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ABSTRACT

The data in this report were collected as part of a study that involved all teacher education graduates at the University of Iowa prior to 1970. The information from this study is considered baseline data for an evaluation of the Iowa-UPSTEP program (Undergraduate Pre-Service Teacher Education Program), which was begun in 1969 as a proposed innovation in science teacher education at the secondary level at the University of Iowa. The information presented includes evaluation of courses in the professional sequence, adequacy of student teacher observation, effectiveness of student teacher supervision, views concerning importance of student teaching, relative importance of specific courses, and preparation for specific tasks required in teaching. Forty-five tables of data are presented, as well as the instruments used in collecting the data. (MLH)

Technical Report Series

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Baseline Data Concerning Science Teacher Education Programs at the University of Iowa, 1955-73

by

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BASELINE DATA CONCERNING SCIENCE TEACHER EDUCATION PROGRAMS AT THE UNIVERSITY OF IOWA, 1955-73

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INTRODUCTION

The Iowa-UPSTEP program began in 1969 as a proposed innovation in science teacher education at the secondary level at the University of Iowa. A three year grant of $113,150 was received from the National Science Foundation in 1970 to support the program. In 1973 another $135,250 was granted to complete the development of the new model.

A handbook describing the model that has been developed was first published in 1975 (1). The handbook describes the various features of the model while illustrating need for formative evaluation and specific work on the development of the specific modules which characterize the program. A new grant totaling $170,670 has been received to complete these two facets of the program by 1978.

Information concerning students and staff and experience with school students are important as an evaluation of the UPSTEP model is contemplated. Various kinds of questionnaires have been used during the five year period. Other instruments have been constructed or located for use with program participants.

Another kind of evaluation exists with comparing studied opinions concerning certain ideas, experiences, or practices among students pre-UPSTEP and UPSTEP. Extracting specific information from other studies which could be useful in later evaluation attempts is desirable and the major objective of this report. The body of this report is a collection of information, tabulations, and tables that can be used for future comparisons. It is only now that students are completing the program with experiencing the model as conceived in 1975 -- the close of the major developmental effort.

THE PROGRAM

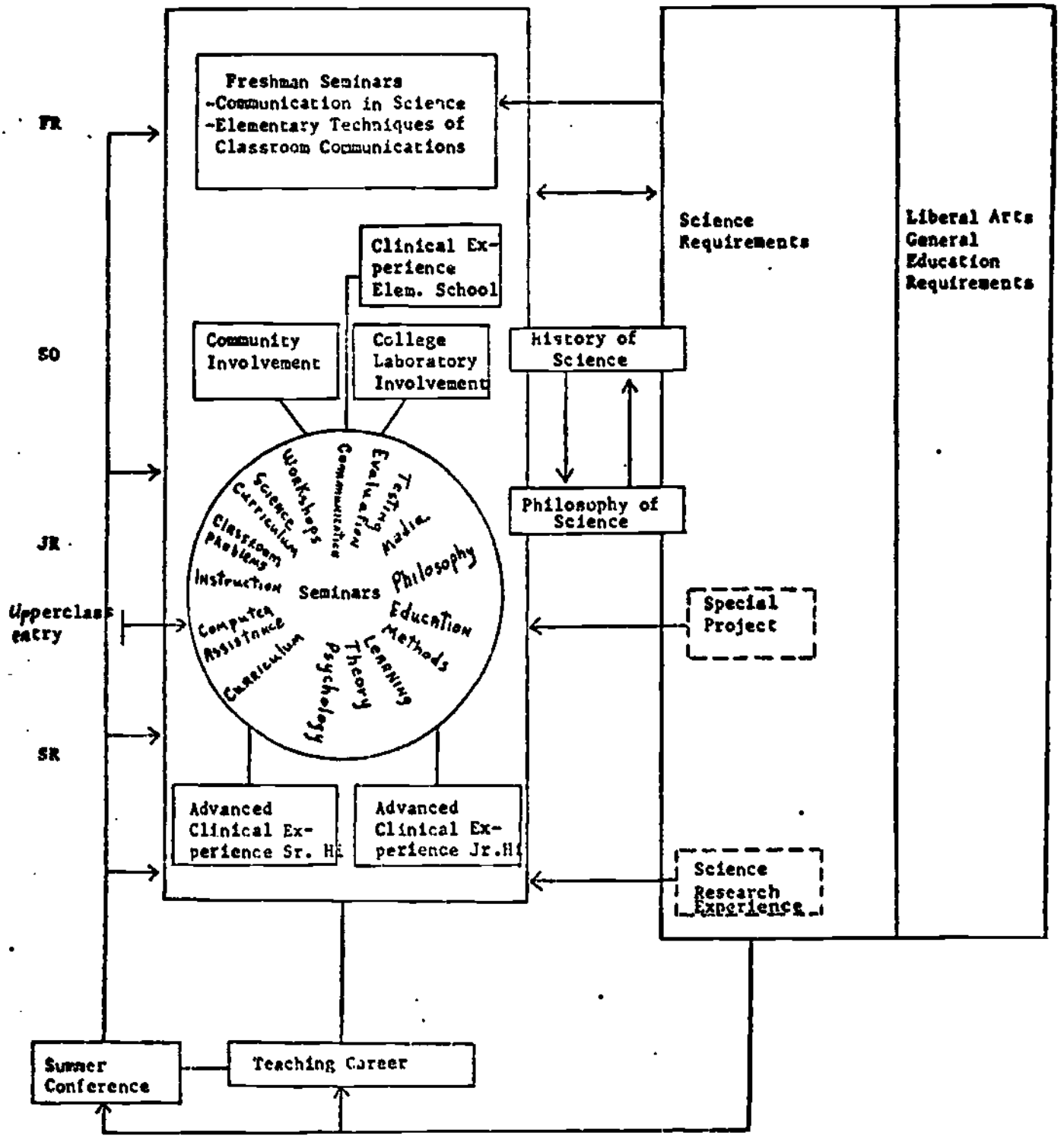
The Iowa-UPSTEP Model is a program in science teacher education at the University of Iowa which has been developed with support from the National Science Foundation during a five year period, 1970-75. Changes in the model during the five year period have been described previously (2). Some of the principal characteristics of the current model include: 1) early identification of students--often prior to high school graduation, 2) a professional program integrated with science major and general education phases, 3) experience in education throughout the four year degree program, 4) field experiences at frequent intervals (some optional) during four year period, 5) opportunities for wide variety of clinical experiences in schools and communities, 6) experience at a variety of teaching levels, including elementary, junior high, senior high, and college, 7) special integrating experiences in the meaning and history of science, 8) opportunity for frequent involvement with Student Program experiences (an extensive enrichment program for high ability students headquartered at the Science Education Center), 9) involvement with curriculum revision in cooperation with in-service teachers, 10) daily involvement with several master teachers during the program thereby experiencing several "models", 11) experience with a research project in an area of basic science, 12) continued involvement with the program and the Science Education Center following graduation and employment as an in-service teacher.

Figure one provides a diagramatic view of the current program.

A report concerning the Iowa-UPSTEP Model was prepared in 1975 (3). It includes the history of the five year program including information concerning staff, program features, budget, field-based examples, and other descriptive data. The report describes generally some of the evaluation efforts which have

Figure One. Iowa-UPSTEP Model:

Science Teacher Education at the University of Iowa



been completed and which continue. The purpose of this Technical Report is to elaborate upon the evaluation information collected and available at the end of the five year developmental period. Such baseline data may be useful as some evaluation procedures continue and others develop.

BASELINE DATA

In 1971, Darrell M. Jensen completed a study that involved all teacher education graduates at the University of Iowa prior to 1970 (4). All of the information reported is concerned with students and programs that can be described as pre-Iowa-UPSTEP. No Iowa-UPSTEP graduates -- even of the evolving program -- were employed as teachers prior to the fall of 1974. No graduates experiencing the evolved model as pictured in Figure One will be employed until the fall of 1977.

Information from the Jensen study is considered baseline data for an evaluation of Iowa-UPSTEP as included in Tables 1 through 12. Information is reported concerning evaluation of courses in the professional sequence, adequacy of student teacher observation, effectiveness of student teacher supervision, views concerning importance of student teaching, relative importance of specific courses -- some elective ones -- in the professional sequence, preparation for specific tasks required in teaching. An examination of the tables permit several general comments. About 60% of the past graduates felt that supervision of student teachers in science was adequate. Over 70% of the past graduates classified the assistance provided by supervising teachers as valuable or extremely valuable. About 95% of the graduates and 96% of the student teachers in 1970 viewed their student teaching experiences as valuable. The student teachers enrolled in 1970 felt that the number of observations made by supervising teachers were adequate (75%) while previous graduates were evenly split concerning adequacy. Seventy percent of the student teachers

enrolled in the program during 1970 rated the quality of supervision as valuable or extremely valuable compared with 56% of the past graduates. Both student teachers and past graduates displayed a wide spectrum of views regarding the adequacy of the guidance provided by their education advisors. The student teachers enrolled in 1972 rated the quality better than did past graduates. The majority of student teachers in 1972 and past graduates felt that adequate preparation had been provided for evaluating pupil progress. However, significant numbers felt more preparation and attention should be provided. Similar statements could be made regarding views toward quantity of preparation for developing better personal qualities in students. The introduction to secondary education courses was viewed critically by 62% of the student teachers enrolled in 1972 and 52% of the past graduates. This is the one place where the evaluation was more critical by the student teacher group then by past graduates. The graduates were much more impressed with the values of the A.V. course than were current student teachers. The socialization course (not normally a part of the program for science majors) was viewed as worthwhile by 57% of the past graduates and of little or no value by 43% of the past graduates.

In 1972 Lynn Glass completed a study concerning science education in Iowa. The major features of this study are reported in Technical Report, Number 6 (5). These data provide accurate information concerning school curricula, teacher preparation, teacher characteristics, and teacher training programs. The information was drawn from reports from every school district in Iowa. As a formal evaluation of the Iowa-UPSTEP model continues such baseline data is extremely important. Tables 13 and 14 represent examples of data available concerning curriculum and enrollments.

Table 1

Responses Concerning the Importance of Specific Education Courses to the Teacher Education Program

	Extremely Worthwhile	Worthwhile	Little Value	No Value	Total Responses	Mean
Educational Psychology	10.2	39.7	36.0	14.1	595	2.54
Introduction to Secondary Education	8.8	38.1	36.3	16.8	565	2.61
Teaching Methods	41.7	39.2	17.0	2.1	628	1.79
Student Teaching	72.1	21.9	5.0	1.0	639	1.34
Audiovisual Teaching Methods	31.3	50.9	13.2	4.6	265	1.90
Socialization of School-Age Child	11.4	41.7	30.2	16.7	96	2.52
Principles of Guidance	26.1	35.5	22.7	15.7	172	2.28
Construction and Use of Classroom Tests	36.8	47.2	12.2	3.8	106	1.83
Philosophy of Education	17.1	37.5	26.1	19.3	88	2.48
History of Education	4.8	34.9	28.6	31.7	63	2.87

Table 2

Adequacy of Supervising Teachers' Observations
by Major Fields

	Total Number of Responses	Yes	No
Women's Phys. Ed.	33	90.9	9.1
Mathematics	36	63.9	36.1
Business	23	60.9	39.1
Science	42	59.5	40.5
English	154	57.1	42.9
Home Economics	21	52.4	47.6
Men's Phys. Ed.	39	48.7	51.3
Social Studies	102	48.0	52.0
Art	39	38.5	61.5
Speech	13	38.5	61.5
Foreign Language	60	36.7	63.3
Music	57	31.6	68.4
Journalism	8	25.0	75.0
TOT	627	321	306
PCT		51.2	48.8

Table 3

Respondents' Evaluations of Supervising Teachers' Assistance
by Major Fields

	Total Responses	Extremely Valuable	Valuable	Little Value
Women's Phys. Ed.	34	32.4	44.1	23.5
Science	44	18.2	54.5	27.3
English	156	27.6	38.5	34.0
Business	24	20.8	41.7	37.5
Men's Phys. Ed.	40	10.0	47.5	42.5
Mathematics	35	31.4	25.7	42.9
Home Economics	21	23.8	33.3	42.9
Social Studies	102	15.7	41.2	43.1
Speech	13	7.7	46.2	46.2
Foreign Language	60	8.3	35.0	56.7
Art	39	7.7	28.2	64.1
Music	57	12.3	15.8	71.9
Journalism	8	0.0	12.5	87.5
TOT	633	119	234	280
PCT		18.8	36.9	44.3

Table 4

Student Teachers vs Graduates Concerning
Importance of Student Teaching

	TOT	PCT	Student Teachers	Graduates
Extremely worthwhile	585	73.7	80.0	72.1
Worthwhile	165	20.8	16.1	21.9
Little value	33	4.2	0.6	5.0
No value	11	1.4	3.2	0.9
TOT	794		155	639
PCT			19.5	80.5

S = 7737.000
SDS = 3938.527
ZS = 1.964 Significant at .05

Table 5

Student Teachers vs Graduates Concerning Importance
of Socialization of School-Age Child Course

	TOT	PCT	Student Teachers	Graduates
Extremely Worthwhile	15	13.5	26.7	11.5
Worthwhile	48	43.2	53.3	41.7
Little value	32	28.8	20.0	30.2
No value	16	14.4	0.0	16.7
TOT	111		15	96
PCT			13.5	86.5

S = 507.000
SDS = 218.712
ZS = 2.316 Significant at .05

Table 6

Student Teachers vs Graduates Concerning Adequacy of Number of Supervising Teacher Observations During Student Teaching

	TOT	PCT	Student Teachers	Graduates
Yes	433	55.3	71.8	51.2
No	350	44.7	28.2	48.8
TOT	783		156	627
PCT			19.9	80.1

S = 20148.000
SDS = 4353.822
ZS = 4.628 Significant at .001

Table 7

Student Teachers vs Graduates Concerning Effectiveness of Assistance Provided by Supervising Teacher

	TOT	PCT	Student Teachers	Graduates
Extremely valuable	162	20.5	27.4	18.8
Valuable	302	38.2	43.3	37.0
No value	326	41.3	29.3	44.2
TOT	790		157	633
PCT			19.9	80.1

S = 16812.000
SDS = 4761.550
ZS = 3.531 Significant at .001

Table 8

Student Teachers vs Graduates Concerning
Guidance Provided by Adviser in Education

	TOT	PCT	Student Teachers	Graduates
Excellent	128	16.4	19.7	15.6
Good	172	22.0	27.2	20.8
Average	180	23.0	21.8	23.3
Fair	130	16.6	12.9	17.5
Poor	171	21.9	18.4	22.7
TOT	781		147	634
PCT			18.8	81.2

S = 10748.000
SDS = 4823.148
ZS = 2.228 Significant at .05

Table 9

Student Teachers vs Graduates Concerning Quantity of
Preparation for Evaluating Pupil Progress

	TOT	PCT	Student Teachers	Graduates
Much more preparation than needed	35	4.5	2.6	4.9
Slightly more preparation than needed	89	11.3	7.2	12.3
Proper amount of preparation	384	48.9	44.4	50.0
Less preparation than needed	216	27.5	37.3	25.2
Almost no preparation	61	7.8	8.5	7.6
TOT	785		153	632
PCT			19.5	80.5

S = -14601.000
SDS = 4667.983
ZS = -3.128 Significant at .01

Table 10

Student Teachers vs Graduates Concerning Quantity of Preparation for Developing Better Personal Qualities

	TOT	PCT	Student Teachers	Graduates
Much more preparation than needed	25	3.2	0.7	3.8
Slightly more preparation than needed	68	8.7	6.5	9.2
Proper amount of preparation	387	49.3	49.0	49.4
Less preparation than needed	182	23.2	22.9	23.3
Almost no preparation	123	15.7	20.9	14.4
TOT	785		153	632
PCT			19.5	80.5

S = -10349.000
SDS = 4676.365
ZS = -2.213 Significant at .05

Table 11

Student Teachers vs Graduates Concerning Importance of Introduction to Secondary Teaching Course

	TOT	PCT	Student Teachers	Graduates
Extremely worthwhile	57	8.1	4.9	8.8
Worthwhile	261	36.9	32.4	38.1
Little value	260	36.8	38.7	36.3
No value	129	18.2	23.9	16.8
TOT	707		142	565
PCT			20.1	79.9
	S = -10225.000			
	SDS = 4112.795			
	ZS = -2.486		Significant at .05	

Table 12

Student Teachers vs Graduates Concerning Importance of Audiovisual Teaching Methods Course

	TOT	PCT	Student Teachers	Graduates
Extremely worthwhile	88	28.0	10.2	31.3
Worthwhile	150	47.8	30.6	50.9
Little value	52	16.6	34.7	13.2
No value	24	7.6	24.5	4.5
TOT	314		49	265
PCT			15.6	84.4
	S = -6168.000			
	SDS = 1085.353			
	ZS = -5.682		Significant at .001	

Table 13

Enrollment Trends in Selected Science Courses as a Percentage of Total 9-12 Public School Enrollment for the School Years 1958-1959 Through 1970-71

School Year	Physics	Biology	Chemistry	Earth Science	Physical Science
58-59	7.2%	22.0%	8.0%	.1%	.4%
59-60	6.4	20.5	7.9	.1	.9
60-61	5.8	21.0	8.2	.2	1.4
61-62	5.2	21.2	7.6	.2	2.0
62-63	4.1	23.5	8.4	.7	2.7
63-64	4.7	22.5	11.6	.9	3.5
64-65	5.1	21.6	8.4	1.0	6.2
65-66	4.3	22.1	8.9	2.2	5.6
66-67	---	---	---	---	---
67-68	---	---	---	---	---
68-69	4.0	22.8	8.5	5.7	10.5
69-70	3.9	23.8	8.3	4.3	9.0
70-71	3.9	23.1	8.0	4.9	11.5

NOTE: Data are not available for the 1966-67 and 1967-68 school years.

Table 14

Percentage of Students In Grades 9-12 In Iowa Public High Schools Enrolled In Science Courses for the School Years 1958-1959 Through 1970-1971

School Year	Total 9-12 public school enrollment*	Total 9-12 science enrollment*	Science enrollment as percent of total
58-59	136,704	80,545	58.9%
59-60	137,086	75,393	55.0
60-61	139,568	79,293	56.8
61-62	150,256	84,506	56.2
62-63	159,562	92,129	57.7
63-64	170,020	105,604	62.1
64-65	177,283	103,729	58.5
65-66	179,898	103,871	57.7
66-67	183,163	-	-
67-68	186,787	-	-
68-69	190,339	113,366	59.6
69-70	191,705	121,664	63.5
70-71	193,437	111,760	57.8
		Mean percent enrollment ----	58.7

Data are available concerning these factors for each of the 450 schools in the State. Studies of individual schools following in-service contact and following employment of Iowa-UPSTEP graduates are planned. These data are included as samples of much more data available from the Iowa Information Center. It can be seen from the table comprising Table 13 that physics enrollments have decreased by about half; biology and chemistry enrollments have remained rather constant; earth science and physical science enrollments have increased significantly. Table 14 indicates enrollment patterns for 1958 to 1971. In general, enrollment in public schools has increased by over 27,000 students during the past thirteen years. This is an increase of over 60%. During the same time period total enrollments in science classes increased by nearly 70%. At the same time the percentage of students in science classes has remained rather constant in Iowa. Data from the last three years are extremely interesting as possible new trends are surfacing.

Information concerning characteristics of Iowa graduates in science teaching would provide valuable information for evaluating the Iowa-UPSTEP model. Melton Golmon completed a study in 1972 which provides information concerning eighty past graduates of the Iowa science teacher education program (6). Tables 15 and 16 indicate differences between low and high inquiry teachers with respect to techniques employed and with respect to philosophy used. High inquiry teachers spend more time with laboratories and discussions then do low inquiry teachers. Low inquiry teachers spend significantly more time with lectures. High inquiry teachers display significantly "better" philosophies (as measured by the Science Teaching Assessment Test included as Appendix IV) than do low inquiry teachers.

Table 15

Differences Between Teachers Using Low and High Inquiry Techniques as to Teaching Mode

	Low Inquiry	High Inquiry
Science Teaching Checklist Average	15.20	20.89
Percent of Total Class Time Used for the Following Activities		
Lectures	34.89	13.85
Laboratories	25.84	49.00
Discussion	17.78	24.30
Independent Study	12.84	6.35
Student Initiated Activities	4.84	3.75
Other	3.81	2.75

Table 16

Comparison of Science Teaching Philosophy Between Low and High Level Inquiry Science Teachers as Measured by the Science Teaching Assessment Test

*Significant at the 0.05 Level $N^l = 20$, $N^h = 20$, df = 38

	Low Inquiry Mean	High Inquiry Mean	t
Cognitive Domain			
Objective Desirability	45.50	47.20	1.16
Objective Measurability	43.45	46.90	1.99
Teaching Strategy	49.35	60.80	2.40*
Total Cognitive Score	138.30	154.90	3.46*
Affective Domain			
Objective Desirability	28.15	28.35	0.14
Objective Measurability	21.80	21.60	0.11
Teaching Strategy	31.95	43.90	3.37*
Total Affective Score	81.90	93.85	2.84*
Total Composite Score	220.20	248.75	3.55*

Critical Region = $|t| \geq 2.03$

Golmon has also studied changes in methods students enrolled in the regular teacher education program (prior to 1970). Tables 17, 18, 19, and 20 provide evidence of changes in students enrolled in a six semester hour methods block. Science methods students demonstrate significant growth in self-concept in three areas including the Total Positive Score (Table 17). Methods students also demonstrate significant growth in the area of flexibility and elaboration as part of creativity as measured by the Torrance Figural Test of Creativity (Table 18). Science Methods students also display significant and positive changes in seven of ten areas as measured by the Science Teaching Assessment Test (Table 19). There is a similar range of low and high inquiry skills in a given group of students following completion of a science methods block (Table 20).

Table 21 indicates the results of a survey of past graduates as to their opinions regarding satisfaction with their science teacher education sequence as to effective preparation for use of current innovative school materials and practices. Table 21 indicates that the students feel that the program at Iowa has improved during the 1965-1971 time period. It will be interesting to compare these results with the situation that exists when Iowa-UPSTEP students enter the field.

In 1973 Edward Pizzini completed a major study concerning the effects of the Iowa-UPSTEP program upon the first two groups of students -- those beginning during the fall of 1970 and the fall of 1971 (7). Pizaini used a variety of instruments (included in the Appendix) to measure effects of the program and its parts upon students.

Table 17

Pretest and Posttest Results of Self-Concept as Measured by the Tennessee Self-Concept Scale for Science Methods Students

*Significant at the 0.05 Level N = 31, df = 30

	Pretest Mean	Posttest Mean	t
Total Positive Score	339.48	346.83	2.05*
Physical Self	68.97	69.19	0.23
Moral Self	68.55	72.00	2.18*
Personal Self	64.03	65.77	1.72
Family Self	69.77	70.61	0.73
Social Self	68.16	68.52	0.43
Self-Criticism	35.77	36.10	0.38
Identity	122.52	123.16	0.47
Self-Satisfaction	105.45	110.45	2.66*
Behavior	111.52	113.23	1.19
Variability	42.52	38.94	1.53
Distribution	101.19	105.32	1.48

Critical Region = $|t| \geq 2.04$

Table 18

Pretest and Posttest Results of Creativity as Measured by the Torrance Figural Test of Creativity for Science Methods Students

*Significant at the 0.05 Level N = 31, df = 30

	Pretest Mean	Posttest Mean	t
Fluency	43.81	41.94	0.82
Flexibility	47.74	42.65	2.83*
Originality	58.45	62.94	1.36
Elaboration	61.74	55.68	3.11*

Critical Region = $|t| \geq 2.04$

Table 19

Pretest and Posttest Results of Science Teaching Philosophy as Measured by the Science Teaching Assessment Test for Science Methods Students

*Significant at the 0.05 Level N = 31, df = 30

	Pretest Mean	Posttest Mean	t
Cognitive Domain			
Objective Desirability	47.13	47.84	0.83
Objective Measurability	44.74	47.65	3.27*
Teaching Strategy	55.74	63.88	4.16*
Total Cognitive Score	147.61	159.37	5.15*
Affective Domain			
Objective Desirability	30.61	30.77	0.22
Objective Measurability	21.19	23.23	2.22*
Teaching Strategy	40.17	47.42	4.14*
Total Affective Score	91.97	101.42	3.88*
Total Composite Score	239.58	260.79	5.38*

Critical Region = $|t| \geq 2.04$

Table 20

Comparison of Science Teaching Checklist Scores Between Low and High Level Inquiry Science Teachers and Science Methods Students

	$N^l=20$, $N^h=20$, $N^m=23$
	Group Mean
High Level Inquiry Science Teachers	20.89
Science Methods Students at the Conclusion of the Professional Semester	18.04
Low Level Inquiry Science Teachers	15.20

Table 21

Preparation of Teacher Education Graduates in Science
for
Participation in Innovative School Practices

Year	Number of Responses from Graduates	Percent Responses				
		Excellent	Good	Average	Fair	Poor
1965	24	10.3	21.0	17.5	30.1	20.1
1966	32	12.6	17.2	26.4	27.8	16.0
1967	37	17.3	16.3	25.6	26.0	14.8
1968	48	18.4	18.3	26.7	23.4	13.2
1969	44	22.7	18.2	22.7	20.5	15.9
1970	38	26.8	22.6	24.8	15.6	10.2
1971	30	30.2	24.3	26.4	10.6	8.4

Using the Semantic Differential (Appendix I), it is readily apparent that the UPSTEP courses were popular in comparison with science and general education courses. Table 22 includes a comparison of each of the ten adjective pairs where students were asked to pick one of three points on an eight point scale comparing the three categories of courses.

The Attitude Survey (Appendix II) has been used periodically. Table 23 includes results related to attitude of participants toward teaching science as a career. In general, the attitude is more positive as groups of students progress through the four year program. The result is not unexpected since students who drop from the program are probably the ones with the least positive attitudes. The table also indicates that the attitudes are more positive with each new group of students during the 1970 to 1973 years.

The use of a semantic differential (Appendix III) also reveals some interesting results reported in Tables 24 and 25. UPSTEP II students develop statistically more positive attitudes toward eleven of twelve educational concepts after participating in the program for a year. The results are similar when the 1971 and 1972 students are compared.

The use of the Science Teaching Assessment Test (Appendix IV) produces some interesting results reported in Tables 26, 27, and 28. Table 26 suggests that the UPSTEP I program does little to affect philosophy of science teaching. However, it can be seen that most shifts are in a positive direction--though few of the differences are statistically significant. Tables 27 and 28 reveal that UPSTEP II students develop significally in the area of science teaching philosophy. UPSTEP II students developed significant changes in three of six areas in the cognitive and affective domains in addition to the total affective, the total cognitive, and the total science teaching philosophy score. UPSTEP II students during 1972 displayed even more positive

Table 22

Results Semantic Differential and Attitude
Towards College Courses during a Given Semester

	Students Beginning Fall 1970									Students Beginning Fall 1971								
Year:	1970			1971			1972			Year:	1970			1971			1972		
Item	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3	1	2	3
1	7	4	3	6	3	3	6	5	3		7	4	2	6	5	3	7	4	4
2	3	4	7	2	4	3	2	4	6		2	4	6	2	5	6	3	4	5
3	6	5	3	6	5	2	7	6	3		6	4	4	7	3	3	6	4	5
4	2	4	6	3	4	5	2	3	5		2	3	5	2	4	4	2	3	4
5	1	6	5	1	5	5	1	4	5		2	7	6	2	6	5	1	5	6
6	3	2	3	4	3	3	3	2	2		4	3	2	5	3	3	4	2	4
7	4	7	5	5	7	4	3	6	4		3	6	5	3	6	4	4	7	3
8	3	7	5	4	7	6	3	6	5		3	6	6	3	7	6	3	6	5
9	7	6	5	7	7	4	7	7	6		8	7	6	7	6	5	7	7	7
10	7	3	4	7	4	3	7	3	4		7	5	4	7	3	4	7	4	5

* Note alternating value of numbers from scale (Appendix I)

Table 23

Attitude Toward Teaching as Career Choice

Group	To Original Recruits			% Total Group		
	Positive	Neutral	Negative	Positive	Neutral	Negative
Freshmen						
1970-71	24	74	4	26	70	4
1971-72	31	66	3	31	66	3
1972-73	33	65	2	33	65	2
Sophomore						
1971-72	50	49	1	53	46	1
1972-73	66	32	2	63	35	2

Table 24

Pretest and Posttest Results of Attitude Toward Selected Educational Concepts as Measured by the Semantic Differential for Iowa-UPSTEP II, 1971

*Significant at the 0.05 Level N=21, df=20

	Pretest Mean	Posttest Mean	t
Individualized Learning	22.67	11.48	6.39*
Being a Science Teacher	25.38	15.67	5.15*
Teaching Secondary Students	25.24	14.81	6.45*
Interaction	21.05	7.62	7.25*
Content-Oriented Approach	33.57	26.86	3.63*
Classroom Management	35.43	30.10	2.84*
Science Teaching Materials	25.05	14.00	5.52*
Teaching Elementary Students	25.05	12.43	8.09*
Process-Oriented Approach	22.76	11.67	6.69*
Importance of Discipline	31.81	28.57	1.76
Early Exploratory Teaching	23.95	15.57	3.11*
Total Composite Score	293.33	188.76	11.54*

Critical Region = $|t| \geq 2.08$

Table 25

Pretest and Posttest Results of Attitude Toward Selected Educational Concepts as Measured by the Semantic Differential for Iowa-UPSTEP II, 1972

*Significant at the 0.05 Level N=28, df=26

	Pretest Mean	Posttest Mean	t
Individualized Learning	24.63	12.13	7.12*
Being a Science Teacher	23.24	13.48	6.34*
Teaching Secondary Students	27.28	14.72	7.32*
Interaction	24.71	6.38	8.04*
Content-Oriented Approach	34.62	21.34	4.82*
Classroom Management	36.24	28.21	3.61*
Science Teaching Materials	26.41	14.83	6.63*
Teaching Elementary Students	26.32	12.97	8.72*
Process-Oriented Approach	24.63	10.87	7.42*
Importance of Discipline	33.26	27.62	2.00
Early Exploratory Teaching	24.83	14.62	4.58*
Total Composite Score	300.27	177.17	12.63*

Critical Region = $|t| \geq 2.08$

Table 26

Pretest and Posttest Results of Science Teaching Philosophy
As Measured by The Science Teaching Assessment Test for Iowa-UPSTEP I Students, 1970-72

	1970			1971			1972		
Cognitive Domain	Pre	Post	t	Pre	Post	t	Pre	Post	t
Objective Desirability	47.2	47.3	.62	48.5	46.1	2.70*	42.3	44.6	.34
Objective Measurability	42.6	43.4	.92	43.7	43.6	.04	44.6	46.7	.18
Teaching Strategy	56.7	57.6	.43	59.2	62.6	1.47	54.7	62.5	1.91
Total Cognitive Score	146.4	150.3	.74	151.0	153.7	.97	141.6	153.8	1.06
Affective Domain									
Objective Desirability	32.6	31.4	.13	30.0	30.3	.40	28.4	32.6	1.72
Objective Measurability	24.3	25.6	.36	22.9	23.5	.41	23.6	25.7	.82
Teaching Strategy	45.6	45.5	.01	44.0	43.7	.16	43.6	44.8	.61
Total Affective Score	102.5	102.5	.00	97.8	98.0	.05	95.6	103.1	1.41
Total Composite Score	238.9	252.8	.46	248.6	251.6	.66	237.2	256.9	2.05

Critical Region = $|t| \geq 2.07$

1970 N = 27, df = 23

1971 N = 23, df = 22

1972 N = 30, df = 24

Table 27

Pretest and Posttest Results of Science Teaching Philosophy As Measured By The Science Teaching Assessment Test For Iowa-UPSTEP II Students and Control Group, 1971

	UPSTEP			Control Group		
Cognitive Domain	Pre Mean	Post Mean	t	Pre Mean	Post Mean	t
Objective Desirability	44.77	46.55	1.15	45.50	44.27	1.33
Objective Measurability	38.77	42.23	2.98 *	43.36	44.64	.78
Teaching Strategy	59.50	64.68	1.91	56.23	54.18	1.30
Affective Domain						
Objective Desirability	29.50	29.86	.42	27.81	29.14	1.98
Objective Measurability	18.86	21.59	3.30 *	21.95	22.55	.64
Teaching Strategy	44.45	48.73	2.38 *	42.23	40.23	1.37
Total Scores						
Total Cognitive	143.95	158.63	4.66 *	145.09	143.09	.70
Total Affective	92.91	99.54	3.82 *	91.09	91.92	.58
Total Science Teaching Philosophy	237.32	258.27	6.16 *	236.18	235.01	.23

Critical Region = $|t| \geq 2.08$

* Significant at the 0.05 level

N=22

df-21

Table 28

Pretest and Posttest Results of Science Teaching Philosophy As Measured By The Science Teaching Assessment Test for Iowa-UPSTEP II Students and Control Group, 1972

	UPSTEP			Control Group		
Cognitive Domain	Pre Mean	Post Mean	t	Pre Mean	Post Mean	t
Objective Desirability	43.72	46.51	2.43 *	42.60	43.71	.84
Objective Measurability	36.82	44.62	3.01 *	38.60	40.26	.92
Teaching Strategy	58.61	63.92	2.09 *	57.62	56.82	1.01
Affective Domain						
Objective Desirability	30.01	31.24	1.02	29.61	30.41	.86
Objective Measurability	17.73	22.34	3.67 *	23.81	24.01	.43
Teaching Strategy	46.07	49.23	2.61 *	44.36	45.94	1.06
Total Scores						
Total Cognitive	139.15	155.05	5.03 *	138.82	140.79	.86
Total Affective	93.81	102.81	4.86 *	97.78	100.36	.63
Total Science Teaching Philosophy	232.96	257.86	6.67 *	236.50	241.15	.31

Critical Region = |t| 2.08

* Significant at the 0.05 level

N - 28

df - 23

resulta with only one of nine scores being non-significant (See Table 28). The result with a control group produced differences which are not significant.

Tables 29 and 30 include information concerning administration of the Tennessee Self-Concept Scale (Counselor Recordings and Tests, Nashville, Tennessee). As with Science Teaching Philosophy significant changes in self-concept are not observed in the freshmen students. However, the results following the second year experiences are most striking. All differencea between pre- and posttest means are significant except for self-criticism and distribution (ten of twelve areas). Only growth in the area of family-self was observed with a control group of students.

Pizzini's study has indicated that participation in the first two years of Iowa-UPSTEP results in statistically significant growth in the following areas:

1) Ten of twelve areas of self-concept
2) Five of six areas of science teaching philosophy
3) Three total scores for science teaching philosophy
4) Attitude toward eleven of twelve educational concepts
5) Positive attitude toward teaching aa a career
6) Positive attitude toward UPSTEP "courses" compared to general education and science major courses.

Another study completed in 1973 by Robert Boes provides valuable information for evaluating the Iowa-UPSTEP model (8). As indicated in Figure One (page 3), courses in the meaning and history of acience provide significant bridges between the science major and the professional sequence. In a sense the courses are also designed to provide a bridge between the science teaching major (both science and education courses) on the one hand and the general

Table 29

Pretest and Posttest Results of Self-Concept as
Measured by the Tennessee Self-Concept Scale for Iowa-UPSTEP I, 1970-72

	1970			1971			1972		
Internal Frame	Pre	Post	t	Pre	Post	t	Pre	Post	t
Identity	117.6	121.3	.62	122.3	119.7	.58	121.3	122.6	1.03
Self-Satisfaction	108.7	111.4	1.62	102.8	107.6	1.22	107.3	113.2	1.51
Behavior	110.7	112.3	.34	109.0	111.1	.60	107.3	109.2	.49
Total Score Self-Esteem	337.0	345.0	.52	334.30	337.26	.27	335.9	345.0	.65
External Frame									
Physical Self	64.3	66.6	.21	67.6	68.0	.14	63.4	67.2	.13
Moral Self	70.1	70.8	.12	69.3	70.6	.59	70.6	71.2	.27
Personal Self	64.3	63.8	.18	65.6	65.9	.16	64.3	65.2	.34
Family Self	63.6	64.2	.32	64.5	65.4	.28	66.2	66.9	.18
Social Self	66.1	67.8	.71	67.1	68.1	.52	67.8	69.4	.82
Self-Criticism	34.8	35.2	.69	35.8	34.8	.82	32.4	34.6	.84
Variability	42.1	41.9	.14	44.1	41.1	1.19	43.6	44.2	.34
Distribution	108.3	110.2	.74	104.57	110.1	.83	98.2	108.6	1.02

Critical Region = $|t| \geq 2.07$

1970 N = 26, df = 23
1971 N = 23, df = 22
1972 N = 30, df = 24

Table 30

Pretest and Posttest Results of Total Self-Concept as Measured by the Tennessee Self-Concept Scale for Iowa-UPSTEP II and Control Group, 1971

	UPSTEP II			CONTROL GROUP		
	Pretest Mean	Posttest Mean	t	Pretest Mean	Posttest Mean	t
Internal Frame						
Identity	116.90	120.27	2.13 *	121.90	121.00	.71
Self-Satisfaction	102.00	108.59	3.53 *	104.81	107.09	1.42
Behavior	104.50	109.55	3.78 *	104.18	105.82	.89
Total Score Self-Esteem	323.45	338.41	4.29 *	330.89	333.91	.78
External Frame						
Physical Self	64.59	67.45	2.88 *	66.45	66.73	.17
Moral Self	64.86	67.22	2.07 *	66.64	66.82	.15
Personal Self	62.68	66.05	2.63 *	65.09	64.64	.44
Family Self	66.86	69.77	2.57 *	66.09	69.05	2.35 *
Social Self	64.41	67.45	2.49 *	66.64	66.45	.18
Self-Criticism	35.64	35.95	.31	36.95	34.09	1.84
Variability	42.54	37.41	-3.01 *	40.73	38.09	1.11
Distribution	95.04	103.32	1.44	96.04	90.68	1.17

Critical Region = $|t| \geq 2.08$
N - 22, df - 21
* Significant at the 0.05 level

education (Liberal Arts Core Areas) on the other. Boes studied the effect of the Meaning of Science course upon the students enrolled in two sections during the fall semester of 1972.

Boes administered a variety of test instruments -- most of which are available commerically. After some careful analysis, Boes made the following summarizing statements:

1) The "Meaning of Science" course can promote a significant improvement in understanding of science.
2) The "Meaning of Science" course can promote a significant improvement in attitude toward science.
3) The "Meaning of Science" course can remedy some of the misconceptions of science harbored by students entering the course.
4) Graduate students profited significantly more from the "Meaning of Science" course than did undergraduates.
5) Science achievement is the student characteristic most closely related to understanding of science.
6) Science achievement is the student variable most closely related to growth in understanding of science resulting from the "Meaning of Science" course.
7) There is a tendency for flexible students to profit more from the "Meaning of Science" course than dogmatic students.
8) The student variables employed in this study are not in themselves sufficient to explain performance on the criterion instruments or growth on these instruments.

As suggestions were made for program improvement, it seemed desirable to collect data more systematically concerning student perceptions. Information from questionnaires was collected. Table 31 is a report of results tabulated in 1973. The table suggests that the majority of students preferred that the length of UPSTEP seminars remain the same, that the content was popular, that an afternoon meeting was preferred, that more student-student interaction was desired, that more activities outside of the seminar would be popular, that more community involvement would be preferred, that the upperclassmen would enjoy more interaction with new UPSTEP students, and that more integration of UPSTEP with the total University program was desired.

Results with another questionnaire (Appendix V) concerning the freshmen seminar series is reported in Table 32. The graph suggests that the freshmen series was generally classified as excellent. Further the graph reveals that the series improved as viewed by the students in each successive year 1970-73.

Attitudes and perceptions of students in the UPSTEP program were regularly evaluated at specific points during 1973. There was close personal contact between staff members and students in private conferences and in group meetings; evaluative questionnaires were distributed to get anonymous student reaction to UPSTEP activities. A copy of one such questionnaire is included as Appendix VI. Students were asked to complete the questionnaire at the completion of a particular UPSTEP unit to provide information to the staff and to the UPSTEP Student Planning Group.

The instrument was routinely administered at the conclusion of an overview unit on Science Teaching in the Elementary School Classroom. The unit included work with elementary activity-centered materials, interactive use of the SCIS film "Don't Tell Me, I'll Find out", and visits with elementary

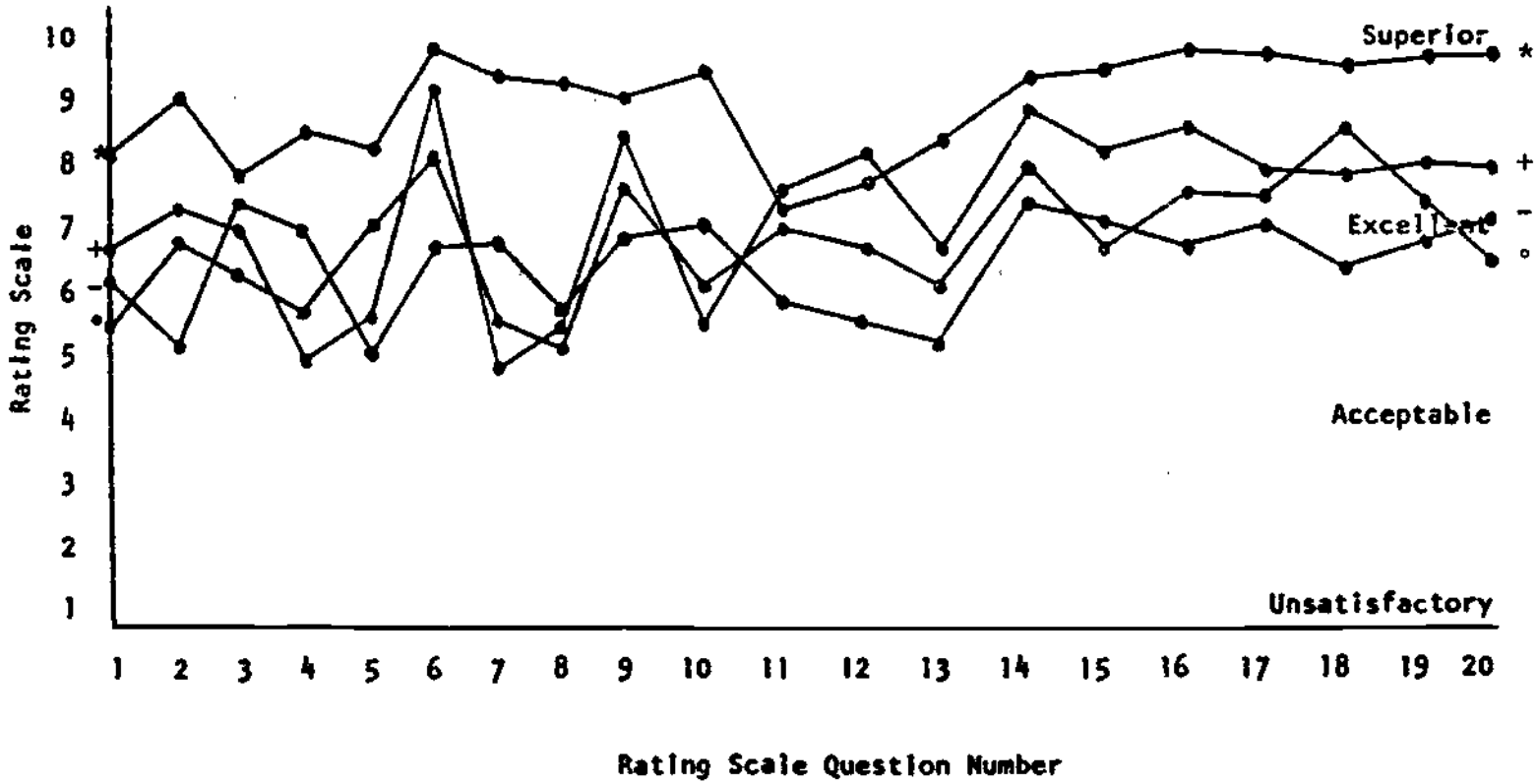
Table 31

UPSTEP Questionnaire Regarding Program Mechanics

	Spring 1973 (UPSTEP I, II, & III) Percent Reporting		
1) Length of UPSTEP Seminars	Longer 12	Same 68	Shorter 20
2) Content of UPSTEP Seminars	More Science 21	Retain as are 63	More Education/ Communication 16
3) Change Meeting Time	A.M. 31	Afternoon 44	Evening 24
4) Interaction with other UPSTEP participants	More 53	Same 45	Less 2
5) More involvement with Activities Outside of Special Seminar	More 66	Same 43	Less 1
6) More Community Involvement	More 58	Same 36	Less 6
7) Involvement with new UPSTEP "classes"	More 80	Same 20	Less 0
8) Integration with Total University Program	More 76	Same 15	Less 9

Table 32

Student Evaluation of Iowa-UPSTEP Program, 1970-73



*Average of ratings by Iowa-UPSTEP I Students, 1970-73

* 1973
\+ 1972
° 1971
– 1970

school teachers. A summary of one such set of student responses on the questionnaire is reported as Table 33. The table clearly shows that students had positive perceptions of the unit. Since honest and anonymous responses were requested, complete results were not kept with the permanent records.

Another attitude instrument was developed and piloted with various UPSTEP groups. This Pilot Attitude Survey instrument is included as Appendix VII. Table 34 indicates the results with administering the instrument to three groups of students.

Because of publicity concerning teacher surpluses, data were collected concerning teacher vacancies, hiring patterns, teachers certified, and the general employment picture for science teachers in Iowa. Table 35 suggests that there were far more vacancies reported to the University of Iowa Placement Office than numbers of teachers available as program graduates. Table 36 indicates that there were several vacancies during 1970-73 for which no persons were available as possible applicants.

Tables 37 and 38 provide information concerning science teacher preparation in the State as a whole. The number of secondary science teachers that have been prepared has decreased significantly from 1970 to the number prepared for 1973.

Other information concerning teacher numbers and institutions producing them was compiled by Glass (5). Information in Table 39 indicates that there remain significant number of teachers in Iowa schools with temporary certificates. Table 40 provides baseline data regarding the placement positions for science teachers prepared in Iowa for the 1969-70 graduates of Iowa colleges. Table 41 provides a breakdown of where science teachers are prepared in Iowa for the 1970-71 year. Again, this will be valuable baseline data for

Table 33

UPSTEP SERIES QUESTIONNAIRE

Science Teaching in the Elementary School Classroom

1. I enjoyed this UPSTEP series. (# of students responding in each category with representative use of instrument in 1973)

Rating:*	1	2	3	4	5	6
Student Response:	6	22	3			

Mean Score: 1.9

2. This series was worthwhile.

Rating:*	1	2	3	4	5	6
Student Response:	5	18	7	1		

Mean Score: 2.1

3. Interaction with materials and with our visiting guests were an important part of the series.

Rating:*	1	2	3	4	5	6
Student Response:	12	4	4	1		

Mean Score: 1.8

4. The involvement of the instructional staff was appropriate.

Rating:*	1	2	3	4	5	6
Student Response:	2	23	4	2		

5. Please make written comments and/or suggestions here:

1. Working with things we are supposed to be teaching.
2. Small group discussions--more discussion between students.
3. Discussions earlier, activities to follow-more time.
4. More teachers from schools.

*1=strongly agree
2=agree
3=neutral
4=disagree
5=strongly disagree

Table 34

Pilot Attitude Survay
Pilot Mean Scores

Item Number	Group I	II	III
1.	1.2	1.1	1.3
2.	1.6	1.5	1.6
3.	2.0	1.8	1.9
4.	1.2	1.3	1.2
5.	1.4	1.2	1.3
6.	1.6	1.2	1.2
7.	1.2	1.4	1.2

Respondents number 10-18 third year students.

Table 35

Table of Teaching Vacancies in Science Reported to U of I Educational Placement Office, 1972-73

MONTH Sept., 1972 - Aug. 31, 1973	Iowa	Midwest	East	West	Foreign
Pre-February	24	44	89	32	5
February	22	39	24	1	10
March	14	34	14	6	0
April	23	38	15	12	0
May	20	61	61	11	13
June	7	51	31	3	1
July	10	26	26	8	5
August	13	28	3	2	0
TOTAL VACANCIES	133	321	263	75	34

Table 36

Comparisons of Science Vacancies in Iowa

and University of Iowa Teachers for Placement

Year	Total Vacancies	Total of Teachers Available at U of I	Total Vacancies without Recommended Applicants from U of I
1970-71	152	24	18
1971-72	141	21	21
1972-73	133	18	20
1973-74		20	

Table 37

Secondary Science Teachers Prepared in Iowa

COLLEGE	YEAR			
	1970-71	1971-72	1972-73	1973-74 (projected)
University of Iowa	27	22	11	12*
Iowa State University	33	28	24	21
University of Northern Iowa	46	38	42	32
Drake University	26	22	18	15
Private Colleges (32)	69	51	40	31
TOTAL	201	161	135	111

*University of Iowa data have been corrected to include most up-to-date information.

Table 38

Summary of the Number of Students in the State of Iowa Completing Preparation for a Teaching Certificate with a Bachelor's Degree in Science 1969-72

Subject Area or Level	Number of Graduates by Year			
	1969	1970	1971	1972
1. Elementary Teachers	2,161	2,046	1,943	1,732
2. Mathematics	227	229	213	198
3. Biology	153	134	126	118
4. Chemistry	32	17	15	13
5. General Science	37	43	40	38
6. Physics	12	15	15	12

Table 39

Number and Percentage of Teachers Employed with Temporary Teacher Certificates by K-12 Enrollment Size Categories, 1971-72 School Year

K-12 Enrollment	No. of Districts	No. of Teachers	Teachers with Temporary Certificates	
			Number	Percentage
200-499	114	2,717	163	6.00%
500-749	121	4,230	181	4.27
750-999	64	2,967	106	3.57
1000-1499	63	3,695	83	2.24
1500-1999	20	1,681	36	2.14
2000-2999	43	4,783	132	2.76
Over 3000	28	12,466	236	1.89
TOTAL	453*	32,539	937	2.88%

*Since this data were reported, two districts have merged resulting in a total of 452 school districts in the State of Iowa.

Table 40

Occupation on November 1, 1970, of Personnel who Graduated from Iowa Colleges and Universities between September 1, 1969, and August 31, 1970, with Qualifications for the Professional Certificate

	Elementary	Secondary	Total Elementary & Secondary
Teaching			
In State	61.6%	46.9%	52.4%
Out of State	24.5	21.1	22.4
Not Teaching*	11.4	29.0	22.3
Seeking Teaching Position**	2.6	3.0	2.8
TOTAL NUMBER	2,027	3,334	5,361

*Includes: otherwise gainfully employed, graduate school, military service, and homemaking.

**Usually is restricted as to area because of family obligations.

Table 41

Percentage of Teachers Prepared by Area of Certification in each of the Twenty-Eight Teacher Preparation Institutions in Iowa for the 1970-71 Academic Year

	Area of Certification						
		Secondary					
	Elem.	Science	Gen.Sci.	Biology	Chem.	Physics	Total
Briar Cliff	2.6%		4.0%	1.4%			2.4%
Buena Vista	1.5		4.0	4.3			1.6
Central	1.7	3.7%		0.7			1.7
Clarke	2.4			3.6	3.2%		2.4
Coe	0.9		8.0	0.7	3.2		1.0
Cornell	0.8					7.7%	0.7
Dordt	2.7			2.2	3.2	7.7	2.6
Drake	12.4	9.3	12.0	2.9	12.9		11.7
Graceland	1.9			3.6	3.2		1.9
Grinnell				2.9	3.2		0.2
Iowa State Univ.	9.7		44.0	23.2	29.0	23.1	10.9
Iowa Wesleyan	2.8			5.8			2.2
Loras				4.3			0.3
Luther	3.3			2.2			3.1
Marycrest	2.8			1.4			2.5
Morningside	2.2		4.0	0.7	6.5	15.4	2.3
Mount Mercy	1.9			2.2			1.7
Northwestern	1.6		8.0	4.3	3.2		1.6
Parsons	2.3		4.0	1.4	3.2		2.4
St. Ambrose	0.8			0.7		7.7	0.8
Simpson	1.4	1.9		19.6			1.3
University of Northern Iowa	19.7	33.3			19.4	30.8	19.8
University of Iowa	15.9	51.9					15.3
University of Dubuque	1.1			0.7	3.2		1.0
Upper Iowa Univ.	1.5			5.8			1.6
Wartburg	2.8		4.0	5.1	3.2	7.7	2.9
Westmar	1.3		4.0	0.7	3.2		1.3
William Penn	2.9						2.6
TOTAL NUMBER OF TEACHERS	2,121	54	25	138	31	13	2,382

establishing future trends. In a similar manner, Tables 42 and 43 provide information of a baseline type that can be used in future studies. The data for these two tables are from the survey of teacher education at Iowa completed by Jensen (3). The most often given reasons for leaving the profession and the most common reasons for hiring new personnel will provide interesting comparisons to use when UPSTEP graduates assume full-time teaching positions.

Data concerning enrollment in Iowa-UPSTEP have been maintained. However, changes in the staff (2) and drastic changes in the program (1) during the five year period make such data meaningless. As students have left the program, information has been sought as to the reasons. Table 44 provides general information concerning UPSTEP drop outs and drop out rates in general at the University of Iowa.

In 1973 a survey was completed which included thirty students who dropped out of the UPSTEP program. Seven of the total or 23% either transferred to another institution or dropped out of school altogether. Fourteen or 47% definitely decided on a non-teaching career. These included the following: 1) Six of these entered the College of Nursing; 2) Two gained early admission to the College of Medicine; 3) Two were clearly headed for admission to medical school; 4) One was planning on graduate work in Astronomy; 5) One had been admitted to a graduate engineering program; 6) One had declared a music major; and 7) One was a business major. Five or 17% of the thirty drop outs either had part time jobs or major extra curricular activities which precluded involvement with UPSTEP. Two or 6% stated they did not enjoy the program (no reasons given). Two or 6% decided that they would be unhappy as a teacher but have yet to choose an alternative career.

Table 42

Summary Responses to an Open-end Question Relative to Reasons for Terminating or Leaving Teaching Positions in Iowa

Reason for Leaving	Summary			Elementary			Secondary			Administrative			Service		
	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank
No Reason	777	19	1	270	20	2	426	20	1	9	6	5	72	20	1
Changed Schools	436	11	4	97	7	5	263	12	3	23	16	3	53	15	2
Head of Family Moved	476	12	3	211	15	3	221	10	4	6	4	7	38	11	3
Employed Outside Ed.	337	8	5	33	2	11	265	12	2	26	18	2	13	4	8
Retired	506	13	2	272	20	1	179	8	5	19	13	4	36	10	4
Promotion within District	229	6	6	55	4	8	124	6	6	29	20	1	23	7	6
Pregnancy	210	5	7	104	8	4	91	4	9	0	0	14	15	5	7
Contract Terminated	174	4	8	35	3	10	99	5	8	4	3	10	36	10	4
Marriages	154	4	9	56	4	7	89	4	10	0	0	14	7	2	12
Resumed Education	140	3	10	31	2	12	100	5	7	0	0	14	12	3	9
Assumed Family Duties	125	3	11	49	4	9	60	3	12	4	3	10	12	3	9
Promotion-New School	109	3	12	16	1	14	82	4	11	6	4	7	5	1	13
Personal Reasons	95	2	13	64	5	6	23	1	16	0	0	14	8	2	11
Internal Reorganization	83	2	14	22	1	16	40	2	13	6	4	7	15	5	7
Health	66	2	15	31	2	12	30	1	14	3	2	12	2	1	15
New Position	40	1	16	16	1	14	13	1	18	8	6	6	3	1	14
College Teaching	32	1	17	7	1	17	23	1	16	1	1	13	1	0	16
Deceased	31	1	18	2	0	18	29	1	15	0	0	14	0	0	17
Armed Forces	9	0	19	0	0	19	9	0	19	0	0	14	0	0	18
TOTAL	4029	100		1371	100		2166	100		144	100		348	100	

Table 43

Summary Responses on an Open-end Question Relative to Reasons Given for Hiring New Teachers in Iowa during 1972-73

Reason for Hiring	Summary			Elementary			Secondary			Administrative			Service		
	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank	No.	%	Rank
Best Qualified Applicant	665	17	1	202	15	1	373	17	1	25	19	2	65	19	1
Experience	387	10	2	143	10	2	161	7	3	40	30	1	43	12	3
Training & Preparation	329	8	3	80	6	5	202	9	2	-	-	-	47	14	2
Student Teaching Exp.	270	7	4	119	9	3	137	6	6	-	-	-	14	4	6
Credential Evaluation	260	7	5	92	7	4	152	7	4	2	2	8.5	14	4	7
Recommendations	223	6	6	51	4	7	145	7	5	2	2	8.5	25	7	4
Personality	187	5	7	66	5	6	105	5	7	5	4	4.5	11	3	8
Previous Record	110	3	8	43	3	8	57	3	9	-	-	-	10	3	9
Ability	101	3	9	42	3	9.5	41	2	10	3	2	6.5	15	4	5
Interest in Students	85	2	10	42	3	9.5	-	-	-	-	-	-	8	2	10
Interview Impression	83	2	11	-	-	-	59	3	^	-	-	-	-	-	-
Appearance	61	2	12	-	-	-	-	-	-	12	9	3	-	-	-
Compatibility	51	1	13	-	-	-	-	-	-	3	2	6.5	-	-	-
Philosophy of Education	48	1	14	-	-	-	-	-	-	1	1	10	-	-	-
Organizational Ability	14	0	15	-	-	-	-	-	-	5	4	4.5	-	-	-

Table 44

Baseline Data Regarding Graduation of (A) Given Freshmen Groups at U of I and (B) UPSTEP Students

A. Freshmen n = 3,101 (1971-72)
n = 1,556 graduated with Bachelor's Degree

Time for Graduation	Number of Graduated n = 1,556*	Percentage
4 years	814	52
5 years	612	39
1 year	130	9

*50% of total who enrolled as freshmen

B. UPSTEP Students

Freshmen n = 32 1970
n = 31 1971
n = 33 1972

Year	UPSTEP Group	Number	Percentage
1971	I	26	81
1972	I	25	80
	II	18	56
1973	I	27	82
	II	24	76
	III	16	50

Table 45 indicates the relative data when original UPSTEP students, students joining the UPSTEP group, and regular teacher education students are compared. It is important to note that as the model evolved in 1975, there is no such distinction among the persons completing certification requirements and a science teaching major. The information does reveal that the students attracted to the UPSTEP program were exceptional students. This fact has been used to explain the drop out rate; the students involved have had a wide range of professional choices available to them.

The Iowa-UPSTEP Model includes many features cited as needed by Newton and Watson in their national study completed just prior to the first conceptualization of the project (9). Iowa-UPSTEP has changed in significant ways as views in teacher education have changed. Many (if not most) of the practices identified in the national sampling of promising practices in science teacher education have been tried and incorporated into the model (10). Evaluation is difficult when involving a program which has changed to the degree that Iowa-UPSTEP has and which is as comprehensive as the Iowa-UPSTEP Model is. The evaluative information described and recorded here is an attempt to provide baseline data that can be used for assessing the impact of the model in Iowa and in the nation. When the Iowa-UPSTEP graduates beyond 1977 assume positions as teachers it will be possible to observe, describe, and measure the UPSTEP product. Such studies will be the completion of an exciting developmental effort and will no doubt suggest new directions for the current model.

Tabel 45

Comparison of Abilities of Teacher Education Students at the University of Iowa

UPSTEP Students (Recruits)

Year	Number of New Students	Avg. H.S. G.P.A.	Avg. Science ACT Score	Composite ACT Score
1970-71	34	3.0	25	26
1971-72	33	3.1	28	27
1972-73	35	3.2	27	28
1973-74	41	3.2	28	27

Additions to UPSTEP Program

Date	Number of Students Added to Program	Avg. H.S. G.P.A.	Avg. Science ACT Score	Composite ACT Score
1971-72	13	3.0	24	24
1972-73	26	2.9	26	24
1973-74	33	3.1	27	26

Regular Teacher Education Students

Classification	Number*	Avg. H.S. G.P.A.	Natural Science ACT Score	Composite ACT Score
Freshmen	6	2.8	22	24
Sophomore	12	2.7	23	25
Junior	16	2.5	24	24
Senior	10	2.6	25	24

*Total number of science teaching majors not involved with UPSTEP as of Fall, 1973.

REFERENCES

1. Lunetta, Vincent N., The Iowa-UPSTEP Model, Science Education Center, The University of Iowa, January 1975, 77 pp. ED107511.

2. Lunetta, Vincent N., Yager, Robert E., Sharp, William L., Needed: New Models for Science Teacher Education, Science Education, 58(4): 497-503, 1974.

3. Yager, Robert E., Iowa-UPSTEP: Program Development from 1970 through 1975, Special Report #2, Science Education Center, University of Iowa, Iowa City, Iowa.

4. Jensen, Darrell M., A Follow-Up Study of Graduates of the Secondary Teacher Education Program of the University of Iowa, 1966-70. (Unpublished doctoral dissertation, University of Iowa), 1971.

5. Glass, Lynn, K-12 Science Education in Iowa, Technical Report #6, Science Education Center, University of Iowa, Iowa City, Iowa.

6. Golmon, Melton E. Selected Teacher Traits Characteristic of Inquiry Science Teachers and an Analysis of the Development of These Traits in Science Methods Students. (Unpublished doctoral dissertation, University of Iowa), 1972.

7. Pizzini, Edward L., An Analysis of the Effects of an Undergraduate Pre-Service Teacher Education Program on Selected Personal Characteristics. (Unpublished doctoral dissertation, University of Iowa), 1973.

8. Boes, Robert J., The Relation of Selected Student Characteristics to Understanding of Science. (Unpublished doctoral dissertation, University of Iowa), 1973.

9. Newton, D.E., and Watson, F.G., The Research on Science Education Survey. Harvard Graduate School of Education, 1968.

10. Roberts, D.A., Blosser, P.E., Raven, R.J., Voelker, A.M., and Anderson, R.D., In Search of Promising Practices in Science Teacher Education. ERIC Information Analysis Center for Science, Mathematics, and Environmental Education, Columbus, Ohio, 1973.

Appendix

I. Semantic Differential

II. Teaching Attitude Survey for Iowa-UPSTEP Participants

III. Semantic Differential for Selected Educational Concepts

IV. Science Teaching Assessment Test

V. Student Evaluation of Freshman-UPSTEP Program

VI. UPSTEP Series Questionnaire

VII. Pilot Attitude Survey

Appendix I

SEMANTIC DIFFERENTIAL

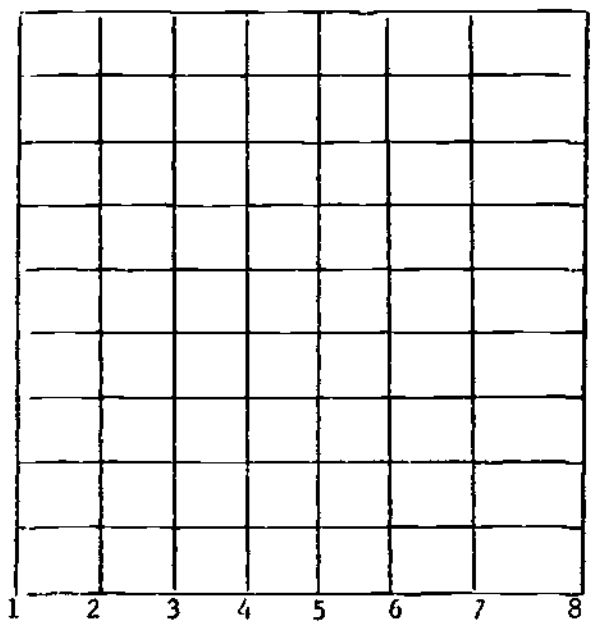
Concepts:

1- My UPSTEP Course this semester is:

2- My Science Courses this semester are:

3- My General Education Courses this semester are: (i.e., rhetoric, literature, social science, western civilization, etc.)

1.	unpleasant		pleasant
2.	active		passive
3.	bad		good
4.	pleasing		annoying
5.	relaxed		tense
6.	deliberate		careless
7.	simple		complex
8.	humorous		serious
9.	insincere		sincere
10.	formal		informal



Appendix II

Teaching Attitude Survey for Iowa-UPSTEP Participants

Check point on continuum which best indicates your attitude toward teaching as a career.

Very positive	positive	neutral	negative	very negative

If you were to choose teaching as a career, which level would interest you most?

Pre-school	elementary	junior high	senior high	college

Which best characterizes your feelings about your high school science teachers?

Excellent	good	average	below average	poor

What is your attitude toward the study of science?

Very interesting	interesting	OK	not as interesting as other studies	negative

How does the study of science at the University of Iowa compare with your science studies in high school?

Much better at University	better at University	about the same	better in high school	much better in high school

Numbers are assigned (one through five) with "one" being assigned as the most positive and "five" assigned as the most negative.

Appendix III

SEMANTIC DIFFERENTIAL FOR SELECTED EDUCATIONAL CONCEPTS

One purpose of this study is to measure the meanings that certain concepts have to various people by having them judge concepts against a series of descriptive scales. At the top of each page of this booklet you will find a different concept to be judged and beneath it a series of ten scales. Glance through the booklet reading just these concepts, to see how they differ, and in general the nature of the task that you will be reacting to. In completing this form, please make your judgements on the basis of what these concepts mean to you. MARK ALL TEN SCALES UNDER EACH OF THE CONCEPTS REGARDLESS OF THE EXTENT OF YOUR EXPERIENCE WITH THE CONCEPT.

Here is how you are to use the scales.

If you feel that the concept at the top of the page is very closely related to one end of the scale, you should place an "X" near that end. For example:

Good_X_:____:____:____:____:____:____:Bad
Good____:____:____:____:____:____:_X_:Bad

If you feel that the concept is quite closely related to one or the other end of the scale (but not extremely), you should place an "X" as follows:

Good____:_X_:____:____:____:____:____:Bad
Good____:____:____:____:____:_X_:____:Bad

and so on. If you consider the concept to be neutral on the descriptive scale, or irrelevant to the concept, then you should place your "X" in the middle space. For example:

Good____:____:____:_X_:____:____:____:Bad

Place your "X's" in the middle of the spaces, not on boundaries:

_X_:____:, not this ____X____.

Be sure to check every scale for every concept--do not omit any.

Never put more than one "X" on a single scale.

Even though this booklet is several pages, you will find that you can work at a fairly high speed. Do not puzzle over individual items. It is your first impression, the immediate "feelings" about the concepts, that we want. On the other hand, please do not be careless, because we want your true impressions.

This booklet has been modified from the instrucment utilized in James Hermas Sanders' Doctoral Dissertation entitled, " Semantic Analysis of Inservice Education In A Five State Region", University of Iowa, 1969.

The eleven educational concepts that were measured against series of descriptive scales are as follows:

1. Individualized Learning
2. Being a Science Teacher
3. Teaching Secondary Students
4. Interaction with Individual Students
5. Content-Oriented Approach to Teaching Science
6. Classroom Management and Record Keeping
7. Science Teaching Materials
8. Teaching Elementary Students
9. Process-Oriented Approach to Teaching Science
10. Importance of Discipline
11. Early Exploratory Experience

The descriptive scale that each concept was measured against was:

Uplifting ____:____:____:____:____:____:____:Depressing
Weak ____:____:____:____:____:____:____:Strong
Pleasant ____:____:____:____:____:____:____:Unpleasant
Interesting____:____:____:____:____:____:____:Boring
Disorganized___:____:____:____:____:____:____:Systematic

Adaptable	_____	_____	_____	_____	_____	_____	_____	Inflexible
Democratic	_____	_____	_____	_____	_____	_____	_____	Autocratic
Progressive	_____	_____	_____	_____	_____	_____	_____	Traditional
Meaningless	_____	_____	_____	_____	_____	_____	_____	Meaningful
Worthless	_____	_____	_____	_____	_____	_____	_____	Valuable

Appendix IV

SCIENCE TEACHING ASSESSMENT TEST

You are invited to evaluate the following statements of objectives which science students might be expected to achieve. These statements do not contain the specificity associated with behavioral objectives for explicit science courses but are more universal statements of behavioral goals implicit in science courses generally, Each statement presented here could be translated into specific behavioral objectives for specific science courses.

Please designate your opinion as to both the desirability and measurability of each student objective by checking the appropriate columns on the answer sheet across from the number which corresponds to the number of the statement.

Please indicate which of the five listed teaching strategies you believe most conducive to student achievement of each stated objective by placing a "t" in the appropriate column. Indicate which teaching strategy you believe least conducive to student achievement of each objective by placing a "-" in the appropriate column.

Definitions of the teaching strategies used in this assessment are as follows:

Total-Classroom is a teacher-directed strategy in which the total class of students move through specified course material together.

Self-Pacing is a strategy in which the teacher monitors all of the students working through identical instructional sequences but each student is allowed to progress at his (her) own rate through the specified material.

Individualized Instruction implies multiple paths of specific instructional sequences used by the teacher in counseling individual students to pursue scientific topics according to each student's interests and abilities.

Guided Discovery is here defined as a strategy in which the instructional sequences or paths are not specified. The teacher poses problems in various scientific settings and then allows the students to select their own means for getting and interpreting data, reasoning out solutions or empirically investigating the specified problems.

Open Discovery is defined in this assessment as a strategy in which each student is allowed to investigate the materials provided by the teacher according to the student's own curiosity and purpose. The teacher serves as a resource person and inquirer.

A science student should be able to . . .

1 . . define technical terms within the discipline of each science course.

2 . . list facts important to systematic classification of natural phenomena.

3 . . identify scientific symbols which represent elements of specific science disciplines.

4 . . compare past and present theories of the specific course discipline.

5 . . classify sets of elements within a discipline. (e.g., phyla, families of chemical elements, etc.)

6 . . describe techniques and methods used by scientists in their investigations.

7 . . delineate important principles which summarize areas of scientific phenomena. (e.g., Krebs cycle, uniformitarianism, etc.)

8 . . interpret graphs and data tables in terms of scientific generalizations.

9 . . distinguish between relevant and irrelevant information when drawing conclusions from a set of data.

10 . . drew inferences and state logical conclusions from observations.

11 . . predict the probable effect of a change in one variable of a closed system.

12 . . apply science concepts and principles to new situations.

13 . . state hypotheses based on his own laborstory observations.

14 . . identify causal relationships between dependent and independent variables.

15 . . recognize the scientific principles which were used in reports of scientific research.

16 . . write precise and factual reports of his own laboratory investigations.

17 . . design a set of laboratory procedures to test new hypotheses.

18 . . build physical, mathematical or abstract models to explain observed phenomena.

19 . . rank different elements within a specific set of elements according to a criterion standard. (e.g., effects of radiation dosage on living tissue, mineral value of a set of core drillings, etc.)

20 . . choose an efficient course of action from a set of alternative procedures for posed investigatory problems.

21 . . list differences and similarities between scientific goals, technological goals and humanistic goals.

22 . . change or modify previously established views when confronted with new evidence.

23 . . seek empirical evidence on his own when presented with statements about natural phenomena.

24 . . accept scientific statements by science teachers and/or texts.

25 . . refrain from conducting leboretory investigations until he hears <u>all</u> of the procedural instructions.

26 . . obtain enough intrinsic reward from laboratory investigations to negate the need for grades.

27 . . attain some complex scientific skills even though much personal concentrated effort must be invested.

28 . . distinguish between popular press sensationalism and research evidence on scientific questions.

29 . . delineate the personal benafits from the study of a science discipline.

30 . . form judgements as to the responsibilities the scientific community has for conserving human and material resources.

31 . . organize his opinions on issues of government (local or national) in which special scientific knowledge is involved based upon expert opinion and empirical evidence.

32 . . judge problems and issues in terms of substantiated evidence and projected consequences rather than on fixed precepts or emotional considerations.

33 . . develop and outline a personal code of behavior based on a premeditated study and evaluation of all available evidence.

Appendix V

STUDENT EVALUATION OF FRESHMAN UPSTEP PROGRAM

Directions: Rate each question below from one to ten by placing the number in the blank preceding the question which corresponds to the following:

0-2:	Unsatisfactory	6-8:	Excellent
3-5:	Acceptable	9-10:	Superior

___ 1. Comparing this program with your other freshmen courses, to what degree did this program acquaint you with the nature of scientific research which is in progress at the University of Iowa.

___ 2. Comparing this program with your other freshmen courses, to what degree did this program provide you with the opportunity to meet and interact with researchers from the various disciplines of science.

___ 3. To what degree did this program help you better understand the identity of research scientists as individuals.

___ 4. How well do you feel the program helped in your developing an understanding of the place of science in society.

___ 5. To what degree was the UPSTEP staff available for counseling assistance.

___ 6. Comparing the UPSTEP staff with your other instructors, to what degree were they more concerned with you as a person and a student.

___ 7. To what degree did the program provide you with a means of identification as a student at the University of Iowa.

___ 8. To what degree did an espirit de corp exist in the program.

___ 9. Comparing this program with your other courses, to what degree did this program encourage group interaction with instructors and fellow students.

___ 10. To what degree did this program assist in the adjustment to college life in general.

___ 11. Compared to other course instructors, to what extent did you feel at ease in seeking out assistance from your UPSTEP staff.

___ 12. To what degree did you feel the program provided an informal atmosphere conducive to speaking freely your thoughts and ideas.

___ 13. To what degree did this program influence your decision to pursue science teaching as a career.

___ 14. To what degree did this program encourage you to develop an attitude of open-mindedness about teaching.

___ 15. To what degree were you shown that communicative techniques varied pending the physical and mental level of the students.

___ 16. How well do you feel that the program emphasized the importance of communication.

___ 17. How well do you feel that the program utilized local, controversial issues in education, emphasizing the role of education in society.

___ 18. To what degree do you feel that the informal get-togethers were beneficial for you as a participant in the program.

___ 19. To what degree do you feel that the program was beneficial in understanding science education.

___ 20. Comparing this program to the best course you have completed at the University of Iowa, please rate it accordingly.

Appendix VI

UPSTEP SERIES QUESTIONNAIRE

Circle the appropriate response to each item evaluating the resent series of UPSTEP sessions.

1. I enjoyed this UPSTEP series.

1	2	3	4	5
strongly agree	agree	neutral	disagree	strongly disagree

2. This series was worthwhile

1	2	3	4	5
strongly agree	agree	neutral	disagree	strongly disagree

3. Interaction with materials and with our visiting guests were an important part of the series.

1	2	3	4	5
strongly agree	agree	neutral	disagree	strongly disagree

4. The involvement of the Instructional staff was appropriate

1	2	3	4	5
strongly agree	agree	neutral	disagree	strongly disagree

5. Please make written comments and/or suggestions here:

Appendix VII

Pilot Attitude Survey

1. How has UPSTEP effected your interest in teaching?

   1) Positively--it has reinforced my interest or I have become more interested.
   2) Neutral--no change in interest
   3) Negative--I have less interest in teaching.

2. To what extent has has UPSTEP satisfied your questions about teaching.

   1) Has answered many important questions.
   2) Neutral.
   3) Has answered very few important question.

3. To what extent has the UPSTEP/T.E.P. provided meaningful teaching related experiences?

   1) To a great extent--many meaningful experiences.
   2) To moderate extent-- some meaningful experiences.
   3) Few if any meaningful experiences.

4. How would you rate your investment of time in UPSTEP?

   1) Time very well spent--would rate a high impact experience-maximum benefit for time invested.
   2) Neutral
   3) Time poorly spent--minimum benefit for time invested.

5. To what extent has UPSTEP affected your teaching philosophy?

   1) Markedly--I have altered my views substantially.
   2) Neutral--my previous convictions have remained the same but were reinforced.
   3) Turned me off.

6. How would you rate the consideration and attention shown to you as a person?

   1) Better than in other courses.
   2) The same as in other courses.
   3) Less than in other courses.

7. Would you recommend UPSTEP to your friends as being a worthwhile experience?

   1) Definitely yes!
   2) Possibly.
   3) Definitely no!