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AN AREA COURSE IN ACTION

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(A report of an area course in the natural sciences as developed and taught at
The College of the Ozarks, Clarksville, Arkansas)

"Modern College Education: Does It Educate in the Broadest and Most Liberal Sense of the Term?" The writer of the article bearing this title continued by saying that, "However much a class of professors, safe from the world's clamor within their own cloisters, may imagine that the education which young men receive is satisfactory and the best that can be given them, they must eventually come to recognize that there is a large and growing class of men who think that a great portion of our university education is absolutely wasteful...

courses that are essential to a man's proper development, subsequent success (success being meant in its best sense) and usefulness to himself and his fellowmen and are entirely omitted or so imperfectly treated as to be of little value....


Yet this author fifty years ago asked the same questions we as teachers and educators are asking ourselves today. We feel that with so many specialized areas requiring specific skills and techniques, our college and university curricula frequently leave our graduates totally unprepared to meet the confusions, complexities and pressures of our family, community, national and international environment. In an effort to overcome this lack in the education of our youth, new courses, new combinations of courses, study of great books, discussions of great issues, core curricula--all have been proposed as possible solutions. As yet no answer has been found, nor probably will be found soon, but we continue to seek and to experiment.

Many educators have advocated the area course, a course dealing with the broad basic principles in an entire field such as the natural sciences, as a means of giving the student a better understanding of the different phases of his environment.

This is a report of an area course in the natural sciences as developed at
The College of the Ozarks. Two years ago we discussed before this academy the place of area courses in the field of natural sciences. As a follow-up study, we gave out a questionnaire here and at the science division of The Conference on Higher Education (1949 meetings). Fifteen replies were received representing nine Arkansas colleges and two out-of-state colleges. (In some cases replies were received from more than one instructor in the same college)

The replies showed that a number of the science instructors in Arkansas are interested in a non-technical science course which emphasizes broad basic principles of both the physical and biological sciences. There was a good deal of agreement as to content, nature of the course, and time allotted to physical and biological material and as to the method of presentation.

The topics which a majority felt should be included can be summarized under
about eight major subjects--matter, its structure, properties, changes; energy, sources, kinds, transformations, electricity, heat, light; geological ages and earth history, formation of soils, weather and climate; evolution; solar system, structure and origin; food and food production; physiology of the body systems; health and disease control. One very practical suggestion was that the course should include a study of local flora and fauna.

The Cosmopolitan: John Brisbane Walker, editor, February, 1900, Volume XXVIII No. 4.
A separate course in the biological and physical sciences was preferred 10 to 5, although the combined course was considered ideal. The method of teaching preferred was the lecture-demonstration-laboratory plan (9 of 15). Most agreed that less time should be spent on lab.--more demonstrations (10 of 15). One teacher in charge was considered most effective (8 of 15). Nearly all allotted equal amounts of time to the biological and physical material.

This information was helpful in developing our area course at The College of the Ozarks. The faculty voted to offer such a course and after the division of natural sciences discussed objectives and general plans, we were asked to develop and teach the course. The experiment began with the spring quarter of 1950.

The course was to be a two-quarter course combining both biological and physical sciences. (If this were the ideal plan, then why not try it.) We set up these specific objectives for the course.

1. To give the student certain concepts and principles of science that will help him see the many interrelationships of scientific development and everyday living.
2. To instill in the student the idea of approaching every problem with an open mind, collecting all possible data on the problem, and giving the data critical appraisal before reaching a decision.
3. To help the student have an understanding of the history and development of science.
4. To give the student an understanding of the value of fundamental and applied research, the need and use of both in our day by day living.
5. To have the student feel the sense of orderliness in the universe, in our planet, and even in our own lives from the microscopic to the astronomical.
6. To develop in the student through the study of the precise laws and relationships of our natural world, a number sense and an appreciation of quantitative values.
7. To enable the student to become familiar enough with the general terminology of science and to have a background for reading intelligently and critically books and articles on scientific matters.
8. To have the student become aware of the fact that scientific developments have produced definite and profound changes in our social and economic life; that such advances as the control of diseases, improvement in medical and health practices have brought new problems in population distribution, in the feeding and care of the world; that these new problems must be solved; and that, with the solving, other problems will develop which will have to be solved--that there always will be a challenge to the thinking person.

Most of all, we wanted our students to see that science is ever seeking the truth and that each new discovery brings changes in the total picture, discards old theories, revises others, opens new vistas and brings us a bit closer to ultimate truth and understanding. Such were our aims in planning the course.

These aims were more of a challenge than they might seem when put alongside the student's reasons for taking the course. The first two classes (36 students) were asked to list the reasons why they were taking the course. Twenty-three listed first "Required" (The course itself was not actually required but could be taken instead of the usual science requirement.) Three listed "Required" second; two listed it third. It was somewhere on each list. A few mentioned an interest in science and some in-service teachers thought it would help them in teaching One took it because it fitted into his schedule. So with ego properly deflated we launched our area course.

The course was built around four major questions. First, "Where did we come from?" This dealt with matter and energy as beginning materials, the relationship of one to the other, basic laws, nature and forms. Following the study of the basic entities we took up origins--origins of the universe, solar system, earth and finally life.
After that was "How has life changed and developed?" The geological ages, changes, physical and biological, in our universe were presented. Environment and our relationship to it and it to us was studied emphasizing both the physical and biological factors.

The third question-- "What of today?" had to do with the problems of maintenance of life, our basic needs for survival, natural resources and their conservation, sources and utilization of power, health and disease control, heredity in race and nationality problems. The role of scientific research in solving these problems, chances of survival, problems yet to be solved--were all considered.

The last question--"What next?" was a sort of look into the future. The place of eugenics in our development, the possible uses of nuclear energy, applied versus pure research, the need, value and purpose of each, the possible direct utilization of the sun's power, cosmic rays and their place in the energy picture--even space explorations were discussed. Of course, no definite answers could be supplied, but we did attempt to make the student conscious of these factors in our life, the possible developments and the need for serious and concerned thought about these possibilities and their effect on our present social order.

Dr. Beach, the present instructor, has been following about the same general plan. His major units are (1) Raw Materials, (2) The Structure of the Universe, (3) The Physical and Biological Factors of Environment and the Inter-relationship of the Environment with the Individual and (4) Problems of Maintenance and Survival. Our detailed outlines of these units paralleled each other very closely in the actual material covered.

Evidence that these major questions were of special interest to the students was shown in the topics listed by them at the beginning of the course as topics they would like discussed.

The topics listed most often were:
1. The relationship of man to his environment, getting acquainted with our natural world, sources and production, control of human machine, and why air is useful to man.
2. The origin and development of life, the universe, the solar system, and names of planets and constellations.
3. Conservation of our natural resources.
5. Meteorology and weather conditions.

Several said they would be interested in any topics which might be studied--since "I don't know anything at all about science." Notice the agreement of choice in topics to be studied as listed by instructors and by students. It gives us reason to believe that these major issues should be the basis of any general course in the natural sciences.

Dr. Beach and I also followed somewhat similar methods of presentation of material. We used the lecture-demonstration-laboratory combination preferred by most of the instructors of the state answering our questionnaire. There were no assigned laboratory periods. Demonstrations as well as individual experiments were performed during the class period. Occasional field trips were made. Also the students had certain projects they had to bring to class. A collection of different minerals found nearby, and of local animals and plants was required. These collections were small but helped the student to become aware of the complex living and non-living environment of which he is a part. A film on the motions of the solar system was used. (Others are available and should be used.) Oral reports for which extra points could be earned were quite popular. Class discussions were a favorite with most students and showed serious interest in the major issues of science. Frequent panel discussions assured everyone a chance to have his "say". Material for their discussions came from reading references in periodicals, newspapers, current magazines and books. In fact, no one textbook was used--only references.

Testing and evaluation has always been a problem. Since in this course there was both factual and debatable material, we used the objective and the essay type questions for examinations. Quizzes were given rather frequently.
Dr. Beach gave weekly quizzes using about half of the period for each test. We gave tests at the end of each of the smaller units into which the major ones were subdivided. These came every two or three weeks. There was a final test over the entire course. This was counted as approximately one-fourth of the student’s final grade.

Some sample questions from both Dr. Beach’s and my tests are:

1. Name the form of energy described: waves transmitted by water_____, molecules of gas in motion (not kinetic)______, electrons traveling through metal______.

2. The third planet from the sun is______.

3. What possible sources of energy may be developed in the future?

4. Can scientific methods and principles be applied to social and moral areas? Explain your answer.

5. Name factors that (a) favor and (b) hinder the spread of living species over the earth.

6. Does a highly specialized or a generalized type of organism have the most chance of survival? Explain.

7. What activities remove oxygen from the air, and what other activities return oxygen to the air?

8. List four problems facing the survival of man and suggest possible solutions science may be able to offer.

9. Discuss one of the theories of the origin of the solar system. Give evidence to support and to refute the theory.

Of course, many of these discussion questions have no specific answer. If they did all our problems would be solved. But evidence was weighed pro and con, possibilities suggested and discussed. The part scientific research and development might play in the solutions, the resources available, developed and undeveloped, were mentioned with the hope that the student might become more aware of vital problems facing him, the methods being used to find a solution and some of the possible solutions. For example, soil improvement and conservation, hydroponics, more nutritious foods, synthetic foods were some of the factors discussed as having a part in the food problem. In these discussions we hoped not only to make the student conscious of the problem but to give him sufficient factual background on the problem to enable him to weigh evidence and make judgments on an understanding basis.

The proof of the pudding is in the eating— and the real test of the course is “What did the students think of it?” and “What did they get out of it?” Seeking an honest evaluation of what the students really thought of the course, we gave a questionnaire at the end of each term. The students were told to be perfectly frank and that the answers would have no effect on the grades--in fact would not be read and tabulated until after the grades were in. Most of the answers seemed to indicate that the students tried to make honest evaluations.

Of the eighty-one taking the course, sixty-two turned in replies to the questionnaire. We will let the replies speak for themselves.

1. Has your interest in scientific development and research been stimulated by this course?
   (59) Yes  
   (3) No

2. If so, in what way?
   (43) Realize the impact of science in our daily life is greater than I ever thought.
   (28) Understand and appreciate more the development of our modern conveniences.
   (16) Read more articles and books of a scientific nature.
   (14) Are interested in studying national issues controlling scientific research.
   (13) Desire to study more in detail some particular field of science. (This was interesting and encouraging.)
3. Has this study helped you to understand scientific data and articles about scientific work?
   (60) Yes
   (1) No

4. If so, in what way?
   (53) Find such articles more interesting now since I have studied in class some of the topics discussed.
   (22) Have learned the meaning of certain scientific terms commonly used in scientific literature.
   (10) Know the meaning of formulas commonly listed in scientific articles.

5. List the topics about which you learned something new.
   (19) The origin and development of life--geological ages, cell theory, etc.
   (19) The structure and organization of the solar system, planets, planetary motions, origin, earth history.
   (16) Reproduction, sexual and asexual.
   (13) Atomic energy, use and development.
   (13) Energy, laws, transformations, kinds, sources, possible development.

   (22) Wanted more laboratory work and student projects (Compare this reply with the reply from the instructors in which less laboratory was favored.)
   (21) Wanted more student discussions. (Evidently our students like to be a part of the class--not just to be talked at.)
   (10) More specific study questions to answer.
   (9) More lectures.
   (4) More outside lecturers.
   (7) More student reports and papers. (Again the student wants to do something in class.)

7. How would you prefer to spend your time in the course?
   (9) Physical Science alone.
   (4) Biological Science alone.
   (13) Separate course for Biological and Physical Sciences.
   (2) Some specific science.
   (34) Gave no answer or stated specifically they liked the course as it was.

8. Should we spend more time on certain topics and go into them more in detail?
   (25) Yes
   (29) No
   (8) No answer

9. List topics about which more should be discussed. The subjects suggested most frequently were:
   Origin of life, universe, solar system, geological ages.
   Research in medical and health problems.
   Food problems.
   Nuclear energy and genetics.

10. Should we spend less time on certain topics and study more topics.
    (9) Yes
    (50) No
    (3) No answer

11. List topics on which too much time was spent.
    None listed.

12. List topics which were not discussed or were not discussed enough but which you feel should be emphasized. The topics listed were:
    Conservation of our natural resources.
    The development of man.
    Disproving superstitions.
13. What suggestions do you have for improving the course?
   (19) A regular textbook.
   (13) More copies of the reference books.
   (13) More detailed outlines.
   (11) More current articles.
One very helpful suggestion, one we plan to adopt, was to have a scientific word list, listing terms which would be used throughout the course. Again, more lab. was suggested.

14. What criticisms do you have of the course?
   (45) No criticism.
   (12) Over my head most of the time.
   (4) Too general.
   (1) More lab. and student projects.
One student very emphatically stated he didn’t see why the instructor’s viewpoint was the only correct one. (Neither do we—but that’s what he said.)

15. What should the length of the course be?
   (35) Two quarters.
   (13) Three quarters.
   (9) One quarter enough.
   (5) No answer.

16. Would you have taken the course had you known at the beginning more of the nature of the course?
   (53) Yes
   (3) No
   (6) No answer

17. Do you prefer this plan of meeting the science requirement for graduation?
   (49) Yes
   (5) Prefer present plan of 10 hours of specific courses in biology, physical sciences or mathematics.
   (8) No answer.

Summarizing the results of the questionnaire, we might say these conclusions express the opinion of the majority of the students.
1. There was an increased interest in science and a better understanding of its impact on our daily life. Thirteen felt they wanted to continue their study, taking up some particular field of science.
2. The students found science articles on topics about which they had studied in class more interesting.
3. They definitely wanted more student participation in the course, more laboratory work, more reports and student projects, more student discussions.
4. In general the combined course was preferred. Although a few (13) would like separate general courses in the two fields, only 2 preferred the traditional specific beginning courses such as Botany 101 or Chemistry 101.
5. Only 9 wanted more topics with less time on each. No topic was listed as one on which too much time was spent.
6. A goodly number (19) wanted a textbook, but most of them wanted either more copies of the references, more references or more current articles.
7. Most of the students had no criticism of the course. Four thought it too general and 12 felt it was over their heads most of the time.
8. Two quarters was thought to be sufficient for such a course.
9. Most of the students liked the course and preferred it to the present science requirement for graduation. Only 5 of the 81 thought the present plan of 10 hours in a specific science or in mathematics better. Only 3 of the students would not have taken the course had they known in the beginning more about the nature of the course.
Some of the comments about the course were revealing in themselves and are quoted here for whatever consideration and evaluation they merit.

"If the second quarter will be as interesting as the first, I wouldn't miss it for all the tea in China."

"This course should help a student decide what particular field of science he would like to follow."

"My education would have been incomplete without this course. If I had known what I was missing I would have minored in science." A senior physical education major.

"I never cared for science until now--my curiosity has been aroused, and I am going to pursue more knowledge of it."

"The instructor has set the mold and we as students were expected to come out perfect finished products....why be so specific on examples of scientific principles unknown in the natural environment of a majority of the class?" The same sophomore in education who felt the only acceptable viewpoints were the instructor's.

"Feel my time in this class well spent. I appreciate your attitude in every way."

"I have had questions answered about which I have wondered but didn't know how to go about getting the answers for myself."

"I have learned many things in this course that will help me in my school work." This was an in-service teacher.

"Stimulates thought and brings an appreciation of the things we have now."

"The course offered just what I wanted and needed. I do not desire to study and particular field of science but to be able to observe natural science day by day and to know something about scientific terms as used in newspapers and magazines as connected with current events."

What then, if anything, can we conclude about the course? Is it worthwhile? Does it have a place in the natural sciences? Does such a course have a place in the college program of our youth? Did we achieve our objectives?

We can draw no absolute conclusions. From the comments of the students and from their responses on the questionnaire, we feel a definite interest in science was developed and that this interest was reflected in increased reading of scientific articles in current magazines, periodicals and newspapers. Evidence of this was further shown by the fact that the students brought to or told the instructor of interesting articles on science--even after finishing the class. We also feel that those who took the course are more aware of the role science plays in their social, political and economic life and of the role research, fundamental and applied, has had in our development.

We accomplished little in developing a number sense in the students. A specific mathematics course of basic principles will probably have to be given to develop particularly a quantitative sense.

Nor can we claim that each of our students henceforth will examine every issue he faces critically with an open mind. In fact, we are sure most will not. Age-old prejudices continually cropped up and persisted regardless of actual facts presented. The "I don't care if it is so, I won't believe it" attitude was not erased. Neither was the, "This is the way it is" attitude lost. Background--miner, teacher, farmer, politician, high or low income--all played their part in the interpretation and acceptance of the material presented. (Doesn't it fit for all of us?)

But we do believe that at least a few new ideas slipped in. A fair majority looked honestly and critically at some of our major problems in which science plays a great part--and were challenged.

The course seems to be meeting a real need for the non-science major at The College of the Ozarks. And since it seems to meet a real need we feel it has its place in the division of natural sciences. The fact that the enrollment in the course has increased and remained around twenty-five would seem to indicate continued interest.
As to its worthwhileness--only the students themselves will eventually answer that. Its ultimate worthwhileness can only be determined as those who have shared in its development as guinea pigs take their place in our complex society.

At least the teaching of the course has been a stimulating and interesting experiment to Dr. Beach and the author--one worth continuing--with certain revisions.