

SCIENCE EDUCATION

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ABSTRACTS

Myths about Human Inheritance That Are Perpetuated in the Biology Classroom Laboratory. THOMAS R. MERTENS and PATRICIA S. BARNES, Ball State University, Muncie, Indiana 47306.—Twenty-six selected introductory biology and genetics laboratory manuals were examined and were found to include 57 human “inherited” traits as examples for classroom study. Forty-three of these 57 traits are included in McKusick’s catalog of human inherited characteristics, *Mendelian Inheritance in Man* (1975). Of these 43 traits, 26 are annotated to indicate that their modes of inheritance are well documented, while 17 traits are not so annotated, suggesting uncertain mechanisms of inheritance. Fourteen of the 57 traits are not found in McKusick’s catalog, implying that they may not be inherited traits or that their modes of inheritance may be polygenic.

Current literature also suggests that certain traits included in the McKusick catalog may not, in fact, have a genetic basis. Notable examples of such questionable traits are handedness, hand clasping, and tongue rolling.

Clearly, a need exists for reliable morphological and easily detected biochemical human genetic traits for use in classroom instruction. Authors preparing instructional manuals for introductory classroom laboratory studies should carefully select the traits with which they illustrate human inheritance. A first requisite for selection must be conclusive evidence that the trait does, indeed, have an established genetic basis.

Changing Elementary Teachers’ Attitudes toward Environmental Education. HAROLD H. JAUS, Purdue University, West Lafayette, Indiana 47907.—The purpose of this investigation was to determine the effects of environmental education instruction on the attitudes of inservice elementary teachers toward environmental education. Two groups of elementary teachers were randomly assigned to two graduate level science methods classes. Both groups were provided the same science methods instruction via self-instructional handouts. Upon completion of this instruction, the experimental group ($n = 26$) received content and methodology training in environmental education. The topics covered in this environmental education instruction included: ecology, pollution, overpopulation, resource allocation and depletion, conservation, and urban and rural planning. The control group ($n = 25$) did not receive this environmental education instruction, but carried out activities from the various national science curricula.

Following treatment, both groups were given an instrument designed to measure their attitudes toward teaching environmental education

in the elementary classroom. This attitude measure consisted of 30 statements which the subjects responded to on a Likert-type scale consisting of five categories. The reliability of the measure was determined on a test-retest basis using a group of teachers not involved in the study. The resultant reliability value was .86.

A t-test for independent samples was used to analyze the scores of the attitude measure. The mean score difference between the two groups was 40.16. The resultant t-value of 9.25 with 49 degrees of freedom was significant at the .001 level.

Based on the results of this study, it would appear that elementary teachers who have received instruction in environmental education have significantly more positive attitudes toward teaching environmental education in their classrooms than teachers who have not received this instruction.

A Survey of Bioethics Courses in United States Colleges and Universities. JON R. HENDRIX, Ball State University, Muncie, Indiana 47306.—In order to facilitate the development of a meaningful bioethics course for Ball State University students, a survey instrument designed to ascertain the nature and number of bioethics courses currently taught in major United States universities and colleges was developed and sent to 360 colleges and/or universities. The *1974-75 Educational Directory of Higher Education* was used to identify every college and university in the United States that had an enrollment of 5,000 or more students and offered a minimum of a baccalaureate degree. Two hundred twenty-three returns (62%) were received and tallied. The data collected in this survey indicate that 26% of 223 responding colleges or universities have a bioethics course. The biology department most frequently houses the bioethics course; however, many other disciplinary as well as interdisciplinary departments also house the course. Medical-paramedical students are the most frequent majors taking bioethics courses in 36% of the reporting institutions; they are closely followed by humanities majors, 26% of the reporting institutions and non-teaching biology majors, 26% of the reporting institutions. Few, 9%, of the institutions reported that bioethics courses consisted largely of biology teaching majors. The teachers of bioethics courses most frequently have either a bioethics or ethics/philosophy background. A variety of teaching methodologies is used in bioethics courses. The most frequently employed methods were lecture and readings with reports. Consensus was reached on three major goals of bioethics courses; however, no consensus was noted on the curricular materials used to teach a bioethics course.

Increasing High School Biology Achievement by Differentially Sequenced Instructional Materials. CLAUDIA B. DOUGLASS, Central Michigan University, Mount Pleasant, Michigan 48859.—The primary purpose of this research was to identify a possible interaction between the cognitive style of the students and the instructional sequence of the materials.

The students were ranked and classified according to cognitive style on the basis of their performance on the Group Embedded Figures

Test. They were then assigned to one of three treatment groups. Two treatment groups were experimental groups following carefully sequenced sets of biology materials on the topics of genetics and probability; while the third group served as a control group following a set of related units. The instructional materials for all students were of an audio-tutorial, self-paced, mastery format. A comprehensive posttest measured achievement, and a measure of general intelligence was obtained for all students to be used as a covariant. This pretest-posttest control group design was conducted in the biology classes of six mid-western high schools.

Two levels of cognitive style (field-dependence and field-independence) and three levels of instructional materials (deductive, inductive, and control) were combined factorially in a 2x3 design. Descriptive statistics and correlation coefficients were calculated to provide an overview of the data. Two-way analysis of variance and covariance were performed to investigate all possible main effects and interactions. A stepwise multiple regression was performed to determine the predictive powers of IQ and field-dependence-independence on the dependent measure of genetics and probability achievement.

The major conclusion of the study was the cognitive style and instructional sequence interacted in such a way that the field-independent subjects experienced a higher level of achievement with inductively-sequenced materials and the field-dependent subjects experienced a higher level of success with deductively-sequenced materials.

Contractual Learning: A Viable Approach to Education in the Sciences.

GEORGE A. ASTERIADIS, Purdue University-North Central Campus, Westville, Indiana 46391.—The traditional role of the educator has been that of an authoritarian who dictates to, rather than guides, his students. I believe an educator can better serve his students by adopting the role of a facilitator. A climate of mutual respect and trust should be established allowing both the student and educator to accept their respective responsibilities in the educational process. The student should be given the responsibility to develop and complete his educational goals and objectives, and thus the opportunity to achieve a personally meaningful education. The educator should attempt to understand and accept his students, become a flexible resource willing to share his views rather than dictating his opinions, and assume the role of a co-learner.

When an educator adopts the role of a facilitator, then consideration of the concepts of individualization within the learning process becomes necessary. I have chosen the concept of contractual learning as a means of individualization. This educational alternative requires the student to develop a three part contract which contains:

- (1) his learning goal(s)—a statement of the overall learning experience(s) to be obtained from the course,
- (2) his learning objectives—a statement of how the student is to accomplish his goal(s) (specific activities, types of resources to be used, etc.), and
- (3) the criteria and procedures to be used in evaluating the level of performance on each objective must be specified.

This alternative can be used in situations where you want to facilitate students' total freedom in the learning process (e.g., elective courses, seminars) or, be somewhat modified for use in required courses where exams are considered necessary by the instructor.

Seminar Procedures for High School Advanced Biology Classes. PATRICIA ZECK, Northwestern High School, Kokomo, Indiana 46901.—As a bridge between ecology and genetics units in her advanced biology classes, the author invited her students to participate in any subdivisinal topic of ecology and genetics. Each group of 3-6 students plans over 2-3 weeks a seminar to last 2 or 3 days. Library research, group conferences, ordering supplies, and inviting speakers are preliminary tasks. Sample seminar activities are field trips, skits, dances, guest speakers, movies, video tapes, songs, games, and worksheet handouts. After all groups are done, oral and written evaluations are made by the students. Teacher evaluation is based on knowledge of subject, variety of media used, preliminary agenda, originality, time budget, overall effectiveness, and amenities.

The Basics of Elementary School Science. H. MARVIN BRATT, The Ohio State University, Marion, Ohio 43302.—In October, 1974, Newsweek magazine carried a rather incisive article which compared two schools in Pasadena, California. The title of the article was "Back to Basics in the Schools." Since then, all one hears at school board meetings, teachers' meetings and the P.T.A. is "Let's get back to basics." The first question one might ask is "What are the basics?"

In this paper I should like to describe what might be called "the basics" for children of elementary school age in terms of science education. An examination of the basics should include some discussion of the content of science, the process or method of science, and certain skills which should be developed in young children as they prepare for additional educational experiences and for life itself.

Some educators behind the back to basics movement feel that reading, writing, and arithmetic should be the only subjects taught in the elementary school. I believe that if the truth were known, schools are spending more money on these three subjects than anything else except law enforcement and school busses. The suggestion is, therefore, that we not forget what we have learned during the past several years, but review it thoroughly. In addition, it would help if students would learn basic thinking skills which seem to be lacking upon graduation from school.

How to Individualize Your Science Class by Developing Folder Carrels. STANLEY S. SHIMER, Indiana State University, Terre Haute, Indiana 47809.—A folder carrel is an activity, skill or game that can be put into a manila folder so that the student can read the directions for performing the tasks, checking his answers, returning carrel to its original condition and place, and completing follow-up assignments. The advantage of the folder carrels is that they provide immediate feedback to students, can be interesting and fun, and are easy to store when space is at a premium.

The proposed items and procedures have evolved over the past seven years as a result of working with university students and in-service teachers as they developed carrels for their classes. For student use the four indicated items are all that are needed. However, when a teacher plans a folder carrel or when a fellow teacher wishes to use or duplicate a carrel, additional information is required. Before developing and/or duplicating folder carrels, the teacher must make decisions regarding the subject area (life, physical or earth); classification (skill, activity or game); grade level range; concept or performance objective; specific outcomes expected; title; materials needed; procedures; and sources.

Creative teachers can select materials for the folder carrels that are attractive and challenging; thus, folder carrels are excellent self-contained teaching aids.

Helping to Conceptualize Large Numbers. FREDERICK K. AULT, Ball State University, Muncie, Indiana 47306.—Using numbers for describing chemical phenomena is an extremely frustrating experience for many students taking introductory chemistry courses. Numbers such as the mole (6.02×10^{23}), Planck's constant (6.6×10^{-27} erg•sec), and the speed of light (3×10^{10} cm/sec) are typical of numbers used in chemical communication. These numbers represent quantities well beyond our experience and consequently are highly abstract. These numbers become more abstract when used in conjunction with other measurement units.

Appropriate analogies with demonstrations have been used effectively in the classroom for treating chemical concepts involving numerical components. A demonstration involving an analogy for treating the mole concept was presented. Other analogies were suggested.

Farm Equipment Use Costs. JAMES MITCHELL SMITH, New Castle Area Vocational School, New Castle, Indiana 47362.—To establish significant figures for several farm operations, this writer developed work sheets which are used with "Purdue University Bulletin EC-130 (Rev) Indiana Custom Rates for power operated farm machines 1974."

Adult men, all military veterans, take part in vocational classes in agriculture in this Vocational School. The educational background of these men vary and projects relating to them must give immediate results which are easily understood.

Class discussion of each phase of the operation was encouraged. Several men developed the project on the basis of least cost, others determined time needed for each operation as well as cost. Several men questioned older practices with numerous trips across a field and use of many different kinds of equipment. As a result of these sheets, students examined the estimated cost of crop production relation to return from the crop.

The sheets can be used in their present form for any part of Indiana. The sheets together with EC-130 (Rev) may serve as a format for expansion of other existing bulletins and existing resource material and their adaption for specific uses.

