



Science/Technology Education in Church-Related Colleges and Universities

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A Pilot Study Of The Present Condition Of Undergraduate Science And Technology Education In Church-related Colleges As Perceived By Department Chairpersons

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A Pilot Study Of The Present Condition Of Undergraduate Science And Technology Education In Church-related Colleges As Perceived By Department Chairpersons

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Methodology

1215 Chairmen of Biology, Chemistry, Physics and Natural Science departments of 794 church-related colleges were asked to complete and return a thirty seven item opinion questionnaire; designed to assist ITEST efforts to determine the current and projected status of science and technology education on the undergraduate level in church-related colleges. This study is intended to be exploratory, i.e., a pilot. Respondents were asked to select one of five levels of agreement - disagreement or no opinion. Information was requested on the number of baccalaureate degrees awarded in 1988. Four statements designed to elucidate respondents opinions on science and technology education within their college or university were included: 301 responses (24.7%) were received: from chairs of Biology (94), Chemistry (96), Physics (74), and Natural Science (35). (Nineteen responses were received too late for inclusion in tabulations).

190 respondents volunteered the names of 28 denominations and 127 did not specify their college or university denomination. Geographical distribution was national.

Responses to 37 questions were scanned and converted into a continuum scale based on 5 as the highest value of agreement with each statement: (5) strongly agree; (4) agree; (3) no opinion; (2) disagree; (1) strongly disagree. The five levels of responses were also combined into agree, disagree and no-opinion and are reported as percent distribution. Results are contained in Appendix #1. Of the four opinion statements provided for respondents comments, 274 were returned. Of these, 68 diverse and provocative statements were selected and are reported in Appendix 2. Chairpersons also sent twelve mission statements and seven offered additional opinion statements.

Recommendations

Following is an abstract of the survey based on review of responses to the 37 statements in tandem with the essay or opinions offered by the respective chairs. The investigation suggests that church-related colleges' faculty and administrators should upgrade their denomination's and the public's perception of the unique mission of church-related colleges' role in the education of generalists' and professionals' ability to integrate and act on scientific and theological knowledge and insight.

ITEST should conduct a follow-up study focused on the educational philosophy of church-related colleges; the desirability of integrated course(s) that address:

1. Ethics of sci/tech *per se* (2) sci/tech based issues on social justice and ethical matters concerning man, earth, environment, space); (3) comparative methodologies of science, technology, religion and social sciences.
2. Plan a 1990 conference organized to develop curricular materials designed to assist church-related colleges faculty to interrelate theological and science and technology instructional goals and objectives through courses, seminars and lecture series.
3. Encourage the formation of denominational and college consortia focused on science and technology, theology and public policy. Note this should be pursued in conjunction with the executives of church-related

higher education groups, council of independent colleges and the various denominational college and university organizations.

4. Participate in initiation and support of legislation designed to support education of scientist and technologists with special focus on facilities, training and scholarships, including recruitment of minority faculty and students.

Abstract

1.1 - 1.5

Church-related Colleges are committed to preparation of Baccalaureate level graduates for advanced studies in the sciences and technology. Respondents consider science as essential to the Liberal Arts and science degree programs offered by their respective institutions. However science and technology instruction as a component of religious education or within their colleges denominational tradition is minimized.

The concept of methodological comparability between science and religion is apparently denied, which suggest that instruction in theological methodology is missing thus diminishing the basis of conversation amongst and between scientists and theologians. (The investigator assumes that scientific methodology i.e., beyond technical competence is paramount in undergraduate science instruction regardless of the role of the department, i.e., pre-professional, devoted to liberal education, *per se* and/or to the religious and philosophical rationale of the respondents college).

A more positive attitude is expressed when the inquiry is focused on ethical aspects of religious practice.

1.6 - 1.8

The “priority” of sci/tech as measured by recruitment, support of students, and curricular status viewed more positively by biologists with natural scientists the least, with, however, a low margin of difference among the four disciplines. (Do church-related colleges with limited resources imperil professional, liberative and integrative goals by reliance on a multi-science department’s limited faculty and curricula, in spite of the conviction that instruction is adequate for admission to Graduate School)?

2.1 - 2.5

Contrary to prior investigations (Oberlin, NSF), proposed Federal college facilities legislation, institutional advancement agenda and philanthropic strategies, respondents believed that the overall church-related colleges’ science infrastructure is adequate.

3.0 - 3.4

Church-related colleges’ faculty are well qualified and committed; compensation is adequate; church-related colleges’ sci/tech departments might be enhanced with additional members. Note the increasing number of projections of faculty and replacement into the next century.

4.1 - None too complimentary.

Respondents assessment of pre-college (secondary school) preparation is provided for comparison:

CHAIR BIOL CH PH NS AV

PRE-COL

4.1 Math	2.46	2.50	2.37	2.31	2.41
4.2 Bio	3.34	3.88	3.45	3.40	3.51
4.3 Ch	2.85	2.98	3.20	2.68	2.92
4.4 Ph	2.67	2.39	2.64	2.22	2.48
4.5 Other Sci	2.86	2.94	3.01	2.71	2.88
Average	2.84	2.94	2.93	2.66	2.84

5.1 - 5.10

Church-related colleges were founded to manifest an impressive range of values from intellectual, education of clergy and laity, evangelical and salvational. And, as scientific and technological advances have cascaded through our culture and institutions, increased sensitivity to the fragility of the earth and people has followed. That entering students score lowest on global issues and relatively higher on life style choices suggest that definition of church-related college’s mission to its students lives and to global issues is more critical now than in less informed times:

6.1 - 6.6

Polarization characterizes section 6. Church-related colleges’ chairs are clearly dedicated to the function of scientific and technological literacy and competence within faith-based liberal arts and pre-professional Baccalaureate degree programs. Items 6.1 - 6.4 suggest a strong commitment to the CRC mission. Item 6.5 dispels assumptions that there is a unified or organic approach to the pedagogic integration of disparate intellectual systems. As to Item 6.6, ITEST’S mission is one of encounter i.e., to come upon face to face. This survey suggests that ITEST is uniquely qualified to pursue the dynamics of encounter in that precious environment, the church-related college. Over 300 CRC/CP’s are amenable to a dialogue and in need of support.

CHAIR

ISSUE	BIOL	CH	PH	NS	T
5.1 Med. Waste	1.87	2.56	2.58	2.42	2.35
5.2 Deforestation	2.05	2.62	2.63	2.54	2.46
5.3 Global Warming	1.89	2.75	2.66	2.62	2.48
5.4 Green house	1.92	2.86	2.72	2.65	2.53
5.5 Acid rain	2.09	2.92	2.81	2.48	2.57
5.6 Toxic waste	2.25	2.73	2.79	2.88	2.66
5.7 Nuclear waste	2.21	2.89	2.85	2.88	2.70
5.8 Food supply	2.27	2.82	2.78	2.94	2.70
5.9 AIDS	3.63	3.77	3.74	3.77	3.72
5.10 Drug abuse	3.74	3.96	3.77	3.88	3.83
AVERAGE	2.39	2.99	2.93	2.91	2.80

Summary

1. CRC’S are committed to preparation of scientists and technologists.
2. CRC’S are committed to teaching science and technology within the framework of liberal education.
3. CRC respondents are not convinced that science and technology instruction is a component of religious and liberal education.

4. Science and technology programs and courses generate a mixed response in rating of their priority within the CRC'S liberal arts and science degree programs.
5. A medium response on the issue of the commitment of resources to the recruitment of superior high school graduates to enter 5 tech undergraduate degree programs.
6. Disagreement with the notion that science and technology instruction and religion courses are interrelated, that is, that the methodology and content are viewed as a whole with the goal of teaching the undergraduates that both are exploratory scientific evidence-based disciplines.
7. Total concurrence in the idea that the ethical aspects of their respective religious persuasion includes knowledge of the science and technological basis of public issues.
8. It is essential that CRC'S maintain a strong presence in science and technology education within American higher education.
9. Respondents are convinced that church-related colleges can compete with public and non-sectarian institutions in recruitment and training of undergraduates to enter or prepare for graduate study in science and technology.
10. Public concern for ethical issues cannot be maintained by the community at large, the legislative, or judicial process.
11. An informed public will not suffice for well-trained, church-related, college graduates competent in the basics of science and technology in pursuit of ethical norms in issues facing American and worldwide society.
12. In keeping with prior comments on the inter-relatedness of science and religion information and methodology, respondents also indicate students are not made aware of the relationship between scientific discovery as it relates to understanding of the respective faith traditions. That such a relationship should occur was not contained within the survey and should be discussed by ITEST participants.
13. Almost total conviction that instruction is adequate in terms of admissions to graduates of church-related colleges to graduate programs in the sciences and technology.
14. through 22. All highs on the positive scale in terms of the quality of the faculty, the commitment of the faculty, 99.1, are adequate.
16. Disagree that faculty are adequately compensated for their efforts or that church-related colleges compete effectively with industry for qualified committed scientists, technologists who could be lured into collegiate teaching professions.
17. Medium agreement on the number of full and part-time faculty available for science instruction.
18. As with Oberland and other studies, middle of the road response to the adequacy of buildings and classrooms, total space available, number and quality of laboratories, support by provision of supplies, and number and quality of books and journals available in respective college libraries relevant to science technology instruction.
23. through 27. Basically low end of the scale and significant disagreement with the notion that students are adequately prepared to enter courses in mathematics, the biological sciences, chemistry and physics, or are adequately prepared for courses in other areas of the sciences. We would note that the lowest level on this scale is in mathematics and the highest level of preparation is in the biological sciences, with chemistry and physics holding the middle ground.
28. through 36. Attempt to assess student awareness of various science and technology issues yields two observations Students are minimally aware of the impact of global warning, acid rain, the greenhouse effect,

tropical deforestation, toxic waste disposal, and nuclear waste storage and medical waste disposal. They score very high in the respondents sense of the students awareness of drug issues, i.e., typical undergraduate most aware of what effects them directly, less informed on national and global environmental issues.

In response to the topic questions treated in some of the pre-papers we have the following points to make from the survey:

Is science technology education on the part of church-related Colleges really feasible, with subsets on the issue of finance as applied to the application of human and physical resources?

While the responses indicate a high level of commitment of the faculty, which in my judgment reflects commitment within the framework of the institutional mission, to support science instruction, the level of support is mixed in terms of buildings, laboratories, equipment, and supplies. It is at this point where one could return to a more reliable study of this subject with the Oberland Report of 1987 which analyzed 50 colleges and was highly effective in influencing current legislation for the support of undergraduate science education programs. Nonetheless, the church-related colleges, though not necessarily in the Oberland group, or institutions supported by other public or private sector groups, are heavily committed to maintenance of a role in science education.

However, in what way can science technologies education enrich the more general liberal arts emphasis of Church-related colleges and in what way can liberal arts enrich the science technology training are somewhat disturbing? It would appear that in science and technology as related to religion, both in content and methodology, there is little effort, perhaps little interest as well as opposition to attempting to relate scientific data and progress to impact on the fundamentals of theology and to impact on state practice, other than in the realm of ethics, as applied to primary environmental issues.

Appendix 1

ITEST Questionnaire & Responses

1.0 *Mission and status of science/technology programs at church-related Colleges*

1.1 At your college, the role of science/technology departments and faculty is to *teach science and technology* in order to prepare the next generation of scientists and technologists.

	SCALE	AGREE %	N	DISAGREE
BIOL	4.35	94.0	2.0	4.0
CH	4.50	97.0	-	3.0
PH	4.31	94.0	-	6.0
NS	4.32	88.0	6.0	6.0
	4.37	93.0	2.0	5.0

1.2 At your college, the role of science and technology departments and faculty is to teach about science and technologies component of a liberal education.

	SCALE	AGREE %	N	DISAGREE
BIOL	4.41	95.0	2.0	3.0
CH	4.26	90.0	1.0	9.0
PH	4.20	92.0	0	8.0
NS	4.34	97.0	--	3.0
	4.30	93.5	1.5	5.7

1.3 At your college, the role of science/technology departments and faculty is to *teach about science and technology* as a component of religious and liberal education within your college's faith tradition.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.68	37.0	10.0	53.0
CH	2.62	36.0	13.0	51.0
PH	2.45	29.0	8.0	63.0
NS	2.66	37.5	6.2	56.2
	2.60	35.0	9.2	55.7

1.4 Sci/Tech and religion are interrelated, i.e., students are taught that methods and content of sci/tech are relevant to religion as a field of study.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.58	29.7	12.7	57.4
CH	2.37	17.7	22.9	58.3
PH	2.29	24.3	8.1	67.5
NS	2.57	31.4	5.7	62.8
	2.45	25.7	12.3	61.5

1.5 The ethical aspect of the practice of religion requires that members of your college's faith tradition understand the scientific and technological basis of public issues.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.63	63.0	22.0	15.0
CH	3.33	61.0	12.0	27.0
PH	3.62	68.0	11.0	21.0
NS	3.51	63.0	11.0	26.0
	3.52	63.7	14.0	22.3

1.6 Sci/Tech is a *high priority* as measured by sci/tech requirements for non sci/tech students.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.05	47.0	12.0	41.0
CH	2.38	24.0	10.0	66.0
PH	2.64	28.0	14.0	58.0
NS	2.47	30.0	-	70.0
	2.63	32.2	12.0	58.7

1.7 Sci/Tech is a *high priority* as measured by active recruitment of superior high school sci/tech graduates and provision of scholarships and related support for such students.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.26	56.0	6.0	38.0
CH	2.90	40.0	16.0	44.0
PH	3.08	43.0	22.0	35.0
NS	2.85	44.0	6.0	50.0
	3.02	45.7	12.5	41.7

1.8 Our college provides *instruction* that is adequate (as measured by admission of our graduates into M.S. and Ph.D. programs in the sciences) to prepare students for careers as professionals in the sciences and technology.

	SCALE	AGREE %	N	DISAGREE
BIOL	4.70	99.0	--	1
CH	4.67	96.0	2.0	2.0
PH	4.51	97.0	0	3.0
NS	4.48	94.0	0	6.0
	4.59	96.5	0.5	3.0

2.0 Resources

2.1 The *total space* available on campus is adequate for students in our college who are preparing to enter the scientific and technological professions.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.86	63.0	5.0	32.0
CH	3.96	82.0	6.0	12.0
PH	3.68	72.0	7.0	21.0
NS	3.45	72.0	--	28.0
	3.48	72.2	4.5	23.2

2.2 *The buildings and classrooms* (age and condition) in our college are adequate for students who are preparing to enter the scientific and technological professions.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.72	75.0	2.0	23.0
CH	3.94	80.0	4.0	16.0
PH	3.72	73.0	7.0	20.0
NS	3.45	68.0	3.0	29.0
	3.70	74.0	4.0	22.0

2.3 *The laboratories* on campus are adequate for preparing students who wish to enter the scientific and technological professions.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.51	63.0	4.0	33.0
CH	3.65	70.0	5.0	25.0
PH	3.37	62.0	6.0	32.0
NS	3.48	74.0	--	26.0
	3.50	67.2	3.7	29.0

2.4 *The biological and chemical supplies* available on campus are adequate for preparing students who wish to enter the scientific and technological professions.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.82	51.0	5.0	44.0
CH	4.06	86.0	5.0	9.0
PH	3.75	67.0	24.0	9.0
NS	3.65	77.0	3.0	20.0
	3.82	70.2	9.2	20.5

2.5 *The library books and journals* available are adequate for students who wish to enter the scientific and technological professions.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.16	24.0	9.0	67.0
CH	3.31	22.0	12.0	66.0
PH	3.63	23.0	11.0	66.0
NS	2.91	24.0	5.0	71.0
	3.25	23.2	9.2	67.5

3.0 Faculty

3.1 The *quality of our faculty* (as measured by their advanced degrees) is adequate to prepare students for careers as professionals in the sciences and technology.

	SCALE	AGREE %	N	DISAGREE
BIOL	4.69	98.0	--	2.0
CH	4.70	98.0	1.0	1.0
PH	4.63	99.0	--	1.0
NS	4.68	97.0	--	3.0
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	4.67	98.0	--	2.0

3.2 The *commitment of our faculty* (as measured by the time and effort devoted to training students in class, laboratory, seminars, journal clubs, and independent research) is adequate to prepare students.

	SCALE	AGREE %	N	DISAGREE
BIOL	4.66	99.0	--	1.0
CH	4.73	98.0	1.0	1.0
PH	4.67	96.0	3.0	1.0
NS	4.51	94.0	--	6.0
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	4.64	96.7	1.0	2.2

3.3 *Number of our faculty* both full-time and part-time is adequate to provide instruction in preparation for admission to graduate school.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.80	75.0	5.0	20.0
CH	3.48	61.0	4.0	3.5
PH	3.64	72.0	3.0	25.0
NS	3.37	60.0	8.0	32.0
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	3.57	67.0	5.0	28.0

3.4 The *compensation of our faculty* (as measured by the college administration's awareness of the need to compete with industry for qualified, committed teachers) is adequate to prepare students for careers as professionals in the sciences and technology.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.80	75.0	5.0	20.0
CH	3.48	38.0	7.0	55.0
PH	3.64	49.0	9.0	42.0
NS	3.37	31.0	9.0	60.0
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	3.57	48.2	7.5	44.2

4.0 Students: Preparation

4.1 Students entering your college from high school are adequately prepared for courses in *mathematics*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.46	24.0	9.0	67.0
CH	2.50	22.0	13.0	65.0
PH	2.37	23.0	11.0	66.0
NS	2.31	23.0	9.0	68.0
	2.41	23.0	10.5	66.5

4.2 Students entering your college from high school are adequately prepared for courses in *biology*.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.34	63.0	3.0	34.0
CH	3.88	58.0	34.0	8.0
PH	3.45	45.0	50.0	5.0
NS	3.40	60.0	11.0	29.0
	3.51	56.5	24.5	19.0

4.3 Students entering your college from high school are adequately prepared for courses in *chemistry*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.85	39.0	11.0	50.0
CH	2.98	39.0	15.0	44.0
PH	3.20	42.0	36.0	22.0
NS	2.68	32.0	8.0	60.0
	2.92	38.0	17.5	44.0

4.4 Students entering your college from high school are adequately prepared for courses in *physics*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.67	31.0	16.0	53.0
CH	2.39	11.0	32.0	57.0
PH	2.64	32.0	16.0	52.0
NS	2.22	15.0	11.0	74.0
	2.48	22.3	18.7	59.0

4.5 Students entering your college from high school are adequately prepared for courses in the *sciences*, other than biology, chemistry and physics.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.86	26.0	37.0	37.0
CH	2.94	22.0	55.0	23.0
PH	3.01	26.0	49.0	25.0
NS	2.71	15.0	49.0	36.0
	2.88	22.7	47.5	30.3

5.0 Students: Awareness

5.1 Students entering your college are aware of and/or concerned about *medical waste disposal*.

	SCALE	AGREE %	N	DISAGREE
BIOL	1.87	26.0	19.0	55.0
CH	2.56	16.0	37.0	47.0
PH	2.58	13.0	39.0	48.0
NS	2.42	23.0	18.0	59.0
	2.35	19.5	28.2	52.2

5.2 Students entering your college are aware of and/or concerned about *deforestation of tropical rain forests*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.05	30.0	21.0	49.0
CH	2.62	21.0	30.0	49.0
PH	2.63	18.0	37.0	45.0
NS	2.54	17.0	23.0	60.0
	2.46	21.5	27.7	50.7

5.3 Students entering your college are aware of and/or concerned about *global warming*.

	SCALE	AGREE %	N	DISAGREE
BIOL	1.89	24.0	27.0	49.0
CH	2.75	21.0	38.0	41.0
PH	2.66	17.0	39.0	44.0
NS	2.62	26.0	17.0	57.0
	2.48	22.0	30.0	48.0

5.4 Students entering your college are aware of and/or concerned about the *green house effect*.

	SCALE	AGREE %	N	DISAGREE
BIOL	1.92	29.0	21.0	50.0
CH	2.86	26.0	35.0	39.0
PH	2.72	22.0	35.0	43.0
NS	2.65	26.0	20.0	54.0
	2.53	25.7	27.7	46.5

5.5 Students entering your college are aware of and/or concerned about *acid rain*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.09	35.0	20.0	45.0
CH	2.92	43.0	27.0	30.0
PH	2.81	26.0	35.0	39.0
NS	2.48	31.0	20.0	49.0
	2.57	33.7	25.5	40.7

5.6 Students entering your college are aware of and/or concerned about *toxic waste disposal*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.25	33.0	27.0	40.0
CH	2.73	33.0	18.0	49.0
PH	2.79	23.0	38.0	39.0
NS	2.88	37.0	17.0	46.0
	2.66	31.5	25.0	43.5

5.7 Students entering your college are aware of and/or concerned about *nuclear waste storage*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.21	35.0	24.0	41.0
CH	2.89	34.0	25.0	41.0
PH	2.85	26.0	38.0	36.0
NS	2.88	37.0	20.0	43.0
	2.70	33.0	26.7	40.2

5.8 Students entering your college are aware of and/or concerned about *food supplies in developing countries*.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.27	37.0	22.0	41.0
CH	2.82	32.0	23.0	45.0
PH	2.78	26.0	35.0	39.0
NS	2.94	37.0	23.0	40.0
	2.70	33.0	25.7	41.3

.9 Students entering your college are aware of and/or concerned about *AIDS*.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.63	76.0	12.0	12.0
CH	3.77	77.0	15.0	8.0
PH	3.74	72.0	22.0	6.0
NS	3.77	77.0	11.0	12.0
	3.72	75.5	15.0	9.5

5.10 Students entering your college are aware of and/or concerned about *drug abuse*.

	SCALE	AGREE %	N	DISAGREE
BIOL	3.74	80.0	12.0	8.0
CH	3.96	84.0	11.0	5.0
PH	3.77	73.0	23.0	4.0
NS	3.88	80.0	14.0	6.0
	3.83	79.2	15.0	5.7

6.0 CRC: Religion, Science and Technology

6.1 With regard to church-related colleges' role and status in American higher education, baccalaureate level training of future scientists/technologists *is essential*, given the importance of faith and ethics within the sci/tech profession.

	SCALE	AGREE %	N	DISAGREE
BIOL	4.30	86.0	8.0	6.0
CH	4.17	89.0	6.0	5.0
PH	4.22	80.0	15.0	5.0
NS	4.00	80.0	5.0	15.0
	4.17	83.7	8.5	7.7

6.2 With regard to church-related colleges' role and status in American higher education, baccalaureate level training of future scientists/technologists, the church-related college *cannot compete* with public and non sectarian institutions in recruitment and training of undergraduates to enter graduate study in science/ technology .

	SCALE	AGREE %	N	DISAGREE
BIOL	2.73	11.0	5.0	84.0
CH	1.46	3.0	3.0	94.0
PH	2.05	11.0	4.0	85.0
NS	2.09	20.0	4.0	76.0
	2.08	11.2	4.0	84.7

6.3 With regard to church-related colleges' role and status in American higher education, baccalaureate level training of future scientists/technologists *is not essential*; churches, the sci/tech community, legislators, judicial process and an informed public will maintain ethical standards on sci/tech issues.

	SCALE	AGREE %	N	DISAGREE
BIOL	1.57	9.0	0	91.0
CH	1.55	4.0	5.0	91.0
PH	1.94	4.0	5.0	91.0
NS	1.64	9.0	3.0	88.0
	1.67	6.5	3.2	90.2

6.4 Church-related colleges were founded to educate laity committed to a faith tradition by emphasis on Liberal Arts, Philosophy and Religious Studies. As such they should not prepare graduates for those professions (especially sci/tech) which require substantial resources and commitment.

	SCALE	AGREE %	N	DISAGREE
BIOL	1.37	6.0	0	94.0
CH	1.28	3.0	2.0	95.0
PH	1.31	0	3.0	97.0
NS	1.45	9.0	3.0	88.0
	1.35	4.5	2.0	93.5

6.5 Students are made aware of *scientific discovery* as it relates to the understanding of your faith tradition and/ or to the further development of that faith tradition.

	SCALE	AGREE %	N	DISAGREE
BIOL	2.60	35.0	25.0	40.0
CH	2.71	25.0	30.0	45.0
PH	2.67	29.0	22.0	49.0
NS	2.88	41.0	15.0	44.0
	2.71	32.5	23.0	44.5

6.6 Within your colleges faith tradition knowledge of Sci/Tech and practice are regarded as:

	CRITICAL	ESSENTIAL	USEFUL	NOT ESSENTIAL	IRRELEVANT	
BIOL	12 %	30 %	41 %	13 %	4 %	100%
CH	3	23	51	16	7	100%
PH	2	26	44	18	10	100%
NS	11	23	49	14	3	100%
AV.	7%	25.5%	46.2%	15.2%	6.0%	

7.0 BACCALAUREATE DEGREES AWARDED
BY DEPARTMENT, 1988

	0-5	6-10	11-15	16-20	20+	
BIOL	13	22	16	15	27	93
	13.9	23.6	17.2	16.1	29.0	
CH	43	33	9	3	7	95
	45.2	34.8	9.4	3	7.5	
PH	43	15	10	1	3	72
	59.7	20.8	13.8	1	4.1	
NS	11.4	40	20	8.5	20	
	4	14	7	3	7	35
	103	84	42	22	44	295

Appendix 2

8.0 Selected Responses To The Question:

In what ways might the liberal arts enrich sci/tech education, in either context -- education *in* science or *about* science?

8.1 Science without liberal arts is poor science. A study of liberal arts without recognition of the process of science and technology is no education at all. Current societal problems have direct science and technology components, but the direction of society and the allocation of resources are traditional liberal arts decisions. Even the choice of problems on which to work by an investigator is an ethical decision. Thus one must conclude that the only responsible education of a scientist is in a liberal arts college and that a liberal arts education must have a science/technology component.

- 8.2 a) Do their classical job. (Several of the classical subjects included under “liberal arts” *are* sciences.)
- b) Require more courses in the sciences to receive the A.B. degree. (The present two semesters required here is ludicrous.)
- c) Professors teaching courses in philosophy and theology might invite science professors to give guest lectures in their courses.

8.3 Pass.

8.4 Our general education requirements have just been revised to include a course in science/technology to be taken by all students in junior or senior year. This course will be developed within an historical context and will address concerns such as those mentioned in items #27-36.

8.5 We offer a one-semester “Science and Religion” course, co-taught by a physicist and a theologian. Our analysis are from “historical” survey to “contemporary” but usually includes both.

8.6 The liberal arts (true liberal arts, not just some vague humanities requirement) would enrich science education by showing the destructive assumptions inherent in scientific thinking. The liberal arts should teach critical thinking about such problematic scientific notions as progress, efficiency, and perfectibility.

8.7 Science without being set in a broader context is a perilous enterprise, as our history attests. Hopefully a liberal arts curriculum provides future scientists with the moral/value context they need to be contributors to society rather than dangers to it.

8.8 There are many ways in which the liberal arts could enrich sci/tech education. *Philosophy* courses could emphasize how the Greek way of thinking led to science, starting with the pre-Socratics. Students could also be made aware of the Anthropic Principle which emphasizes the narrow range of values which our physical constants must have to enable life to exist. Philosophy would also point out the different causes, material, formal, final, efficient, and how predictability of the behavior of material does not imply a comprehension of the essence of material. *History* courses could include the religious motivation of many scientists, such as Newton, Duhem, Pascal and Alexis Carrel. History courses could also include Thomas Kuhn’s emphasis on the role of the paradigm in science and the difficulty of changing it. History could show that modern science derives from Greek philosophy combined with the experimentation carried out by Renaissance man. Technology existed in Egypt, China, etc., but did not develop into science.

9.0 Selected Responses To The Question:

If you believe church-related colleges should offer baccalaureate curricula designed to prepare graduates to seek advanced degrees in science or technology, indicate a rationale specific to the mission of church-related colleges that would *justify investment in preparation of future scientists*. (This may be a broad philosophical or theological statement, or a statement descriptive of the theological statement, or a statement descriptive of the role and status of science within your faith traditions.)

9.1 If the undergraduate curriculum does not demand more knowledge of the sciences, especially the biological sciences, it will not be too long before the churches will have no parishioners, for life (human) may vanish from this planet.

9.2 Clearly, there are life and death issues facing mankind and earth (along with all its inhabitants) that require a thorough knowledge of the scientific/technological aspects, e.g., global warming, acid rain, nuclear weapons and waste disposal etc. Preparing competent scientists to deal with these issues is an absolute necessity. Preparing scientists who, by their training, are *also* alert to the ethical dimensions of these issues at the same time appears to be one area where church-related colleges can play an important if not unique role. If church-related institutions abdicate their responsibility to educate *both* scientifically literate as well as ethically well-formed individuals, who can be expected to do it? It appears to me that church-related colleges are contributing to an ethical vacuum if they do not invest in sound scientific education as well as value education.

9.3 It seems to me that science is increasingly concerned with the role of *values* in research and policy decisions. Issues such as environmental problems, scientific fraud, genetic manipulation, etc. raise ethical questions that students must learn to confront. St. Anselm College, as a Catholic liberal arts institution, can provide an excellent scientific education with significant opportunities for undergraduate research, while also emphasizing the

importance of human values in the application and pursuit of technical knowledge.

9.4 Most historically Black Colleges are church-related. They are the prime providers of education for black people. Statistics show that the majority of the successful black graduates of colleges are graduates of historically Black Colleges. With these facts, HBC's have a responsibility to train students in all professions, regardless of the religious ties.

9.5 Education in our faith tradition should be *Catholic* and freeing. All aspects of our human lives are affected by science and technology; hence these are an essential component of a liberal education.

9.6 There is no conflict between science and the Methodist tradition of our college. Protestant (mainstream) and its emphasis on hard work to achieve desirable ends fits comfortably with the demands of science education.

9.7 I certainly do believe that church-related colleges such as ours should offer science and technology training. We have been doing such for many years and are noted for our accomplishments in this area and have not seen it as incompatible. We believe that it is a mandate to understand as well as possible the components of the world as we now know it. Science at this college has always been one of the two strongest areas available. The church has supported this and is willing to consider seriously what we pronounce. We want our students to think critically, to discriminate values, and be competent in problem-solving all of which can be enhanced through the study of science. We also seek truth, and science is certainly one of the places to attempt that.

9.8 As a Catholic I have always felt uncomfortable in the discussions which attend questions of responsibility, ethical behavior, prudent development of science and technology. Catholic Universities have, historically, contributed proportionally less to the education of scientists than they have to medicine, law and engineering. This lack of involvement is out of keeping with pronouncements concerning ethical dilemmas in science, an enthusiasm which Catholic institutions have felt appropriate and obligatory. For my part, we are not sufficiently involved in the education of research scientists to glibly comment on the value of science and its societal effects.

9.9 Scientists are consistently working to find proximate causes of events. All events, in the context of s Supreme Being are manifestations of God's Divine Plan and man's intelligence is the gift from Him by which we can see order in the Universe. It is incumbent upon us to use those gifts to the extent that we can, and with the expectation that it can benefit humanity.

9.10 This has nothing to do with a faith tradition but rather with a liberal arts education. We feel those with a liberal arts education are better able to grasp the implications and ramifications of their chosen fields.

9.11 First, liberal arts colleges (church-related or not) are a major source of scientists which the nation very much needs in the coming decades. It would be irresponsible for such institutions to shift their duty by giving up their historical role in this area. Second, these schools *can* provide the supporting environment needed to bring more women and minorities into the sciences, thus serving society in two ways at once. Such institutions should also serve to produce scientists with needed ethical sensitivities. All of these are well within the tradition of the United Church of Christ.

9.12 The entire realm of animal rights and human rights is broad enough to rationalize a role for church-related schools. Issues in genetics, reproductive technologies, drug manufacturing, (i.e. orphan drugs), heroic efforts to sustain life, ethical use of resources and toxic waste management, to name a few, all require an ethical and philosophical base from which we need to begin, implement, and refine our laws and statutes.

9.13 Our college is not the place to be asking these questions -- our church connection is loose at best. Our students' religious preferences match the state's demographics and our science faculty of 11 has only one member of our parent church. Even so, there is a campus-wide concern for Christianity and ethics. We teach -- live, really -- that there is something besides science and even our most focused majors must be different from those who graduate from the big state science factories, where the student can get by by taking only a few courses in areas other than science.

9.14 a) I do believe.

b) Churches have an obligation and a vocation to be countercultural prophets.

9.15 The church has the potential of instilling a humaneness to future scientists. It can provide an ethical framework for decision making and action.

9.16 If religion is to pervade all of human life, how can we ignore one of humankind's greatest philosophies: Science?

9.17 The world needs scientists motivated to:

a) help solve some of the world's problems

b) help bring the gospel to non-Christians in science

c) be role-models of Christ-followers, disciples, among others, including our youth.

d) be tuned to a high ethic in all areas of being.

9.18 It is important that sci/tech students encounter educated believers, who are competent professionals in a technical field, and also have a sophisticated and nuanced understanding of faith and theology. Such people have a witness value even if they rarely or never address interface questions between religion and science.

9.19 Scientific empiricism is antithetical to doctrine. When inquiry leads to conclusions that contradict doctrine, one or the other is forced to give way. Church-related schools are more or less bound by doctrine, and thus are forced to reject empiricism, no matter how compelling the evidence. In short, a Catholic liberal arts college is an oxymoron. When science is useful, it is acceptable. When science is neutral, it is tolerable. When science contradicts doctrine, it is ignored, or treated as mere opinion (occasionally, as in "creationism", it is distorted). There is constant tension between science and doctrine, and I see no way around it.

9.20 The mission of a church-related college should obviously be to seek and approach the truth, as outdated as that might sound. Science is a window to truth as are other disciplines, and any institution on such a journey should incorporate science into its pursuit, but reject science's triumphalism.

9.21 Our world is increasingly science-oriented, and scientists rather than other leaders are increasingly respected. Church-related colleges should be training B.S. level scientists so that ultimately the traditional viewpoints of Christianity make up at least a part of the voice of the scientific community.

9.22 If the practitioners of science do not espouse a religion, the influence of positivism will increase due to the positive contributions of science. Religiously committed scientists are needed to serve as spokesmen for a theistic interpretation of the world. Modern science is confronted with many ethical decisions. These can only be reached from a philosophical or theological position involving values. Scientific thinking prescind from such values. It is important for people with a religious belief to be trained as scientists so that they will be in a position to make meaningful contributions to the problems that confront us and that will be respected by scientists. The whole concept of pollution has an ethical dimension that can only be resolved in terms of value systems. Similarly, the very use of nature which involves the animal kingdom is predicated on the Old Testament interpretation that they are created for man.

10.0 Selected Responses To The Question:

Offer any other view point useful to the discussion of sci/tech education at church-related colleges.

10.1 As scientists, our main priority is to provide a first-rate education that will prepare our majors for graduate school and that will equip the non-science student to understand technical issues. The primary difference between St. Anselm and non-denominational institutions is the values-oriented environment in which we achieve these goals.

10.2 The development of critical thinking and problem analysis skills that is so essential for successful scientists is best accomplished in a setting of diverse fields of study. It would be a serious failing if the church-related liberal arts colleges were to abdicate their responsibility in this area.

10.3 Modern technology is presenting us with ethical problems and choices. The scientist in a church-related college is not a theologian, but depends on the theologian to offer some answers. It seems that theological training should keep a pace with technological information and advances. A tall order.

10.4 I believe science offers a humbling perspective in so far as it does not elevate man but allows theories and other work to be overturned as new information is forthcoming. Philosophy can build systems where the intellect can roam free of constraints, yet science places one in a situation of limited knowledge and the limits of experimental evidence. Religion also can be soft in its conception of reality and lead to a primitive mindset that is static and unfair to believers.

10.5 Ecological issues and the “new physics” are calling many to a new interest in the mystical and the religious. We seem to have come full circle!

10.6 Question #1.3 is one-sided. Of greater concern to us is how our Christian perspective can inform our understanding of science. Science describes and explains how things work. Our “religious” perspective provides insight relative to value, purpose, worth, origin of the natural world.

10.7 Extremist/fundamental colleges could very well be antithetical to open-mindedness necessary for the proper practice of science.

10.8 People are often polarized in their thinking. They feel either science is right or religion is. The barriers separating them should come down. Defense of “Turf” should be set aside and issues openly discussed in a rational manner.

10.9 We may be small, but we pack a “punch” that can be a stepping stone to a future individual who holds his own in not only science but also in communication and rational thought regarding issues in society.

10.10 Truth is instructive in any area and its knowledge is wisely governed when the holder has a moral/ethical perspective. A church-related college should balance the secular viewpoint required by science with a spiritual one, and be prepared to withhold a mis-application of science which is perceived to be contrary to God’s intention.

10.11 Scientists have a splendid window on creation at its most beautiful and awe-inspiring levels. Through that window we catch glimpses of the glory, the majesty, the power, and the graciousness of God. To teach science is to bring others to that window (and also to remind them that despite all we see thereby, we don’t see Jesus.) To see the grandeur and glory of God in history in its fullness we have to look to the cross. Hearing this from a scientist *may* (just may) reach someone not easily reached by others.) This work can happen at a church-related college.

10.12 If we become so heavenly minded as to be no earthly good then our religion isn’t worth much. Jesus went about doing good and healing people. How can we be effective in bettering conditions if we are ignorant of scientific and technological issues?

10.13 It seems obvious that one cannot consider oneself educated in any sense of the word without some knowledge of science. If it then follows that the institution must hire scientists to teach the sciences, it is only a small step to offering majors. Many of these departments are small, understaffed and overworked and yet they are among the most productive in meeting the educational goal.

10.14 The relationship between science and church in college education MUST be one of mutual reinforcement. The church must recognize that sci/tech education IS THE PRIMARY MODE of preparation for economic survival in the world. Even the most visionary of church hierarchy must recognize that liberal arts alone will rarely support graduate and family. The job market is technological. The sci/tech educators must recognize that SCIENCE EDUCATION WITHOUT LIBERAL ARTS IS STERILE, ISOLATING, and OFTEN ARROGANT. It may lead to good, even great, personal income and position but it will not enable the graduate to appreciate or benefit from such attainment.

10.15 Our school views natural science as from God and also as a way in which God reveals Himself. We have every right to study it and ought to strive to be excellent in this attempt. Although this college is limited financially - the administration is attempting to increase the faculty and monies to better assist this division. The school is committed to a worthy program.

10.16 Science is not only a profession, it is a way of thinking and solving problems that every educated person should be familiar with. Ignorance in this area incapacitates one from making logical decisions in many areas of our daily life and in determining steps that should be taken by our government, as well as private industry.

11.0 Selected Responses To The Question:

Comment on the philosophy of education at your college as related to the sci/tech curriculum.

11.1 There is a deplorable lack of understanding on the part of the non-scientist faculty and administration concerning the necessity to increase the level of science knowledge of our graduates. The basic philosophy seems to be that science should be required only of the scientist and that the non-scientists can function in the world with essentially no science.

11.2 The centerpiece of the general curriculum at St. Anselm College is the Humanities Program, a two-year integrated course taken by all freshman and sophomores. The program explores the relationships between different fields of inquiry, such as philosophy, theology, history and science. In addition, all students are required to take two semesters of a laboratory science. Undergraduates thus receive training both in the methodology of science and in the human dimensions of science and technology.

11.3 There appear to be two perspectives, one a philosophical one and the other is practical reality. Philosophically, faculty recognize the importance of the sciences and the scientific method appeals to them. The practical reality of limiting the core hours for all students leads them to a compromising situation. Ultimately, it appears, the ability to verbalize a problem is more important than understanding the scientific basis of a problem. We commit all students here to the study of environmental science, yet the course is superficial by virtue of necessity. Perhaps the weakness of the faith mindset shows through. Science is perceived to be complex (as is religion) by the non-science faculty. Yet they see students and society as needing to take a stand and this taking of stands (right or wrong) becomes the critical thing in the end. If this is indeed true, I worry for society. Personally, I like to be skeptical of all things before and after I take a position, with constant reassessment being part of the process.

11.4 This institution (Jesuit) is quite unprepared to become significantly involved in science/technology education beyond the pre-health science level. It has excellent physical facilities for that level and a faculty which is better than one would expect, but it lacks administrative experience with science as a major component of society. There is a gulf between the scientific world as it acts internationally, and the experience and aspirations of those who make policy decisions. For this reason, it is very unlikely that significant change in the level of science education can (or possibly should) occur here.

11.5 This college has historically supported science and technology, to a lesser extent, well. In general, issues involving sci/tech are discussed in many different departments. Science and religion are largely regarded as independent here, although one can support the other in certain ways.

11.6 At present they are minimizing the importance of science for non-majors permitting only one lab course and one lecture science course which could be History and Philosophy of Science. They are looking for science courses on issues and not basics.

11.7 There is no consensus, there is also no demand for a consensus. There is no “Lutheran” position on issues in science and technology. I hope there never becomes one. [Time-conditioned statements on political issues are another matter]. Even here it’s hard to find a way to condemn those who disagree by calling them “Un-Lutheran” or “Un-Christian.”

11.8 There exists no conflict between the philosophy of Xavier University as it relates to the sci/tech curriculum. More than 55% of our students are pursuing degrees in the sci/tech disciplines. We feel a very definite need to produce individuals, rooted in our faith traditions, who will contribute to the forming of a more humane society, with these contributions being made in all possible areas of society.

11.9 a) Have a good masters program rather than a poor doctoral program.

b) Education in science is part of a liberal education.

c) Next January we shall have our Sixteenth Annual Physics Department Reflective Weekend.

11.10 Academic freedom and individual integrity of the teacher is highly prized and respected. I have taught at this institution for over thirty years. The institution has been associated with two different protestant religions and for a brief time, been independent. I have never been a member of the sponsoring church. I am reluctant to support most organized religions. Each seems to be a bit too self centered for my tastes. However, I think churches and religions have an important role to play in society and in science and science education. However, they must not inhibit science or critical thinking by closing areas of investigation as being forbidden because they are contrary to church policy. Such a move is fatal to both religion and science, in my opinion.

This has been my philosophy and experience throughout my professional teaching career. I think it is the correct one and has been, and is, the prevailing philosophy at my college. I have made this philosophy known to various administrations over the years and have never had the slightest suggestion that I change. One faculty member (in science) in the past, was counseled to keep his religion out of the classrooms and “. . . not confuse the commandments with the gas laws.”

11.11 We have recently introduced a course entitled “The Impact of Technology on Women: Reproductive Technology”. This course brings in experts from diverse areas including social work, anthropology, biology, religion, philosophy, psychology, art, literature and communications as well as a physician practicing the new assisted reproductive technology. (Partially funded by UCC). All students take one year of a laboratory based science.

11.12 We try to combine vigor with tolerance, but within a broad view of the nature of man and all his endeavors, which are seen to be affected by the fall.

11.13 I have a bleak picture of education in the future. Colleges that attempt to form the complete person, particularly in the context of biblical presuppositions, will have to compete for a decreasing number of students with publicly funded institutions with low tuition, splendid campuses, and headline football teams. In the space of a generation we can become a generation of specialists who have not the least notion of where we have come from or where we are going. I trust in God’s providence that the outcome will be different, and that we who have labored to pass on the torch will be permitted to have a part in His solution.

11.14 I don’t really *see* what this “philosophy” is as promulgated by administrators. Where the vision is to be just “church-related” and not Christ-centered, we are reduced to pushing the same secular standards as everyone else. What a sad, sad waste. If I asked you, “are you a Christian?” would you reply, “No, but I am church-related”?

11.15 Seventh-day Adventists place a heavy emphasis on healthful living. So of necessity our students need to have a good and solid exposure to science and technology subjects.

11.16 During my career I have taught at a large West Coast University, a very large state related University, a middle sized Catholic University, and at Stetson University which has a student population of 3000. There is no philosophical difference among these schools as far as teaching is concerned. We pride ourselves on the graduates in science who have gone on to many of the very best professional and graduate schools. The administration has remained out of the curriculum, and has increasingly supported the sciences with funds as available. There are no restrictions on recruitment of new faculty, and as a consequence we at present have no Baptists on the staff. I see no pending change in the future that might alter the present relationship.

11.17 The philosophy of education at our college, as related to the science/technology curriculum, suffers from the fact that the majority of our non-science faculty (who outnumber the science faculty) are either ignorant of the role of science and technology in a liberal arts education or are actually anti-science. Too many of them were educated during the past 20 years during which science and technology were portrayed as the source of much of the evil in the world.

11.18 The philosophy is under transition as the college re-examines its core requirements. Hopefully they will listen to the Math/Science Division and increase the sci/tech emphasis (it would be hard for the emphasis to get any smaller).

11.19 We have an administration that does not understand or appreciate the role of natural sciences in the curriculum of all liberally educated students. Hence we are woefully inadequate in terms of facilities and supplies and equipment.

11.20 The philosophy is great, the practice is poor with respect to the non-science/tech majors. The non-majors are very much shortchanged. There is no decent science requirement for them, and there is such a competition for students in the general education science courses that are required that no serious demands can be made on the students. The philosophy of education as applied to the majors is different. The majors get a fairly balanced education with a required liberal arts core of 39 out of 124 semester units in the liberal and fine arts.

11.21 At my institution the philosophy related to science is not on solid ground. We are in the midst of re-evaluating our goals statement, and relative to science our plan of action is not clear. The science faculty is divided as to the role research should play (undergraduate research), and what role publication should play in promotion consideration. In a Christian institution such as mine I feel that strong, if not total, emphasis should be on education for its own end.

11.22 The university recognizes the important role played by science and provides strong support for biology, chemistry, physics and psychology. It also recognizes the importance of a knowledge of science for all people and requires two (2) science courses of all students regardless of majors.

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