IN THE BIOLOGICAL SCIENCES DEPARTMENT OF SACRAMENTO CITY COLLEGE, EMPHASIS HAS BEEN PLACED ON A TYPE OF INDEPENDENT STUDY INVOLVING SELECTION, DESIGN, PERFORMANCE, AND REPORTING OF AN EXPERIMENT TO EVALUATE AN HYPOTHESIS FORMULATED BY THE STUDENT CONCERNING A TOPIC OF HIS SELECTION. THE FACULTY HAS DEVELOPED A PROJECT SELECTION FORM, WITH DIRECTIONS TO THE STUDENT CONCERNING TITLE OF PROJECT, REASON FOR SELECTION, HYPOTHESIS, SUBJECTS, VARIABLES, CONTROL GROUPS, TEST GROUPS, REFERENCES, AND EQUIPMENT. USE OF THE FORM HAS BEEN VALUABLE IN (1) INCREASING EFFECTIVE INSTRUCTOR-STUDENT COMMUNICATION, (2) DETERRING STUDENT PROCRASTINATION, (3) TRAINING IN THE ANALYTICAL PROCESS OF STUDY, AND (4) PROVIDING A FOUNDATION FOR ACTUAL PERFORMANCE OF THE EXPERIMENT AND SUBSEQUENT REPORTING. THE DOCUMENT CONTAINS A REPRODUCTION OF THE FORM. THIS ARTICLE IS PUBLISHED IN "IMPROVING COLLEGE AND UNIVERSITY TEACHING," VOLUME 13, NUMBER 2, SPRING 1965. (WO)
A Tool for Independent Study in Biology

By JACK RICARD

Sacramento City College for a number of years has been providing its students with opportunities for independent study. In the biological sciences department emphasis has been placed upon a specialized version of independent study: selection, design, performance, and reporting of an experiment intended to evaluate an hypothesis formulated by the student through the use of the deductive approach from a self-selected topic. This program has been well accepted by students of all abilities and has proved quite effective in evaluating student performance. Some of the drawbacks experienced by many students as reported by Bonthius et al. (1957) were encountered at City College: also: lack of effective guidance on the part of the advisor, tendency for the student to procrastinate. To overcome these drawbacks various approaches were tested. An effective one was found to be the selection form. This form is made available to the students as soon as the course procedure is explained. It is to be returned to the instructor within two or three weeks after the start of the term. The selection form is as follows:

SELECTION REPORT DIRECTIONS

1. Title: Should indicate what factor (independent variable) you are going to investigate on what characteristic (dependent variable) of what experimental animal(s). For example: "Effect of 

2. Reason for selection: Three major approaches may be used here: (a) previous interest through personal experience of your own, (b) current interest through review of other students' work or proposed experiments in BSCS manuals, "Research Problems in Biology for Juniors," (c) assigned experiment.

3. Hypothesis: What do you predict will be the effect of the independent variable on the dependent variable.

4. Experimental subjects. The selection of these depends on the independent variable primarily, also financial circumstances as well as home facilities. Some of the more convenient ones are: insects, planaria, microorganisms, barley seedlings, etc. The more traditional ones are rats. A limited number of these can be had from the College and the Junior Museum on a first come, first served basis. They can also be purchased from pet shops and laboratory supply houses at cost of about $1 per rat. At least fifteen subjects are needed per experiment, at the rate of 3 per group, and 5 groups. Mice are also suitable in many cases and are slightly cheaper.

5. Variables. Three types of these have to be identified in connection with your topic: the independent variable (Stimulus), the dependent variable and at least two irrelevant variables. The independent variable is the factor which you predict is going to have some effect on the experimental subjects: vitamin on the growth rate of rats, sunlight on the growth rate of baby chicks, etc. to mention some of the simpler ones; or transaminase level in blood serum as a reflection of cardiac infarction, ribonuclease effect on learning transmission through cannibalism in planaria. It has to be measured in concrete units: mg/day, s.i.g. units, micrograms /cal, hours of exposure/day at given intensity level, ml/day. The dependent variable is the factor which you predict is going to have some effect on the experimental subjects: vitamin on the growth rate of rats, sunlight on the growth rate of baby chicks, etc. to mention some of the simpler ones; or transaminase level in blood serum as a reflection of cardiac infarction, ribonuclease effect on learning transmission through cannibalism in planaria. It has to be measured in concrete units: mg/day, s.i.g. units, micrograms /cal, hours of exposure/day at given intensity level, ml/day. The dependent variable (Response) is concerned with the effect of the independent variable on the experimental subjects. It must also be measured in concrete units: average weight per group in grams, height of seedling in cm, percentage of damaged tissue in the heart, percentage of conditioned response to stimulus, etc. to mention some of the more common ones. A more general way to define the term "variable" is: any magnitude which has different values under different conditions. In an experiment, the effort is to hold all such magnitudes constant except two, one which is given different known values (the independent variable), and the resulting values of the other
Effective communication between instructor and student is valuable in various ways:

1. Deference of procrastination as an early deadline has to be set in completion of the first step in the independent study and increasing penalty associated with lack of attention.

2. Training in the analytical process of study as independent, dependent and irrelevant variables have to be identified in a student chosen area.

3. Effective foundation for the actual performance of the experiment and subsequent reporting of the work, using quantitative expression of the results in graphic and tabulated form.

The selection form is the first of four formal assignments involved in the independent study part of the course, which includes also traditional presentation and test. The other three assignments are: the progress report, final report (with extra points allowed for use of a foreign language in whole or part) and oral presentation of the study to the class by the student.

**REFERENCE**

The Credos of John and Jerome

The Credos of John and Jerome

...and uncles...

The book's excellence and timeliness are exemplified in the chapter "After John Dewey: What?" The five basic points of Dewey's 1897 Credo are briefly stated. Their 1962 placements as conceived by Bruner are surrounded with the generation and fascination that characterize the whole book.

While for Bruner the student is avowed a central concern throughout, the emphasis placed upon two premises: (1) "The structure of knowledge—its connectedness and derivations that make one idea flow from another—is the proper emphasis in education." (2) "The units of knowledge is to be found within knowledge itself, if the knowledge is worth mastering." The pursuit of...