

THE INTERMEDIATE SCIENCE CURRICULUM STUDY LEVEL I PROGRAM

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CHAPTER I

AN INTRODUCTION TO THE INTERMEDIATE SCIENCE CURRICULUM STUDY

The Intermediate Science Curriculum Study is an outgrowth of concern on the part of some people at The Florida State University, Tallahassee, Florida, who felt that science education at the intermediate level could be much improved. The Intermediate Science Curriculum Study has developed a content and an approach to science which are somewhat different from the lecture-lab approach. The basic equipment for this approach as well as a core text and student record book have been marketed. Before we investigate the basic rationale behind the Intermediate Science Curriculum Study approach and review the material available, let us take a look at the development of this program.

Ernest Burkman, the original director of the Intermediate Science Curriculum Study, wrote something of the history of the study in his forward to the Fall, 1969, experimental edition of Probing the Natural World, Volume 1, the basic core text:

For some years a group of scientists and educators at The Florida State University have been deeply concerned about the kind of science education being given the nation's junior-high school students. During the period 1961-1963, national authorities on the subject met several times to discuss ways of improving science teaching at this level. From these discussions came a rationale for developing and organizing improved instructional materials. Small-scale writing sessions were conducted during 1964 and 1965, and pilot curriculum materials were tested in selected schools during the 1965-66 school year. All this preliminary work was supported from University funds. In June of 1966 the project came under the financial support of the United States Office of Education, and this aid has permitted an expanded effort.

ILLEGIBLE DOCUMENT

**THE FOLLOWING
DOCUMENT(S) IS OF
POOR LEGIBILITY IN
THE ORIGINAL**

**THIS IS THE BEST
COPY AVAILABLE**

During the summer of 1966, over 30 scientists and teachers from all over the country gathered in Tallahassee and designed a new instructional program for grade seven. These draft materials were tested with over 5,000 students in five states during the 1966-67 school year. They were revised by a second writing conference, conducted during the summer of 1967. This volume represents a slight revision of part of the product of that work.

The long-range goal of the project is to develop for grades seven through nine a coordinated science sequence that is scientifically accurate, consistent with good learning theory, and well adapted to the age level for which it is intended. As envisioned, several years of effort will be required to bring this goal to a reality.¹

Since this 1969 writing, the Intermediate Science Curriculum Study Level I text has gone through four printings and more than 175,000 children in twenty-two states have field tested it. The program has aroused interest throughout the United States as well as Australia, the Philippines, Puerto Rico, several South American countries, and the French speaking portion of Canada.² It seems apparent that this approach to teaching science has some value. This paper will attempt to explore the Level I program of the Intermediate Science Curriculum Study to show how the program is sequenced, what the rationale of the program is, and what aids are available to the beginning teacher in the Intermediate Science Curriculum Study program.

¹Intermediate Science Curriculum Study, Probing the Natural World, Fall, 1969, Experimental Edition, Volume 1 (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1968) Forward.

²Intermediate Science Curriculum Study, ISCS News Report, May 19, 1972, pp. 7-10.

CHAPTER II

RATIONALE FOR THE INTERMEDIATE SCIENCE CURRICULUM STUDY

In the overview for an individualized teacher preparation module entitled Rationale for ISCS we find this rationale clearly stated:

ISCS believes that science teachers at the junior high and middle school level intuitively support the notions that science instruction should be for general education and that science content should be presented in a logical sequence of subject matter together with science processes. ISCS further believes that science teachers support the idea that learning about science involves doing and that this doing leads not only to the ability to carry out science activities in an efficient manner but also to the understanding and appreciation of science as a process. ISCS is convinced that science teachers subscribe to the belief that whenever possible instruction should be individualized to meet the needs of every person and that science has a unique potential for providing students with opportunities to express their own creativity and utilize their own abilities to the maximum.¹

This statement reads as though it were a creed for the Intermediate Science Curriculum Study but it does present four major points:

1. science instruction should be for general education at the junior high school level;
2. science instruction at the junior high and middle school level should be organized around science processes and concepts;
3. science instruction at the junior high school and middle school level should be centered about appropriate activities;
4. science instruction at the junior high school and middle school level should be on an individualized basis to meet the needs of every person.

¹Intermediate Science Curriculum Study, Rationale for ISCS, Summer, 1971 Experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) pp. 1-2.

Let us look in greater depth at these four major points.

Science Instruction at the Junior High School and Middle School Level Should Be for General Education

In their introduction to the Level I teacher's edition of Probing the Natural World the writers mentioned their ideas on this subject:

The ISCS program aims primarily to give the student a valid understanding of the nature of science and of the way that knowledge in science has been accumulated. It arms him with skills and concepts that will help him interpret the natural phenomena and technology that confront him. Preparing the student for future science courses for a specific vocation are secondary to these more general goals.²

The Intermediate Science Curriculum Study, then, chose to develop a general course covering many facets of science rather than a specific unit over a limited topic such as chemistry. In the individualized teacher preparation module explaining the rationale for ISCS the following opinion was expressed:

ISCS views science as a necessary part of the junior high school curriculum. One reason is that many students terminate formal schooling about the eighth or ninth grade. Another is that in many schools only one year of high school science is required, and the course most often selected and offered is biology. If science is not taught in the intermediate grades, the student has an incomplete picture of the world of science.³

²Intermediate Science Curriculum Study, Probing the Natural World/1 (Morristown, New Jersey: Silver Burdett Company, 1970) p. T-1.

³Intermediate Science Curriculum Study, Rationale for ISCS, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) pp. 2-3.

A minimum goal for science teachers, then, must be to educate every student to a point at which he can understand the advances made in the world of science. A knowledge of scientific advances is important since these advances affect the everyday world of the student.

Science Instruction at the Junior High School and Middle School Level Should Be Organized Around Science Processes and Science Concepts

Considerable debate has arisen recently about whether the processes of scientific inquiry or the concepts of science provide the better basis upon which to organize instructional materials. The ISCS program presumes that both of these important aspects of science can and should be introduced simultaneously by allowing major concepts to arise out of student investigation.⁴

One may find it hard to differentiate between a "concept" and a "process" as above mentioned. Some examples of science processes might be "analyzing," "classifying," "hypothesizing," "inferring," or "predicting." Examples of science concepts are "mass," "weight," "density," or "volume." It is easy to see how process and concept could fit well together. One example of process and concept together would be: "Measure the weight of this cart."

In organizing the course to simultaneously include both concepts and processes, the scope and the sequence of the subject matter was defined. The sequence for the Intermediate Science Curriculum Study courses is:

⁴Intermediate Science Curriculum Study, Probing the Natural World/1 (Morristown, New Jersey: Silver Burdett Company, 1970) p. T-2.

Seventh Grade: Physical Science

Eighth Grade: Chemistry

Ninth Grade: Life and Earth Sciences.

ISCS feels that there are sound reasons for organizing the program with the physical sciences first. These reasons are based on psychological theory and practical experience. Studies by psychologists indicate that seventh to ninth grade students are in a transitional stage of mental development. As the student progresses, he develops physically, emotionally, and intellectually. He passes from a stage in which he focuses on the immediate and concrete to one in which he can manage abstract ideas. Concrete, in this sense, refers to material objects which can be manipulated by hand. The student at the concrete operational phase of development must work through problems one step at a time, but he can understand the interaction of two variables if he can directly observe the interaction. Learning occurs best in a hands-on environment, in situations where the student has the opportunity for sensory experience.⁵

The Intermediate Science Curriculum Study was planned to be very manipulative and concrete at the seventh grade level and more abstract as the student progressed. This plan was based, to some extent, on the research of Dr. Jean Piaget.

Three techniques were identified as being important in scientific work and these three techniques were the central themes about which the process was organized. The three techniques and their associated grade levels are:

Level I: operational definition and measurement;

Level II: model building;

Level III: experimentation and investigation.

⁵Intermediate Science Curriculum Study, Rationale for ISCS, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) p. 3-2.

The sequential flow from concrete to abstract fits in well with the subject matter choice which teaches physical science first. The content flow fits in even better with this choice of sequence:

The content for Level I is organized under the theme "Energy, Its Forms and Characteristics." Primary emphasis is given to physics-oriented activities with a gradual shift to those of a more chemical nature. The Level II (eighth grade) program begins with chemically oriented activities and ends with the content of a more biological flavor. Level III (ninth grade), interdisciplinary in nature, shows the applicability of some of the fundamental concepts introduced earlier to subjects ranging from astronomy to genetics, and from health and disease to geology.⁶

The designers of the Intermediate Science Curriculum Study course felt that chemistry is built on a basis of physics and both of these promote an understanding of the life and earth sciences. This feeling led the designers to change the usual sequence of science courses which starts a student in biology and follows this with either physics or chemistry. A diagrammatic explanation of the content and process flow, with flow charts showing both the concepts and the process skills expected at each level of the Intermediate Science Curriculum Study course, will be found on the following three pages.

⁶Intermediate Science Curriculum Study, Probing the Natural World/1 (Morristown, New Jersey: Silver Burdett Company, 1970) p. T-7.

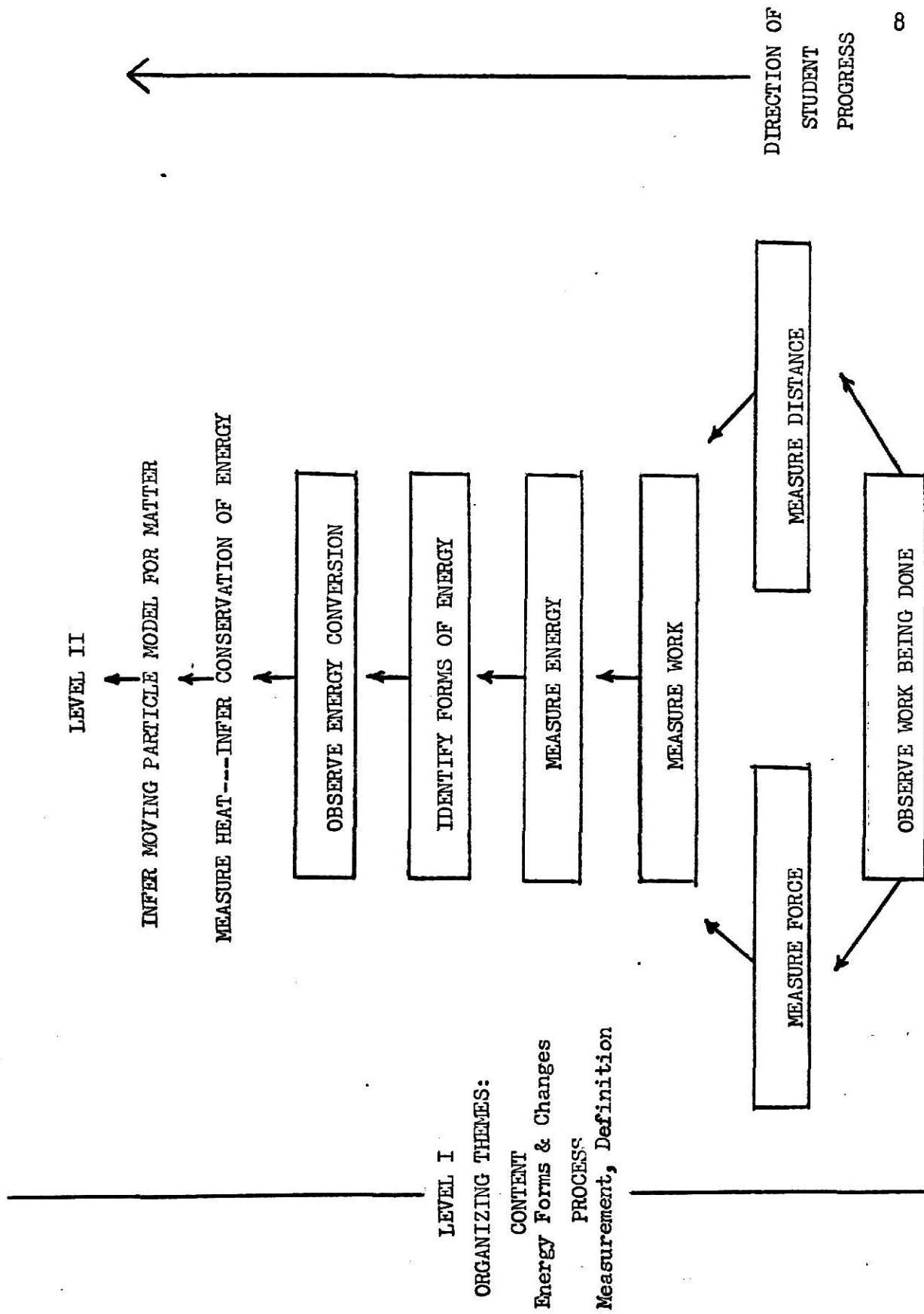
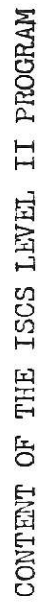


FIGURE 1
CONTENT OF THE ISCS LEVEL I PROGRAM

Model Building



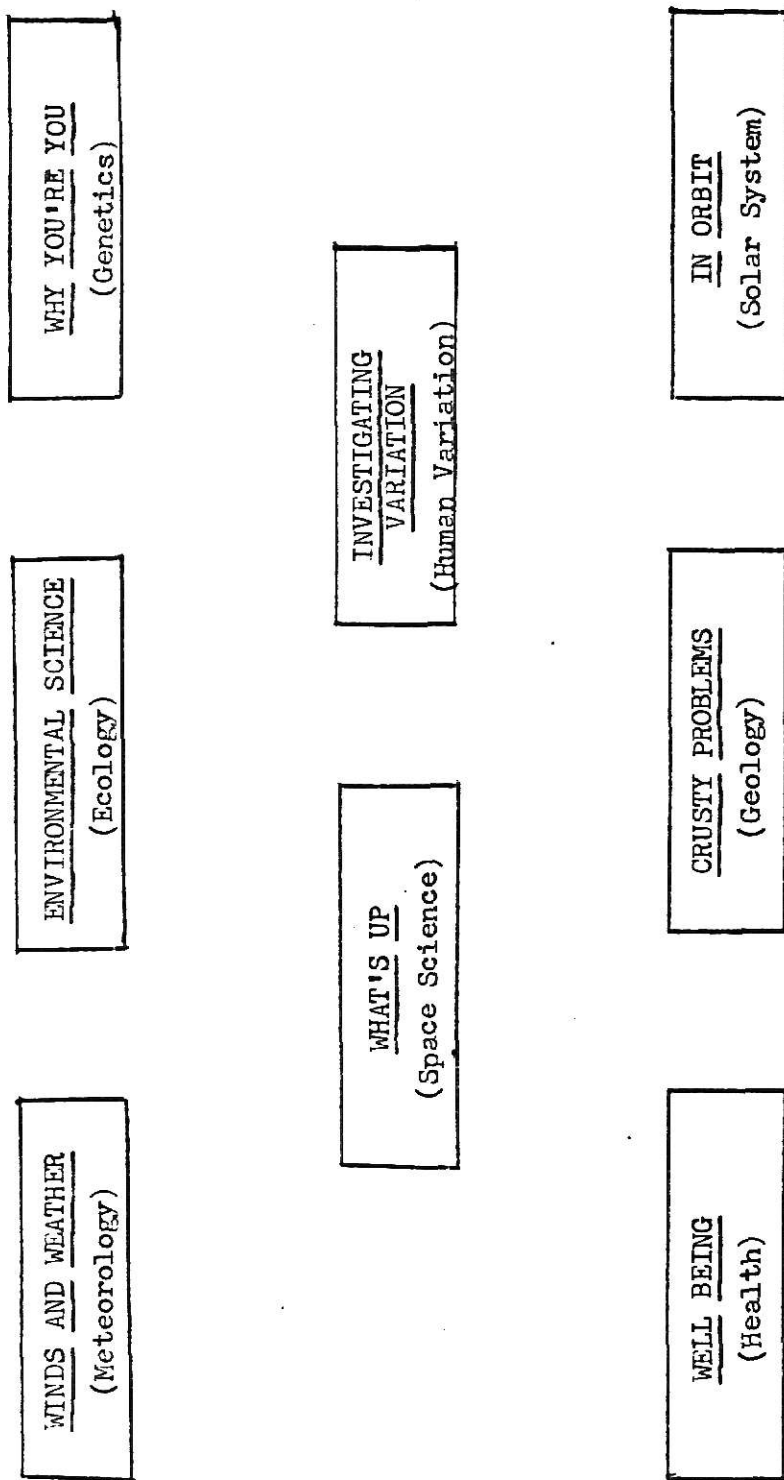


FIGURE 3
CONTENT OF THE ISCS LEVEL III PROGRAM

Science Instruction at the Junior High School and Middle School Level Should Be Centered About Appropriate Activities

ISCS believes that science teachers must encourage their students to have confidence in their abilities and provide them with opportunities to use these abilities to the fullest. If you give students concrete objects to manipulate, if you present them with knowledge, if you challenge them to apply learned information, if you stimulate them to seek solutions to the problems, then and only then will they function in the spirit of the scientific enterprise.⁷

Once again the influence of Dr. Jean Piaget becomes apparent in the suggestion that students should have concrete objects to manipulate. The activities in the Intermediate Science Curriculum Study program are incorporated with the textual core and the equipment for use in these activities is normally purchased at the same time as the texts. The intended result of this approach was to remove the option of using core and activity materials independently.

Science Instruction at the Junior High and Middle School Level Should Be On an Individual Basis to Meet the Needs of Every Person

The ISCS materials have been designed to allow the rate of instruction and the scope and sequence of content to vary with the individual student background, interest, and ability. The project developers feel that the inability to provide for this is the greatest deficiency in present day education.⁸

⁷Intermediate Science Curriculum Study, Rationale For ISCS, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) p. 5-4.

⁸Intermediate Science Curriculum Study, Probing the Natural World/1 (Morristown, New Jersey: Silver Burdett Company, 1970) p. T-2.

Young teenagers tend to be talkative and bored when sitting in a classroom. The ISCS planners recognized this fact and designed a course that allows students to converse freely and to move about seeking materials. The ISCS course was also designed to take each individual's learning speed into account. Students who were weak in science because of basic learning deficiencies in reading or in arithmetic may still perform the activities in the ISCS text. "To promote readability, the format has been kept as open as possible, and the authors have made liberal use of illustrations to clarify and intensify the meaning of the printed word."⁹ The authors also carefully avoided activities that called for the use of arithmetic at any level above addition, subtraction, multiplication, or division of decimals. In spite of these precautions, there are a few students who have a hard time with the reading or with the mathematics. The design of the course was intended to leave the teacher free to give help to individual students whenever that help is needed. An additional resource is available in that students help each other on these basic reading or mathematics skills.

The Intermediate Science Curriculum Study designed the course to encourage both the quick student and the slow one. By presenting each student with a challenging problem that he can solve, the course encourages success. Success is important to the student but he would soon become bored with a series of easy successes. To provide challenges on the proper level for all

⁹Ibid., p. T-4.

students, the Intermediate Science Curriculum Study provided a core program intended for all students and an additional set of exercises, called excursions, to give a challenge on either the remedial or the advanced level. Even the smartest student will find a challenge in the enrichment excursions and even the slowest student will find himself challenged by the remedial excursions. It is assumed that the teacher will be readily available to guide the students in their search for learning. If a student is particularly interested in a single major theme, he may spend several weeks investigating that theme to his satisfaction.

The teacher finds himself in a different role with the Intermediate Science Curriculum Study course than in the more teacher-centered lecture-lab approach. In order to acquaint him more fully with what is expected of a teacher in the new program, the authors developed and made available a series of "individualized teacher preparation modules" for the teachers to use.

The Intermediate Science Curriculum Study has realized for some time that the success of an activity-centered individualized science program depends heavily upon the preparation of science teachers. In addition to requiring a new instructional philosophy and rationale, individualized instruction appropriate for student-directed learning calls for organizational and instructional strategies that differ markedly from those characteristic of a more teacher-centered program.

Most teachers require much time to interpret, accept, and incorporate into their own teaching style instructional techniques that are significantly different from those they are currently using. This role adjustment is likely to be costly in time and in teaching efficiency.

The purpose of the ISCS Individualized Teacher Preparation modules is to provide a mechanism for accelerating the teacher's role adaptation by identifying and analyzing the unique features of that role. Further, it is the purpose of these

modules to provide specific and continuing support for the various phases of implementation of the ISCS Level I program.¹⁰

The Intermediate Science Curriculum Study has made ten individualized teacher preparation modules available for teacher use with the condition that summer institutes and workshops have a priority on orders:

Rationale for Individualization;
 Classroom Organization;
 Questioning;
 Evaluating and Reporting Progress;
 Individualizing Objective Testing;
 Your Student's Role;
 Operationally Defining Work;
 Energy and Systems;
 Measuring Electricity;
 Heat and Particles.

These teacher modules can be of significant help to a teacher just entering upon the first year of teaching in the Intermediate Science Curriculum Study program. The modules may give the teacher confidence in himself and in the program by showing him the amount of planning that went into the program and answering his questions about the program. The teacher modules may also provide the teacher with a background in concepts where he finds

¹⁰Intermediate Science Curriculum Study, Rationale For ISCS, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) Foreward.

himself to be weak, for example electricity. One valuable aid in calming the teacher's uneasiness at approaching a new program is the individual teaching module entitled Classroom Organization which gives some concrete suggestions for designing the classroom and leads the teacher to make decisions in some basic areas before he enters the classroom on the first day of school.

CHAPTER III

CLASSROOM ORGANIZATION FOR ISCS

The ISCS teacher must enter the classroom at the beginning of school with some decisions already made and some planning already done. An individualized teacher preparation module has been prepared to help the teacher make some of these decisions and to present some possible problems for the teacher's consideration. The teaching module helps the teacher make decisions in eleven basic areas for safe, adequate use of space by making the following suggestions:

1. Establish appropriate work centers for individuals and small groups;
2. Plan for smooth traffic flow of students and reduce congestion in supply areas;
3. Design and provide a method of displaying equipment so that it is accessible to all your students, is easily returned by them for storage, can be quickly inventoried, and is secure from damage and theft when not in use;
4. Provide for the temporary storage of hold-over experimental materials;
5. Plan for storage of student texts, notebooks, and record books so that easy access is permitted but safekeeping is insured;
6. Establish a strategy for maintaining and repairing equipment and for replacing that which is lost, damaged, or expended;
7. Quickly locate in the Teacher's Edition information on advance preparation of equipment and use it to prepare apparatus and chemicals before students need them;

8. Make your students aware of their responsibilities for safe and careful use of equipment and the prompt return of cleaned equipment to proper storage areas;
9. Determine what extra materials you will need to obtain locally and ascertain ways to get them;
10. Inventory your equipment at the end of the year and requisition supplies for the next year;
11. Plan for the safety of your students by establishing special storage areas for potentially dangerous materials; providing goggles, aprons, and gloves when needed; teaching safety procedures as preventive measures; and suggesting emergency procedures to use in case of an accident.¹

The authors of the ISCS program provided some concrete facts to help the teachers make wise decisions. The authors suggested proper amounts of space and alternate methods of storage for the student record books and for the student batteries. The authors suggested that the teacher plan a minimum work space of two square feet per student. A permanent space two feet by four feet was suggested for the battery charger and harness since some experiments can only be performed in the immediate vicinity of this apparatus. In addition to a sixty-four square foot area for open storage of often used equipment, the authors suggested that eight square feet be planned for storage of chemicals and liquids. The authors broke the equipment down into several major categories with a suggested method of storage to help the teacher overcome the seemingly overwhelming task of inventory and storage planning. The categories suggested by the authors are pretty much the same

¹Intermediate Science Curriculum Study, Classroom Organization, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) p. 1-2.

categories in which the equipment is received by the school for assembly. The six categories and the suggested methods of storage are:

1. Personal items used daily which should have an open permanent storage area provided:

Textbooks;
Student Record Books;
Batteries.

2. Fixed storage items in permanent open areas easily accessible to students:

Battery charger and Harness;
Metronome Clock.

3. Basic materials used daily which should be in open storage and inventoried each class period:

Balance Package;
Alcohol Burner Package;
Cart;
Electricity Measurer Package;
Electric Motor Package;
Force Measurer Package;
Inclined Plane Package;
Mass Set (sinkers and one-half kilogram);
Gram Mass Set;
Metersticks;
Metric Scales;
Motor Kit (student assembled);
Pegboard Kit;
Spinigig Kit;
Surface Board Set;
Test Leads;
Washer Set.

4. Standard supply set which must be readily available to the students at all times but which need not be inventoried:

Aluminum Cups;
Modeling Clay;
Felt;
File Cards;
Index Cards;
Masking Tape;
Nails;
Paper Clips;
Paper Fasteners;

4. Standard supply set (continued)

Rubber bands;
Soda Straws;
String;
Thermo Cups;
Tongue Depressors;
Wax Block;
Wax Pencil.

5. Seldom used items which should be stored in a closed area when not in use:

Battery and Holder;
Bulb and Socket;
Copper Wire;
Magnesium Rod;
Nichrome Wire;
Resistor Board;
Resistors;
Zinc Strip;
Beakers;
Rubber Stoppers;
Rubber Tubing;
Test Tubes;
Blank Thermometers;
Thermometers;
Plastic Vials.

6. Selected security items which are seldom used and may be dangerous, fragile, or easily lost. These should be stored where only the teacher can get them:

Butyl Alcohol;
Ethyl Alcohol;
Burner Fuel (methyl alcohol);
Ammonium Chloride;
Calcium Chloride;
Coloring Bottle;
Cupric Sulfate;
Glycerin;
Nitric Acid;
Potassium Permanganate;
Silicone Glue;
Sodium Thiosulfate;
Zinc Metal;
Zinc Powder;
Air Piston Package
Rubber Balls;
Balloons;
Magnetic Compasses;
Magnets;
Nichrome Wire Leads;

6. Selected security items (continued):

Palm Glass;
Radiometer;
Shot Kit (Aluminum, Copper, Lead);
Steel Balls;
Thermometer Tube Package.²

One must keep in mind that the Intermediate Science Curriculum Study activity centered program cannot continue if the equipment is not available. It is the responsibility of both the teacher and the students to see that use of equipment is maximized while damages or losses are minimized. It is a primary responsibility of the teacher to keep the equipment available but proper storage methods will allow the teacher more time for another primary responsibility: interaction with individuals and small groups.

²Intermediate Science Curriculum Study, Classroom Organization, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) pp. 3-6 - 3-26.

CHAPTER IV

EVALUATION IN ISCS

One question commonly asked by prospective teachers of the Intermediate Science Curriculum Study course is: "How can I design an evaluation system to report each individual student's progress?" This evaluation system should be consistent with the rationale for the ISCS course. Since the ISCS course was designed to be self-pacing, the teacher defeats his own purpose if he evaluates only on the quality of the work, which leads a student to copy other people's work to get correct answers, or if he evaluates only on quantity of work, which leads a student to push on regardless of whether he understands the exercise. Let us look at some basic goals of the Intermediate Science Curriculum Study program and observe the implications presented by these goals with respect to evaluation.

In the summer of 1971, the Intermediate Science Curriculum Study produced an individualized teacher preparation module entitled Evaluating Student Progress to present the ISCS teacher with some considerations for the best possible means of evaluating his students. This teacher module has since been revised and will be available in two modules entitled Evaluating and Reporting Progress and Individualizing Objective Testing. In the experimental edition of Evaluating Student Progress, the authors of the ISCS program suggested that four basic goals of the program should be considered by the teacher in selecting the proper method of

evaluating his students:

1. ISCS serves a general education function; the student should be able to apply the skills and concepts learned in ISCS to new situations not in his prior experience. As with performance objectives, this says more about the nature of your test items than about your choice of evaluation procedures.

2. 'The ISCS program presumes that both . . . processes of scientific inquiry and concepts of science . . . can and should be introduced simultaneously by allowing major concepts to arise out of student investigation.' Such a goal implies that evaluation should be made in both processes and concepts.

3. 'The ISCS materials . . . allow the rate of instruction and the scope and sequence of content to vary with the individual student's background, interest, and ability.' Since all evaluation is concerned with how well a student performs, if you accept this goal as your own, you'll also need to give an accounting of the rate of the student's progress. Since the scope and sequence of ISCS are also different for each student, you'll want to design an evaluation system flexible enough to report these.

4. 'The ISCS approach is activity centered.' Performance objectives and evaluation of process skills can be related to this goal.¹

These four basic goals indicated a definite need for performance objectives as well as written questions on a test. Some performance objectives were suggested at the start of each chapter in the teacher's edition of the text. The basic purpose of evaluation in ISCS is to provide feedback for both students and teacher. One means of self-evaluation for the students was provided by the authors in the student record book where a self-evaluation check

¹Intermediate Science Curriculum Study, Evaluating Student Progress, Summer, 1971, experimental edition (The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971) p. 1-6.

for each chapter may be found. These self evaluations were intended as a source of feedback by which the student could judge his own progress and should not become a part of the grading process. In the ISCS program the teacher should have plenty of opportunity for feedback from each student in the everyday interaction with the student. This daily interaction also provides ample opportunity for the teacher to observe each student's progress in the student record book. "The purpose of this kind of interaction is to get an overall impression of the student's pace and the precision of his work. You can quickly identify his concept and process difficulties."² As the teacher observes the work in the student record book, he should ask certain key questions to ascertain the degree of mastery achieved by the student.

The authors of the Intermediate Science Curriculum Study program have made available a module entitled The Art of Questioning to assist the teacher in finding the most appropriate method of choosing and using key questions in his classroom.

Many ISCS teachers require their students to answer an oral key question for each chapter. You might use one of the same key questions that were identified in the Teacher's Edition of the core and excursions textbook. Or you might devise your own oral key questions based on key ideas in the content.³

Key questions should have an important place in the person-to-person interaction between the teacher and the student. In addition to the student record book and the oral key questions, a

²Ibid., p. 2-4.

³Ibid., p. 2-5.

third subjective source of feedback suggested by the authors of the ISCS program is the student's social interactions. One goal for which each teacher should plan is to make students accept their responsibilities in safe, efficient use of the equipment. One indicator of this acceptance is the student's willingness to make a positive contribution to the class in his relations with his peers. The teacher's overall subjective evaluation of a student's performance is likely to be influenced by the student's willingness and ability to accept social responsibility. In a typical ISCS class, each person must be willing to work with others, even for an extended period of time, when more than one set of hands is needed or equipment is too scarce for each person to work individually. The teacher can be of some help to the student by planning to use every person in a position of responsibility over some part of the equipment or classroom facility.

A fourth subjective feedback factor that can be observed in day-to-day interaction with the students is termed "self-pacing efficiency" by the authors of the program. The authors explain self-pacing efficiency thus:

If one objective is to teach a student to pace his own learning efficiency, one feedback factor should evaluate his progress in doing it. You will have an intuitive idea of each student's self-pacing efficiency . . . that is, how well he uses his time, the extent to which he is self-reliant, and his progress in the ability to manage his own work.⁴

In order to develop this responsibility, it was suggested that the student be allowed to choose his own excursions, start work with-

⁴Ibid., p. 2-6.

out prompting, and, except in very special cases, pace himself. The teacher may find himself to be uncomfortable in this independent atmosphere but will soon find that his roll of learning director instead of lecturer is a satisfying one. The authors of the ISCS program feel that it is important for the student to accept the responsibility for pacing himself.

In addition to the subjective evaluation factors discussed above, the authors of the ISCS program suggested two objective feedback factors in their individualized teacher preparation module Evaluating Student Progress. One advantage of objective feedback factors is that the results of such factors mean approximately the same to several different people examining them separately. One suggested objective source of feedback is a test given at the end of a section of work. This test should be written to avoid ambiguities while still testing major concepts from both the core and the excursions. The authors presented some hints for writing such tests and making them easy to score as well as some standards for choosing a particular type of test item. A second type of objective test is also suggested. Since manual process skills are considered important in the Intermediate Science Curriculum Study program, laboratory process tests should be given to check behavioral skills. Some suggested test items are presently available for experimental use in the program and these testing materials for all three levels should be commercially available by the spring of 1973.

These sources of feedback will be useful to the teacher in determining his grades but each teacher must take into account the

individual approach being used in this program. Each student, in the individualized program, should achieve some success and this success should be reinforced by the teacher. If grades are over-emphasized so that they are looked upon as the only source of evaluation from the teacher some students will miss the success for which they work daily. In the everyday interaction with students, the teacher should not overlook the value of oral reinforcement for good habits; this source of evaluation can be important to the youngsters experiencing science in the program.

CHAPTER V

SUMMARY

This paper has presented some of the history, rationale, and organization of the Intermediate Science Curriculum Study Level I program to introduce this science program to the reader. The paper noted some aides made available by the Intermediate Science Curriculum Study for prospective teachers of the program and gave some hints on classroom organization and feedback factors for the course. The ISCS Level I text, Probing The Natural World/1, can no longer be considered an experimental version as it has been ten years in developing to its present level. This work on the ISCS approach to science is continuing. What can be expected in the future? The Intermediate Science Curriculum Study has been funded again for 1972-1973 and will be developing individualized teacher preparation modules for the Level II program as well as materials to introduce the Intermediate Science Curriculum Study course to parents and administrators. Student testing materials for ISCS Levels I, II, and III are being developed and field tested with a goal of commercial availability in 1973. The National Science Foundation has funded nine institutes largely aimed at preparing ISCS teachers in the summer of 1972. Ten colleges have begun Co-operative College-School Science programs in cooperation with local school systems. In addition, the National Science Foundation is supporting two leadership workshops in ISCS science and four

conferences for school administrators to introduce them to the program.

On the basis of the rationale and testing in pilot studies, the Intermediate Science Curriculum Study program seems to be a fundamentally sound program based on rational goals and constructed with the learner and the classroom teacher in mind. A great deal of effort was taken in developing aids to acquaint new teachers to the program but not all teachers feel comfortable in such a program:

Becoming an ISCS teacher can be quite a disquieting experience. In fact, many of the experienced teachers who have used the materials report that, at first, they felt a little threatened by the program. In the past they had made many decisions as to the pace, depth, and level of instruction that are now made either by the student or by the materials. For some teachers the realization that they are now part of the educational process instead of at its center comes as somewhat of a shock. Most ISCS teachers come to realize very quickly, however, that despite their changed role they are still most vital to the student's learning experience.¹

It is to be hoped that this paper will introduce such teachers to the aids available for their use and make their introduction to the ISCS individual, activity-centered course an enjoyable one. The course releases the teacher for the important role of learning leader where he may encourage students to creatively pursue their interests in science. The teacher should not neglect the school resource center and the cooperation of other teachers in seeking to help the student find his way toward a learning goal.

¹Intermediate Science Curriculum Study, reprint from Ernest Burkman, "ISCS: An Individualized Approach To Science Instruction," The Science Teacher, Volume 37 (December, 1970) p. 9.

BIBLIOGRAPHY

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- The Intermediate Science Curriculum Study. The Art of Questioning, summer, 1971, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.
- The Intermediate Science Curriculum Study reprint of Burkman, Ernest. "ISCS: An Individualized Approach To Science Instruction," The Science Teacher, Volume 37, Number 9, December, 1970.
- The Intermediate Science Curriculum Study. Classroom Organization, summer, 1971, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.
- The Intermediate Science Curriculum Study. Evaluating Student Progress, summer, 1971, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.
- The Intermediate Science Curriculum Study. ISCS News Report. May 19, 1972.
- The Intermediate Science Curriculum Study. Probing the Natural World/1. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.
- The Intermediate Science Curriculum Study. Probing the Natural World, Volume 1, Fall, 1969, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1968.
- The Intermediate Science Curriculum Study. Rationale for ISCS, summer, 1971, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.
- The Intermediate Science Curriculum Study. Science Concept: Electrical Energy, summer, 1971, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.
- The Intermediate Science Curriculum Study. Science Concept: Heat Energy, summer, 1971, experimental edition. The Florida State University, Tallahassee, Florida: The Intermediate Science Curriculum Study, 1971.

The Intermediate Science Curriculum Study. Science Concept:
Work, summer, 1971, experimental edition. The Florida State
University, Tallahassee, Florida: The Intermediate Science
Curriculum Study, 1971. .

THE INTERMEDIATE SCIENCE CURRICULUM STUDY LEVEL I PROGRAM

by

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AN ABSTRACT OF A MASTER'S REPORT

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The intention of this paper is to introduce the beginning teacher or administrator to the Intermediate Science Curriculum Study and the ISCS Level I course. The paper explores the Level I program of the Intermediate Science Curriculum Study and explains the position of the Level I course in the overall program. A short history of the Intermediate Science Curriculum Study is presented and the rationale for the new ISCS program is explored.

The Intermediate Science Curriculum Study designed a course that is individualized, activity-centered, organized around both concepts and the processes, and fulfills a general education function.

Some aids to the beginning ISCS teacher are mentioned and appropriate organizational preparations for the Level I course are suggested. Some storage designs for the ISCS Level I equipment are explored. Feedback factors and appropriate evaluation procedures are discussed and cautions are given against inappropriate behavior in the ISCS classroom.

The future of the Intermediate Science Curriculum Study is considered and some possible developments in the course are mentioned. On the basis of the rationale, a conclusion is drawn that the ISCS Level I program is fundamentally sound, based on rational goals, and designed with the learner and teacher in mind.