

SCIENCE EDUCATION

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Abstracts

How to Produce Your Own Learning Package. STANLEY S. SHIMER, Indiana State University, Terre Haute, Indiana 47809.——Developing learning packages are not as difficult as it may seem. This presentation will demonstrate the steps and techniques for making a 35 mm slide and sound tape program. The author will explain at least three ways the learning package can be utilized in the classroom.

Simple Slide Rule to be Used by Brain Damaged and Other Handicapped Persons. JAMES MITCHELL SMITH, Science Education Section, Indiana Academy of Science.——Only numbers 1 through 10 are used on an expanded slide rule, the spacings of which have been increased four times.

The bulky nature of the rule and the length of the rule give a sense of physical action in working the rule. The photo used with this presentation shows a multiplication of 2 time 3 or a division of 6 by 3. Young persons of very limited ability quickly learn to use the slide rule and enjoy teaching their friends to use the slide rule.

Because only whole numbers are used, this is an intermediate teaching device, attempts to multiply 4 time 6 lead to a situation in which the teacher must step in to help.

The rule can also be used with cards for numbers 1 through 10 each card (about the size of a playing card) has the information, (use the number 2 as an example) *TWO* II 2 · Students place each card with the suitable number on the board.

This rule, together with other teaching material developed by this writer, was used by severely handicapped young persons, several Downs Syndrome youngsters, at New Castle, Indiana over a period of several months.

The assignment of this writer—teaching adult classes in agriculture in another part of the building—was not with the handicapped persons. Any teaching of the young persons was done with the regular teacher present.

It is the thought of this writer that the slide rule can be made commercially and he seeks a sponsor for such a program.

Advertisements and Scientific Analysis. LAWRENCE B. STEWART, Biology Department, Saint Mary's College, Notre Dame, Indiana 46556.——A recent trend can also apply to the teaching of important basic concepts in any science course. There is always room for improving the skills of observing, inferring, and critically or scientifically analyzing information. A good source of

information is advertisements, presented to us in the form of television and radio commercials, or magazine and newspaper ads.

One can teach students to sharpen their powers of observing and critically analyzing through studying the visual and audio messages of ads. Advertising agencies employ subtle techniques to attract the attention and influence the consumer to purchase a product. One can identify the common techniques used by advertising agencies, but more appropriately for a science class, one can study the scientific claims presented in the ads. Advertisers must be able to support a scientific claim with experimental data as the Federal Trade Commission's "Truth in Advertising Law" states.

Studies can be made of scientific claims in ads and tested for verification in the laboratory. Grammatical analyses can also be made of the use of words or phrases in the advertisement for their impact.

The major purpose of this enterprise is to encourage students to question and pay close attention to the way in which advertisements can influence the buying public. This scientific analysis can also help to discourage gullibility on the part of the consumer.

Galvanic Skin Response as a Measure of Emotional Involvement in Biology Instruction. BEVERLY L. KETCHAM and JERRY J. NISBET, Department of Biology, Ball State University, Muncie, Indiana 47306. _____ Evaluation should be comprehensive enough to include all outcomes of learning, not merely those in which learning is most easily assessed. Measurement of emotional responses offers a logical, though indirect, approach to the evaluation of instructional strategies which are intended to facilitate learning in the affective domain.

The function of affective learning situations is to provide a stimulating learning environment in which the student may become emotionally involved. Emotional responses are associated with learning in the affective domain. Internal physiological responses are effective indicators of emotion. These physiological reactions are associated with unconscious responses and can be monitored continuously, whereas verbal and written reports are obtainable only at discrete points within or before and after the learning experience. One method of measuring physiological responses is by monitoring the galvanic skin response (GSR).

Significant, measurable changes occur in the electrical properties of the skin that are closely associated with visceral and neural activities that occur during emotion.

In measuring galvanic skin reactions, electrodes may be attached by velcro strips to the plantar surface of the first and third finger of the non-preferred hand. Resistance per unit area of the electrode plate surface is calculated in ohms/mm² and converted into conductance (mhos/mm²). Increase in conductance indicates a greater emotional involvement, whereas a decrease in conductance indicates a calm, relaxed condition.

We have used GSR to measure emotional responses of students who participated in electronic response (ER) instruction in a biology course at Ball State University. Each of nine ER programs produced a gradual rise in average conductance. Certain combinations of music, narration and 35mm slides

produced higher levels of conductance than other combinations. Answer slides, projected following projection of question slides, produced the highest average conductance recorded in the study.

Learning strategies which produce increased emotional arousal are theoretically the most effective for facilitating learning, increasing remembrance and enhancing retention. GSR measurements have the potential for providing guidance to educators interested in enhancing the impact of their instructional programs.

Piaget, the Learning Cycle, and the Laboratory. JOHN A. RICKETTS, Chemistry Department, DePauw University, Greencastle, Indiana 46135.——Within the Piagetian model intellectual development proceeds through four levels: sensory-motor, pre-operational, concrete operational, and formal operational. Transition from one level to another occurs via the process of dis-equilibration and accommodation. Since the first two levels are normally completed by the age of 7 or 8, it is the last two of the intellectual levels that are of concern. A concrete operational student can perform intellectual operations on objects such as classification and spatial and temporal ordering and can perform the operations of elementary mathematics; he can use the proper algorithm to solve a problem with no idea of why he uses the particular recipe. In addition to being able to operate on objects a formal operational student can reason abstractly using hypotheses and can construct new operations involving propositional logic.

One teaching strategy that facilitates the transition from concrete to formal operational is the "learning cycle." The cycle has three phases: *Exploration* in which the students learn through their own actions and reactions in a new situation, *Invention* in which the concepts recognized as part of *Exploration* are used, and *Application* in which the range of applicability of the *Invention* is extended. In the case of science instruction the "learning cycle" can be employed in the laboratory most effectively. As an example one experiment, "A Chemical Dilemma", is described. Unlike the normal learning cycle which directly involves student-instructor interaction with emphasis on instructor guidance during the *Invention* and *Application* stages, this exercise depends on student-student interaction exclusively.

Science from a Pocketbook. NANCY T. WATSON*, JAMES WATSON, JR., Ball State University, Muncie, Indiana 47306.——Elaborate equipment is not needed to perform simple and interesting science experiment for all levels. The "equipment cabinet" is a lady's pocketbook. A slide presentation will show how Newton's laws, center of gravity, circular motion, sound, electricity and other principles can be demonstrated using "equipment" from a pocketbook.

Human Genetic Education in the Secondary School. S. A. RHINE, and R. M. ANTLEY, Genetics Division, Methodist Hospital, Indianapolis, Indiana and N. S. LANTZ, Marion County Association for Retarded Citizens, Indianapolis, Indiana.——Of 200 normal human conceptions, 80 are lost before the pregnancy is recognized. Of the 120 recognized pregnancies, 20 are lost due to naturally occurring miscarriages and stillbirths. Of the 100 resultant newborn babies, 4(1/25) will have severe birth defects. When these figures are applied to

the >150,000 Juniors and Seniors in Indiana high schools this year, we should expect that they would be involved with >600,000 conceptions; 240,000 early pregnancy losses; 360,000 deliveries; and *12,000* babies with severe birth defects!

We have developed a convocation-slide presentation entitled "The Most Important 9 Months of Your Life" which we hope will reach most of the Juniors and Seniors in Marion County during this school year. Our goal is to promote an understanding of the causes of birth defects, mental retardation, and genetic diseases. Both genetic and acquired etiologies will be elaborated in the program.

Genetic causes are separated into chromosomal, single gene, and multifactorial categories. The basic biologic mechanisms and mistakes which are involved with each category are discussed and examples of affected patients are described. The ever increasing potential for prevention of many of the genetic conditions is pursued by a discussion of genetic counseling and prenatal diagnosis.

The acquired birth defect problems are outlined as environmental insults to the pregnancy which usually affect the fetus via the mother, i.e. alcohol, tobacco, drugs, medications, venereal disease, virus infections, poor nutrition, radiation exposure, environmental pollutants, etc. In addition, perinatal insults such as difficulties during labor and delivery are discussed and the importance of good professional and hospital care during pregnancy and delivery are emphasized.

We hope an evaluation, comments, criticisms, and suggestions by Academy members will help us further develop and improve the program. In addition, we hope to eventually make the program slides and/or a video tape plus a text available to the secondary schools.