1948-49

Appendix I

Projected Basic Science Course for Bennington College

At a joint meeting of the Faculty and Student Committees and after discussion with President Conant the following outline was agreed upon. Only the general headings are given, the details being understood as outlined in the plans of the two committees. It was further agreed that the general purposes would be sufficient in any case, since the instructor of the course would undoubtedly want and should have freedom in the selection of his own subject matters under each heading.

I. First Semester

The Main Characteristics of Scientific Method
Lecture, discussion and demonstration: Laboratory
By means of selected case histories to illustrate the main characteristics of scientific method. Crucial experiments and historical scientific controversies to be selected so as to bring out clearly the following:

(a) The nature and problems of observation
(b) Classification, definition and measurement
(c) The role of instruments
(d) Experimentation - its nature and significance
(e) Hypotheses and theory
(f) The role of mathematics
(g) The sciences as conceptual systems

II. Second Semester - First Half

The Social Relations of Science. Lecture, discussion

(a) The impact of science
(b) The relation of science to political planning

III. Second Semester - Second Half

The extension of scientific method to fields outside the natural sciences
Lecture, discussion, field work
The class during this period to be divided into groups each of which will work on problems in social areas. The aim is to achieve an understanding of the application of scientific method to such problems, the revision of method demanded by different subject matter, the different conditions of observation and testing.

Appendix III

Analysis of Answers to Methods of Science Questionnaire

The following is a summary of replies to a questionnaire filled out by 18 of 22 students in the course Methods of Science as taught by President Burkhardt. The questionnaire covers only the first semester of the course. As taught by Mr. Burkhardt the course included no laboratory experience and very little demonstration. The replies on this aspect of the course are particularly significant in view of the fact that none of the students had ever had a college laboratory course, and most of them admitted to having avoided such a course in the past.

The questionnaire indicates the books and subjects covered in the course. The course, in outline, was as follows:

I. The Medieval World-View
II. Astronomy - its development up to Copernicus
III. The Copernican versus the Ptolemaic Hypothesis
IV. Galileo versus Aristotle: Mechanics
V. Brahe, Kepler, Huygens
VI. The Newtonian Synthesis
VII. The Chemical Revolution: Lavoisier versus Phlogiston
VIII. The Atomic Theory - Dalton, Avogadro
IX. Evolution versus Creation - The Darwinian Hypothesis
X. Modern Physical Theories

(1) (a) Students were asked to grade each of 19 assignments on the basis of interest, difficulty, and value to the course. (Minimum grade - 0; maximum grade - 5). The answers have been tabulated and the arithmetical averages of these answers are given below. (Averages are to the nearest one-half.)

	No. of Replies	Interest	Difficulty	Value to Course
Jeans, Growth of Physical Science	17	3.5	2	4
Armitage, Sun, Stand Thou Still	18	3.5	.5	3.5
Randall, Making of the Modern Mind	16	4	2	3
Galileo, Two New Sciences	18	3	4	3.5
Wolf, History of Science, Philosophy and Technology in the XVII Century	16	3.5	2.5	3.5
Conant, On Understanding Science	17	4.5	2	4.5
Moulton-Shefferes, Autobiography of Science	16	4	1.5	4
French, Torch and Crucible	15	3.5	1	4
Scott, Theory of Evolution	15	4.5	1.5	4.5
Bacon, The New Organon	12	4	3	4
Descartes, Discourse on Method	18	4	2.5	4
Ornstein, The Role of Scientific Societies	9	3	1	3
Vallery-Radot, Life of Pasteur	14	3.5	1	3
Einstein and Infeld, Evolution of Physics	11	3	3.5	3.5
Holmyard, Makers of Chemistry	18	4	1.5	4
The Colgate Syllabus	17	4	1	4
Krauskopf, Foundations of Physical Science	9	3.5	1.5	3.5

Appendix III (cont.)

Lemon, From Galileo to Cosmic Rays	14	3.5	1.5	3.5
Hecht, Explaining the Atom	12	4	2	4

It will be noted that the averages place all items above the middle grade for interest and value. Three of them (Two New Sciences, The New Organon, and Evolution of Physics) are above the middle grade for difficulty. Only one (Two New Sciences) is graded higher in difficulty than in either interest or value. One other (Evolution of Physics) is graded higher in difficulty than in interest.

The answers showed great diversity of opinion concerning the various assignments. In most cases at least four of the six possible grades were represented.

The close agreement between grades for interest and value was in general present on individual questionnaires as well as in the averages.

In general, high interest does not seem to be correlated with low difficulty, as might have been expected.

(1) (b) The assignments were:

	No. giving this answer
Too long	0
About right	16
Too little	2*
	18

*Both Junior Division students.

(2) Other books recommended for assigned reading:

(Six students made suggestions)

Marx, The German Ideology
Otto, The Human Enterprise
Dewey, Reconstruction in Philosophy
Aldous Huxley, After Many a Summer Dies the Swan
Leo E. Saidla and Warren A. Gibbs, Science and the Scientific Mind
Paul DeKruif, Microbe Hunters
Darwin, Theory of Evolution /sic/
Farrington, Science in Antiquity

(3) Circle the answer which expresses your opinion:
Do you think your understanding of this course would be improved by
(a) Regular laboratory demonstrations? Yes No
(b) Some laboratory experience? Yes No

There probably was some confusion about this question. Some probably thought that laboratory experience presupposed demonstrations, and therefore that a "yes" answer to (b) should be accompanied by a "yes" answer to (a). Others must have thought demonstrations and experience were to be considered separately. The combination answers and total answers are shown below.

Appendix III (cont.)

Combination answers:			No. giving this answer
	Demonstrations Experience	Yes) No)	1
	Demonstrations Experience	No) Yes)	6
	Demonstrations Experience	Yes) Yes)	6
	Demonstrations Experience	No) No)	1
	No answer on Demonstrations Experience	)) Yes)	4
Total answers:	Demonstrations	Yes	7
	Demonstrations	No	7
	Experience	Yes	16
	Experience	No	2

Only one person indicated that she thought neither demonstrations or experience desirable.

(4) Check the sections of the course you found most worth while. Draw a line through those you thought were duds. Leave well enough alone.

	No. giving this answer			
	Most worth while	Duds	Well Enough	Total
(a) The Medieval World View	13		5	18
(b) Copernicus and Astronomy	9		9	18
(c) Galileo and Mechanics	5	2	11	18
(d) The Newtonian Synthesis	7	2	9	18
(e) Phlogiston versus Oxygen	13	1	4	18
(f) The Evolution Theory	10	1	7	18
(g) The Historical Material in the Course	10	1	7	18
(h) The Philosophical Material in the Course	13	1	4	18
(i) The Logical Analysis of Scientific Method	15		3	18
Total	95	8	59	162

(5) Do you think the case study method is on the whole successful in providing an understanding of scientific method?

	No. giving this answer
Yes	16
No	1
Partly	1

Appendix III (cont.)

(6) Do you think more direct analysis of scientific method in class would be desirable?

	No. giving this answer
Yes	10*
No	6
?	2

*2 of the 10 thought it could be done in 2nd term.

Nine students answered both #5 and #6 in the affirmative.

(7) As the course was taught this semester, do you think the level was best for Junior Division or for Senior Division students?

	No. Junior Division Students giving this answer	No. Senior Division Students giving this answer
Junior Division	9	2
Senior Division	2	1
Either	1	1

2 students did not answer this question.

(8) Check whichever of the following represent your views.

		No. who checked this statement
(a)	The class was too large.	8
(b)	There was too much lecturing, not enough discussion.	2
(c)	The theme of the course was difficult to follow.	4
(d)	A scientist should teach this course.	1
(e)	Someone else should teach this course.	0
(f)	The course was on the whole worth while.	16
(g)	More time should be left in the first semester for a thorough, systematic summary of the scientific methods illustrated in the case histories.	7

Of the two who did not check (f), one checked only (c), the other checked only (g).

(9) In your opinion does this type of course give promise of providing literacy in science for the unscientific student?

	No. giving this answer
Yes	16
No	2

One of the two who answered in the negative qualified her statement by saying, "In understanding method, yes; in eloquence on the subject, no."

Appendix III (cont.)

(10) Do you feel you have a better understanding of science than before?

	No. giving this answer
Yes	17
No	1

(11) Of the 18 who answered the questionnaire, 9 commented under #11, or elsewhere. Two of the 9 said only that they thought the course was very satisfactory.

The two students who checked (b) under question (8) commented on the need for more discussion, one suggesting more short papers, the other hoping there would be some means by which the class could be got to read more and therefore "feel capable of discussing the posed questions". The latter thought additional optional references might be helpful.

One person suggested that the 2nd term might be devoted to the "social aspects" and another said she would be interested in a study of Marxism in relation to science. She added: "How about statistics?"

Two people thought more time should be given to certain phases of the course. One of them had checked (a), (f), (g), (h), and (i) under question (4). The other had checked (a), (d), (e), (f), (h), and (i).

Three people felt that it would help if the aim of the course were clearer at the outset--if the line were more direct--if they knew what to look for.