost and Glenn Hawkes, editors (Boston: Houghton Mifflin Company, 1970), p. 141.

to analyze the quality of education in the inner city schools.² Finally, many people are recognizing the necessity to prepare well-informed, literate, thinking members of our society to become responsible citizens.

Our society has attempted to move from education for the elite to education "for all". Unfortunately, we have often failed to realize that the needs of students of varied backgrounds are so different that merely providing the materials for education is not enough. It is necessary to reach the child before one can teach him. If he comes from a background of failure, he must experience success. If he has lost his ability to trust others--especially anyone associated with the school--this trust must be restored. As he sees relevance between the topic studied and his own life, as he experiences success and develops trust, he will begin to learn within the bounds of his own capacity.³

In order to help each student develop within the limits of his potential, the teacher must know as much as

²Kenneth R. Johnson, "The Culturally Disadvantaged--Slow Learners or Different Learners?" Journal of Secondary Education, 45:46, January, 1970.

³John Holt, How Children Fail (New York: Dell Publishing Co., Inc., 1964); John M. Lembo, Why Teachers Fail (Columbus, Ohio: Charles E. Merrill Publishing Company, 1971); Carl R. Rogers, Freedom to Learn (Columbus, Ohio: Charles E. Merrill Publishing Company, 1969); W. R. Wees, Nobody Can Teach Anyone Anything (Garden City, New York: Doubleday and Company, 1971).

possible about slow learners and disadvantaged children in general and about his students in particular. This necessitates cooperation from the administration and counselors to provide the information about the students.⁴ It also requires small classes with freedom to utilize the information he has obtained.⁵ The teacher needs to be a sensitive, well-trained individual who is mature and self-confident enough to provide the atmosphere for learning which these students deserve and need. This is indeed a challenge!

I. STATEMENT OF THE PROBLEM

This literature survey was undertaken to prepare for meeting the challenge of providing a suitable atmosphere for learning for slow learners and disinterested students in physical science. An attempt was made to: (1) determine the characteristics of students who are called slow learners or disinterested students (2) compare the objectives suggested for physical science for classes which are not college-preparatory, (3) report methods of instruction which have been successful with slow learners and disinterested students,

⁴James R. Okey, "Diagnosing Learning Difficulties," The Science Teacher, 37:60, May, 1970.

⁵Jules Henry, "White People's Time, Colored People's Time," The Disadvantaged Child: Issues and Innovations, Joe L. Frost and Glenn R. Hawkes, editors (Boston: Houghton Mifflin Company, 1966) p. 399.

and (4) identify characteristics of teachers who are effective in facilitating learning of students--particularly the disinterested student.

II. DEFINITION OF TERMS

Slow learner. This term was used to refer to the student whose achievement in most areas is lagging two or three grade levels below his present grade level in school; whose IQ range is usually 75-95; and whose pattern of learning has appeared slower than his peers.⁶

Disadvantaged or deprived student. This student also has a low achievement in the basic academic skills of reading, writing, and arithmetic but this is often due to the limited experiences and differences in language system, interest, and general information in his culture as compared with the school.⁷

Disinterested student or educationally uninvolved student. These two terms have been used synonymously to refer to the student who, for any reason, has lost interest in school.

⁶Description given in directives from the Superintendent's Office, USD 383, Manhattan, Kansas.

⁷Kenneth R. Johnson, "The Culturally Disadvantaged--Slow Learners or Different Learners," Journal of Secondary Education, 45:46, January, 1970.

Non-academic classes. This term has frequently been used to refer to non-college-preparatory classes. There is sometimes a connotation of inferiority which may be detrimental to learning. Included in the non-academic class are the slow learners, disadvantaged students, and disinterested students. The criteria for placement in these classes vary from one school to another and even within schools.

III. LIMITATIONS

Because the students with IQ below 75 are usually placed in special education classes, information pertaining to them is not included in this paper. Also, information specifically referring to the physically handicapped or the intensely emotionally disturbed students was not included.

IV. DESIGN AND PROCEDURE

This study involved a review of the literature from 1965 to 1971 which dealt with the low-achieving student and physical science. This literature was identified by using such references as the Education Index and Dissertation Abstracts. The Educational Research Information Center (ERIC) microfiche collection at Kansas State University library was also surveyed. Several new courses of study for slow learners and disinterested students were investigated.

CHAPTER II

REVIEW OF THE LITERATURE

Any teacher who will be involved in preparing a course of study or in teaching a physical science class which includes slow learners and disinterested students needs some background information. To provide this information, several areas were studied. First, the general characteristics were identified which would separate the slow learner and disinterested student from other students. Second, objectives were cited which were considered appropriate for physical science classes which were not college preparatory. In the light of the differentiating characteristics and suitable objectives, methods of instruction and available courses of study were reviewed. Finally, the characteristics of teachers who had been effective in facilitating learning for the disinterested student were identified. With this information, the teacher should be better able to meet the challenge provided by this interesting segment of our population.

I. CHARACTERISTICS OF STUDENTS IN NON-ACADEMIC CLASSES

In many schools the emphasis has been on classes for the college-bound student. The goals of the classes which

were not college-preparatory, sometimes called non-academic classes, were often not well-defined. Consequently a wide variety of students could be found in these classes. This fact makes identification of characteristics an almost impossible task. In order to determine some objectives and methods for facilitating learning in classes which include slow learners and disadvantaged students, a few of the most common characteristics of these students will be discussed.

The non-academic classes are often "dumping grounds" for students who did not adjust well to other classrooms. Sometimes this included the youngster with above average intelligence who was physically handicapped, emotionally disturbed, or socially maladjusted.¹ Occasionally a student will not score well on a group intelligence test and (if this is the main criterion for placement) will find himself in a class of slow learners. These students are usually not actually slow learners.

The slow learner usually has an IQ between 75 and 95. By the time he reaches high school there will probably be a difference of several grade levels between his achievement in reading and mathematics and the achievement of other students in his class in high school. He may have repeated an earlier

¹Willard Abraham, The Slow Learner (New York: The Center for Applied Research in Education, Inc., 1964) pp. 11-16.

grade and so may be older chronologically than his classmates. It may take these youngsters longer to think through a problem and many of them have less ability to transfer thinking from one problem to another.

Because of a history of failure, many slow learners have developed an attitude of apathy and disinterest in school. They also often have a very poor self-image.²

The slow learner usually has a short attention span and is easily distracted. It also seems to be difficult for him to put ideas together and to plan his work. The directions which are given should be simple, clear, and specific.³

Many slow learners need extra time and opportunity to see relationships and build mental models for themselves through a variety of activities.⁴

Another consideration is that a student may be a slow learner in one subject but because of interest or other reasons may be a fast or average learner in another subject.

²Samuel Malkin, "The Culturally Deprived Child and Science," The Disadvantaged Child: Issues and Innovations, Joe L. Frost and Glenn Hawkes, editors (Boston: Houghton Mifflin Company, 1966) p. 328.

³Gladys Gardner Jenkins, Helping Children Reach Their Potential (Glenview, Illinois: Scott, Foresman and Company, 1961) p. 56.

⁴Lorenzo Lisonbee, "Teaching Science to the Slow Learner--The BSCS Point of View," School Science and Mathematics, 65:41, January, 1965.

Sometimes frustrations have also developed for the slow learner because his parents' ambitions do not match his ability. Parent-teacher conferences, student-teacher conferences, and a success-oriented course of study may help to alleviate some of this frustration.

Another large segment of many non-academic classes is the group often called disadvantaged or deprived. This student may come from the urban ghetto or the poor rural areas. Usually he is from the lower socio-economic level, but this is not necessarily true.

The culturally disadvantaged child is one whose entire way of living--attitudes, beliefs, and value system--are different from the school and the dominant society in which he is attempting to function.⁵ This difference often makes it very difficult to understand the relevance of much that he learns in school to his way of life. His poor environment may also inhibit the development of pre-language skills.⁶

The disadvantaged learner usually has low achievement in the basic skills such as reading, listening, writing, and

⁵Kenneth R. Johnson, "The Culturally Disadvantaged--Slow Learners or Different Learners?" Journal of Secondary Education, 45:44, January, 1970.

⁶Morsley G. Giddings, "Science Education and the Disadvantaged: Adapting Curriculum Reforms to the Special Requirements of the Disadvantaged," Science Education, 50: 210, April, 1966.

arithmetic. This retardation may be due to low mental capability but there are also other possible explanations. Reissman suggests that the disadvantaged child has a different style of learning--that he learns more readily with physical and visual involvement and at a slower pace than some other students.⁷ There are frequent absences and tardies with the disadvantaged child and this causes him to lag behind still further.⁸

The disinterested student may be a slow learner or he may be a culturally disadvantaged student. On the other hand, he simply may not see the relevance of the concepts he is expected to learn and his "real life". He may also have personal problems of such importance to him that school actually seems nonsensical to him. Unfortunately, this student is frequently overlooked until he has erected such a barrier to learning that it is difficult to help him surmount this barrier.

A summary of some of the student characteristics which the teacher of a non-academic class is likely to observe are: low achievement in basic skills, short attention span,

⁷Frank Reissman, "The Strategy of Style," Teachers College Record, 65:484, March, 1964.

⁸Earl C. Kelley, "Seeds of Dropouts," The Disadvantaged Child: Issues and Innovations, Joe L. Frost and Glenn R. Hawkes, editors (Boston: Houghton Mifflin Company, 1966) p. 61.

difficulty in learning by traditional methods such as lecture, need for physical involvement and general lack of interest in school. These students have long been neglected in the development of appropriate curricula--programs in which they can experience at least a measure of success.

II. OBJECTIVES FOR PHYSICAL SCIENCE CLASSES WHICH ARE NOT COLLEGE-PREPARATORY

The student who is not enrolled in a college-preparatory course needs a first-rate program in science and other basic subjects for several reasons. He represents a significant segment of our society which can contribute many worthwhile services to the society. He is important as a potential voter and as one who shares in the responsibility of maintaining and improving our democracy.⁹

These students need to acquire an understanding of the important contributions of science and technology in today's world as well as the problems and social implications which arise because of these technological advances.¹⁰ They

⁹Lorenzo Lisonbee, "Teaching Science to the Disadvantaged Pupil," The Disadvantaged Child: Issues and Innovations, Joe Frost and Glenn Hawkes, editors (Boston: Houghton Mifflin Company, 1966) p. 336.

¹⁰J. David Lockhard, Seventh Report of the International Clearinghouse on Science and Mathematics Curricular Developments (Washington, D.C.: American Association for the Advancement of Science, 1970) p. 533.

need to become involved in the processes of science to better understand how the scientist goes about his work.¹¹ They need to learn a few basic concepts of science. Finally, they need to find out that learning can be enjoyable and exciting.¹²

Are there some basic concepts in science which all students need to learn? Gagné¹ has said:

At the earliest level of instruction, the individual needs to learn how to observe, how to figure, how to measure, how to orient things in space, how to describe, how to classify objects and events, how to infer, and how to make structural models. These capabilities he will use all his life.¹³

One major objective for the teacher of any physical science class would be to provide opportunities for the students to acquire these basic capabilities.

When the Milwaukee Public Schools prepared their science project for central city secondary schools, they developed several objectives which are worth considering for any non-academic physical science course. One emphasis was the improvement of basic communication skills such as reading,

¹¹Lorenzo Lisonbee, "Teaching Science to the Disadvantaged Pupil," The Disadvantaged Child: Issues and Innovations, Joe Frost and Glenn Hawkes, editors (Boston: Houghton Mifflin Company, 1966) p. 336.

¹²S. A. Proctor, "Reversing the Spiral Toward Futility," Personnel and Guidance Journal, 48:712, May, 1970.

¹³Robert M. Gagné¹, "The Learning Requirements for Enquiry," Journal of Research in Science Teaching, 1:153, 1963.

writing, listening, and speaking, through the use of specially prepared materials of instruction. They also hoped to develop an awareness of the environment and its opportunities through field trip experiences. They planned to provide more direct participation for the student through laboratory investigations. Another goal of the program was to develop more positive attitudes in the students toward education, teachers, peers, and society in general in order to improve behavioral patterns.¹⁴

Another program developed for the educationally uninvolved includes some of the previous objectives in addition to the following: (1) to make possible continued success for the student, (2) to make scientific problems with social implications an integral and relevant part of as many lessons as possible, and (3) to use examples familiar to the urban and non-white student.¹⁵

Sometimes objectives which relate to the values or attitudes of students are overlooked or even avoided in science classes. However, such values as honesty in reporting, openmindedness, and the usefulness of evidence in making

¹⁴Nancy Noeske, "Science Program for the Disadvantaged," The Science Teacher, 37:31, December, 1970.

¹⁵Malvin S. Dolmartz and Harry K. Wong, Ideas and Investigations in Science--Physical Science Teachers Manual (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1971) p. 1.

decisions are very important to scientists.¹⁶ Perhaps a greater emphasis on values and attitudes would actually make the topic seem more relevant to the student. For example, if the student is asked to identify his attitude about seat belts after studying Newton's laws of motion or if he is asked to determine ways in which he can help conserve electrical energy in his own daily life, he is asked to take a stand and perhaps do something about a problem rather than just study for a test.¹⁷

In planning the objectives, it is essential that the focus is on the total growth of the individual student rather than the subject matter to be taught. Particularly for the slow learner and educationally disadvantaged student, it is important that the student learn how to learn and to adapt to change. He must also direct his knowledge and skills toward a constructive change of man's situation.¹⁸

¹⁶Albert F. Eiss and Mary Blatt Harbeck, Behavioral Objectives in the Affective Domain (Washington, D.C.: National Science Supervisors Association, 1969) p. 3.

¹⁷Merril Harmin, Howard Kirschenbaum, and Sidney Simon "Teaching Science with a Focus on Values," The Science Teacher, 37:18, January, 1970.

¹⁸John Lembo, Why Teachers Fail (Columbus, Ohio:Charles E. Merrill Publishing Company, 1971) p. 42.

III. SUGGESTED METHODS OF INSTRUCTION FOR DISINTERESTED STUDENTS

In the popular magazines, new books, and even the education journals, many writers are pointing out the defects in American education. With this criticism can also be found many constructive suggestions for improvement.

One suggestion that is frequently mentioned is individualized instruction. Professional educators have been urging teachers to teach each child according to his individual needs for many years. Although attempts have been made to develop curricula and teaching methods with this concept in mind, the practical application of individualized instruction in the classroom has often left much to be desired in the past. Large classes and lock-step curricula were deterrents to individualized instruction; but, even more influential, were the difficulties in diagnosing the strengths and weaknesses of the individual and in providing the special teaching methods to meet these individual needs. Research on how to teach the mentally retarded, emotionally disturbed, blind, deaf, neurologically impaired and others with learning disabilities has given new insights about how all children learn, including both normal and abnormal.¹⁹ As a result, many commercial

¹⁹Lester Tarnopol, editor, Learning Disabilities (Springfield, Illinois: Charles C. Thomas, publisher, 1969) p. 20.

systems of individualized instruction are now available. Teachers or school systems may also develop individualized learning packets to meet the special needs of the students in that school system. The schools in Ogden, Utah reported great satisfaction with an individualized program for slow learners.²⁰

One advantage of individual learning packets for the slow learner is the ease with which remedial work may be provided for specific skills or areas of knowledge which are missing for these students. Again it must be emphasized that it is necessary for the teacher to be familiar with the needs of each student. If the teacher can diagnose the need, he can often provide a means for overcoming this deficiency. One danger is that the teacher will expect these individualized learning packets to provide a panacea, when in reality they should be one part of a diversified but well-coordinated program of study.

Although laboratory work has sometimes been excluded from science courses which were not college-preparatory because of fear of equipment breakage, the slow learner and disadvantaged student especially need this opportunity to manipulate objects and become physically involved in learning.²¹

²⁰Therald P. Quayle, "Individualized Science for the Slow Learner," Today's Education, 59:50, March, 1970.

²¹Frank Reissman, "The Strategy of Style," Teachers College Record, 65:484, March, 1964.

The laboratory program in the non-academic class needs to be structured somewhat differently from the laboratory class for the college-preparatory student. One consideration in some classes is the reading ability of the students. Perhaps the directions could be tape-recorded or a good pre-lab session provided which includes a demonstration of the equipment and technique required for that experiment. Giving clear and explicit directions for handling equipment is not the same as the "cookbook lab" which has been so widely criticized. In the past, some exercises which were called laboratory experiments were structured in such a way that even the slow learner could predict the outcome without doing the experiment. Laboratory lessons based on solving problems of significance to the student are more likely to hold his interest.

If the laboratory experiments are short, even the student who is absent frequently can work on the days he is there. A class record of the completed exercises will also show him what he misses when he is absent.²²

The slow learner and the disadvantaged student have usually experienced many failures in school; therefore it is very important that this course emphasize success. Short laboratory investigations with the results of the entire class

²²Eunice Liberson and Eleanor Fabiano, "Teaching Biology to Non-academic Students," The Science Teacher, 32:33, November, 1965.

recorded on a large data table on the chalk-board (if everyone does the same experiment) or a self-test, which the student can take and check himself, will allow him to be aware of his progress immediately. Even errors can be corrected in a positive atmosphere when the student is involved in the learning process.

Because of the wide range in reading ability of the students in non-academic classes, it would be wise to provide a wide variety of supplementary reading materials. Some teachers have used science-oriented pulp magazines, Popular Science, Popular Mechanics, Hot Rod, and similar magazines to stimulate interest in reading.²³ The teacher should certainly try to provide references at different reading levels for the current topics. Librarians are usually eager to fulfill this request whenever possible. Often students also enjoy sharing some books or magazines which they have. Some industries will provide free pamphlets on topics which may be studied.

In addition to an assortment of reading materials, other kinds of learning aids should be utilized whenever appropriate. Many films are available on a wide variety of topics. Some companies have films which may be borrowed for the cost of return postage. Other films may be rented at a reasonable cost. These films should be chosen carefully and

²³Frank W. Gilleland, ". . . And the Truth Shall Make Them Free," The Science Teacher, 32:34, November, 1965.

never ordered just to fill a class period. Sometimes film loops or film strips are very useful. In other cases, the transparencies, sometimes with overlays, on the overhead projector provide the best means for explaining or helping a student grasp a particular concept. In science especially, a well-developed demonstration is frequently very effective. The multimedia approach has tremendous possibilities, particularly for the disinterested student.

Field trips have often been used by science teachers, especially in biology. In the program developed by the Milwaukee schools, the field trips enabled students from the inner city schools to explore areas outside their immediate environs.²⁴ These students often have such limited experience that information in a textbook, even when they can read it, is not meaningful. A field trip provides an opportunity for the student to actually smell and sometimes even taste or feel a different environment, in addition to the sight and sound which could be provided by television or a movie.

Some provision should be made for interaction in small groups. Discussion may take place during the laboratory experiment, but if the teacher also wishes to focus on attitudes and values, this can often be done effectively in

²⁴Nancy Noeske, "Science Program for the Disadvantaged," *The Science Teacher*, 37:32, December, 1970.

group discussions.²⁵ These discussions must be handled rather carefully. If the student feels he will be graded or that there is only one correct response, he will merely parrot the teacher rather than develop his own value standards. This does not mean that the teacher has not set up some goals for attitudinal changes, but only that he has not made the goals known to the student.²⁶ Changes in attitude can also be evaluated by observation in the classroom.

The goals or objectives in the area of knowledge should be well-defined and made known to the student. Sometimes a student fails to learn simply because the objectives were so indefinite that he became frustrated and stopped trying.²⁷ Many times the objectives can be developed by the group with some guidance.

There has been evidence which indicates that learning is enhanced through informal, self-directed activity.²⁸ More than forty years ago, Herbert Williams was put in charge of a

²⁵Merril Harmin, Howard Kirschenbaum, and Sidney Simon, "Teaching Science with a Focus on Values," The Science Teacher, 37:19, January, 1970.

²⁶Albert F. Eiss and Mary Blatt Harbeck, Behavioral Objectives in the Affective Domain (Washington, D.C.: National Science Supervisors Association, 1969) p. 13.

²⁷Ibid.

²⁸George M. Carnie, "Doing Your Thing Via Self-determined Units," The Science Teacher, 37:35, February, 1970.

class room in which all of the most serious delinquents in a large school system were brought together. He had very little special equipment. There were only two rules: A boy must keep busy doing something, and no boy was permitted to annoy or disturb others. The group remained together for four months. During this period the measured educational achievement (on the Stanford Achievement Test) of those who had been in the group for the major part of this period increased fifteen months on the average. This incredible improvement came about when these boys were simply given opportunities to learn with no attempt made to "teach" them. Mr. Williams stated that he wanted to get acquainted with each boy and spent his time in this sort of activity rather than in teaching.²⁹ Carl Rogers has expressed the opinion that studies such as this have been disregarded because they appear to be a threat to teachers even though there is evidence from industry as well as the field of education that such participative learning is far more effective than passive learning.³⁰

It is important for the slow learner and disinterested student to experience success. Donald Schmidt's suggestion that "Students should leave the classroom every day knowing

²⁹H. D. Williams, "Experiment in Self-directed Education," School and Society, 31:715-718, 1930.

³⁰Carl Rogers, Freedom to Learn (Columbus, Ohio: Charles E. Merrill Publishing Company, 1969) p. 160.

how appropriate their performance was"³¹ becomes even more important in the non-academic class. Evaluation needs to be prompt and positive. This evaluation may be in the form of a self-test; an informal, ongoing process by questions and observation; or a post test, if this is the best means for the student to determine that he has mastered the objectives of that topic.³² Evaluating outcomes in the area of attitudinal changes or identification of value systems frequently involves personal discussion and interviews with the students as well as performance tests, individual inventories, and subjective test questions.³³ In general, teachers have found that immediate praise and frequent evaluation is appreciated by the limited learner.³⁴

In summary, the methods which have been used successfully in classes for slow learners and disadvantaged students are: individualized learning packets, laboratory experiments, wide assortments of reading materials, various audio-visual

³¹Donald W. Schmidt, "Can We Teach?" Journal of Research in Science Teaching, 4:177, 1966.

³²Therald P. Quayle, "Individualized Science for the Slow Learner," Today's Education, 59:50, May, 1970.

³³Albert F. Eiss and Mary Blatt Harbeck, Behavioral Objectives in the Affective Domain, (Washington, D.C.: National Science Supervisors Association, 1969) p. 18.

³⁴Lorenzo Lisonbee, "Teaching Science to the Slow Learner--The BSCS Point of View," School Science and Mathematics, 65:45, January, 1965.

media, small group discussions, and an opportunity for self-directed activity. The main concern should be choosing whatever methods of instruction seem the most appropriate for the individual needs of the student. It is important that the student learns to take responsibility for his own learning.

Several commercial programs of study have been produced which could be used for slow learners and disadvantaged students--either in part or as a total program.

One program developed by Dr. N. E. Bingham in Florida is called DISCUS--Demonstration of an Improved Science Curriculum for Underachieving Students. It is described as a success-oriented science program for junior High students who are educationally disadvantaged and underachieving. It uses the directed discovery approach with small group laboratory activities.³⁵

Although the Individually Prescribed Instruction in Science is designed for elementary to beginning of high school,³⁶ it is possible that some areas of study could be used also for later high school years. Similarly, the

³⁵David J. Lockhard, Seventh Report of the International Clearinghouse on Science and Mathematics Curricular Developments (Washington, D.C.: American Association for the Advancement of Science, 1970) p. 347.

³⁶Ibid., p. 425.

Introductory Physical Science course was designed for grades eight and nine, but many schools have used the course for students in grades eleven and twelve who do not plan to take further science courses.³⁷

In 1968, Dr. Irvin T. Engler initiated a course of study in Harrisburg, Pennsylvania called "Science for Non-Sciences Majors." This was designed specifically for grade eleven and emphasized population, pollution, and social problems of science origin.³⁸

The only science program which was specifically designed for the educationally uninformed in high school is Ideas and Investigations in Science. This program was developed by Harry K. Wong and Malvin S. Dolmartz at the Menlo-Atherton High School in California and is now available commercially. The course is completely lab- and experiment-centered and stresses student success. It was planned with a sixth grade reading level and makes scientific problems with social implications an integral part of as many lessons as possible. Each investigation is designed to help the student discover one concept at a time by a series of concrete

³⁷David J. Lockhard, Seventh Report of the International Clearinghouse on Science and Mathematics Curricular Developments (Washington, D.C.: American Association for the Advancement of Science, 1970) p. 436.

³⁸Ibid., p. 545.

experiences. These investigations are sequentially arranged to develop a larger, more general idea. Much of the program directs the student toward a process or method of science rather than an exact answer. The entire program consists of enough ideas and investigations for a year of biology and a year of physical science, but they may be taught in combination as a one year course.³⁹

Some advances have been made in developing successful methods and techniques for helping the slow learner and disinterested student become involved in learning some of the content and process of science, but there is still room for further research in this area. Much work is needed in developing methods and techniques for effective consideration of the values implications of science content. Above all, each school and each student represents a unique situation which must be considered on an individual basis.

IV. CHARACTERISTICS OF EFFECTIVE TEACHERS OF SLOW LEARNERS

The role of the teacher in the non-academic class is almost a paradox. On the one hand, it is essential that he

³⁹Malvin S. Dolmatz and Harry K. Wong, Ideas and Investigations in Science--Physical Science Teachers Manual (Englewood Cliffs, New Jersey:Prentice-Hall Inc., 1971) Pp. 1-14.

have a strong background in the subject matter, and yet, research has indicated that he should be a director of learning rather than a dispenser of information.⁴⁰

When one attempts to list the personal and professional qualities of capable teachers, the list becomes overwhelming. Some of the qualities of a teacher which are helpful to one child will prove to be a hindrance to another. There are, however, some characteristics which most teachers of slow learners and disinterested students should possess.

Contrary to the belief of some people--that anyone can teach the low classes--the teacher for the slow learner and disinterested student must have a strong background in the subject matter he teaches. In this way he will be able to use different approaches to the same basic concept. He also needs to know something of the history and philosophy of science to help the student understand the process and methods of science.⁴¹

These students need a teacher who will tolerate and respect them. Genuine tolerance and respect of pupils requires persistent confidence in their potential, an awareness of the circumstances that affect them and an appreciation of the

⁴⁰Therald P. Quayle, "Individualized Science for the Slow Learner," Today's Education, 59:51, March, 1970.

⁴¹F. James Rutherford, "The Role of Inquiry in Science Teaching," Journal of Research in Science Teaching, 2:84, 1964.

positive values of a different culture.⁴² As Reissman has said, "Too many people talking about respecting culturally deprived youngsters really see nothing to respect, and, consequently, their discussion of respect becomes an empty phrase."⁴³

In studying child development, it has been shown that children tend to behave as others expect them to behave--sometimes called the "self-predicting prophecy". It is especially important for the teacher of the slow learners and disinterested students to have faith in the achievement of his students.⁴⁴ He needs to accept them for what they are and build a healthy respect for achievement, originality, and creativity.⁴⁵

Finally, the teacher needs to be concerned with the total growth of his pupils. His teaching should be aimed at encouraging students to use their minds as well as their less rational feelings and beliefs.⁴⁶ In fact, these feelings and

⁴²Lorenzo Lisonbee, "Teaching Science to the Slow Learner--The BSCS Point of View," School Science and Mathematics, 65:46, January, 1965.

⁴³Frank Reissman, "Education of the Culturally Deprived Child," The Science Teacher, 32:14, November, 1965.

⁴⁴Willard Abraham, The Slow Learner (New York: The Center for Applied Research in Education, Inc., 1964) p. 74.

⁴⁵Donald W. Schmidt, "Can We Teach?" Journal of Research in Science Teaching, 4:177, 1966.

⁴⁶E. W. Menzel, "Science Teaching and Sensitivity Training," The Science Teacher, 36:20, November, 1969.

beliefs can impede the learning, therefore it is important to diagnose these feelings so they can be used to improve rather than impair learning.

Dealing with attitudes and values has usually been avoided by the classroom teacher. Sometimes a token reference to "change of attitude in students" is made in a list of objectives, but in actual practice this is often neglected. One reason for this neglect is the classroom teacher. Teachers usually feel more comfortable in the area of skills, facts, and concepts, partially because this is the way they were instructed, and partially because it is much easier to evaluate the outcomes of instruction involving skills, facts, and concepts. Values are often personal and controversial, so dealing with values in the classroom is sometimes avoided for this reason.⁴⁷

The teacher of slow learners and disinterested students needs to realize that these students often have been alienated by emphasis on facts and skills.⁴⁸ As Harmin and others have said, the subject matter becomes more relevant to the student when he is asked to take a stand and perhaps do something

⁴⁷Albert F. Eiss and Mary Blatt Harbeck, Behavioral Objectives in the Affective Domain, (Washington, D.C.: National Science Supervisors Association, 1969) p. 10.

⁴⁸Earl C. Kelley, "Seeds of Dropouts", The Disadvantaged Child: Issues and Innovations, Joe L. Frost and Glenn Hawkes, editors, (Boston: Houghton Mifflin Company, 1966) p. 64.

about a problem--when the teaching is aimed at his life and values.⁴⁹

Students need an opportunity to understand the importance of values and to make tentative decisions concerning them. The teacher's personal example is an excellent means for developing a sense of values in students. For example, if the teacher is open-minded and tolerant of others' views, this will be more effective in helping students develop good value systems than any devised program on values.⁵⁰

The teacher who is concerned with the total growth of his students needs to be comfortable accepting and working with a wide range of pupil behavior. He must be able to accept spontaneity, confrontation, open-endedness, and variations in levels of understanding and language facility.⁵¹ He needs to have broad, but well-defined goals so he can move with confidence toward meeting the individual needs of his students.⁵²

⁴⁹Merrill Harmin, Howard Kirschenbaum, and Sidney Simon, "Teaching Science with a Focus on Values," The Science Teacher, 37:18, January, 1970.

⁵⁰Albert F. Eiss and Mary Blatt Harbeck, Behavioral Objectives in the Affective Domain (Washington, D.C.: National Science Supervisors Association, 1969) p. 10.

⁵¹E. W. Menzel, "Science Teaching and Sensitivity Training?" The Science Teacher, 37:18, November, 1969.

⁵²Willard Abraham, The Slow Learner (New York: The Center for Applied Research in Education, Inc., 1964) p. 74.

CHAPTER III

SUMMARY AND RECOMMENDATIONS

The large number of students who drop out of school, those who actually drop out as well as those who are only physically present in school, indicates a failure of the school system to meet the needs of many students.

To prepare for the challenge of providing an atmosphere for effective learning for these students, several areas were investigated: (1) characteristics of students in non-academic classes, (2) appropriate objectives for physical science classes which are not college-preparatory, (3) methods of instruction and available courses of study for disinterested students, and (4) characteristics of effective teachers for slow learners.

Although slow learners and disinterested students are like other students in many respects, research indicates some general differentiating characteristics. Some of the most prevalent characteristics which have helped to identify the slow learner and disinterested student are: short attention and interest span, slow reaction time, academic retardation, general lack of interest in school, and difficulty in learning by traditional methods such as lecture and textbook assignments.

To prepare a student for living in a world which is greatly influenced by science, certain major objectives must be met. The student needs to become involved in the processes of science; to investigate some of the basic concepts of science; to understand some of the contributions of science and technology in today's world; to be made aware of the problems and social implications of technological advances; and to find out that learning can be enjoyable and exciting.

Some of the methods which have been used effectively for slow learners and disadvantaged students include individualized learning packets, laboratory experiments, various audio-visual media, small group discussions, and opportunity for self-directed activity. The general emphasis throughout needs to be toward improving the self-image of this student and developing the program of study to fit the individual needs of the student. There is some evidence that the slow learner or disinterested student has a style of learning which is different from other students; therefore he needs a variety of instructional methods to facilitate his learning. Several commercial courses of study have been developed within the last five years which show some promise for the slow learner and disinterested student.

The teacher needs to have a strong subject matter background and yet to be able to adapt to the individual needs and interests of his students. He must be able to listen to

the feelings of students and to pay attention to the relationships with students. The teacher must be willing to let the student take the responsibility for his own learning but also to help him achieve success. He needs to understand the student and the way subject matter can best be learned by him.

No attempt has been made to suggest a specific course of study. More possibilities need to be developed and considered. For example, some suggestions were made concerning the non-academic class in urban or ghetto schools, but methods of approach are also needed for the small-town or rural student. Also, in many schools the slow learner and disadvantaged student are not placed in a separate class. What provisions can be made for this student's learning under these circumstances?

Several other questions have arisen during the preparation of this paper. How can the potential dropout, the slow learner, or the disinterested student be identified and started on a relevant program of study earlier? How can administrators be made aware of the special problems which arise or the special techniques which are necessary for the slow learner and disadvantaged student? How can teachers be given worthwhile in-service training in identifying and facilitating learning in the disinterested student? Should work with slow learners be a part of teacher training courses? What kind of in-service and pre-service training would help prepare

teachers for including values issues as a part of their science teaching?

The challenge is here. Much work has been done, but there is still a necessity for further study and for the implementation of the methods and techniques which have proved to be effective. More educators need to be convinced of the value of the individual and then convinced of their ability to handle that individuality.

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A SURVEY OF THE LITERATURE RELATING TO
PHYSICAL SCIENCE FOR THE SLOW LEARNER

by

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AN ABSTRACT OF A MASTER'S REPORT

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A survey of the literature was undertaken in an attempt to (1) determine the characteristics of students who are usually placed in non-academic classes, (2) compare the objectives suggested for physical science for classes which are not college-preparatory, (3) report methods of instruction which have been successful with disinterested students, and (4) identify characteristics of teachers who are effective in facilitating learning of students--particularly the disinterested student.

Some of the identifying characteristics of slow learners and disinterested students which were cited from the literature were: short attention and interest span, academic retardation, general lack of interest in school, and difficulty in learning by traditional methods such as lecture and textbook assignments.

Most researchers indicated that the student in the non-academic class also needed to become involved in the processes of science; to understand some of the contributions of science and technology in today's world; to be made aware of the problems and social implications of technological advances; and to find out that learning can be enjoyable and exciting.

Effective methods for disinterested students were those which aimed at improving the self-image of the student and at meeting the individual needs of the student. The effective teacher, therefore, not only needs to understand the student, but also the way subject matter can best be learned by the student.