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ABSTRACT

This publication for methods instructors contains articles dealing with science education in elementary schools. Titles of articles appearing in this issue are: Undergraduate Independent Studies in Elementary School Science, A Concern About the Teaching of Science in the Elementary School, A Random Sampling of Graduate Students' Critiques of a Method of Instruction Using Doctoral Dissertation Abstracts in Elementary Science Education, A Lost Dimension in Elementary School Science, Teaching Science as a Spectator Sport, Simulation of a Food Web, Science for the Seventies: Pennsylvania's Directions for Change in Elementary Science, Chemical Pesticides, and Doctoral Dissertation Studies of Interest to Science Educators. (CP)

THE PENNSYLVANIA CLEARINGHOUSE

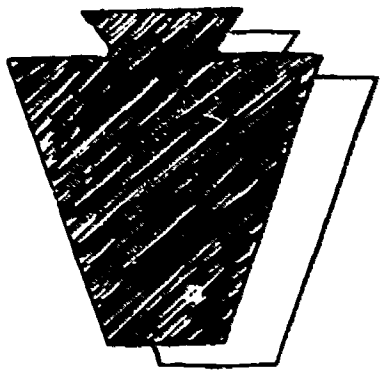
ON METHODOLOGY IN ELEMENTARY SCIENCE

A Publication For

The Methods Instructors In Higher Education

Edited by

Donald A. Vannan, Ed.D.



April, 1972

Edited, printed, and bound at Bloomsburg State College,
Bloomsburg, Pennsylvania, as a service to all educators

EDITOR'S MESSAGE

Greetings to all of you involved in elementary **science education in institutions of higher education.** If you are an old reader of The Clearinghouse (we're four years old this year), welcome back for the latest edition. If you are a new reader this year, may you find something of interest to you within these covers which will enable you to improve your preparation program for prospective elementary teachers in the field of elementary science. Also, you are encouraged, along with the old readers, too, to inspect the last page of the publication and to decide to be not just a reader next year, but a contributor, too.

Well, what's the good word this year? The word, as I see it, is two words--namely, writing letters. Our Bloomsburg program works thusly:

UNIQUE PROGRAM ON EDUCATION BLOOMSBURG

Prospective elementary teachers currently enrolled in the course in elementary science methodology at Bloomsburg State College are participating in a unique experimental education program entitled, "Operation Elementary Science Understanding." The students, preparing to teach elementary science in public and private schools, exchange letters with selected pupils in grades three through six in the Allentown School District in which the college students learn about childhood science concerns.

The program, originated and directed by Dr. Donald A. Vannan, a former Danville resident, Professor of Education, School of Professional Studies, currently involves 95 students and will have a total student population of approximately 180 by the end of the current semester. Coordinating the Allentown portion of the organization is Ray Sunderland, Associate Professor

of Education at Kutztown State College, Kutztown, Pennsylvania. He is assisted by Mrs. Kathleen Worman and Dennis Blankowitsch of Allentown School District.

The college students are requested to write a friendly letter, and to introduce themselves as juniors or seniors taking the course in elementary science at Bloomsburg State College. They are warned about the vocabulary level of their letters, and are asked to find out about each child's likes and dislikes in science and just what the child would really like to learn about in science classes. Such questions as: "What things are you learning about in science which please you the most?" and "What things are you learning about in science that you don't particularly like?" and "If you had your choice of any areas of science for study, what areas would you choose?" are some of the suggested questions to be included in the college letters.

Questions dealing with the teacher's personality and teaching style, etc. are specifically omitted in this correspondence, and the children are thanked for their answers and for their prompt replies.

Among the advantages suggested for the program are the following: (1) the child gains experience in letterwriting and reading in a practical setting, (2) the teacher, in guiding letterwriting, learns about writing style, errors, strengths, and problem areas in Language Arts, (3) the child makes value judgements in selecting his answers and reveals something of himself in his writing, and (4) the teacher learns some valuable pointer about his or her teaching of elementary science. In addition to these points, teacher security is protected by the distance factor involved and no college school human relations problem is anticipated. An evaluation of teachers, college students, and pupils will be used to ascertain the continuance or non-continuance of this program for another academic year.

Among the advantages suggested for college students in the program are the following: (1) the student is forced into a situation where he must

adjust his vocabulary level to suit comprehension levels of elementary children in a real-life situation, (2) he learns something about what goes on inside a child's head when he is actually learning science in a school situation, and (3) he should profit from the experience of learning about children's experiences and applying them to his study of science principles and methodology.

A benefit to all concerned which cannot be evaluated is just what happens to elementary children and college students when they exchange the hundreds of letters among themselves as the program progresses.

Try it, you'll like it.

My best wishes are extended to all of you for a pleasant remainder of the academic year, a delightful and restful and learning summer, and a proud attack on the problems and challenges of the new year to come.

Donald A. Vannan

Donald A. Vannan, Ed.D.
Editor

Note: On the following page is an example of the letters pouring in from the elementary children. This sample letter is from a fifth grade girl.

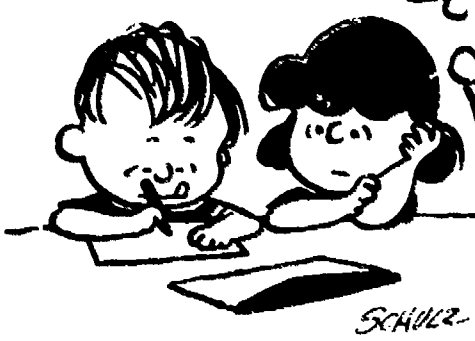
1226 W. [redacted] St.
Allentown, Pa.
March 8, 1972

Dear Peggy,

Hi! I was really excited to get your letter. I'm glad for you that you will be graduating in May, but the work must be hard. I think our tests are hard but yours must be difficult.

Well, anyway, here are the answers to your questions. My favorite things in science are: Conservation, pollution, plants and a few others. The things I don't really like in science are: space, rockets, and about our water system. The areas that I would like to study about are: drugs, magnets, chemestry, and may be oceanography. In our house we have a chemestry set with which I like to do experiments with my brother.

I like science if the topic is exciting. I like when the teacher brings in samples of things, like the time when the other class was studying drugs and the student teacher brought in some drugs and burned them. It had an odor of rotton eggs. Thanks for writing to me. I just love to get mail. BYE!



Yours Truly,
Linda [redacted]

ACKNOWLEDGEMENTS

The Editor wishes to extend his thanks to:

(1) the administration of Bloomsburg State College for allowing this publication to go into its fourth year

(2) the Department of Education in Harrisburg and Dr. Irvin T. Edgar for financial support needed to maintain this publication

(3) the authors who have contributed their time, energies and creative talents so that others may share ideas and philosophies

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(6) Miss Phyllis Marcuccio, Editor, Science and Children, (NSTA) for advertising the availability of the publication in the "Ad-Vailables" column

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PROSPECTIVE AUTHORS

If you are interested in submitting an article for consideration, the following points will be of interest:

(1) you must be a college instructor teaching a course generally titled "Methods And Materials In Elementary Science" or have a specific connection with science education

(2) the article must deal with a topic applicable to elementary science as it applies to a methods course at the college level

(3) you should use the form at the end of this publication to submit your article for consideration

(4) you will not be paid for the article, but you and your campus library will each receive one free copy; additional copies will cost $1.00 paid in advance with check made out to THE BLOOMSBURG STATE COLLEGE TRUST FUND #477T and sent with your order to the Editor (Zip 17815)

(5) contributers from out of state are always welcome to send in manuscripts for consideration; this issue contains some articles from out of state readers, too

(6) a permanent mailing list is not maintained; if you want a copy each year you must send in an article, or ask for a library loan copy from the Editor

(7) articles usually deal with methods used in the methods course but may include specifics such as college public relations, consultative work, and philosophical viewpoints or operational imperatives

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REPRINT CREDITS

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UNDERGRADUATE INDEPENDENT STUDIES IN ELEMENTARY SCHOOL SCIENCE

Thomas C. Moon

Perhaps one area of utmost concern in many undergraduate students' preparations for elementary school teaching focuses upon their initial experiences in working with children within the confines of an organized learning sequence. Often college instructors in elementary science methods classes hear their students voice a wish for more extensive contact with children in science activities, more contact perhaps than their methods courses can devise. In an attempt to both meet the needs of many students wishing extended science teaching experience with children prior to student teaching and to bolster rapport with neighboring public school systems and in-service teachers, California State College has generated a unique independent studies course.

This course is designed with much student flexibility and evolves through the efforts of both the undergraduate and the cooperating faculty member. The course

Dr. Moon is a Professor of Science Education at California State College, California, Pennsylvania.

is offered for variable credit of one, two, or three semester hours, and presupposes some earlier formal instruction within an elementary science methods course that attempts to convey science as a continuing process of inquiry. There are no written examinations, but these independent studies instead revolve around both the development of an extensive teaching unit that reflects some of the qualities expressed by the newer elementary science curricula developed within the past decade and a two weeks' presentation of portions of such a unit in the classroom of a cooperating teacher.

Such an independent study begins with a visitation to the classrooms in which the student will teach, coupled with consultation among the undergraduate, cooperating teacher, and college instructor. Generally at this initial meeting the student outlines his tentative teaching unit and his plans are discussed and suggestions are considered. One point that is continually stressed is the fact that the student's proposal should be oriented as much as possible toward having the children involved directly with the materials of science through active experimentation.

Certainly the success of such an independent study revolves around the experienced classroom teachers, for their guidance and suggestions are of optimum importance. California State College has been most fortunate these past three years in marshalling the cooperation of teachers in neighboring elementary schools who volunteer their services with no financial renumeration. Among those teachers recently involved have been Mr. Dennis Johnson, Bethelem Center Public Schools, Mrs. Florence Skiles of the Monessen Public Schools, and Mrs. Eileen Catalano of the Noss Laboratory School, California, Pennsylvania.

The teaching units developed by a students are varied in scope and complexity, primarily based upon the number of selected hours of credit. Some of the more recent topics involved developing a unit on ecology and environmental pollution partly patterned after some of the life science activities in the Science Curriculum Improvement Study, and organizing science lessons that focused upon conserving Pennsylvania's natural resources. Another student developed activities around the Elementary Science Study guide entitled Behavior of Mealworms, while

still another worked with children on the effect temperature has on rates of change as suggested in lessons originally generated by Science-A Process Approach. The University of Illinois Astronomy Program formed the basis for a unit produced by one undergraduate on astronomy. Another recent unit had children consider the e effects of electrical and magnetic interaction in the development of parallel and series circuits and static electricity.

The evaluation of such independent studies by necessity rests heavily upon the cooperating classroom teacher. Even though the college faculty member generally meets with the studnet at least once a week as the teaching unit evolves and visits the student at least twice during his teaching endeavors, the in-service teacher working daily with the undergraduate during this period does much in assisting and evaluating his science activities with children.

Such an independent studies course in elementary school science at California State College developed originally to meet the needs of those students who wished extended teaching experiences with elementary school children prior to conventional student teaching. Thus far, the course has been favorably received by these undergraduates and seems well worth the extra effort involved in designing such a curriculum offering. Additionally, the course has contributed to the strengthening of educational ties among college personnel and public school teachers. Perhaps such a strategy deserves consideration by other individuals and institutions interested in improving undergraduate elementary science instruction.

A CONCERN ABOUT THE TEACHING OF SCIENCE IN THE ELEMENTARY SCHOOL

David S. Sarner

I am concerned about the quality of the teaching of science which I have observed taking place in the average elementary public school classroom.

I am concerned because for the past two years as a science consultant observer for the Center for Urban Education I have failed to see more than an occasional teacher involved in what could be considered as a science lesson. During this same period, I have taught a few hundred public elementary school teachers in a graduate methods course concerned with the teaching of science.

I am concerned for a result of these experiences I have noted that the "teaching" of science in the elementary grades contains very little science content; that science is seldom taught and that when it is, the science lesson is usually a teacher demonstration performed in a half-hearted manner.

Mr. Sarner is an Associate Professor of Elementary Education at The City College of New York, New York, New York.

Birnbach,[1] in a recent paper, noted that there is very little carry over from in-service courses designed to prepare elementary teachers to teach the discovery method for a particular curriculum of science. However, Professor Hunter[2] has found that "teachers who have had specific training in a new curriculum program will tend to have pupils using materials as they teach science to a greater extent than teachers in a control group and their pupils will talk more while using the materials."

Whose fault is it then, that the elementary public school teacher does not and really cannot teach science? As a professional educator and an instructor of elementary school science methods, my first impulse is to place the blame at the feet of the science instructor in the Liberal Arts colleges who teach our candidates to memorize and parrot answers. The students at both the undergraduate and graduate level who come to our professional courses are illiterate about science. They have been exposed to General Education courses in science generally without accompanying laboratory experiences. Or, at least they come to us with only introductory courses in the sciences, seldom does one come along who has had more than one course in a given area. Science has usually been presented as a moun not a verb necessary to indicate activity. It has often been said "that we are prone to teach as we are taught not as we are taught to teach." However, to shift the blame will not solve the problem and produce good science instruction in the elementary school classroom.

In my own methods courses I try to help the student to gain confidence in his own knowledge of science concepts; to show the student that science can be fun and that many basic concepts are so simple that they can often be done at home; to show that teaching can be simplified by involving the child in the process of discovery; and to help the teacher learn how to improvises simple

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[1]Birnbach, L.J., "A Comparative Study of Teacher and Observer Ratings of The Same Science Lesson", Unpublished paper, The Center for Urban Education, New York, NY 1968.

[2]Hunter, E. Kirk, J.; Goldstein,R., "The Effect of Training In The Use Of New Science Programs Upon the Classroom Verbal Behavior of First Grade Teachers As They Teach Science." Unpublished paper, The Center for Urban Education, New York, NY 1968.

equipment to provide each child with material with which to discover.

The elementary teacher in her self-contained classroom must also realize that the motivation which can be derived from an exciting concept of science can be carried over to reading interest, vocabulary and most importantly to mathematics as it relates to measurement. Too often, the teacher presents each subject by itself and fails to realize that the curriculum, as in life, must be interrelated. There is a need to teach elementary education methods courses using this same philosophy of interrelated subject matter within the methoss course. The teaching of science is definitely enhanced by the use of measurement which makes the science action that much more meaningful.

For example, there is the simple science demonstration which uses some steel wool placed in the bottom of a glass tumbler and then the inverted glass is allowed to stand for 48 hours inverted in a shallow dish of water. The child discovers that the water has risen in the glass and that the steel wool has rusted. The average teacher will then tell the children that the oxygen in the air has been used up in the rusting process and that the water rises to take its place. Now this is where the average teacher ends the lesson and leaves the class with the bit of knowledge that the water rises to replace the used oxygen in the air.

The good teacher would probably relate this observed phenomenon to some interesting questions which would motivate the child to some thinking about such things as the following:

How high will the water rise in the glass? Will the distance the water rises in the glass be the same each time? How can you be sure? Can you prove it? Suppose you measured the amount of water in the glass, what portion of the total volume is it? What fraction? What percentage? Can you make a statement about the amount of oxygen in the air?

These questions should be open-ended, thus giving the student an opportunity to speculate about the answers and their possible implications. Note, too, that mathematics has been brought into the science lesson to aid the student in finding a solution or explanation of the phenomenon which he has observed.

In a like manner, the teacher can develop language arts by asking the student to record his answers as a written report which would contain his observation and measurements so that he could arrive at a supported conclusion. The many words such as oxygen, replacement, steel, nitrogen, measure, proportion, etc. make for a spelling list which relates to the exercise and thus gives the meaning to the need for correct spelling.

We have produced this problem of teaching science in the elementary classroom for many years and so far the majority of the teachers are still afraid to teach science. During the past few years many curriculum innovations have appeared on the market and most of them have dealt with process, concept and discovery but few of us have taken the specific pains to train the teacher how to teach for process, concept and discovery. It is time we did something about it.

A RANDOM SAMPLING OF GRADUATE STUDENTS' CRITIQUES OF A METHOD OF INSTRUCTION USING DOCTORAL DISSERTATION ABSTRACTS IN ELEMENTARY SCIENCE EDUCATION

Donald A. Vannan, Ed.D.

Working and learning with teachers-in-service in a graduate level program in elementary science is an exciting and rewarding experience. These teachers are usually tired after a long day of teaching, but manage somehow to travel some distance to learn more about what is happening in the ever-changing field of elementary science education, and to share ideas and techniques with colleagues.

The instructor of such a course is defeating the purpose of the course if he merely lectures and shows films and plays tape recordings. What must be an integral part of such a course is researching the field, a chore which most elementary teachers with their other subjects to read about and teach do not have sufficient time to undertake. Getting the educators into the library is essential in a graduate level course.

With this point in mind, let us find out what teachers-in-service think about using the research generated by doctoral candidates in the field of elementary science specialization. Their comments should prove valuable guides to professors teaching graduate level courses not only in science but in other methodology fields, too.

Dr. Vannan is a professor of education at Bloomsburg State College, Bloomsburg, Pennsylvania.

To begin with, 112 graduate students taking the course "Current Practices In Elementary Science"[1] over the past five years were each assigned a number. Using a table of random numbers, and dropping a pencil point on a starting point, identified the list of 18 students whose critiques are included in this article. Of the sample population, 6 were males and 12 were females, roughly the proportion usually entering the course each semester in which it is taught. In order for the reader to gain a bit more insight into each critique, each one is identified as "male" or "female;" no teacher in the sample had less than two years of teaching experience in elementary schools. None were teachers from the secondary level seeking elementary certification, and none of the critiques became a part of the course grade.

MALE

I can honestly say that this assignment had great value. First, may I say that this is the first graduate course I have taken at Bloomsburg. I did not know that such research publications[2] existed. During my four years of undergraduate work, I was never enlightened to the fact that doctoral dissertations were offered in the form of abstracts.

Now that I am aware of their existence and have examined a few of them, I must admit that they are excellent. They offer the teacher many new ideas which he could try in his own particular classroom situation. Not only ideas, but methods, materials, and many other classroom activities are suggested.

They not only furnish the teacher with ideas but moreover have instilled in me an attitude. I will not be hasty to make a decision to use someone's research, thinking it will give positive results. This exercise instilled in me the attitude of "test for yourself." Just because something worked one time for one individual in a particular situation does not mean it will be a "cure-all" for similar situations. Each teacher has his own unique system and situations and you must first test the findings in light of your own situation to see whether they are acceptable.

FEMALE

This activity was a very meaningful experience. I learned of an excellent resource which contains up-to-date research on science as well as other subjects. Before doing this assignment, I was unaware that the publication of abstracts ever existed.

Most of the studies I read were not all on my grade level; it would have been more beneficial to me if they had been. However, I can use the ideas gained from these studies and apply them to my grade level.

During the school term it would be beneficial to go to this excellent resource to see what type of programs are being conducted in other schools and possibly try some of them in my classroom. By doing this, I could see how the results of my class compared with the results of the children used in the study.

MALE

After reading several dissertation abstracts and after hearing summaries of numerous other dissertation abstracts, I have come to the conclusion that these are quite valuable pieces of literature. The startling results of some of these abstracts have proven to me that a trained school teacher cannot always use common sense reasoning to decide whether or not a new teaching idea, method, etc., is better than the old conventional method.

Naturally, the findings of these writers cannot be accepted universally because of the many factors that vary between one school and another. The purpose of these papers seems to be to motivate teachers to test new ideas in their own classrooms, or check the values of things they are already using. Also, there are many useful hints to be found in these articles to aid the teacher in setting up a curriculum, developing sound teaching procedures, choosing proper methods and materials, etc.

In conclusion, I would like to relate that I feel the use of dissertation abstracts will be a part of my self-evaluation and curriculum evaluation which I will make from time to time throughout my teaching career.

FEMALE

What I have learned by doing this research amounts to changes I may make next year in my teaching. With all my lessons I will be using more questions, and guide the experiences of the children better. Also, I have learned that construction of projects is good, especially for the slow learner.

I have found that by looking to these dissertations a person can get new ideas and find out how some traditional ideas hold up to the new ideas. A person, if he wishes to try something new in his room, can go over these studies and find out if it has been tested, and the outcomes. However, this is just for information, because one study cannot prove anything for sure.

Most of all, I have greater faith in the traditional classroom method of teaching.

MALE

In summary, I find that the important new ideas I gained from this research would be as follow:

(a) resource textbooks have been designed to aid the teacher in his science science work and planning

(b) most children show more interest in exology and conservation as compared with chemistry, health, biology, astronomy, etc. This shows they are concerned with their world.

(c) science units which are planned show greater interest for children and interest gains...(schools) should make a unit study so teachers will not emphasize units previously learned in lower grades

(d) students, in general, can learn factual material as well when learning by themselves as when taught by the teacher

(e) teachers should not make assumptions about what they believe children should know

(f) I.Q. does not always indicate a child's ability to do work of a "good" classification

FEMALE

I personally feel that the most significant discovery I have made concerning doctoral abstracts is the fact that another good science source has been brought to my attention. I have found that there is much to be learned from this

excellent resource.

Some conclusions of the studies contradicted what I had thought to be true. For example, in Dr. _____'s study there was no significant difference between classes taught with television when compared with those taught without television. This gives an indication that progress is not always necessarily good.

In conclusion, I appreciate the opportunity to discover this added source. For myself, I have found these studies, for the most part, to be very interesting and enlightening, especially those dealing with the primary grade levels.

MALE

I feel this assignment has helped me a great deal in the areas of using laboratory techniques and video tape in my classroom.

Concerning the first area, laboratory techniques, the child is immediately motivated by the experiment used and the equipment being utilized. Video tape is another fine area to stir the child's imagination. If a child has the chance to visualize (a volcano eruption) in his mind afterwards, he will be able to remember it much better than might otherwise be expected.

FEMALE

I have found that non-reading methods of testing are the only fair ways to evaluate children who are classified as poor readers. First graders are capable of going well beyond the basic concepts covered in their textbooks. Also, students learn more when the responsibility for learning is put on them. There was one study I did not understand sufficiently to get any meaning our of it.[1]

And finally, the "best" teacher is not necessarily the one with the most experience and advanced training.

FEMALE

I believe the over all significance of this research assignment was to make us aware of present research being done in the field of elementary science. Especially important were those facts in studies which contradicted the logically expected conclusion.

It is also important to note variables which alter the outcomes and the procedures used by these men and women in the process of research.

Another good aspect of the assignment was that it provided me with some ideas for my master's research paper and some areas I might investigate in my own classroom. The ideas and methods were good, too.

MALE

This assignment has pointed out to me many science techniques and procedures which are not as effective as one would like to believe. The "common-sense" conclusions are not so common in research. From these studies and others in this course I would now question the value and findings of any new science program or idea. Before these studies were read and discussed in class, I would have undoubtedly accepted almost any idea without a second thought about its merits. Perhaps when I get into curriculum planning, some of these studies we went over

[1]A highly technical study dealing with reading and science which involved a lot of tests and higher level statistical analysis.

in class will have even more meaning for me.

FEMALE

This being my first graduate course, the doctoral abstracts reported on in class were my first introduction to this realm of research.

I am overwhelmned by the volumes and volumes of studies now being done which can give teacners valuable new ideas and understandings in teaching. Many of us are disilliusioned by the unexpected results of some of the studies. I believe that this is good, for this is the only way that the effective theories and methods of new ideas and the often downgraded traditional methods can be utilized in building an effective program.

In addition, the awareness of these studies has given me a "can do" attitude. The motivation to begin research for my departmental paper so early in my graduate work is attributed to this class activity.

FEMALE

I feel that the activity concerning the doctoral dissertation abstracts was good. I experienced some difficulty however in understanding some of those which I read. In general though, I became aware of many findings that conflicted with the opinions expressed by many educators. In one of my readings it was found that, contrary to popular belief, science achievement and attitude were not improved using one of the modern teaching methods. However, it was heartening to note that the "confidence" was increased.

It was interesting to find out that there were more kinds of studies carried out than just the ones that stated clear objectives and findings. In general, I am glad to be aware of the abstracts as a possible source for research. They would be good in answering conflicting questions that might arise concerning attitudes or methods that may possibly have been covered by one of these studies.

MALE

The one dissertation by _____ was especially interesting to be because it made me consciously aware of something that I hadn't previously thought about. This is the fact that average and low ability children do better by doing. Much must be done with concrete forms. The reading free tests techniques were also interesting and will be applied by me in my classroom next September. Why didn't I think of that?

All in all, the dissertations were diffiuclt but informative. I will need that education research course more than ever, now.

FEMALE

As a beginning master's degree candidate, the doctoral dissertation were especially good in introducting me to this resource. As an undergrad I had not been introduced to this source and had never worked with it. This gave me the needed push to become adquainted with and learn the use of the abstracts. The studies found, however, did not answ. all of my questions. Instead, they asked many more. Often the results questioned common sense and in this respect encouraged further research. These are studies, not established facts. Often the studies were relevant to education in general and not just science education. Many of the findings were applicable to any grade level, too.

FEMALE

This is an excellent source for finding out what is being tried at present in education, so this assignment was a good means of enlightening me in this area of concentrated science for six weeks. In my opinion, I thought it was helpful in reading some studies that were not concerned with the grade level I was teaching -- sixth. At times we become too involved with our own grade level and forget to read about what others are doing. I thought we heard too many reports in class concerning the dissertations. I would think that fewer would be better. Maybe we could present only five in class rather than seven.

FEMALE

What is read is only as important as how much is learned from one's reading. Several of the studies were easy to read and gave obvious conclusions, whereas the reverse is also true. In essence there is something practical to be learned from each abstract. The extent to which it is applied is up to the reader.

FEMALE

Basically, the major findings of the studies which I looked at will help me in the following ways:

(a) children from lower socio-economic areas can do as well as others in science in a non-verbal behavior test

(b) now I should teach and use more creative exercises in my science class - I know I will try the science fiction story

(c) I will now question my state science guide and try to see ways in which it can be improved

(d) children can learn information more easily by the use of advance organizers

(e) I am going to teach more problem-solving abilities so that children are better at identifying valid conclusions.

FEMALE

From hearing and reporting on the various doctoral studies in science education, I've gained a better understanding of the research being done in the field. There are limited areas in some research but there are limitless opportunities for research. Of the studies I reported on in class, I feel that Dr. _____'s study was most helpful to me.

SUMMARY

One must certainly proceed with caution utilizing only the opinions of 18 our of 112 graduate level students, but, with this in mind, the following suggestions to other college instructors are proffered:

(1) some benefit seems to be forthcoming by using the dissertation abstracts in class

(2) it would be best if students could be required to have the educational research or advanced statistics course before having wide reading in the abstracts

(3) there appears to be an encouraging realization by the students (those above and to whom I have talked with personally) that "one study doesn't prove anything"

(4) some new ideas and techniques are learned

(5) some impetus (limited) to get started in research my be started by this activity

(6) the realization of how the general fund of knowledge is increased and up-dated is discovered

(7) ideas for the graduate student's personal study for the master's degree are discovered (term paper or theses ideas)

A LOST DIMENSION IN ELEMENTARY SCHOOL SCIENCE

Ann Howe

In elementary school science we have moved away from teaching science as a body of static facts and proven theories toward a new way of teaching and thinking in which science is conceived of as both process and the product of process. The objectives which are most commonly mentioned for elementary science education today are for children to learn the processes of science, to learn how scientists work, to learn basic scientific concepts, and to gain increased ability for intellectual functioning. It is rare to find any mention of how or where people fit into this scheme of concepts, processes and skills. I believe that there is another dimension which should be included in science programs for children-an understanding of themselves as a part of, and in relation to, the reality around them.

Ian McHarg (1) in his book, DESIGN WITH NATURE, suggests that our tendency to set man apart from the rest of nature on our planet is the result of the historical Western view of man. Western religion and culture, he maintains, have placed man at the pinnacle of creation and have promoted the idea of man's dominion over nature. We have believed, and sometimes taught, that plants and animals were created for the sole purpose of benefiting us and that we were justified in

References

1. I. McHarg, DESIGN WITH NATURE, Natural History Press, Garden City, NY 1969.

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using them in any way we chose. The nice cow produces milk so we will have something to drink. The hen lays eggs so we will have eggs to eat. The rain falls in order for us to grow crops. We can experiment with animals in any way that may benefit us. We have thought that it was our prerogative to dominate nature, to subdue it, to use it, to disregard our obligations to it.

Not all cultures and religions have been so self-centered. In primitive cultures all over the world people have had a strong sense of dependence on, and kinship with, other living things. We can see this today in parts of Africa, among the American Indians, and the people of the Pacific islands. In the higher cultures of the East the aim of life is to be submerged in nature. In the West we have lost this sense of man as a part of, and limited by, all that exists. Our great achievements have been based on humanistic values, the ideas of individual significance and worth. Will it now be possible to hold on to our humanistic values, and, at the same time, to recapture some of the feeling of kinship with and dependence on nature?

The values and beliefs of our culture are reflected in education. Elementary school science has always included the study of the natural environment, but shifts and changes in thought and theory have been reflected in different approaches in the subject. Rocks, shells, stuffed animals, and other natural objects were the subjects for object teaching a hundred years ago. This gave way to nature study which turned attention from the static elements of lefeless forms back to the world of living things but resulted in much teaching which was animistic and sentimental and out of touch with the scientific thought of the time. In the 1920's the impetus for social utility affected all aspects of the curriculum, placing emphasis in science on technology, applications of scientific principles, and the threshold of conquering nature forever. Something about conservation was introduced from time to time but the emphasis was on conserving our natural resources so that we could use them in the future. Again, nature was thought of as resources, that is, something for man to use.

The next change in the elementary science curriculum was a shift of emphasis to the idea of the child as a scientist and the classroom as a laboratory. The best of the new materials have brought a wonderful openness and freedom to the classroom and have presented an array of new possibilities for ways of working with children. They were needed. They are a step forward in science education. But I am disturbed that some of the writers of these materials seem to have been more interested in having children learn about science than about the world around them. What scientists do assumes unwarranted importance. Children are not scientists; they are children Real scientific experimentation requires knowledge, discipline and imagination: it is far from an automatic carrying our of steps. How did the notion arise that children need to imitate scientists in order to find out about things? Experimentation is not the only route to knowledge and understanding. We have almost arrived at the point where no self-respecting teacher is supposed to have the children grow plants unless she has a plan for measuring them every day. She wonders whether she can justify having an aquarium unless she can think of experiments with goldfish. Just growing things, and watching them live and grow, has become suspect in the elementary school. A prominent scientist who helped conceptualize one of the new programs said that "children must work with their own hands, minds, and hearts." We have encouraged the use of their hands and minds but we hav left out their hearts. We have been thinking that we had to teach children to become detached in order for them to learn. We have been afraid of feeling as though it were unscientific, and therefore anacceptable.

In Coming of Age in America Edgar Friedenberg says that "the highest function of education is to help people understand the meaning of their lives and to become more sensitive to the meaning of other peoples' lives". If this is indeed the highest function of education, then we should consider what it is that gives meaning to people's lives and how science education may contribute to that end.

In the prescientific age men found meaning through their myths. These stories told how the earth began, how people came into being, the meaning of birth and death. They connected individual lives and destinies with an all-encompassing reality. Today, for good reason, we dismiss the ancient myths. We understand natural phenomena and processes in a completely different way. But we are mistaken when we equate myths only with falsehood and superstition. In doing this we betray a lack of understanding of the power of myth and the human need for integrating experience and finding relationships. Through myth and ritual people were able to break out of their limited separate existences and participate in a vast cosmic drama.

The undermining of myth by science began slowly; for hundreds of years the new knowledge impinged on the lives of only a few people. But finally the ideas gained momentum, the new knowledge began to have practical effects, the amount of knowledge exploded, the Western world was caught up in the new age and the old myths no longer had the power to grasp the imagination or to help man find a place for himself in the reality to be.

We know that this view of reality has changed during the past and that it will surely continue to change. It is never possible to say with finality what reality really is. We do know that the present scientific view of the universe is of a structure which is overwhelming in its size and complexity. Astronomers and physicists speak of galaxies and star clusters, of unimaginable distances and time spans. In comparison our own dimensions shrink into nothingness. But, somehow, somewhere, inexplicably, earth was formed and life began and flourished on it. Here we are, living, breathing, thinking, taking. Our eyes respond to the energy released by far-off stars and our brains conceptualize a universe and design instruments to probe it. The universe is our home, as improbable as that may seem. Somehow, a lifeless planet brought forth life.

We have shied away, in elementary science, from doing anything that could possibly be construed as "teaching evolution". I believe the time has now come to search for an acceptable way to help children understand that life has been, and still is, part of an on-going process; that the forms of life which now exist on earth have evolved through millions of years and are still in the process of changing and evolving, that the process goes back into time and forward into the future, that each person has within him the product of the past and the seed of the future.

In social studies classes children learn about other people and learn to see themselves in relation to other people. In science classes I believe they should learn about biological and physical phenomena and processes and learn to see themselves in relation to these. It is through an understanding of relationships and interdependencies that meaning can be found.

The world needs people who can think and feel; people who know the earth and also love it; who know much about the forms of life and respect all life; who know what the stars are made of and can still look up at them and wonder.

References

1. I McHarg, Design With Nature, Natural History Press, Garden City, NY 1969.

TEACHING SCIENCE AS A SPECTATOR SPORT

Chester W. Dugger

Early in my college teaching career (last year) I had a dream about going to a basketball game. I loaded up some crunchy peanut candy and a nice soft cushion and started off. Arriving early I was able to obtain a center seat right down front where it would be easy to keep the referees honest.

As I snuggled into the kapok, ordered a coke, began to look over my program and watched the vivacious cheerleaders out of the corner of my eye a most unsettling event occurred. In ran this herd of giants and instead of going into a routine of fancy dribbling and "dunk" shots they began handing out basketballs to members of the audience. Sending these hapless fellows on to the court the giants then proceeded to confiscate the cushioned spectator positions.

Being in the front row, I was soon accosted. So unsettled was I at this turn of events that I spilled my coke down the front of my pants, got a peanut

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particle caught in my throat which casued a terrible fit of coughing, and am sure I would have suffered a heart attack had I not awakened with a start.

Now I am no fancier of the art of dream interpretation, but I do remember some psychologist on the Dick Cavett show saying that dreams are usually related to some recent event which has occurred in the dreamer's life. Thus, I began to search for the significant event related to this bazaar dream. After no little amount of considering, I think I have it. Not two days earlier I had begun a three week "science methods" experience which a colleague of mine had requested for a group of her undergraduate elementary education majors. As the students shuffled their way into the over-crowded laboratory for the first time I sensed an aire of reluctance. The message I seemed to be getting was something to the effect that, "Here are your spectators, Sport. Show us what you can do!"

To make a short story shorter, I took the bait (ham, of course) and away I went. To such dazzling demonstrations and presentations of interest inducing discrepant events I am sure that little science laboratory has seldom been host. Why in two and one-half hourse there was a show that even Sir Humphry Davy would have been hard pressed to equal. Only once was a student observed yawning.

But, alas, there was tomorrow and it came all too soon. I had reasoned this:

> Yesterday I go their interest--and how!
>
> Today they will be ready to dig in and start to learn ways to get their future students involved in science.

What better way to start than to get them involved in an inquiry experience.

What happened was a fine example of how theory does not always fit practice. My approach was met with what might best be described as mixed apathy; i.e., the period started off slow and tapered off.

Things did pick up during the remaining twelved days, but I have found that the initial reaction described above is not atypical of many undergraduate elementary education major's toward a process oriented approach requiring extensive student participation. In addition, I have noted that, generally, there seems

to be a tendency for elementary education majors to avoid laboratory courses in science. When these students do find themselves in a science course they are great at observing demonstrations, enduring lectures and participating in intellectual discussions about "what could be done" in an elementary classroom. Even participating as inquirers in a "Suchman Inquiry" experience is not too bad as long as I remain the leader. But, to actually lead a discussion, perform a demonstration, or engage in a solo inquiry attempt often seems to be asking too much. Frustration quickly develops and often students begin to groan about me not doing my job and about the class not seeming to get any place.

There are probably many reasons for such reluctance. Among the reasons must surely be the customary performer--spectator approach which is widely employed in college and university courses. And it should come as no surprise that, when comfortably seated spectators are thrust on to the court, there is apt to be no little amount of confusion.

In an attempt to minimize the reluctance of some students to become participants I have found it helpful to set the stage for a "student as participant" experience starting with the very first day. This has called for some adjustment on my part. Instead of taking a major participant role initially, I have had to repress my tendency to want to perform and give out precious pearls of wisdom. I find that I talk less and spend more time in a "faciliatation" capacity. When students are performing I have more time to devote to observation. This time is well spent gathering valuable information about individual students and how the learning process is meeting their needs.

Teaching science as a "spectator" puts the spot-light where it should be--on the student. This allows students to:

> "Learn by doing (which) is far superior to vicarious learning. In fact, a preponderance of vicarious learning has a tendency to produce students whh are afraid to actually try what they are supposed to have learned. Somehow the student begins to believe that he should be able to do, without practice, what he has seen or heard. If he cannot, he feels as if he has failed. Not-to-attempt-to-do- is to a avoid failure. He may intellectualize to avoid having "to do."

> A feeling of inferiority may develop when the student feels, deep down inside, that he cannot do what he feels he should be able to do and what he has seen others do."[1]

SUMMARY

There seems to be a reluctance on the part of many elementary education majors to participate in laboratory type science courses. This reluctance is understandable in that the "teacher as performer," "student as spectator" pattern for learning is prevalent in many if not most college and university courses. It is possible to reverse this pattern, and there is much to be gained by doing so.

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[1]Chester W. Dugger, "individualization and the Inquiry Approach," The Teaching Act Applied to Science, LeRoy Barney, (Dubuque, Iowa: Kendall/ Hunt Publishing Company, 1971), p. 25.

SIMULATION OF A FOOD WEB

David J. Kuhn

The role of simulation and role playing in science classes is increasing as the search continues for more effective teaching devices. Pedagogical activities are needed that reduce important biological phenomena to their essential components. A simple, inexpensive, easily-executed simulation can be a dramatically effective teaching instrument. The simulation described in this article may be used at various levels of complexity in environmental education in the elementary or secondary school.

The concept of the biological community is basic to the understanding of the environment. The concept is usually transmitted in the form of a line diagram arrows going every which way, leaving the student confused. Visual illustrations improve the situation, e.g., a transparency or film. However, the

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effect is abstract rather than concrete, indefinite rather than precise. A simulation involves the student directly and helps him grasp the essence of the process. After the study of a biological community is completed, the biology teacher can construct a simulation to illustrate the relationships among the various populations of living things.

There are a variety of ways to collect this data on biological communities. A field trip should be taken to study a forest, pond, or open field communities. The studies will be primarily observational or involve qualitative or semiqualitative analysis, e.g., a survey of the organisms found in leaf litter. The interactions of the various organisms in a particular habitat should be analysed. This study may require additional field trips to study a particular habitat.

Large color photographs, e.g., the illustrations of classic communities in the Time-Life Book entitled "Ecology" (1) are a source of "data" on biological communities. A class can also "collect" data from written descriptions of biological communities in standard textbooks, e.g., a good passage for possible use with the simulation is the description of a west florida river community in the BSCS Green Version (2).

Another source of material on biological communities are color fims and film loops. The use of these visual aids is an excellent way to develop the student's skills of observation. A section of a film such as Walt Disney's "The Living Desert" or a loop film, e.g., Plankton: Food Webs and Feeding Relationships (3) or Jacques Cousteau's Coral Reef Community (4) can provide opportunities to explore exotic communities that are not easily set up in the classroom in miniature or readily available in the nearby environment.

After data has been collected and the relationships have been discussed, the instructor can develop the simulation. All that is needed are balls of string of different colors--red, blue, yellow, purple, green, etc. The students sit in a circle. As the data is analysed, each student assumes the role of an organism of the community--one might be a green alga, another a water flea,

another a catfish, another a snail, etc. As each relationship is established, a line is strung, e.g., between the "producer" organism and primary consumer. Other relationships can be established in a similar manner. As the analysis continues, the existing relationships become evident; one primary consumer may feed upon several producers; a third-order consumer may feed upon several other animals. The complexity of the food web becomes strikingly evident and the visual impact is substantial.

The simulation may also be applied, perhaps even more effectively, to the biological community in a microecosystem, e.g., an aquarium community. The same procedure that was applied to communities in nature are used in the study of a microcosm; record the organisms that are present and determine their relationships. (The teacher may have to supply some information on organisms not easily seen, e.g., bacteria and molds.) After the simulation has been completed, the class can alter the microecosystem, e.g., add more plants or fish. A subsequent simulation can illustrate the results. The possibilities in this area are endless. The simulation techniques can be utilized to illustrate the results of studies of pollution, overcrowding, etc. on the biological community in the microcosm. The use of a series of simulations is particularly effective at the elementary or junior high school level.

The instructor can use this simulation to illustrate man's role in the environment. Unfortunately, man is often considered apart from the environment; he is considered as an observer of it rather than a part of it. Man's function as a "consumer" in the food web as well as the indirect and direct effects of his action can be simulated, e.g., the introduction of new species into an area where no natural predator exists. The concept of the balance of nature and the effects of environmental disturbances on the community are graphically re-enforced for the student.

Simulation techniques do not represent a panacea; they should not replace laboratory or effective visual instruction. But they can be a useful supplement. If they can easily be applied and do not require elaborate preparation or expensive material, they provide the science instructor with a valuable tool for developing in the student an understanding of the essential aspects of several scientific phenomena.

SCIENCE FOR THE SEVENTIES:
PENNSYLVANIA'S DIRECTIONS FOR CHANGE IN ELEMENTARY SCIENCE

Dr. Irvin T. Edgar

Four years ago, the Pennsylvania Department of Education initiated the development of a program to foster sound science instruction in the elementary schools of the Commonwealth. Entitled "Science for the Seventies", the printed materials created to date consist of a main section (guide) and accompanying separate lessons. The lessons are designed for primary or intermediate classroom use and are written to satisfy the stated aims of SFTS rather than specific subject matter.

The SFTS development committee carefully designed each lesson activity to assure that student behavioral outcomes would serve as the focus of the learning process. Fourteen aims summarizing the terminal student outcomes

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desirable to any science program were formulated and included in the guide together with science evaluation suggestions, equipment listings, and additional items such as the relationship of textbooks to elementary science programs.

Since its inception, SFTS has been guided by the development committee with specific concern for providing assistance to both preservice and in-service teachers. It is important to note that SFTS does not attempt to compete with S--APA, ESS, or SCIS. The emphasis of SFTS, to the contrary, is best descibed in the following quote from the preface in the guide:

> "The existence of various national programs for elementary science is obvious to the most casual reader of professional publications. Science for the Seventies is designed to support the intent of these programs and does not attempt to supplant them. Nor do the originators of the series expect that schools will discard any existing science programs to "wipe the slate clean" and begin anew using the ideas presented by SFTS, unless of course such action is indisputably justified. Instead, by identifying appropriate activities and procedures to consider and adapt to a variety of circumstances, SFTS provides assistance to persons interested in improving their elementary science instruction, regardless of the program they are now using."

SFTS may best be described as "...a label for a design to further the growth of elementary science as a curricular experience for children" (SFTS Preface). The materials of the program have been, and will continue to be provided free to practicing Pennsylvania educators.

The success of SFTS can be documented in a number of ways. The most obvious example of success can be found in the need for four printings of the materials to date by the Department. The inservice demand alone appears to be sufficient to exhaust this procedure for printing and supply. Consequently, a new method has been established to supply preservice teachers, non-educators, and out of state requests.

Another example of the acceptance of the SFTS program can be illustrated by the large number of school district requests to utilize the program as a means to assist them in curriculum revision. The Self Study program for the elementary school has also drawn extensively on the aims of SFTS as a measure for evaluative comparison of a school district's elementary science program.

Many of the state colleges and teacher-preparing schools in universities use SFTS in the teaching of elementary science courses. In some instances, SFTS serves as a required test for both undergraduate and graduate teachers. The demand and use of SFTS for this purpose has been so extensive as to warrant a special procedure for the printing and supply of the materials used in this way.

A commercial edition of SFTS, identical to the materials already produced, is available from the Clarion Foundation-printed as a service to the PDE. Preservice teachers, out of state residents, and non-educators may obtain copies of the SFTS materials in this form for approximately $1.65 from:

Mr. William Proudfit
Clarion State College
Clarion, PA 16214

As stated earlier, SFTS materials will continue to be free to Pennsylvania School personnel. Representative copies and descriptive literature will be forwarded to most of Pennsylvania's teacher-preparing institutions.

The prospects for SFTS continue to brighten. Present plans include, in addition to the expansion of materials and program usage, a prospective pilot television program. Subsequent to successful experience with the TV pilot, additional SFTS TV lessons will be produced for television.

The actual measure of success for SFTS will be the number of schools and classrooms that show acceptance and practice of SFTS learning procedures. Success in this regard has been rewarding to date. Future goals include a greater rate of expansion which may constitute, with considerable future effort, the next report on Science for the Seventies.

CHEMICAL PESTICIDES

Clifford Knapp

Chemical pesticides are poisons used to kill plant and animal pests. Animal pests may include certain insects which harm food and fiber crops, trees or animals; rodents such as rats and mice which cause disease and crop damage; and other small organisms which are a nuisance to man. Plant pests may include types of fungi which harm other plants, or weeds which interfere with certain crops and other vegetation.

Thousands of modern chemical pesticides have been produced for various purposes. Many fall into three main groups.

MODERN PESTICIDE GROUPS

Pesticides in the chlorinated hydrocarbon group are called "hard," because they take a long time to break down chemically and become harmless. These pesticides have caused a great deal of concern, for they remain active in the environment. Although they do not dissolve easily in water, they travel around the world in fresh and salt water. They also cling to soil and dust particles and travel by land, sea, and air. DDT belongs to this group.

Other kinds of pesticides belong to the phosphate group. They break down much faster in the environment, but may be more dangerous upon direct contact. Many ecologists prefer phosphate pesticides to the chlorinated hydrocarbon group because they do not remain harmful for very long.

A third type of modern chemical pesticides is the carbamate group. Most of these "soft" pesticides, like those of the phosphate group, break down and become

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harmless in the environment after a relatively short time. Because of these characteristics, phosphate and carbamate pesticides are relatively safe for wildlife. However, some of them are expensive and must be applied more often.

HELPFUL PESTICIDES

Pesticides have been responsible for saving the lives of many people. DDT has been used to kill mosquitoes and other disease carriers around the world, preventing millions of deaths from diseases such as malaria, yellow fever, and typhoid.

Through man's use of pesticides, many crops yield better, grow in areas not possible before, and look more attractive.

Trees are one kind of crop.j Spraying against insect enemies of the forest has helped in the production of lumber and wood products.

Pesticides are also used to control weeds along roads, on farms, and in park areas.

HARMFUL PESTICIDES

If pesticides can accomplish all this, why has their use been so seriously questioned? The problem is that pesticides are designed to kill, and many pesticides do not stop with killing the pest for which they were originally developed.

For example, when a pesticide of the chlorinated hydrocarbon group is sprayed on the land, it may kill earthworms, robins, and cats. After DDT or some other hard pesticide accumulates in the soil from spraying, earthworms absorb it into their bodies. When robins eat earthworms, they acquire greater concentrations of the poison. If cats catch and eat some of the robins, they accumulate even more DDT in their systems and may die. As larger animals eat smaller ones, the concentration of pesticides in their bodies increases. Animals at the higher levels of different food chains (pelicans, falcons, and ospreys), suffer death or other problems from the accumulation of poisons in their body fats.

The loss of animals and wild birds may not appear to be important to some people, but ecologists, who study the interrelationships of living things and their environment, believe it is important to preserve as many forms of life as possible. Living things depend upon this diversity to function properly and to survive. Some chemical pesticides threaten to reduce the diversity of life and kill the animals which naturally prey upon pests. Man would suffer harmful effects if this happened. For example, if all bees were eliminated from the earth, man's diet would change and many people would probably starve, because of the importance of bees in pollinating fruits and vegetables.

In laboratory experiments, DDT has been found to be related to the formation of tumors in mice. In the natural environment, it is causing some birds to lay thin-shelled eggs. The bald eagle, for example, is threatened with extinction, because its eggs are so thin-shelled they break or dry out before they hatch.

Many fish have been discovered with large amounts of hard pesticides in their bodies. Death of the fish eggs and young or adult fish often results when concentrations are high. Dangers may exist when humans and other animals eat these contaminated fish. The Federal government has established regulations to protect people from eating foods containing dangerous levels of pesticides.

Ecologists are also very concerned about the effects of pesticides on the tiny organisms living in the soil and in the world's oceans. Soil organisms maintain a productive soil for plant growth. Ocean organisms are responsible for the production of most of the world's oxygen.

Research has not clearly proved that pesticides cause harm as they accumulate slowly in adult humans, but neither has it shown that pesticides are completely safe. One big problem is that we do not know what the long-term effects of pesticides on human reproduction and mental health will be. Many concerned persons feel that the use of certain hard pesticides should be reduced or banned

while research continues.

BIOLOGICAL CONTROL METHODS

The use of chemical pesticides can be reduced by using biologically controlled methods which are less harmful to the environment. These controls have the advantage of usually killing only a specific pest, instead of killing indiscriminately.

A cat that kills rats and mice can be considered a biological pesticide. Some kinds of birds can control insect pests that harm crops. Praying mantises and ladybird beetles have been used effectively in controlling some kinds of garden insects. Natural predators like these should be protected because they help control pests without expense.

Scientists have been experimenting with importing animals that prey upon pests. This control method can create other problems, if the impact of the introduced animals is not predicted accurately.

Another method of biological control involves sterilizing and releasing the males of the insect pests. When these males mate with the females, no young are produced. This type of control has been very effective with a kind of fly that attacks livestock. However, it has not yet been shown that the method works well with all kinds of insect pests.

OTHER CONTROLS

Scientists have developed substances which attract certain pests. When the pests gather in one spot, they may be trapped and killed with a safe pesticide. Experiments in pest control have also been done using sound and light as repellents or attractants.

Another way of controlling pests is by changing man's use of the environment. Instead of planting large areas with the same crop, farmers could plant different kinds on the same land. This would tend to reduce the number of pests. By varying the times of planting, spacing the plants farther apart, developing pest-resistant crops, and practicing other good agricultural methods, the problem of insect pests will be reduced.

Mosquitoes can be controlled by draining their breeding places. Drainage methods should be applied only when valuable wetlands are not destroyed in the process. Many pest problems can be avoided through good sanitation programs in dumps and other man-made breeding places.

Still another pest-control method is through the use of mechanical traps and devices. Although these methods usually require more manpower and expense, the total environment is less affected. A mousetrap and a fly swatter are two examples of mechanical pesticides which do not contaminate the environment.

RESPONSIBILITY

The Department of Agriculture, which is responsible for regulating the use of pesticides, urges their safe use. Misuse can lead to harmful results. It is important that people using pest-control chemicals understand the problems and risks misuse can cause.

ACTIVITIES

1. Problems involving pesticide use are often difficult to resolve. Have the students discuss and try to resolve the following situation which actually occurred in Florida. Have them role-play some of the people representing different positions regarding the controversy.

Situation--State authorities requested permission from the government to spray DDT on the seaweed along the beaches to control flies. The flies.were the flie

nuisance and were affecting the important tourist business in the area. The Department of the Interior refused to allow the spraying because of the danger to the shtimp-fishing industry in the Gulf of Mexico.

2. Have the students develop a list of suggestions or rules for the proper use of chemical pesticides around the home. Ask them to consider the effects on beneficial insects, the proper amounts to apply, the alternative non-chemical means for dealing with pests, and the danger of hard pesticides entering water systems. Make a survey of the hard pesticides used around the home. Read the pesticide labels. What kind of information is provided?

3. Find out about some kinds of soft-chemical pesticides which do not persist in the environment for very long. Some examples are nicotine sulphate, pyrethrum, rotenone, malathion, Abate, and Sevin. What are their advantages and disadvantages?

4. Have the students trace some animal food chains to discover how various fish-eating birds gradually concentrate high amounts of certain pesticides in their bodies. Make "What Eats What?" posters showing how hard pesticides can be passed from one animal to another through their diets.

5. Have the students do research to find out about the historical use of pesticides. For example, read how Paris green stopped the outbreak of the Colorado potato beetle in the middle 1800's; how Bordeaux mixture saved the wine industry in France; how DDT was hailed as a miracle of science in saving millions of lives.

6. Discuss some of the consequences of completely banning the use of certain hard pesticides. How would this decision affect:

(1) the death rate around the world,
(2) the price of certain foods and fibers
(3) the appearance of certain produce
(4) the labor force of involved industry? Is the price too high to keep hard pesticides from contaminating the environment?

DOCTORAL DISSERTATION STUDIES OF INTEREST TO SCIENCE EDUCATORS

Staff

The following information is a listing of titles, researchers, and specific volume and page numbers for a selected sampling of doctoral studies of interest to elementary science methods instructors. In each instance the information is from DOCTORAL DISSERTATION ABSTRACTS - UNIVERSITY MICROFILMS found at the Bloomsburg State College Andruss Library. The volume number (ex. 27:) is followed by the page numbers involved. These studies would be of personal interest to a science educator, or could be used as assignments for undergraduate and graduate students.

1. An analysis of elementary science textbooks and their relations to science programs in three districts in New York City, T. G. Vinci, 27: 3766-A
2. Changes in attitudes toward science and confidence in teaching science of prospective elementary teachers, E. A. Oshima, 27: 4157-A

3. The development of conceptual framework for the construction of a mulci-media learning laboratory and its utilization forelementary school science A. R. Haugerud, 27: 2942-A
4. Planning elementary school science facilities, L. J. Heldman, 27: 2783*A
5. The effectiveness of a procedure for teaching quantitative physical science in grades six through eight which employs a conceptual scheme involving dimensional description coupled with unit operator analysis, R. E. Smith, 27: 2753-A
6. Determination of competence in the AAAS elementary science curriculum of elementary school teachers in two Florida counties, R. A. Lane, 27: 2426-A
7. Machines, materials, and energy: a source book for the modern elementary school science program of the science manpower project, W. Croasdale, 27: 2420-A
8. An experimental study of the development of science continua concepts in upper elementary grades and junior high school children, J. A. Brusini, 27: 2094-A
9. The effectiveness of cooperative planning upon children's acheivement in science, W. R. Zeitler, 27: 1727-A
10. Science interests of elementary school children as revealed by a forced choice questionnaire, M.C. McElhinney, 27: 606-A
11. An examination of some effects of pupil self-instruction methods compared with the effects of teacher-led classes in elementary science on the fifth grade pupils, W. P. Gleason, 27: 1656-A
12. Measuring elementary school children's ability to use evidence from scientific instruments in decision-making situations, R. W. Menefee, 27: 117-A
13. An exploratory study of science achievement as it relates to science curricula and programs at the sixth-grade level in Montana public schools, M. D. Swan, Jr., 27: 4175-A
14. A study of the effectiveness of selected creative exercises on creative thinking and the mastery of a unit inelementary science, E. F. DeRoche, 27: 4162-A
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