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ABSTRACT

The IPSE (Incentive Program in Science and Engineering) was designed to increase the number of lower socioeconomic status students who major in engineering and science. This document is a progress report of the demonstration project. It focuses on the third year evaluation, changes observed in students over time, and a summary evaluation. Students were enrolled in the IPSE program during their sophomore year in high school, and most continued in the program through senior year. The goals of this evaluation were to assess the effects of participation in the program on the following variables: (1) students' attitudes toward science, (2) attitudes toward the various components of the IPSE program, (3) the number of math and science courses attempted, and (4) college attendance and major field of study. A job interest questionnaire, interivews, and mail surveys were used to obtain data. Results of the study indicated that IPSE students had more positive attitudes toward science and scientific occupations than did control groups. They took more science and mathematics courses, and a larger proportion of IPSE students went to college. When compared to the control group, twice as many IPSE students chose science majors in college. (Author)

INCENTIVE PROGRAM IN SCIENCE AND ENGINEERING

A Progress Report for 1976-1977*
(Final Report)

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A. PREVIOUS EVALUATIONS OF IPSE

The IPSE program has been a three year demonstration project aimed at increasing the number of lower socioeconomic status students who major in science and engineering upon entering college. The demonstration involved enrolling students in the IPSE program when they were high school sophomores, and following and guiding their progress over the next three years. Membership in the IPSE program involved several experiences, described in previous progress reports. The goals of the evaluation of the project were to assess the effects of participation in the program on 1) students' attitudes toward science; 2) students' attitudes toward the various components of the IPSE program; 3) the number of math and science courses attempted; and 4) intentions and actual behaviors concerning college attendance and major in college.

Major evaluation efforts were undertaken in the spring of each year of the IPSE project. In addition, follow up efforts continued through June 1977, in order to determine what the students did upon graduation from high school. The evaluations for the first and second years were contained in the first and second progress reports, respectively, (cf Appendices A and B). Therefore, the final report will not cover these evaluations again. Instead, the final report will focus on the third year evaluation, on the changes observed in the students over time, and on summary evaluations.

B. GOALS OF THE THIRD YEAR EVALUATION

The basic goals of the third year evaluation were to continue along the line established during the second year evaluation and to attempt to assess participants' feelings and attitudes based upon their three year experience with IPSE. It was felt that this "retrospective" point of view would be helpful in interpreting the strengths and weaknesses of the entire program.

The methods of evaluation were the same as for the second year evaluation. Specifically, the Colorado State University Job Interest Questionnaire (see Appendix C) was administered during April of 1977. This questionnaire contains: (1) a ten item attitude toward science scale; (2) fifteen various occupations rated on seven semantic differential scales; (3) background information, such as ethnic affiliation; (4) open ended questions concerning such things as least and most favorite courses; (5) questions about the various components of IPSE based upon the participants' three years in the program; and (6) questions about plans for the future.

In addition to the questionnaire, interviews were done with 52 of the IPSE students and 20 of the associated high school personnel, such as principals and counselors (see Appendix D for sample interview forms). Data was also obtained concerning the course work of the students. Finally, a mail survey was conducted to locate the students in June of 1977 to determine what they intended to do, i.e., attend college, work full time, work part time, etc.

C. SELECTION OF GROUPS

The sole criterion for selection of possible participants in the IPSE program was that the student's junior high school record indicate no problems with mathematics or science. No attempt was made to only select those who had performed well in these areas; rather, the selection system could be viewed as a minimal cut off strategy. After an eligibility list of prospective students was formulated, the Field Coordinator met with these students in small groups and described the IPSE program to them. They were then asked if they would like to participate in such a program, and if so, permission slips were sent to their parents.

Selection of students to be in the various control groups was also based upon examination of each students' junior high school record, and the same criteria used for membership in the IPSE eligibility list was used to include a student in the control group. Unfortunately, whereas the IPSE group underwent a subsequent diminution, because of self-selection into the program, there was no such self-selection for any of the control groups. (Since there was no "group" per se, there was never a decision to make as to whether to be in a control group or not.) Thus, the IPSE group and the various control groups differed in terms of this additional self-selection factor. In order to control for this to some extent, the control groups were given a description of a program like IPSE on their questionnaires, and asked whether they would be interested in being in such a program. It is assumed that those who responded in the affirmative are similar to those students who elected to be in IPSE, while those who responded negatively are similar to the students who elected not to be in IPSE. Of course, there are probably several students who elected not to be in IPSE owing to factors other than a lack of interest (e.g. time pressures). There is adequate control for this type of student in the present evaluation effort.

II. ATTRITION DATA

Of the original 141 students in IPSE, 90 completed the program. This represents a retention rate of 64%. Only 12 of the 51 dropouts occurred during the third year of the program. At least 18 of the 51 dropouts from the program were involuntary. These students had either moved (13 of the cases), graduated early (1 of the cases), became pregnant (1 of the cases), or their school was no longer one of the target schools (3 of the cases). The other 33 cases dropped out for a variety of reasons, most often stating disinterest in the program or the difficulty of the math and science requirements of the program.

The three year summary for the control groups available for testing are summarized in Table 1. The control "groups" are not groups per se, and thus the only way of determining if a participant remains in a group is to see if he or she is present during the day that the CSU Job Interest Questionnaire is given out. There are two basic control groups: The Post-IPSEs are those students who were sophomores when the IPSEs were juniors; the Pre-IPSEs are those students who were juniors when the IPSEs were sophomores. Obviously, the Post-IPSE group was not available for testing during the first year of the program, and the Pre-IPSE group was not available for testing during the last year of the program. The designation of "YES" or "NO" is based on the responses to the one item question describing the IPSE program and then asking the students if they would be interested in being in such a program.

TABLE 1: Number of Participants in Each Group.

Group	Year 1975	1976	1977
IPSE	141(133)	102(95)	90(85)
Pre-IPSE-Yes	117	87	-
Pre-IPSE-No	83	57	-
Post-IPSE-Yes	-	58	50
Post-IPSE-No	-	30	22

Notes: Figures in parentheses are the numbers who were present for the CSU Job Interest Questionnaire. "Yes" and "No" designations indicate those control group participants who either said they were or were not interested in a program like IPSE.

III. ATTITUDINAL DATA

A. GROUPS

Over the three year period of the IPSE program, five basic groups were formed: the IPSE group itself; the pre-IPSE:YES group; the pre-IPSE:NO group; the post-IPSE:YES group; and the post-IPSE:NO group. The IPSE group was tested during three consecutive years. All the other groups were tested during only two consecutive years. (See Table 1.)

B. ATTITUDE TOWARD SCIENCE

The means and standard deviations of the five groups on all measurement occasions for each of the ten items on the attitude toward science scale, as well as for the total score on this scale, are found in Table 1E of Appendix E.

There are several questions one can ask concerning these data: Did the groups differ when measured at the same period in time? Did the groups differ when measured at the same point in their progress toward their diplomas? Did the groups change over a period of time? If so, was there more change for one group than for another group? This section will address each of these questions in turn.

1. Data for 1977. Comparisons for the data on the three groups tested in 1977 indicates that the IPSE group had a more positive overall attitude toward science than either of the post-IPSE groups. In addition, the IPSE group scored more favorably than the post-IPSE:NO group on seven of the ten items, and more favorably than the post-IPSE:YES group on five of the ten items (see Table 2). This pattern is similar to the data obtained for 1976 and 1975 (see Appendices A and B).

2. Data for Seniors. Table 3 summarizes the statistical analyses comparing IPSEs tested as seniors in 1977 to pre-IPSE:YES and pre-IPSE:NO

TABLE 2: Attitude Toward Science: Comparison of Groups Tested in 1977.

Item[a]	F	Significance[b]	Post-hoc Differences[c] Among Groups[d]
1	10.793	.001	9 > 11
2	2.368	ns	
3	2.341	ns	
4	2.726	ns	
5	8.783	.001	9 > 10, 11
6	16.086	.001	9 > 10, 11
7	3.789	.025	9 > 11
8	19.887	.001	9 > 10, 11
9	12.817	.001	9 > 10, 11
10	12.998	.001	9 > 10 > 11
Total	24.582	.001	9 > 10 > 11

[a] For item content, see Appendix C

[b] Statistical significance of F test, with degrees of freedom = 2,154 in most cases.

[c] All post hoc tests are Scheffe.

[d] The code for groups is: 1 = IPSE, 1975 (Sophomores); 2 = Pre-IPSE:Yes, 1975 (Juniors); 3 = Pre-IPSE:No, 1975 (Juniors); 4 = IPSE, 1976 (Juniors); 5 = Pre-IPSE:Yes, 1976 (Seniors); 6 = Pre-IPSE:No, 1976 (Seniors); 7 = Post-IPSE:Yes, 1976 (Sophomores); 8 = Post-IPSE:No, 1976 (Sophomores); 9 = IPSE, 1977 (Seniors); 10 = Post-IPSE:Yes, 1977 (Juniors); 11 = Post-IPSE:No, 1977 (Juniors).

TABLE 3: Attitude Toward Science: Comparison of Seniors.[a]

Item	F	Significance[b]	Post-hoc Differences Among Groups
1	15.104	.001	9 > 5, 6
2	1.510	ns	
3	1.323	ns	
4	5.207	.01	9 > 6
5	5.232	.01	9, 5 > 6
6	23.098	.001	9, 5 > 6
7	.428	ns	
8	22.866	.001	9, 5 > 6
9	21.075	.001	9, 5 > 6
10	24.798	.001	9, 5 > 6
Total	32.371	.001	9 > 5 > 6

[a] See footnotes a, c, and d of Table 2.

[b] Statistical significance of F test, with degrees of freedom = 2,224 in most cases.

groups tested as seniors in 1976. The IPSE group has a more positive attitude toward science, as indicated by total scores, than either of the other two groups. In addition, the IPSE group scored significantly higher than the pre-IPSE:NO on seven of the ten items, and higher than the pre-IPSE:YES group on one of the items.

3. Data for Juniors. The comparisons of the IPSEs tested in 1976 with the post-IPSE groups tested in 1977 and the pre-IPSE groups tested in 1975 are summarized in Table 4. Owing to the large number of groups used in this analysis, interpretation becomes cumbersome. To summarize briefly, the IPSE group had a more favorable attitude than all the other groups, as indicated by total score; while the pre-IPSE:YES group and the post-IPSE:YES groups had more favorable attitudes than their "NO" counterparts. Similar trends were found on several of the items.

4. Data for Sophomores. IPSE students tested in 1975 were compared with post-IPSE students tested in 1976. These comparisons, summarized in Table 5, show that the IPSE group had more favorable attitudes than the post-IPSE groups on the total attitude toward science, and had more favorable attitudes than the post-IPSE:NO group on seven of the ten items, as well as more favorable attitudes than the post-IPSE:YES groups on two of the items.

5. Changes in Attitude. The statistical analyses for changes in attitude over time are summarized in Tables 6-9 inclusive. For the purpose of detecting changes, the important columns are the ones headed "trials" and "group by trials" interaction. The former indicates whether there were constant changes over time for all of the groups considered in the given analysis, while the interaction indicates whether there were differential changes over time among the groups considered. The "groups" column just gives information about the differences among the various groups, which has

TABLE 4: Attitude Toward Science: Comparison of Juniors.[a]

Item	F	Significance[b]	Post-hoc Differences Among Groups
1	8.117	.001	4,10,2 > 3
2	4.518	.001	4 > 3
3	1.479	ns	
4	4.423	.005	ns
5	9.966	.001	4 > 3,11,10;2 > 3
6	29.553	.001	4 > 2,10,11,3;2 > 3,11;10 > 3
7	3.911	.005	4 > 11
8	17.449	.001	4 > 10,11,3;2 > 3,11
9	7.979	.001	4 > 11,3;2 > 3
10	17.138	.001	4 > 11,3;10 > 3
Total	29.754	.001	4 > 2,10,11,3;2 > 3,11;10 > 3

[a] See footnotes a, c, and d of Table 2.

[b] Statistical significance of F test, with degrees of freedom = 4,362 in most cases.

TABLE 5. Attitude Toward Science: Comparison of Sophomores.[a]

Item	F	Significance[b]	Post-hoc Differences Among Groups
1	6.750	.001	1 > 8
2	.100	ns	
3	4.721	.01	1 > 7
4	2.155	ns	
5	7.173	.001	1 > 8
6	16.877	.001	1,7 > 8
7	5.413	.005	1,7 > 8
8	15.940	.001	1,7 > 8
9	8.638	.001	1 > 7,8
10	6.995	.001	1 > 8
Total	18.575	.001	1 > 7 > 8

[a] See footnotes a, c, and d of Table 2.

[b] Statistical significance of F test, with degrees of freedom = 2,217 in most cases.

TABLE 6: Comparisons of Changes in Attitude Toward Science from Sophomore to Junior Years.

Item	Groups[a]		Trials		Groups by Trials Interaction	
	F	Significance[b]	F	Significance[c]	F	Significance[d]
1	8.006	.001	.066	ns	.238	ns
2	1.377	ns	.272	ns	.726	ns
3	5.597	.005	.441	ns	3.484	.05
4	3.107	.05	.476	ns	1.743	ns
5	13.214	.001	4.112	.05	.474	ns
6	22.565	.001	.144	ns	4.883	.01
7	8.567	.001	.763	ns	.640	ns
8	19.577	.001	1.717	ns	2.337	ns
9	14.070	.001	2.075	ns	.398	ns
10	14.211	.001	.260	ns	.653	ns
Total	23.943	.001	3.062	ns	1.595	ns

[a] The groups involved in this comparison are IPSE, 1975 and 1976; and post-IPSE:Yes and post-IPSE:No, 1976 and 1977.

[b] Degrees of freedom for F test are 2 and 161 in most cases.

[c] Degrees of freedom for F test are 1 and 161 in most cases.

[d] Degrees of freedom for F test are 2 and 161 in most cases.

TABLE 7: Comparisons of Changes in Attitude Toward Science from Junior to Senior Years.

Item	Groups[a]		Trials		Groups by Trials Interaction	
	F	Significance[b]	F	Significance[c]	F	Signficance[d]
1	19.223	.001	2.815	ns	.470	ns
2	6.275	.005	5.404	.025	3.250	.05
3	.447	ns	3.889	.05	1.308	ns
4	8.963	.001	.004	ns	.184	ns
5	18.115	.001	2.059	ns	6.494	.005
6	46.427	.001	.741	ns	3.894	.025
7	3.488	.05	.199	ns	.064	ns
8	32.320	.001	2.143	ns	.452	ns
9	25.542	.001	1.827	ns	1.079	ns
10	45.923	.001	1.823	ns	.935	ns
Total	48.004	.001	3.785	.05	2.690	ns

[a] The groups involved in this comparison are IPSE, 1976 to 1977; and pre-IPSE:Yes and pre-IPSE:No, 1975 and 1976.

[b] Degrees of freedom for F test are 2 and 224 in most cases.

[c] Degrees of freedom for F test are 1 and 222 in most cases.

[d] Degrees of freedom for F test are 2 and 222 in most cases.

TABLE 8. Comparisons of changed in Attitude Toward Science from 1976 to 1977.

Item	Groups[a]		Trials		Groups by Trials Interaction	
	F	Significance[b]	F	Significance[c]	F	Significance[d]
1	10.558	.001	1.521	ns	.732	ns
2	1.987	ns	.215	ns	.093	ns
3	3.928	.025	1.183	ns	2.479	ns
4	3.289	.05	.893	ns	.111	ns
5	19.571	.001	.094	ns	2.265	ns
6	22.368	.001	6.612	.025	.434	ns
7	11.263	.001	.147	ns	.144	ns
8	28.380	.001	.002	ns	.829	ns
9	20.294	.001	.502	ns	.613	ns
10	19.013	.001	.027	ns	.424	ns
Total	28.563	.001	.036	ns	.116	ns

[a] The groups involved in this comparison are IPSE and post-IPSE groups.

[b] Degrees of freedom for F test are 2 and 149 in most cases.

[c] Degrees of freedom for F test are 1 and 149 in most cases.

[d] Degrees of freedom for F test are 2 and 149 in most cases.

TABLE 9: Analyses of Changes in Attitude Toward Science in IPSE Students from 1975 through 1977.

Item	F	Significance[a]
1	1.607	ns
2	.525	ns
3	.174	ns
4	.961	ns
5	2.010	ns
6	1.467	ns
7	2.361	ns
8	3.650	.05
9	1.324	ns
10	.837	ns
Total	2.094	ns

[a] Degrees of freedom for the F test are 2 and 258 in most cases.

already been discussed. Looking at just the total attitude scores, there are very few changes in attitude noted. The only significant difference was an increase in attitude between the junior and senior years noted for the pre-IPSEs and the IPSEs (see Table 7). While there are other significant differences on several of the items in this group of analyses, there does not appear to be a general trend in terms of changes in attitude.

6. Attitude toward Science: Summary. The IPSE students had generally more positive attitudes toward science and scientific work than did all the various control groups. Those control group members who said they would be interested in being in a program like IPSE were in turn generally more positive about science than those who indicated they would not be interested in such a program. The crucial question is what effect did participation in the IPSE program versus self-selection into the program have on these attitudes. The two "YES" groups should serve as a control on the self-selection factor, but it is certainly not a perfect control. Since the IPSE group was not tested until after they had been selected into the program and in fact had participated in it, it is impossible to conclusively determine the cause of the differences between the IPSE group and the "YES" control groups. Analysis of the changes in attitudes indicates that participation in IPSE did not increase a favorable attitude toward science over time. The increased favorability of attitudes toward science between the junior and senior years cannot be credited to participation in IPSE, since there was a similar increase for the pre-IPSE control groups. In general, the IPSE students started off with positive attitudes toward science and remained that way over the two years of testing. Similarly, the "NO" control groups started off with less positive attitudes toward science and remained that way over the two years of testing. The "YES" control groups were generally in between the IPSE and the "NO" groups.

C. SEMANTIC DIFFERENTIAL RATINGS OF OCCUPATIONS

A second part of the CSU Job Interest Questionnaire involved having the students rate 15 occupations ("being a ... (1) Biologist, (2) Chemist, (3) Physicist, (4) Doctor, (5) Mathematician, (6) Social Worker, (7) Engineer, (8) Guidance Counselor, (9) Dentist, (10) Physical Therapist, (11) Veterinarian, (12) Artist, (13) Writer, (14) Business Executive, and (15) My future occupation") on seven semantic differential scales (Good:Bad, Difficult:Easy, Interesting:Boring, Worthless:Valuable, Free:Limited, Pays Well:Pays Poorly, and Low Status:High Status). The means and standard deviations of these ratings for the data collected in 1976 were given in the second progress report (see Appendix B, pp. 51-57). In order to save space, only the means and standard deviations for the data NOT found in the second report are shown in Table 2E of Appendix E. The questions which were relevant for the attitude toward science scale are also relevant for the semantic differential. Therefore, this section will follow the same format as the previous section.

1. Data for 1977. The data for the IPSE students were compared with the data for the post-IPSE groups. Of the 105 possible statistical analyses, 28 reached conventional levels of significance ($p < .05$). The statistically significant results are summarized in Table 10. As can be seen from this table, most of the significant differences occurred on the ratings of the scientific occupations. In order to facilitate interpretation, the ratings on the nine scientific occupations were combined, and these were compared to the combined ratings over the five nonscientific occupations. These comparisons are shown in Table 11. The IPSE group rated the scientific occupations as higher on the Good·Bad scale, more interesting, and more valuable. Although the post-hoc comparison was not statistically significant

TABLE 10: Statistically Significant Comparisons among Groups on Semantic Differential Ratings: 1977.

Occupation	Scale[a]	F	Significance[b]	Post-hoc Differences Among Groups[c]
BIOLOGIST	Bad:Good	5.411	.005	9 > 11
CHEMIST	Bad:Good	9.481	.001	9 > 10,11
	Boring:Interesting	4.503	.025	9 > 11
	Worthless:Valuable	12.141	.001	9 > 10,11
PHYSICIST	Bad:Good	3.351	.05	ns
	Worthless:Valuable	3.822	.025	9 > 11
	Low Status:High Status	3.366	.05	9 > 11
DOCTOR	Bad:Good	5.339	.01	9 > 11
	Worthless:Valuable	7.546	.001	9 > 10
	Low Status:High Status	3.244	.05	ns
MATHEMATICIAN	Bad:Good	3.403	.05	ns
SOCIAL WORKER	Difficult:Easy	5.079	.01	10 > 11
ENGINEER	Bad:Good	9.352	.001	9 > 10,11
	Difficult:Easy	5.144	.01	10 > 9
	Boring:Interesting	4.792	.01	9 > 11
	Worthless:Valuable	5.622	.005	9 > 11
	Pays Poorly:Pays Well	3.824	.025	ns
	Low Status:High Status	4.933	.01	9 > 10,11
DENTIST	Low Status:High Status	3.540	.05	ns
VETERINARIAN	Bad:Good	3.399	.05	ns
	Difficult:Easy	4.926	.01	10 > 9
	Worthless:Valuable	4.480	.025	ns
	Pays Poorly:Pays Well	5.042	.01	ns
	Low Status:High Status	4.851	.01	ns
ARTIST	Difficult:Easy	4.247	.01	9,10 > 11
	Limited:Free	3.719	.05	9 > 11
WRITER	Pays Poorly:Pays Well	4.619	.025	10 > 9
MY FUTURE OCCUPATION	Difficult:Easy	7.543	.001	10 > 11,9

[a] Some scales were reversed for this table so that high scores always reflect more of the adjective on the right in each scale.

[b] Degrees of freedom = 2 and 154 for most cases.

[c] See footnotes c and d, Table 2.

TABLE 11: Semantic Differential: Comparisons for 1977 Data for Combined Scientific and Nonscientific Occupations.

Scale[a]	F	Significance[b]	Post-hoc Differences Among Groups[c]
SCIENCE			
Bad:Good	8.490	.001	9 > 10,11
Difficult:Easy	2.462	ns	
Boring:Interesting	4.756	.01	9 > 11
Worthless:Valuable	8.293	.001	9 > 10,11
Limited:Free	1.566	ns	
Pays Poorly:Pays Well	2.140	ns	
Low Status:High Status	4.781	.01	ns
NONSCIENCE			
Bad:Good	.428	ns	
Difficult:Easy	5.661	.005	9,10 > 11
Boring:Interesting	1.541	ns	
Worthless:Valuable	.542	ns	
Limited:Free	2.060	ns	
Pays Poorly:Pays Well	2.487	ns	
Low Status:High Status	.246	ns	

[a] Science scale scores are obtained by summing the scale scores of the following occupations: Biologist, Chemist, Physicist, Doctor, Mathematician, Physical Therapist, Engineer, Dentist, and Veterinarian.

Nonscience scale scores are obtained by summing the scale scores of the following occupations: Social Worker, Guidance Counselor, Artist, Writer, and Business Executive. See footnote a, Table 10.

[b] Degrees of freedom = 2 and 154 for most cases.

[c] See footnotes c and d, Table 2.

the IPSE group also rated the scientific occupations as having higher status than did the post-IPSE groups. On the nonscientific occupations, the IPSE and post-IPSE:YES groups rated these as being easier than did the post-IPSE:NO group.

2. Data for Seniors. The ratings of the IPSE group in 1977 were compared to the ratings of the pre-IPSE groups done in 1976, when all these groups were seniors. As in the previous section, almost all of the significant differences, summarized in Table 12, involved the IPSE group being significantly different from at least one of the other two groups, and most of the differences occurred on the ratings of the scientific occupations. The analyses done on the combined ratings over the scientific and nonscientific occupations, summarized in Table 13, shows that the IPSE group rated the scientific occupations as higher on the Good:Bad scale, more interesting, more valuable, and better paying, although the post-hoc analyses of these last two comparisons were not significant.

3. Data for Juniors. The ratings on the semantic differential by the IPSE group gathered in 1976 were compared to the ratings by the post-IPSE groups obtained in 1977, and the ratings by the pre-IPSE groups obtained in 1975. Thirty-four of the possible 105 analyses reached statistical significance, as summarized in Table 14. Again, the IPSE group was involved in most of these, and most of the differences involved the scientific occupations. The analyses for the combined scientific occupations versus the combined nonscientific occupations, summarized in Table 15, shows that the IPSE groups and the two "YES" control groups rated the scientific occupations as higher on the Good:Bad scale than did the pre-IPSE:NO group; the IPSE and post-IPSE:YES groups rated the scientific occupations as more interesting than the post-IPSE:NO group; and the IPSE group and the pre-IPSE:YES groups rated the scientific occupations as more valuable and as having higher

TABLE 12: Statistically Significant Comparisons Among Seniors on Semantic Differential Ratings.[a]

Occupation	Scale	F	Significance[b]	Post-hoc Differences Among Groups
BIOLOGIST	Bad:Good	12.396	.005	9,5 > 6
	Boring:Interesting	4.900	.01	9 > 6
CHEMIST	Bad:Good	12.341	.001	9 > 5,6
	Boring:Interesting	3.920	.025	9 > 6
	Worthless:Valuable	4.071	.025	9 > 6
PHYSICIST	Bad:Good	5.936	.005	9 > 6
DOCTOR	Bad:Good	8.197	.001	9 > 5,6
	Low Status:High Status	4.985	.01	9,5 > 6
MATHEMATICIAN	Bad:Good	6.753	.001	9 > 5,6
	Boring:Interesting	5.357	.005	9 > 6
SOCIAL WORKER	Boring:Interesting	4.225	.025	6 > 9
	Worthless:Valuable	4.203	.025	5 > 9
	Low Status:High Status	3.572	.05	6 > 9
ENGINEER	Bad:Good	14.665	.001	9 > 5,6
	Difficult:Easy	4.540	.025	6 > 9
	Boring:Interesting	15.928	.001	9 > 5,6;5 > 6
	Limited:Free	3.214	.05	5 > 6
	Pays Poorly:Pays Well	5.673	.005	9 > 6
	Low Status:High Status	5.284	.01	9 > 6
GUIDANCE COUNSELOR	Pays Poorly:Pays Well	6.966	.001	6 > 5
DENTIST	Bad:Good	3.029	.05	ns
	Pays Poorly:Pays Well	4.567	.025	9 > 5,6
VETERINARIAN	Bad:Good	4.705	.010	9 > 6
	Difficult:Easy	7.196	.001	5,6 > 9
	Boring:Interesting	5.715	.005	9 > 6
	Pays Poorly:Pays Well	9.797	.001	9,5 > 6
	Low Status:High Status	6.473	.005	9 > 6
MY FUTURE OCCUPATION	Difficult:Easy	7.123	.001	6 > 5,9
	Pays Poorly:Pays Well	6.700	.001	9 > 5,6

[a] See footnotes a and c, Table 10

[b] Degrees of freedom = 2 and 227 for most cases.

TABLE 13: Semantic Differential: Comparisons Among Seniors for Combined Scientific and Nonscientific Occupations.

Scale[a]	F	Significance[b]	Post-hoc Differences Among Groups[c]
SCIENCE			
Bad:Good	13.956	.001	9 > 5,6
Difficult:Easy	.771	ns	
Boring:Interesting	9.853	.001	9 > 5,6
Worthless:Valuable	3.528	.05	ns
Limited:Free	.916	ns	
Pays Poorly:Pays Well	3.540	.05	ns
Low Status:High Status	2.450	ns	
NONSCIENCE			
Bad:Good	.164	ns	
Difficult:Easy	.095	ns	
Boring:Interesting	.582	ns	
Worthless:Valuable	1.967	ns	
Limited:Free	.564	ns	
Pays Poorly:Pays Well	2.897	ns	
Low Status:High Status	1.452	ns	

[a] See footnote a, Table 11.

[b] Degrees of freedom = 2 and 227 for most cases.

[c] See footnotes c and d, Table 2.

TABLE 14: Statistically Significant Comparisons among Juniors on Semantic Differential Ratings.[a]

Occupation	Scale	F	Significance[b]	Post-hoc Differences Among Groups
BIOLOGIST	Bad:Good	9.291	.001	4,10,2 > 3
	Difficult:Easy	2.711	.05	ns
	Boring:Interesting	10.979	.001	4,10,2 > 3
	Worthless:Valuable	2.728	.05	ns
CHEMIST	Bad:Good	7.688	.001	4,2,10 > 3
	Boring:Interesting	7.300	.001	4,10,2 > 3
	Worthless:Valuable	3.854	.005	ns
	Low Status:High Status	2.782	.05	ns
PHYSICIST	Bad:Good	2.951	.025	2 > 3
	Boring:Interesting	3.836	.005	4 > 3
	Worthless:Valuable	2.510	.05	ns
DOCTOR	Bad:Good	5.242	.001	10,2,4 > 3
	Boring:Interesting	3.321	.025	ns
	Pays Poorly:Pays Well	4.313	.005	4 > 3
	Low Status:High Status	4.007	.005	4,2 > 3
MATHEMATICIAN	Bad:Good	3.420	.01	2 > 3
	Boring:Interesting	3.324	.025	ns
	Worthless:Valuable	3.661	.01	4,2 > 10
	Pays Poorly:Pays Well	2.785	.05	ns
	Low Status:High Status	3.567	.01	ns
SOCIAL WORKER	Difficult:Easy	4.228	.005	2 > 11
ENGINEER	Bad:Good	5.900	.001	4,10,2 > 3
	Boring:Interesting	10.559	.001	4,10,2 > 3
	Worthless:Valuable	6.884	.001	4 > 3
GUIDANCE COUNSELOR	Difficult:Easy	2.915	.025	2 > 3
VETERINARIAN	Difficult:Easy	2.970	.025	ns
	Worthless:Valuable	4.304	.005	4 > 3
	Pays Poorly:Pays Well	3.894	.005	4 > 3
	Low Status:High Status	4.364	.005	4 > 3
ARTIST	Pays Poorly:Pays Well	2.761	.025	ns
MY FUTURE OCCUPATION	Difficult:Easy	5.444	.001	3,10 > 4
	Boring:Interesting	2.494	.05	ns
	Pays Poorly:Pays Well	4.320	.005	4 > 3
	Low Status:High Status	3.737	.005	4 > 3

[a] See footnotes a and c, Table 10.

[b] Degrees of freedom = 4 and 352 for most cases.

TABLE 15: Semantic Differential: Comparisons among Juniors for Combined Scientific and Nonscientific Occupations.

Scale[a]	F	Significance[b]	Post-hoc Differences Among Groups[c]
SCIENCE			
Bad:Good	6.395	.001	4,2,10 > 3
Difficult:Easy	1.207	ns	
Boring:Interesting	7.480	.001	4,10 > 3
Worthless:Valuable	6.752	.001	4,2 > 3
Limited:Free	1.408	ns	
Pays Poorly:Pays Well	1.235	ns	
Low Status:High Status	6.057	.001	4,2 > 3
NONSCIENCE			
Bad:Good	1.088	ns	
Difficult:Easy	3.808	.005	10,2 > 11
Boring:Interesting	1.093	ns	
Worthless:Valuable	.219	ns	
Limited:Free	.417	ns	
Pays Poorly:Pays Well	1.257	ns	
Low Status:High Status	.662	ns	

[a] See footnote a, Table 11.

[b] Degrees of freedom = 4 and 356 for most cases.

[c] See footnotes c and d, Table 2.

status than did the pre-IPSE:NO group. In addition, the "YES" control groups rated the nonscientific occupations as being easier than did the post-IPSE:NO group.

4. Data for Sophomores. As can be seen in Table 16, relatively fewer analyses among the sophomore groups (IPSE, 1975 and post-IPSE, 1976) resulted in significant differences. The analyses involving the combination of scientific versus nonscientific occupations resulted in only one significant difference, that was the fact that the IPSE students rated the nonscientific fields as less interesting than did the post-IPSE:NO group.

5. Changes in Semantic Differential Ratings Over Time. Statistical analyses of changes in semantic differential ratings between the sophomore and junior years (IPSE and post-IPSE groups), between the junior and senior years (IPSE and pre-IPSE groups), between 1976 and 1977 (IPSEs as juniors and seniors versus post-IPSEs as sophomores and juniors), and over the entire three year period for the IPSE group are found in Tables 3E through 6E in Appendix E. This data is rather cumbersome to interpret, owing to the large number of statistical analyses. The task becomes easier if one wishes to focus on the question of whether participation in IPSE had any differential effects over time on the students in the program as compared to the control groups. The question can be answered by examination of the "Groups by Trials Interaction" column in Tables 3E, 4E, and 5E of Appendix E. The number of significant interactions in each of these tables is 11, 10, and 9 respectively. Given the fact that 105 tests of significance were run in each case, these numbers do not depart radically from what would be expected by chance. An examination of the "Trials" column in these tables indicates more of these tests reached statistical significance. Generally, these were attributable to the groups evaluating the scientific occupations more favorably over time.

TABLE 16: Statistically Significant Comparisons among Sophomores on Semantic Differential Ratings.[a]

Occupation	Scale	F	Significance[b]	Post-hoc Differences Among Groups
BIOLOGIST	Bad:Good	7.721	.001	1,7 > 8
	Worthless:Valuable	5.898	.005	1 > 8
	Low Status:High Status	3.124	.05	1 > 8
DOCTOR	Boring:Interesting	4.184	.025	7 > 1
MATHEMATICIAN	Low Status:High Status	3.956	.025	1 > 8
ENGINEER	Worthless:Valuable	9.187	.001	1 > 7,8
	Low Status:High Status	6.363	.005	1 > 8
DENTIST	Boring:Interesting	4.256	.025	ns
VETERINARIAN	Worthless:Valuable	4.164	.025	8 > 7
BUSINESS EXECUTIVE	Boring:Interesting	5.383	.005	8 > 1
MY FUTURE OCCUPATION	Boring:Interesting	3.975	.025	8 > 7

[a] See footnotes a and c, Table 10.

[b] Degrees of freedom = 2 and 216 for most cases.

Another way of summarizing the data consisting of changes in semantic differential ratings over time is to combine the scientific and nonscientific occupations, as was done previously. The results of the four sets of analyses involving these combined data are shown in Tables 17-20, respectively. In Table 17 we see that there are significant differences over trials (sophomores to juniors) on five of the seven scales for the scientific occupations, as well as two significant groups by trials interactions. The five trials factors are owing to the groups rating the scientific occupations as better, more difficult, more interesting, more valuable, and having higher status in their junior years as compared to their sophomore years. The two groups by trials interactions are because of the post-IPSE:NO group rating the scientific occupations as more boring over time, whereas the IPSE and the post-IPSE:YES groups rated these occupations as more interesting over time; and the post-IPSE:NO group rating the scientific occupations as paying better between their sophomore and junior years. The one effect for trials for the nonscientific occupations is owing to the groups rating these occupations as more difficult in their junior years as compared to their sophomore years.

Turning to Table 18, we see that five of the scales had significant effects for trials on the ratings of the scientific occupations, whereas two of the scales for the nonscientific occupations had significant effects for trials. There was also one significant interaction each in the ratings of the scientific and of the nonscientific occupations. The significant trials effects were due to the students rating the scientific occupations as better, more difficult, more interesting, more valuable, and having higher status; and the nonscientific occupations as more difficult and having higher status when they were seniors as compared to their ratings when they were juniors. The significant groups by trials interactions were

TABLE 17. Changes in Semantic Differential Ratings on the Combined Scientific and Nonscientific Occupations: Sophomore to Junior Years.

	Groups[a]		Trials		Groups by Trials Interaction	
	F	Significance[b]	F	Significance[c]	F	Significance[d]
SCIENCE						
Bad:Good	1.263	ns	8.169	.005	.048	ns
Difficult:Easy	.674	ns	31.231	.001	2.366	ns
Boring:Interesting	1.241	ns	7.564	.01	3.304	.05
Worthless:Valuable	2.825	ns	6.439	.025	2.651	ns
Limited:Free	1.139	ns	.526	ns	.187	ns
Pays Poorly:Pays Well	.049	ns	1.133	ns	3.100	.05
Low Status:High Status	1.216	ns	12.628	.001	2.040	ns
NONSCIENCE						
Bad:Good	2.235	ns	.863	ns	.459	ns
Difficult:Easy	4.983	.01	6.786	.01	2.140	ns
Boring:Interesting	3.311	.05	1.273	ns	.964	ns
Worthless:Valuable	1.068	ns	.985	ns	.483	ns
Limited:Free	.509	ns	2.725	ns	2.541	ns
Pays Poorly:Pays Well	1.038	ns	.299	ns	.144	ns
Low Status:High Status	.219	ns	1.819	ns	.123	ns

[a] The groups involved in this comparison are IPSE, 1975 and 1976; post-IPSE:Yes and post-IPSE:No, 1976 and 1977.

[b] Degrees of freedom are 2 and 161 in most cases.

[c] Degrees of freedom are 1 and 161 in most cases.

[d] Degrees of freedom are 2 and 161 in most cases.

TABLE 18: Changes in Semantic Differential Ratings on the Combined Scientific and Nonscientific Occupations: Junior to Senior Years.

	Groups[a]		Trials		Groups by Trials Interaction	
	F	Signficance[b]	F	Signficance[c]	F	Significance[d]
SCIENCE						
Bad:Good	15.466	.001	8.501	.005	4.539	.025
Difficult:Easy	.534	ns	4.743	.05	.872	ns
Boring:Interesting	17.726	.001	8.745	.005	1.384	ns
Worthless:Valuable	6.331	.005	11.213	.005	1.838	ns
Limited:Free	1.863	ns	1.124	ns	1.101	ns
Pays Poorly:Pays Well	3.521	.05	2.124	ns	.655	ns
Low Status:High Status	4.720	.01	5.056	.05	1.462	ns
NONSCIENCE						
Bad:Good	.313	ns	1.667	ns	1.590	ns
Difficult:Easy	.102	ns	4.640	.05	.017	ns
Boring:Interesting	.568	ns	.160	ns	.359	ns
Worthless:Valuable	2.194	ns	1.917	ns	.181	ns
Limited:Free	.648	ns	2.466	ns	.220	ns
Pays Poorly:Pays Well	2.017	ns	.020	ns	1.679	ns
Low Status:High Status	.083	ns	4.302	.05	4.145	.025

[a] The groups involved in this comparison are IPSE, 1976 and 1977; pre-IPSE:Yes and pre-IPSE:No, 1975 and 1976.

[b] Degrees of freedom are 2 and 225 in most cases.

[c] Degrees of freedom are 1 and 225 in most cases.

[d] Degrees of freedom are 2 and 225 in most cases.

TABLE 19. Changes in Semantic Differential Ratings on the Combined Scientific and Nonscientific Occupations: 1976 to 1977.

	Groups[a]		Trials		Groups by Trials Interaction	
	F	Significance[b]	F	Significance[c]	F	Significance[d]
SCIENCE						
Bad:Good	6.434	.005	16.196	.001	.829	ns
Difficult:Easy	2.719	ns	12.003	.001	.627	ns
Boring:Interesting	4.434	.025	.866	ns	1.018	ns
Worthless:Valuable	9.537	.001	.255	ns	.183	ns
Limited:Free	.985	ns	.566	ns	.969	ns
Pays Poorly:Pays Well	1.539	ns	.427	ns	1.067	ns
Low Status:High Status	6.197	.005	2.019	ns	.002	ns
NONSCIENCE						
Bad:Good	1.190	ns	5.915	.025	.486	ns
Difficult:Easy	4.098	.025	2.216	ns	1.619	ns
Boring:Interesting	2.099	ns	.038	ns	.072	ns
Worthless:Valuable	1.074	ns	.351	ns	.472	ns
Limited:Free	2.355	ns	1.032	ns	2.249	ns
Pays Poorly:Pays Well	2.287	ns	.634	ns	.313	ns
Low Status:High Status	.131	ns	.040	ns	.170	ns

[a] The groups involved in this comparison are IPSE, post-IPSE:Yes, and post-IPSE:No.

[b] Degrees of freedom are 2 and 152 in most cases.

[c] Degrees of freedom are 1 and 152 in most cases.

[d] Degrees of freedom are 2 and 152 in most cases.

TABLE 20. Changes in Semantic Differential Ratings on the Combined Scientific and Nonscientific Occupations: IPSE Students, 1975 through 1977.

	F	Significance[a]
SCIENCE		
Bad:Good	15.312	.001
Difficult:Easy	9.571	.001
Boring:Interesting	10.103	.001
Worthless:Valuable	7.804	.001
Limited:Free	.451	ns
Pays Poorly:Pays Well	3.759	.05
Low Status:High Status	11.542	.001
NONSCIENCE		
Bad:Good	1.416	ns
Difficult:Easy	1.932	ns
Boring:Interesting	.542	ns
Worthless:Valuable	.021	ns
Limited:Free	2.798	ns
Pays Poorly:Pays Well	.880	ns
Low Status:High Status	.379	ns

[a] Degrees of freedom are 2 and 310 in most cases.

owing to the IPSEs and pre-IPSE:NOs rating the scientific occupations as better over time, whereas the pre-IPSE:YES group rated these occupations as slightly worse over time; and the pre-IPSE:NO group as rating the non-scientific occupations as having higher status over time, whereas the IPSEs and the pre-IPSE:YES did not change their ratings of these occupations between their junior and senior year.

The comparisons for changes between 1976 and 1977 indicated only two significant trials effects for the scientific occupations and only one such significant effect for the nonscientific occupations. These effects exist because of the groups rating both the scientific and nonscientific occupations as better in 1977 as compared to their ratings in 1976, and rating the scientific occupations as more difficult over time.

Finally, turning to Table 20, we notice significant changes over time for the IPSE students' ratings of the scientific occupations on all but one of the scales, with no differences over time on the ratings of the non-scientific occupations. These significant differences were because of the scientific occupations being rated as better, more difficult, more interesting, more valuable, better paying, and having higher status over time.

6. Semantic Differential Ratings of Occupations: Summary. In general, the IPSE group rated the scientific occupations more favorably than did the control groups. Specifically, they rated these occupations as better, more interesting, more valuable, better paying, and having higher status than did the comparable control groups. Interestingly enough, when differences did occur on the "easy:difficult" scale, the differences were usually in the direction of the IPSE students rating the scientific occupations as being more difficult than did the comparable control groups. Thus, there is a tendency for the IPSE students to value the scientific occupations more

highly than other students, but also to recognize that these occupations are not easy. This perception may very well be reality-based, since the IPSE students took significantly more science related courses than did the control groups (see later section on course performance). In fact, because of the negative reputation that many science courses have among high school students, and since IPSE students have taken many more science courses, one might expect a less favorable attitude toward science and scientific occupations. That this hypothesis is not confirmed with the present data indicates that the IPSE program and its concomitant experience in science has done nothing to detract from the students' attitudes toward science, and in fact has enhanced these attitudes, as revealed by both the semantic differential data and the attitude toward science data.

In contrast to the differences among the groups on the ratings of the scientific occupations, there was not a consistent pattern of differences among the various student groups in their ratings of the nonscientific occupations. The few items that did show significant difference among the groups in the ratings of these occupations were not concentrated on any one scale nor did they consistently contrast the IPSE group with the other groups. Thus, it would be difficult to attribute these differences to participation in the IPSE program. Given the relatively small number of these differences and the incoherent pattern among them, they might best be attributed to random perturbations in the data.

A slightly technical note is in order at this point. Not all of the groups were equally sensitive to differences among the scientific occupations. Specifically, there were no differences among the groups for the ratings of dentist. The fact that ratings on these two occupations were combined with ratings on the other scientific occupations to create the "science" scale scores results in these newly created scale scores being

less sensitive to differences among the groups than if these two occupations were not included in the creation of this scale. Thus, use of this scale to investigate differences among the groups is a conservative procedure.

The evidence regarding changes in ratings over time is somewhat perplexing. In general, the groups all increased their evaluations of the scientific occupations over time. This might reflect some societal changes over the three year period of the IPSE program, such as increased demand for technical and scientific personnel over this period. Again, at the minimum, the exposure to science courses and other experiences did not negatively affect the IPSE students' evaluations of the scientific occupations. However, their increased evaluation over time was generally matched by the evaluations of the control groups. They did not become more favorably disposed than did these control groups. The few groups by trials interactions that did occur, however, were generally in the direction of the IPSE students evaluations of the scientific occupations showing greater increases than the control groups. The fact that this was not found more often might be attributed to a "ceiling effect", i.e., the IPSE group was so much more positive than the other groups to begin with that increases in evaluation of the scientific occupations could not be reflected in the seven point scales. The overall conclusion to be gained from the semantic differential is that the IPSE students rated most scientific careers more positively than did the control groups (although recognizing that they are more difficult in many cases), and all groups tended to increase their favorable evaluations of these occupations over time. The fact that the IPSE students did not become even more favorably disposed to these occupations than the control groups may be due to a methodological artifact.

IV. INTERVIEWS

A. INTRODUCTION

In an attempt to obtain a wider spectrum of data than is obtainable on the basis of a questionnaire alone, IPSE students, as well as high school staff associated with IPSE, were interviewed. Interviews allow one to probe for more detail and to uncover the meaning of subtly phrased responses. Although the entire population of the relevant groups were not interviewed, owing to difficulties in scheduling, 52 of the 90 IPSE students were interviewed, as well as 20 high school staff members. All interviews were done in April, and respondents were assured that their remarks would be kept confidential.

B. IPSE STUDENTS

After a brief "warming up" phase, students were asked "What do you plan to be doing next year?" Forty-three (83%) of the respondents said they were planning to go to college, and 38 indicated that they had already been accepted in at least one institution. Most of these acceptances were at in-state schools (predominantly Colorado State University and the University of Colorado), and all but one were four year institutions. When queried about intended major, 30 students indicated science related majors, 6 indicated nonscience or social science majors, and 7 were undecided or gave no response. In an attempt to assess the perceived impact of IPSE on attending college and in the choice of major, those students who planned to attend college were asked "What was the role of IPSE in your decision to attend college? to choose your major?" Whereas only 13 (30%) of these students indicated that IPSE influenced their decision to attend college, 21 (49%) indicated that IPSE played a role in their choice of major. These students were also asked what role their guidance counselors played in these decisions.

Whereas six students said the counselor gave them information about colleges; five students said that the counselors gave advice as to which classes to take, three others said that the counselors aided them by their general encouragement of the student, and one student each said that the counselor helped with forms or arranged interviews or helped little.

The above data should be interpreted with caution when trying to infer the influence of IPSE on the students' choices of college attendance and major. These data are purely phenomenological. Choice of college attendance and major probably have multiple causes, many of which the individual may not even be aware. This is especially true with a three year program like IPSE, in which the students' interests and skills are developed over a long period of time. It is potentially difficult, therefore, for the participant to single out the program as a causal factor. The above data must be interpreted in conjunction with the actual behavioral data obtained from the IPSE and control groups.

The nine students who did not plan to attend college were asked what type of work they intended to do upon graduation. Five of them did not know, two indicated they would enlist in the military, one indicated a clerical position, and only one student indicated a possibility of a science related job in the electronics or construction field. In contrast to this, when asked "How do you feel about a career in science or engineering?", seven responded positively and only two responded negatively. In response to why they chose not to go to college, five cited lack of interest or desire, three cited lack of money, and one cited parental pressure. Finally, four of the students thought that having been in IPSE would be helpful in their finding a job, while four students did not think it would be helpful and one student was undecided. Again, the phenomenological nature of these data must be stressed. There is no mechanism in the present evaluation design

to determine if participation in IPSE is indeed helpful in finding a job upon graduation from high school.

The next series of questions tried to take advantage of the students' three year participation in IPSE to reflect back on the entire program. The first question asked the students "Has IPSE lived up to what you expected or hoped it would be when you first got into it three years ago?". Somewhat surprisingly, 41 students said that it had not, while 8 said that it had met their expectations, and 3 said that it was even better than they had expected. Further probing of those students who said that IPSE had not lived up to their expectations revealed that the majority of these respondents (54%) did not know what to expect, and therefore the question was irrelevant. The other students indicated that they expected: more field trips and more activities (3 responses each); more tutors, more scholarships, more science projects, more contacts with Colorado State University and that it would be more difficult than it was (2 responses each), more talks with professionals, more career information, and more general helpfulness (1 response each). The large number of responses indicating the failure of the program to meet expectations can be attributed to the expectations never having been clearly communicated to begin with; the students' having forgotten what these initial expectations were after the three year period; or the program actually failing to deliver what it had promised. Although there is no way to choose which one of these is the most correct explanation on the basis of data available, the truth probably contains an element of all three of these causes.

When asked what was the best part of the IPSE program over their three year participation in the program, 18 students responded with the math and science courses they took; 15 responded with the field trips; 13 responded

with the help they obtained concerning college (e.g. deciding which college to attend, aid in getting into college, consideration of major in college, etc.); 11 cited the Field Coordinator's counseling and encouragement; three cited the science project, and there were three miscellaneous responses not easily classified.

When asked in the following question what the worst part of IPSE had been over the last three years, 32 students said that they could not think of anything. An additional 7 students said that there was not enough contact with the Field Coordinator and 2 others said that there were not enough field trips. The only negative responses concerning actual components of the program were five citations of the science project and three citations of the math and science course as the worst aspects of the program. The next question asked the students how the IPSE program could be improved to be more helpful to them. Most of the respondents wanted more of the program: more contact with the Field Coordinator (10 responses); more or different career information (9 responses); more field trips (4 responses); and more information about college (3 responses). Ideas for improvements not involving components already inherent in the IPSE program included 8 suggestions for either visits by professional scientists or the opportunity to sit in on college science classes; 3 suggestions for making scholarships available to IPSE students; and one suggestion each for starting earlier in the student's school career and for having a group science project.

The final series of questions for the students concerning their perceptions of the field coordinator, Caroline Urvater. (The students were again assured that their responses would be kept confidential.) The first question asked the students "How do you feel about the job Caroline did as Field Coordinator?" Fifty-one of the 52 students said they thought she did a good job, with the other student saying that he or she was not influenced

by Caroline. The next question tried to find out exactly how Caroline had been helpful to the students. Thirteen students cited individual help and counseling as a key factor in Caroline's relation with them; 8 others cited the encouragement and motivation Caroline gave them; and 6 others cited incidents (e.g., introducing the student to a college counselor, writing a letter of recommendation, getting the student registered for the necessary science and math courses, etc.). When asked how Caroline could be even more helpful, 14 cited more contact with her would be desirable, 2 students said that more college or career information would be better, and 1 student each responded that more field trips and not leading the students to expect scholarships would be an improvement.

The final question asked the students "If we had to choose other people to be field coordinators, what qualities should we look for? (i.e., What exactly made Caroline so good or effective?)". The following characteristics were thought to be desirable: The field coordinator should care about the individual, should want to help, be a motivator and be patient and understanding to high schoolers (24 responses); she or he should be a good counselor (13 responses); she should know about colleges and career opportunities (10 responses); she should be outgoing (5 responses); and have an assortment of other traits (strict, sense of humor, enthusiastic, friendly, treats you as equal, young, etc.). In essence, the students want someone who takes a genuine interest in them and with whom they can relate. The person should be a friend as well as a mentor.

C. HIGH SCHOOL PRINCIPALS AND COUNSELORS

As already mentioned, in addition to interviewing the IPSE students, a sample of 20 principals and counselors were also interviewed. Because of the nature of the IPSE program, the high school staff did not play an integral role in IPSE. This is reflected in their responses to what they

perceived their role with respect to IPSE to be. There were 21 responses centering around coordination with the Field Coordinator or initial approval of the program. Only five responses reflected a somewhat more active role in the project: 3 responses dealt with making sure the IPSE students applied to college, and 2 responses involved the initial selection of students to be in the IPSE program. Seventeen of the 20 respondents felt with at least some confidence that IPSE was capable of reaching its goals. When asked what they thought the strongest aspect of IPSE was, the large majority of responses focused on the relationship that had been established between the Field Coordinator and the students (25 such responses). Other responses cited the field trips (2 responses), the smoothing of the high school to college transition and the career information given to the students (1 response each).

In terms of the relative weaknesses in the IPSE program, the respondents gave a variety of answers. The largest single response was the need for more contacts between the students and the field coordinator (8 responses), with the other responses scattered among the need to start the program earlier, include more non-minority members, and the need for greater teacher cooperation (2 responses each); better selection standards for inclusion in IPSE, more students should be involved, better interfacing between the high school and Colorado State University, more convenient scheduling of meetings, and the need for IPSE to be centered in the high school (1 response each). One additional response was the strong dependence of the success of the program on the Field Coordinator, a theme that recurs in a later section of the interview. In terms of how they thought IPSE might be improved, there were very few real suggestions for changes. Most responses focused on the need for more of the same: more teacher and parent involvement; more field coordinators; more contact with the students;

greater duration than three years; more rigid selection criteria; more students, as well as a larger variety of students in the program; more career information; more counselor input; and more field trips. In terms of substantive differences, one respondent suggested extending IPSE to include relevant summer employment for the students, and one other respondent suggested supplying scholarships for IPSE students.

Twelve of the respondents said that they noticed differences between the IPSE and non-IPSE students. These differences centered around the IPSE students being better oriented for college; more motivated, confident, and goal oriented; and having a greater interest in math and science. Several of these respondents believed that these differences were probably true even before the IPSE program. When asked what they thought Caroline Urvater's role in the IPSE program was, most people responded with characteristics associated with her role as external counselor. Additional responses centered on her public relations role, her role as liaison between Colorado State University and the high schools, and administrative function in terms of doing the necessary paperwork. All 20 of the respondents thought the Field Coordinator was doing her job very well. Typical comments were "great", "wonderful", "better than we could expect", etc. When asked how they thought she might improve, 8 of the respondents did not think she could and 6 others thought that more contacts would be helpful. The other 6 comments were distributed over five different suggestions, ranging from getting more input from counselors to awarding scholarships.

In terms of their opinions of the IPSE program itself, all 20 respondents were very positive about the program, with two of the high school staff suggesting that more or different students should be included. Finally, all of the respondents said they would like to see the program continue in their school, although one person qualified this by saying he

would like it to continue only if it started earlier in the students' academic career. The last question of the interview asked for any additional comments the respondent would like to make concerning IPSE. Several people commented that the success of the program was largely determined by the characteristics of the Field Coordinator. No other formal aspect of the program was singled out (e.g., science project). Several of the other comments again centered around getting more students involved in the program, having greater involvement by the high school counselors and by the parents, and starting earlier with the students than in high school.

D. INTERVIEWS: SUMMARY

There are certain common themes that recur in the interviews, both with the IPSE students and with the high school principals and counselors. One common theme is that IPSE is generally viewed very positively. Whatever weaknesses are discussed about IPSE generally center around the program not delivering enough of its basic substantive parts, rather than disagreeing with these parts themselves. Specifically, both students and high school staff would have liked to see more contacts with the Field Coordinator, more field trips, and more college and career information. Given the scope and budget of the project, it would have been difficult to meet all these demands. Future projects should consider having more field coordinators, each having responsibility for fewer students.

A second common theme was the influence of the Field Coordinator on the success of the program. Students and administrators alike were quite insistent on this point. Although the present evaluation design does not allow for separating out the influence of the Field Coordinator from the influence of the other components of the program (this would require a study involving several field coordinators, each differing on important characteristics such as approach to counseling, age, etc.) the anecdotal

evidence based upon the interviews and other observations is provocative. The Field Coordinator in the present program was described as enthusiastic, caring, being able to relate well to the students, friendly, motivating, patient, knowledgeable, being a good administrator and public relations person, and "the essential element" (to the program) among other terms. When queried as to how she might change to be more effective, there were no criticisms of her style. All comments were addressed to wanting more of her time and attention. Thus, a viable hypothesis is that the Field Coordinator for future projects has to be substantially more than a "paper shuffler". The Field Coordinator must know how to administer and coordinate a program of this sort, but must also know how to gain entree into the schools, how to gain the confidence of the high school personnel, how to gain the confidence and trust of the students in the program, how to obtain relevant information and applications from various institutions of higher learning, how to motivate students, and often how to deal with crises in the students' lives. From the initial description of the IPSE program, one would have thought that being an excellent administrator would be the essential element for the job of Field Coordinator. However, the evidence from the present study would indicate that this is only one very small aspect of the job. Unfortunately, as already indicated, the present evaluation design does not allow us to emphatically state a conclusion about the importance of the Field Coordinator based on any data other than the interviews.

A third theme based upon the interviews with the IPSE students is that the field trips were positively evaluated, whereas the science project was not as uniformly liked. Several of the students viewed the projects as the best aspects of the program, while several others viewed it as one of the

poorer aspects of the program. Problems with the science project were discussed in last year's progress report. and readers are referred to pages 19-25 of Appendix B for further details. Finally, a good proportion of the students cited the math and science courses they took as a requirement of the IPSE program as being the highlight of the program. The questions concerning college intentions and major are better answered from the actual behavioral data, discussed later.

V. AUXILIARY QUESTIONS: CSU JOB INTEREST QUESTIONNAIRE

A. INTRODUCTION

In addition to the attitude toward science scale and the semantic differential ratings of various occupations, the CSU Job Interest Questionnaire also contained several questions concerning the students' attitudes toward the various components of the IPSE program and their interests concerning their course work. The wording of several of the questions differed from the comparable parts of previous questionnaires, thus precluding comparisons with prior years.

B. OPINIONS CONCERNING COURSES

Students were asked which course they like least and which course they like most, as well as which course they find easiest and which course they find most difficult. The results are categorized and summarized in Table 21. As can be seen from this table, 62% of the IPSE students listed a math or science course as their favorite, and only 29% of the IPSE students listed a math or science course as their least favorite. In contrast, only 28% of the post-IPSE groups listed a math or science course as their favorite and 37% of the post-IPSE:NO and 34% of the post-IPSE:YES groups listed a math or science course as their least favorite. While comparison across groups is difficult at best in the present case, since the actual courses are not the same, it is interesting to note that the IPSE group was about twice as likely to list a math or science course as their favorite course as opposed to their least favorite, while this rati is less than 1.0 for both the post-IPSE groups.

In terms of which courses they find most difficult and easiest, 64% of the IPSE group listed a math or science course as their most difficult course, and only 34% of them listed such a course as being their easiest.

TABLE 21: Opinions Concerning Coursework.

	Group					
	IPSE		Post-IPSE:No		Post-IPSE:Yes	
	#	%	#	%	#	%
"Favorite Course"						
Math	15	18	3	14	8	15
Science	37	44	3	14	7	13
Social Science	3	4	2	9	9	17
Humanities	10	12	4	18	7	13
Arts	10	12	5	23	6	12
Other or None	10	12	5	23	15	29
"Least Favorite Course"						
Math	18	21	5	23	10	19
Science	7	8	3	14	8	15
Social Science	14	16	6	27	7	13
Humanities	25	29	7	32	13	25
Arts	2	2	0	0	2	4
Other or None	18	21	1	5	10	19
"Easiest Course"						
Math	13	15	6	27	3	6
Science	16	19	2	9	4	8
Social Science	7	8	2	9	8	15
Humanities	18	21	3	14	8	15
Arts	12	14	5	23	6	12
Other or None	18	21	4	18	22	42
"Hardest Course"						
Math	32	38	7	32	18	35
Science	24	28	5	23	6	12
Social Science	3	4	3	14	3	6
Humanities	11	13	7	32	14	27
Arts	2	2	0	0	0	0
Other or None	11	13	0	0	9	17

The comparable figures for the post-IPSE:NO group are 55% and 36%, and for the post-IPSE:YES group, the figures are 47% and 14%. The differences among the groups on these questions are not as sharply defined in relation to the questions concerning their preferences. Apparently all students find science and especially mathematics courses to be among their most difficult, and relatively fewer students find these courses to be among their easiest. Thus, one can conclude that although the IPSE program does not necessarily make the courses easier for the students, it does appear to make them more enjoyable.

C. LEISURE TIME CORRELATES

One question asked the respondents if they would watch a T.V. special program dealing with any one of seven subject matters. The proportion of respondents in each group who said they would is summarized in Table 22. The IPSE group was more likely to indicate they would watch a special on medicine or on science than the post-IPSE:YES group.

D. OPINIONS CONCERNING THE FIELD COORDINATOR, CAROLINE URVATER

The next section of the auxiliary questions asked the students to list the specific things Caroline had done that had been helpful, how she may have been more helpful, and whether they would like to have seen more of her. These questions parallel several of the questions from the interviews, and the answers obtained also parallel the responses to the interview. Table 23 summarizes the content analysis of the open ended responses to how Caroline had specifically helped the student, as well as opinions as to what else she could have done. As in the interviews, the responses to the first question highlight the role the Field Coordinator had as an external counselor. She encouraged the students, obtained information for them, prodded them to do well, was a friend and counselor to them, and in

TABLE 22: Proportion of Students Indicating They would Watch a T.V. Special in each of Seven Subject Matters.

	Group		
Subject	IPSE	Post-IPSE:No	Post-IPSE-Yes
Math	.42	.18	.41
Medicine	.86	.77	.69
Sports	.93	.86	.96
Drama	.50	.64	.53
Science	.93	.55	.73
Geography	.55	.45	.55
Politics	.48	.41	.43

TABLE 23: IPSE Students' Opinions of Caroline Urvater.

"What specific things has Caroline done to be helpful to you?"	
Motivation and encouragement	26
Information about colleges	22
Advice and information about careers	21
Personal counseling (write and talk to her)	16
Introduced me to math and science	13
Field trips and campus tours	13
Prepared me for college	12
Explained importance of college	11
Kept after me to do well	10
Got me into college	9
She cared about me	8
Got me through math and science	8
Was a good friend	4
Increased my self-confidence	3
Was honest and open	3
Miscellaneous (e.g., wrote letter of recommendation, etc.)	8
"What else could Caroline have done?"	
More and longer visits	22
Nothing	16
More career/college information	11
More communications with students	5
Be less demanding	4
More information on college life	3
More specific about IPSE	3
Supply scholarships	3
More motivation	3
Miscellaneous (e.g., become a Christian)	9

general, went out of her way to help them whenever she could. In terms of how she could have done better, again the students emphasized the desire for more visits, with a scattering of other suggestions. Finally, when asked specifically if Caroline should have visited more often, less often, or the same amount as she had, 57% of the students thought she should have visited more often and 43% thought she visited often enough.

E. OPINIONS CONCERNING IPSE PROGRAM IN GENERAL

1. "The best and worst parts of IPSE". Two separate questions asked the students to list the two best and the two worst parts of IPSE. The content analysis of their responses are summarized in Table 24. Again, as in the interviews, the best parts of IPSE were perceived to be the field trips, interactions with Caroline, and the advice and information on colleges and careers obtained from Caroline. Although twenty students answered that taking math and science courses and the science project were the best part of IPSE, twelve other students said that this was the worst part of the program.

2. Perceived personal benefits. One question asked the students "Do you feel you have personally benefited from IPSE? If so, name one or more ways in which you have benefited." Eighty-seven percent of the students felt they had benefited from the program. Table 25 summarizes how the participants felt they had benefited. The primary benefits were perceived to be in terms of college preparation (taking the necessary math and science courses, obtaining information about colleges, and motivating the students to do well). In terms of how they would improve IPSE, we again see the major item being more visits from the field coordinator, with requests for more field trips, more information, and more activities also being requested.

3. Semantic differential ratings of overall program. Students rated their overall feelings about the IPSE program on four evaluative scales from

TABLE 24: Students' Opinions of the Best and Worst Parts of IPSE.

"What were the two very best parts of the IPSE program for you?"

Field trips	31
Visits and interactions with Caroline	27
Taking math and science	20
Science project	17
Information on college/careers	16
Meeting new people	10
Getting into college	7
Learning experience	6
Miscellaneous	3

"What were the two worst parts of the IPSE program for you?"

None	31
Science project	17
Taking math and science each semester	12
Not enough field trips	4
Caroline's pressure to do well	3
Miscellaneous (spread over 16 separate categories)	21

TABLE 25: Perceived Benefits from IPSE and Suggestions for Improving IPSE.

"How have you benefited from IPSE?"

I would not have taken math and science otherwise	32
Information and planning for college and major	18
Choosing and getting into a college	15
Motivated me	10
Good college preparation	5
Increased self-confidence	5
Good learning experience	3
Career information	3
Miscellaneous	7

"How could the overall program be made more helpful for students?"

More contact with Caroline	14
More college/career information	9
More field trips	7
More activities and projects	7
Explain program better	4
Aim program for those with greater need	4
Get more teachers involved	3
More than one field coordinator	3
More tutors	3
Miscellaneous (spread over 15 separate categories)	21

the Semantic Differential. The means and standard deviations of these ratings are shown in the first part of Table 26. Overall, the students rated the program very highly, i.e., they liked it, rated it as good, valuable and positive.

F. RATINGS OF COMPONENTS OF IPSE PROGRAM ON "WORTHLESS:VALUABLE" SCALE

The students rated eight separate aspects of the program on a single "worthless:valuable" semantic differential scale. The means and standard deviations for each of the eight ratings is found on the second part of Table 26. As can be seen from the table, the two field trips, the visits and contacts with the field coordinator, and the experience of taking a math and a science course each semester were all rated as being valuable, as was the concept of "science". The science consultant and the tutoring by other students were perceived as relatively worthless. Part of this is probably because only a few students received tutoring. The problems with the science consultants, as discussed in last year's progress report, were mostly organizational and not an inherent weakness of IPSE.

TABLE 26: Auxiliary Questions: Semantic Differential Ratings.

Overall IPSE Program	Mean Rating[1]	Standard Deviation	
Dislike:Like	6.226	1.112	1.106
Bad:Good	6.226	1.034	1.028
Worthless:Valuable	6.298	1.027	1.021
Negative:Positive	6.274	1.101	1.095

Ratings of "Worthless:Valuable" of Eight Components of IPSE Program.

Program Component	# of Responders (out of 82)[2]	Mean Rating[1]	Standard Deviation	
Science	82	6.110	.981 N-1	.974 N
Science consultant for project	74	3.581	8.355	8.298
Visit to CSU Engineering Days	73	5.685	1.383	1.374
Visit to CU Planetarium	62	5.435	1.585	1.572
School visits by Caroline Urvater	82	6.012	1.252	1.244
Personal contacts with Caroline	81	5.667	1.500	1.491
Taking one math and one science course each semester	81	6.457	.852	.847
Being tutored by other students	57	4.368	1.915	1.898

[1] All scales are seven point scales and have been reversed where necessary so that 1 reflects low evaluation and 7 reflects high evaluation.

[2] A non-response indicates that the particular activity was not done or used by the student.

VI. PERFORMANCE IN SCIENCE AND MATHEMATICS HIGH SCHOOL COURSES

A. COMPARISONS AMONG SAME GRADE LEVEL GROUPS

There are six indices of interest concerning course performance data. These are the number of courses attempted and grade point average (GPA) for mathematics, life science, and physical science courses. Means and standard deviations of all groups on these indices are displayed in Table 27. Statistical analyses of these data for the three senior groups (IPSE, 1977, and both pre-IPSE groups, 1976); the five junior groups (IPSE, 1976, pre-IPSE groups for 1975, and post-IPSE groups for 1977), and the three sophomore groups (IPSE, 1975, and post-IPSE groups for 1976), show that there were significant differences among the comparison groups for the number of each type of course taken. Specifically, Table 28 shows that the IPSEs as seniors took significantly more life science and physical science courses than the two pre-IPSE groups did as seniors, and significantly more life science courses than the pre-IPSE:NO group. Similarly, as juniors, the IPSE students took significantly more mathematics, life science, and physical science courses than all the other four relevant comparison groups. Finally, the IPSE sophomore group took significantly more mathematics courses than the post-IPSE:YES group. There were also significant differences among the three groups in the number of life science courses completed, but the post-hoc differences did not show any of the groups to be significantly different from the others in a pairwise fashion, even though the IPSE group did take the greatest number of this type of course. To recapitulate, the IPSE group took significantly more mathematics and science courses than did comparable control groups. The least support for this conclusion came from the comparison among sophomore groups. This is probably because of the greater number of required courses students generally have as sophomores.

TABLE 27: Means and Standard Deviations (shown in parenthesis) of Course Performance Data.

	SOPHOMORE			JUNIOR			SENIOR		
	Math	Life Science	Physical Science	Math	Life Science	Physical Science	Math	Life Science	Physical Science
I. Courses per Student									
IPSE	1.774 (.659)	1.147 (.979)	.265 (.717)	1.735 (.628)	.990 (.939)	.951 (1.120)	1.348 (.906)	.382 (.699)	1.034 (1.123)
Pre-IPSE:Yes				1.138 (.995)	.422 (.748)	.509 (.850)	.741 (.970)	.207 (.520)	.595 (1.030)
Pre-IPSE:No				.731 (.935)	.256 (.653)	.256 (.612)	.410 (.763)	.039 (.194)	.154 (.458)
Post-IPSE:Yes	1.396 (.840)	.793 (.948)	.264 (.625)	.804 (.999)	.536 (.830)	.161 (.496)			
Post-IPSE:No	1.630 (1.006)	.667 (1.074)	.296 (.669)	.370 (.629)	.296 (.724)	.074 (.385)			
II. Grade Point Average									
IPSE	2.391 (1.008)	2.571 (.926)	2.750 (1.312)	1.942 (1.118)	2.193 (1.101)	2.163 (1.175)	2.358 (1.064)	2.544 (.928)	2.564 (1.038)
Pre-IPSE:Yes				2.414 (1.080)	2.484 (1.084)	2.480 (.883)	2.218 (1.102)	2.806 (.770)	2.274 (1.121)
Pre-IPSE:No				2.145 (1.233)	2.455 (.961)	2.692 (.925)	2.579 (1.283)	2.000 (1.732)	2.833 (1.061)
Post-IPSE:Yes	2.167 (1.124)	1.193 (1.174)	2.056 (.917)	1.686 (1.281)	2.111 (1.195)	2.167 (.753)			
Post-IPSE:No	2.380 (1.215)	2.125 (.810)	2.000 (1.173)	2.250 (.926)	2.500 (.408)	1.500 (.000)			

When we turn to the G.P.A.'s in the science and mathematics courses we find a different pattern of results. As seen in Table 28, there were, with very few exceptions, no significant differences among the groups in terms of grade performance in the courses taken. There were no differences among the senior groups, a significant difference in the mathematics G.P.A. as juniors (although no significant post-hoc differences); and significant differences between the IPSE group and the post-IPSE:YES group as sophomores in the life science G.P.A.'s, with the IPSE group attaining the higher G.P.A.'s. Thus, although the IPSE students did not generally do better than the relevant control groups in their math and science courses, they definitely took more of them. Of course, part of the requirement of being in the IPSE program was to agree to take a math and science course each semester. These data tend to confirm that the IPSE students generally lived up to this agreement.

Admittedly, the case for IPSE would have been much stronger had the IPSE students not only taken more math and science courses, but also performed better in these courses. This was not the case for the groups in this program. However, it is felt that of the two, satisfactory performance in a large number of math and science courses is to be preferred over satisfactory performance in just a few such courses. Much college science coursework depends not so much on superior performance in high school math and science courses as it does on mere exposure and satisfactory performance on a large number of such courses.

B. CHANGES IN COURSE PERFORMANCE OVER TIME

In the analyses of changes in course performance over time, the interesting information is whether there is a difference over time in course performance (i.e., both G.P.A. and number of courses completed), as well as

TABLE 28: Statistical Analyses of Course Performance Data

Comparison/Variable	F	Significance	Post-hoc Differences[a]
SOPHOMORES[b]			
1) # of Math Courses	4.19	.025	1>7
2) # of Life Science Courses	3.79	.025	ns
3) # of Physical Science Courses	.03	ns	--
4) GPA - Math	.66	ns	--
5) GPA - Life Science	3.99	.025	1>7
6) GPA - Physical Science	1.29	ns	--
JUNIORS[c]			
1) # of Math Courses	23.14	.001	4>2,10,3,11,2>3,11
2) # of Life Science Courses	11.21	.001	4>10,2,11,3
3) # of Physical Science Courses	13.41	.001	4>2,3,10,11
4) GPA - Math	2.73	.05	ns
5) GPA - Life Science	.45	ns	--
6) GPA - Physical Science	1.09	ns	--
SENIORS[d]			
1) # of Math Courses	23.94	.001	9>5>6
2) # of Life Science Courses	8.96	.001	9>6
3) # of Physical Science Courses	18.12	.001	9>5>6
4) GPA - Math	.75	ns	--
5) GPA - Life Science	1.11	ns	--
6) GPA - Physical Science	1.33	ns	--

a. See Table 2 for groups corresponding to each number.

b. Degrees of freedom for all tests involving sophomores were 2 and 179.

c. Degrees of freedom for all tests involving sophomores were 4 and 374.

d. Degrees of freedom for all tests involving sophomores were 2 and 280.

whether there is a different pattern over time for the IPSE groups as compared to the control group at the same level in high school. These types of differences are indexed by the "trials" and by the "groups by trials" interaction in the repeated measures analyses of variance, displayed in Table 29. The effects for "groups" are similar to the analyses discussed in the previous section. (One will note that more of the differences among groups are significant in Table 29 than in the comparable analysis in Table 28.) This is owing to the combining of the data for a given group over both years. This is essentially a test of whether the combined performance of the groups over two years differ. (Therefore it is not a question of much interest in the present case.)

Turning first to the changes from sophomore to junior years, it can be seen that there were significant changes over time on all but one of the indices, and there were differential patterns of change on all but two of the indices. The effects for trials indicated that number of mathematics and science courses completed generally decreased over time. The interactions were attributed to the IPSE group experiencing a relatively small drop, or an increase, while both control groups showed large decreases in numbers of courses taken for math and physical science. The two significant interactions involving G.P.A.'s are less clearly interpretable. The IPSE group and both of the control groups exhibited decreases on the math G.P.A., with Post-Yes showing the largest decrease and Post-No the smallest. For physical science, IPSE and Post-No both had large decreases, but Post-Yes showed a small increase to explain that interaction.

Examination of the comparable set of data for junior to senior years shows the effects for trials indicate the number of math and science courses taken decreased for all groups over time. For G.P.A., there was a substantial increase for the IPSE group in both math and life science G.P.A.; for Pre-Yes,

TABLE 29: Analyses of Repeated Measures - Course Performance Data

1. Sophomore-Junior Years : (IPSE vs. Post:Yes vs. Post:No)

Variable	F	Groups	F	Trials	F	G × T
# of Math Courses	35.764	.000	19.415	.000	13.993	.000
GPA - Math	9.864	.000	41.028	.000	6.851	.002
# of Life Science Courses	16.204	.000	3.900	.047	.246	ns
GPA - Life Science	16.821	.000	3.080	ns	.110	ns
# of Physical Science Courses[1]	14.271	.001	22.256	.000	20.042	.000
GPA - Physical Science[1]	9.854	.002	11.762	.001	11.046	.002

2. Junior-Senior Years : (IPSE vs. Pre:Yes vs. Pre:No)

# of Math Courses	42.875	.000	36.670	.000	.269	ns
GPA - Math	23.090	.000	8.481	.004	2.654	ns
# of Life Science Courses	29.281	.000	28.345	.000	3.233	.040
GPA - Life Science	19.364	.000	12.346	.001	1.059	ns
# of Physical Science Courses	29.857	.000	.022	ns	.581	ns
GPA - Physical Science	20.244	.000	.892	ns	2.197	ns

[1] Only IPSE '75 and Post:Yes '76 were included in this analysis, because there was only one Post:No '76 subject who took a physical science course, yielding zero variance in that within-group cell.

an increase in life science and a decrease in math G.P.A.; and for Pre-No, a decrease in life science and an increase in math G.P.A. There was only one significant interaction, this was because the number of life science courses taken had decreased for all groups, but to a relatively larger extent for the IPSE group.

Finally, Table 30 shows the repeated measures analyses for each of the six indices for the changes in IPSE students over the three year course of the program. Results indicate the significant changes over time for number of math and life science courses stems from a constant decline, especially from junior to senior years. The trend for number of physical science courses taken is just reversed, with more being taken during every succeeding year. The only significant change over time, with regard to G.P.A.'s occurred with the math G.P.A. where the G.P.A. was originally 2.391, it dropped in the junior year to 1.942, then recovered during the senior year to approximately the sophomore level, 2.358.

TABLE 30: Analyses of changes in Course Performance in IPSE Students from 1975 through 1977.

Variable	F	Significance	dF[a]
# of Math Courses	9.60	.000	2,290
GPA - Math	5.02	.01	2,255
# of Life Science Courses	19.31	.000	2,290
GPA - Life Science	2.33	ns	2,138
# of Physical Science Courses	17.66	.000	2,290
GPA - Physical Science	2.30	ns	2,113

[a] Degrees of freedom.

VII. DATA CONCERNING COLLEGE ADMISSIONS AND MAJOR IN COLLEGE

As high school seniors, the Pre-IPSE control group (in 1976) and the IPSE group (in 1977) responded to several questionnaire items regarding college intentions. Concerning the question of "Are you planning on going to college next year?" 82% of the IPSE group responded "Yes", 11% responded "No", and 7% were "Undecided". Corresponding figures for the control group were 66% "Yes", 12% "No", and 22% "Undecided". The difference between the groups was not significant. Regarding the question of tentative college majors (for those students intending to go to college), 71% of the IPSE students reported that they planned majors in science-related fields, 15% in non-science fields, and 14% were still undecided. Twenty-nine percent of the control group reported majors in science, 57% in non-science fields, and 14% were undecided. The difference between groups was significant. These results indicate that, as seniors, a similar percentage of IPSEs and controls were planning on going to college, however of those planning on college, a significantly greater percentage of IPSEs than controls planned science-related majors. These figures relate to plans made by high school seniors in the middle of their final semester. We turn now to actual outcomes.

Data concerning actual college admissions and majors in college was collected in the period May - June of 1977 for both IPSE and Pre-IPSE groups. For the Pre-IPSE group this data represents actual behavioral responses since this group, at the time the data was taken, was a year beyond high school. For the IPSE group the data was taken at a time just after high school graduation but before actual entrance into college. Thus, although not behavioral in the sense of the Pre-IPSE group, the data was taken after the IPSE students had applied to, and been accepted into college. The results of these surveys are shown in Table 31, which

TABLE 31. College Admission Data - Comparison of IPSE and Pre-IPSE Control Group.

	Total Polled	Number Responding	College	
			Yes	No
Pre-IPSE				
First Poll	194	73	53 (73%)	20 (27%)
Second Poll	121	62	30 (48%)	32 (52%)
Summary*	194	135	83 (61%)	52 (39%)
Summary (allocating non-respondents according to 2nd Poll)**	194		111 (57%)	83 (43%)
IPSE				
First Poll	141	45	41 (91%)	4 (9%)
Second Poll	96	26	22 (85%)	4 (15%)
Third Poll	70	9	8 (89%)	1 (11%)
Summary*	141	80	71 (89%)	9 (11%)
Summary (allocating non-respondents according to 2nd Poll, Control Group)**	141		100 (71%)	41 (29%)

*Respondents only included.

**Non-respondents allocated by procedure specified in text.

summarizes the college vs. non-college numbers for both groups, and Table 32 which shows the choice of majors. Unfortunately, for the data shown in these tables, interpretation is complicated by the ambiguities related to those students not responding to the survey. It is clear from the data that a simple "proportional" allocation of non-respondents to the total would result in an over-estimate of the number of students attending college. That this is the case can be seen by comparing the results of the first and second mail-surveys. For both the IPSE and control group, there is a significant decline from the first to the second polls in the fraction of students indicating they are attending college. The data seem to imply that students who were going to college more readily responded to this survey than did those who were not going to college. Perhaps students not choosing to go to college felt there was a stigma attached to their choice. Whatever the reason, the trend is fairly obvious.

Perhaps a reasonable procedure is to allocate the non-respondents in the same proportion as the second poll. This, we feel, is more realistic than allocation according to the overall proportion, but still might represent an over-estimate biased in favor of college. The last two lines for both IPSE and the Control Group therefore represent a summary obtained in two ways. The line designated "summary" simply leaves out the non-responding students. The line marked "summary according to 2nd poll" allocates non-responding students in the same proportion as the second poll of the Control Group, that is: 48% college; 52% non-college. This proportion was used for both Control and IPSE non-respondents. The overwhelming majority of IPSE non-respondents were those who dropped (involuntarily and voluntarily) out of the program. We therefore feel uneasy treating these as if they would have responded like the second IPSE poll. Our guess is that they are more readily typified by the Control Group, and we have therefore allocated the

non-responding IPSE students as if they would have behaved in a fashion similar to the Control Group. Although the result of this kind of allocation reduces the "success" of the IPSE program relative to the Control Group, we feel it is a procedure which represents a best conservative estimate of the college admission data. The bottom line of Table 31 therefore indicates that while the Control Group saw 57% entering college, 71% of IPSE students went to college. Although this is a difference of 14%, it is not as startlingly successful as the 28% difference obtained when the non-respondents are omitted from the data.

Therefore, the latter figure represents our most optimistic interpretation of the data, while the former figure is our most pessimistic. In conclusion then, we can say that between 14% and 28% more IPSE students have gone to college than did their Control Group counterparts.

We turn now to choice of majors. The post-card mailing yielded the results shown in Table 32. Here, we have combined the results of all mailings, have allocated non-respondents as in Table 31 (conservative procedure) and assigned the non-respondents to majors in two different ways. Again we have chosen a conservative, or pessimistic procedure, and an optimistic one. The optimistic procedure consists of assigning non-responding IPSE students to majors in the same proportion as responding IPSE students. The pessimistic procedure consists of allocating non-responding IPSE students in the same proportion as responding Control Group students.

In these procedures, as Table 32 shows, the final column is not very sensitive to the various methods of calculation. The pessimistic procedure says that out of 141 students who began in the IPSE program, 48 (34%) have gone on to begin science majors in college. The optimistic procedure says that 55 (39%) have gone on to begin science majors in college. In either

TABLE 32. Major Fields in College - Comparison of IPSE with Pre-IPSE Control Group.

	Total Polled	Number Responses	Number Majoring in Science	Number Non-Respondents	Number Non-Respondents Allocated to College*	Non-Respondents Allocated to Science	Total in Science
Pre-IPSE	194	135	24 (18%)	59	28	8 (29%)	32 (16%)
IPSE							
(Pessimistic Estimate)	141	80	40 (50%)	61	29	8 (29%)**	48 (34%)
(Optimistic Estimate)	141	80	40 (50%)	61	29	15 (50%)***	55 (39%)

*See Table 31.

**Allocated as if non-responding IPSE students behaved like Control Group.

***Allocated as if non-responding IPSE students behaved like responding IPSE students.

case, these numbers are larger than the Control Group figure of 16% by a factor of at least two.

There are several factors which must be taken into account in considering this figure and in deciding whether IPSE was a "successful" program: 1) It is likely that many of the students who dropped out of IPSE proceeded to college and majored in science, especially among the 18 students who dropped out involuntarily (e.g., moved away). The curtailed experiences of these students in IPSE may have proven very beneficial to these students for majoring in science; 2) Those students who did not indicate that they would be majoring in science have the high school math and science prerequisites to become science majors if they so choose. It is doubtful that many of the Control Group students could make the same claim; 3) Those IPSE students who never major in science at least have a more favorable attitude towards and appreciation of scientific work, which is extremely important for future citizens in our technological society; 4) It must be recalled that selection into the program was based on having at least an adequate record in junior high school math and science (i.e., no evidence of failure). A more selective system would undoubtedly result in a more successful program. Of course, this was not the goal of IPSE. IPSE from the very beginning focussed on the typical student, and not necessarily on the precocious or those who had shown high interests in science; 5) In analyzing the program in terms of benefits and costs, it should be recognized that much of the costs were for administrative and evaluative functions. An ongoing IPSE program would only need a full time field coordinator with a travel budget, salary and minimal secretarial support, and 6) It must be cautioned that the estimate of 34% to 39% science majors in college is undoubtedly an overestimate of the percentage of students who will eventually graduate from college with a degree in a

science related field. However, the same caution will also apply to the Control Group.

Appendix A

INCENTIVE PROGRAM IN SCIENCE AND ENGINEERING: A PROGRESS REPORT FOR 1974-1975*

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INTRODUCTION

This report is intended to describe the progress of the Incentive Program in Science and Engineering (IPSE), a three-year National Science Foundation-funded program to test mechanisms for increasing the flow of minority students into the sciences. Briefly, the program is hoping to test the effect of harnessing more fully those facilities already available in most high schools, but often not used by minority and/or low income students. The program seeks, through the use of group and individual counseling, to encourage the students in the program to take advantage of the full range of science and mathematics courses available to them in the schools. This is done by stimulating an interest in scientific careers through vocational and career counseling, involvement in scientific study projects, and field trips to science centers. Finally, students will be aided in planning for and applying to colleges and in securing access to financial aid from these colleges.

IPSE has now completed its first year working with 137 students in 16 high schools in the state of Colorado. The ethnic and sex breakdown of these students is given in the table below:

ETHNIC AND SEX BREAKDOWN OF IPSE STUDENTS

	Male	Female
Mexican-American	53	43
Black	10	12
Asian-American	3	2
Caucasian and other	5	3
Unknown (Control High School)	3	3
TOTAL	74	63

The report that follows is divided into two sections: the first, "Description of Program Activities" contains a reasonably detailed accounting of the actual activities and operations of the program in the first year, and

includes, in an informal way, some subjective impressions of various activities. These are included wherever it is felt that they help in an understanding of important problems as they developed and in their resolution. The second section, "Evaluation", presents a description of the evaluation component of the IPSE program.

DESCRIPTION OF PROGRAM ACTIVITIES

The Minority Incentive Program in Science and Engineering began with a letter from the program director to all high school principals involved, followed by a visit to each school with the field coordinator. At the first meetings, several principals expressed reservations about emphasis on minority students. "We, the whites, are a minority now, at least in terms of grants and special programs," they complained. It was explained that the principal aim of MIPSE was to reach students from economically deprived backgrounds and that such students often were Black and Chicano. The principals seemed to feel much more affirmative about the program when they were assured that poor Caucasians would not be excluded. After several discussions of this kind it was decided that dropping the word "minority" from the title of the project, while it would in no way change the aims of the project, would serve to make it more acceptable to the administrators with whom we had to work.* Thus, "MIPSE" became "IPSE".

Each high school has its own discrete identity. For example, in one high school the assistant principal is the IPSE contact person. He is genuinely interested in the program and goes out of his way to greet the field coordinator and to help her arrange meetings with the students. He invariably invites her to lunch in the school cafeteria and actively seeks information about the program's development and asks questions about the students' responses and about what they are being told. He expresses concern about the Black students in his school

* It was found later that many students were hesitant to identify themselves publicly with a minority group, so that the name change also appears to have smoothed the way for the recruitment of some students.

and admits frankly that they are there only as a result of the recent Denver integration ruling. He is a little nervous about their presence in the school but is learning to communicate with them and the new Black staff.

His sensitive and affirmative attitude not only encourages the field coordinator in her work, but also transmits itself to the staff and students. On the other hand, another high school, also in Denver, was 'uptight" from the very first contact. When the director and the field coordinator initially visited the school, the principal seemed far more concerned with what was going on outside his window (he saw a student drinking wine) than with what was being discussed in his office. He directed the field coordinator to work with his assistant principal. The latter seemed almost exasperated at "yet another research project". He showed little concern about the implementation of the program beyond insisting upon official approval from the Denver Public School Administration. Once this was obtained he ignored the field coordinator which created some difficulty in terms in getting in touch with the students. The field coordinator had to look up the student programs, fill in call slips, arrange for rooms, and arrange for monitors to call the students out of class. Since she is not known in the school, the appearance of this stranger who was making various demands, engendered something of a "who the hell are you?" attitude. Such an attitude in turn, had an inhibitory effect on the role of the field coordinator and made her work in the school difficult. Such ranges in the responses of the administration to the program will undoubedly have an impact on the effectiveness of the program in the various schools which will be difficult to evaluate in other than a subjective way. Nevertheless, careful attention to these details is deemed essential to a final assessment of IPSE in each school. Finally, it should be noted that the attitude toward IPSE is not unrelated to a general attitude toward minority students which cannot but have an effect upon student interest in academic studies and achievement.

After the field coordinator had established the IPSE presence in each school

she consulted student records to collect names of potential candidates for the program. The selection of IPSE students proceeded as follows: first she looked for Hispanic surnames; then she checked to make sure that none of these students had failed a mathematics or science course during their junior high school years. Identifying Black students proved more difficult except where pictures were attached to the records (as was the case in Pueblo). However, in the search for Black students she enlisted the aid of records clerks who were usually able to provide information on which junior high schools (feeder schools to the high schools) had predominantly Black student bodies. When a list of about 30 names had been compiled, the field coordinator asked that it be circulated among the counselors and the mathematics and science teachers for specific comments on individual students. Circulation of the lists allowed for additional identification of minority students and also allowed for the weeding out of students who were already heavily committed to scientific careers and for those students whose records did not fully describe what was considered to be a very definite deficiency in mathematical aptitude. Unfortunately, there were several schools in which the contact person failed to circulate the lists which resulted in the inclusion of several students who did not meet the original criteria. Nevertheless, the proceedure described above did yield 152 IPSE students who, with very few exceptions, met the selection criteria.

The initial contact with the IPSE students followed approximately the same format in all schools. The field coordinator always asked that the contact person, or a counselor, be present at the initial meeting with the students so that questions by the students could be answered by someone in the school in case the field coordinator could not provide ready answers on procedures. At several schools, where official interest in IPSE was less than enthusiastic, no one from the administration came to the initial meeting. It is probably not

accidental therefore that these same schools produced the fewest number of participants in the program.

It is important then, that the administration of the school feel affirmative about a project being conducted in the school. The official attitude transmits itself to the staff and the students and can facilitate or hamper the physical and psychological operations of the project. Endorsement from the district is useful insofar as it reassures the school staff that the project is acceptable but the attitude within the school is what is crucial.

Colorado Springs presented a special problem. The school zones there were being redrawn with redistricting to take effect starting in 1975. The counselors there generated their own lists of potential IPSE students based not only upon the IPSE criteria, but also upon their own judgements as to whether or not a particular student would stay with the school for 3 years.

As the field coordinator began to get aquainted with the students in each school, she became aware that no single approach would work with each group. Apart from the individual differences between students, the IPSE groups in each school differed markedly from one another. With some groups, notably two of the schools in Pueblo, a relaxed, joking, conversational approach produced warm and enthusiastic responses in group discussions. However, in Pueblo County, just ten miles or so away from the central city, this style of interaction yielded no response and the same was true in several Denver schools. Observing this, the field coordinator found that a more business-like approach (e.g., delivering a short lecture on various careers followed by a question-answer period) was much more fruitful. Many students found it difficult to overcome the familiar role of student (vis á vis teacher) or child (vis á vis adult) in relating to the field coordinator. To help overcome these barriers, the field coordinator invited students to send her short, written autobiographes if they felt so inclined. A surprisingly large number of students chose to do this and more than 80 were received. These often helped to break the ice

between the field coordinator and the students more effectively than had face to face contact (one sample autobiography is attached).

Student responses to the initial IPSE presentation ranged from apparant indifference to explicit enthusiasm, with the majority reaction being one of cautious interest. At almost every initial meeting the students, having been called from class, arrived apprehensively. They had been called by "the office" and this sort of summons generally was associated with "getting into trouble". After encountering this response in the first two schools, in subsequent meetings the field coordinator stood at the door and said "This is nothing bad; you don't have to worry." Then the students would want to know what it was all about. They were told as soon as the entire group of fifteen to thirty students were present. The number varied drastically from school to school. In one Denver school 30 or more call slips were sent out over a period of 2½ hours but only 15 students came. However, in another Denver school 30 call slips produced 27 students in a very short time. The field coordinator introduced herself and the opening remarks went something like this:

"Colorado State University and the National Science Foundation, a government agency, are sponsoring an experimental project. We are going to take 10 students in 15 high schools in Colorado and these 150 people will participate in the project which is named 'Incentive Program in Science and Engineering.' These students will promise to take math and science courses every semester until they graduate, and in return I will promise to visit them about once a month and give them specific information about the many careers which exist in science and engineering. Not only will we discuss what you have to study to enter these careers, but we will also talk about how much you earn and what sort of things you do in the various science and engineering jobs.

The reason for this project is that we hope to encourage students to take math and science in high school so that if they decide to go to college and major in an area of science or engineering, they will not be held back

because they have to make up courses which they should have taken in high school. We have found that many students who might have gone into science and engineering careers have not done so because they did not want to spend the extra time making up courses which they should have had in high school.

Furthermore, careers in science and engineering pay well. Salaries often start at $1,000 per month. Employers are also trying to hire qualified minority people and women but claim that they cannot find enough of them in scientific fields. So one major aim of this project is to increase the number of minority people and women in science and engineering. If you do volunteer to participate in IPSE and take science and math all through high school and then you change your mind (and don't go on to a science career) you will have lost nothing. On the contrary, you can only benefit, no matter what career you eventually choose, from your exposure to science and math."

The field coordinator then described the rest of the IPSE program in detail, (as set out in the original MIPSE proposal) and then asked for questions. A typical question was: "How did you get my name?" Students were told that their names were selected on the basis of their 9th grade records and in consultation with their counselors. "What happens if I fail?" was another concern in almost every school. Students were told that first it was hoped that at the first sign of trouble IPSE would be able to provide help, in the form of counseling, arranging for peer tutoring and instructor help. If they failed a course because of a genuine inability to master the material, then IPSE would encourage them to take some other course or repeat the same one in the hope of passing it the second time through. It was made clear however, that if the failure was a result of "goofing-off" or non-attendance in class, then the student would cease to be a participant in the project, since IPSE was a special group of students who had promised to work hard toward a specific goal.

Other questions included: "Do you give scholarships? Will you find me a job? Do I get money? Will the program cost me money? What happens if I don't want to continue in the program?" The students were told that while the project itself could not provide scholarships, IPSE had, as one of its primary goals, the job of finding out where and what kinds of financial aid were available, not only in colleges in Colorado, but elsewhere as well. The field coordinator explained to students the operation of college placement offices and how they were used to help graduates find jobs. The money questions were both answered with a "no". The response to the final question was that students should not volunteer for the program unless they felt very affirmative about it. However, it was made clear that no binding contract was involved and that anyone could withdraw at any time without penalty.

Students were then given a letter to their parents explaining what IPSE was all about, a brochure further describing the program for both parents and students, and a permission form (see attached samples). They were told that the latter had to be returned within a specified time period to indicate the student's desire to participate in IPSE.

152 students returned the permission slips and started as regular IPSE participants. At the time that this report is being written there are 137 IPSE students (6 in the control high school*). In the first year then, 15 students have left the program. Six of these are from the control school--they are students who never filled out and returned the questionaire which was sent to them by mail. Of the 9 normal IPSE students, 3 left because they indicated they felt the program was not for them--the other 6 left for reasons incidental to the program itself: some moved to other localities; one got married.

* The control high school, as distinct from the much broader "post-IPSE" and "pre-IPSE" control groups in each school, is being used to test impact of the personal contact (which the normal IPSE students receive), as opposed to the impact of the information itself, which is sent by mail to the control school students.

The choosing of the students in the control school was done under the guidance of a new principal who was so nervous about minorities that he refused to allow the field coordinator to look at records or approach students. Instead, the assistant principal picked out a list of names (using the IPSE criteria described above) and wrote to the parents asking whether or not IPSE could contact their children. The 12 students whose parents were agreeable were then contacted by mail and all subsequent contact has been through the mail. So far, the group has received (apart from the questionnaire and procedural letters) printed material which parallels the information which the field coordinator has transmitted to the normal IPSE students in person (see attachments). Because of the attrition among the control students in the control high school (which in itself is already an indication that the personal contact is crucial to at least a minimum level of success for the program) it will probably be necessary to add additional control high schools in the coming two years if reliable attitudinal studies of the control students are to be made.

After the participating students had been identified the first meeting with them as IPSE students was spent having them fill out the Job Interest Inventory (see attachment). This instrument is described more fully in the "Evaluation" section. The questionnaire is a key component of the IPSE research design, and changes in the student's response to this instrument over a three year period will be used, in part, to gauge the effectiveness of the program in influencing the student's attitudes toward science and toward themselves in relation to careers in science. It should be pointed out that there was an important "Heisenberg effect" associated with the administration of the questionnaire. Students do not like to fill out questionnaires; no matter how attractively they are packaged students still find them irksome. Thus, the first encounter that the students had with the IPSE program was to "take a test". This produced many negative reactions from the students and was

certainly not an attractive activity for the first IPSE meeting. Yet, it is difficult to contruct an alternative procedure: experimentally, the questionnaire cannot be administered after the program has begun to influence the students. Although the negative student responses to the first meeting have been largely overcome by subsequent contact, it is felt that the problem is sufficiently important to cause some concernand that the value of the information obtained from the questionaire must be weighed against the deleterious effects of obtaining that information. A final judgement on this question must be deferred until the program is completed. It is suggested however, that a preoccupation with objective testing may obscure other roads to the same information which do not have such counterproductive side effects.

The second meeting with the IPSE students was devoted to what will become an ongoing discussion throughout the program: the importance of developing scientific skills, what can be done with these skills, and what the work of various scientific occupations is. For example, in one school the discussion began by asking why basketball players earn as much as they do. The conclusion reached was that a desireable and rare skill can command a high salary. In each school the discussion took its own unique direction, but the same basic conclusions were reached. Career aspirations were also discussed and seemed to differ markedly from school to school. For example, the students from high schools serving rural communities on the plains east of the Rockies talked about becoming auto mechanics, telephone linemen, and secretaries. Students from the urban schools had different aspirations: in one Denver high school three boys were interested in forestry and one girl wanted to be a pediatrician (and knew roughly what that would involve). During these discussions the field coordinator, where appropriate, would point out the sexual biases associated with job categories. Thus, girls who expressed an interest in nursing were asked to think about the possibility of becoming physicians and to be clear

about why they might be choosing the former career over the latter.

By the third meeting, the field coordinator felt that she was beginning to develop relationships with many of the students. Quite a few were writing her during the weeks between meetings, and names were associated with faces in most cases. Some students were discussing personal matters with her and a warm, trusting relationship was beginning to develop. In two or three schools students began to express open dissatisfaction with certain science and math teachers. In one case, with the group's permission, the field coordinator discussed the matter with the counselor who in turn tactfully transmitted the complaints to the teacher. In another group, two students were having trouble with math and felt uneasy at discussing their problems with the teacher (they claimed he was impatient and unresponsive). The field coordinator was able to arrange for one of the students in the group who was particularly adept at mathematics, to tutor the others. These experiences, and others like them have led to an impression that there is a definite advantage in being separated from the school beaurocracy. The students feel that the field coordinator is there for them, and that she can be of real use in dealing with problems which develop within the school setting, and can act as a buffer between the students and the school authorities. However, a very careful balance must be maintained so that the administrators and teachers are not antagonized by this role of the field coordinator.

On April 26th, the students from all participating high schools (except the control school) were brought to Colorado State University for an "Engineering Days" visit to the campus. Ninety IPSE students were bussed to Fort Collins from the various localities and spent the day at the university looking at exhibits and demonstrations set up by the Engineering, Physics, Veterinary Medicine, and Computer Science Departments. The director, field coordinator,

members of the Physics Department, and student volunteers all helped in showing the IPSE students around the campus. There was a great interest in the exhibits, and most students gave the impression of not being able to get enough of many of the activities. Some watched a hysterectomy (on a cow) on closed circuit TV, others experimented with landing a LEM on the moon using an interactive computer terminal, and many enjoyed being an "Energy Czar" with the A. E. C.'s "Energy and Environment Simulator". The students were given a lunch pass in the grill, and after lunch there were small group journeys to the gym, dormitories, and other school facilities. Many of the IPSE students had never before visited a university campus and their interest and enthusiasm was obvious. They also appeared most interested in meeting each other and several inter-city correspondences have resulted from the trip. When the field coordinator visited the students in the weeks following the trip, they were full of suggestions for other trips, and at least one group of students is busy arranging for their counterparts in another city to visit and it is hoped that the idea will spread.

The last event of the school year was an evening meeting of the IPSE parents (in the city of Pueblo--other parent meetings are planned for next year). Sixty-five parents met in the auditorium of Pueblo Central High School with the field coordinator and various administrators in the Pueblo school system. The formal part of the meeting consisted of a short description of IPSE and then the field coordinator asked for questions. Chief among the parent's concerns was the availability of stipends and grants for college. Many parents asked whether IPSE provided scholarships. They were told that one of IPSE's aims was to find such money for their students, but that IPSE itself had no such funds. Interest was expressed about how far IPSE could go in aiding students who had academic problems. The field coordinator explained that wherever possible peer assistance would be arranged, that the high school staff would be enlisted to give extra help to students, and if necessary,

tutors would be employed. Finally, several parents suggested that they would like a Saturday workshop, involving students and teachers, to discuss career opportunities, college, and matters of general interest to the future careers of their children. This suggestion will be put into effect with the help of the Pueblo school district. All in all, the parents seemed pleased that their children had been chosen to participate in IPSE and it was clear that anything which might aid their sons and daughters in getting into college and in alleviating the financial stresses that this would create, was welcome. It was clear that most parents were more than eager to do whatever they could to ensure that their children would be able to fulfill satisfying and lucrative career objectives.

In order to maintain the IPSE "presence" during the summer vacation months, a newsletter (copy attached) was mailed to each student on July 15th. It is planned that another letter will go out at the end of August reminding students of IPSE's plans for the coming year. In the second IPSE year all students will be required to select a science "mini-course" or project from a group of 10-15 self-paced modules which are now being developed by the program staff. At this writing, four mathematics and science teachers are working to prepare these modules and this task should be completed by October 1. Students are expected to select their project during the month of October and to begin working on it by early November. Each project is designed to be completed in about 10 weeks, consuming about 2 hours of work each week. As soon as the modules are completed IPSE will present them to the Colorado State University Curriculum Committee in the hopes that it will grant 1 or 2 college credits for completion of these modules. It is expected that the modules will present the greatest challenge to continuation in the program for the students. One high school science or mathematics teacher in each school will be paid to spend one afternoon each week helping IPSE students with problems encountered in working with the modules.

EVALUATION

In the first year of the IPSE program, the basic tasks of the evaluation team were to (a) reevaluate the research design, (b) develop measurement instruments, (c) establish base line data for the various groups within the research design, (d) plan for next year's evaluation based on the three preceding tasks. At this point in the year there has been one cycle through on the first task (the research design will be continually reevaluated throughout the project, part of the second and third tasks has been completed, and the fourth task remains to be tackled.

The research design calls for several different control groups. Specifically, a cohort group is required, as well as a pre-IPSE group. Moreover, a post-IPSE group will be required next year. This design was evaluated during the summer of 1974 and deemed to be efficient and robust in terms of supplying the information necessary for properly evaluating the effectiveness of the IPSE program.

However, a problem inherent in the design is the reactivity of being in a control versus an experimental group. Obviously, random assignment to control and treatment groups was not possible. It is likely, therefore, that the very act of selecting a student for the IPSE program might increase interest in science. Moreover, the problem comes full circle when it is recognized that those who volunteer to be in the IPSE program probably have a higher interest in science, a priori, than the students who do not volunteer. In order to account for those biasing factors, the evaluation design was modified by considering two types of control participants--those who would be interested in participating in a program like IPSE and those who would not be so inclined. The groups were determined by briefly describing the IPSE program to the control groups at the end of the Job Interest Inventory (described below) and asking the students if they would be interested in participating in such a program.

In summary, the basic research design was evaluated as being powerful enough to supply answers to the questions concerning IPSE's effectiveness. The design was modified only slightly to allow for the assessment and eventual statistical control of reactivity and selection bias factors.

The ultimate criteria of the IPSE program's effectiveness are behavioral measures, i.e., whether the students go to college and in what they intend to major once in college (and ultimately whether or not they complete their program of study). A more short term criterion is the determination of which courses they actually enroll in throughout their high school careers. Data on course selection by IPSE students will not be available until the students return to school for the start of their Junior year in the fall. At that time an evaluation of the impact of IPSE on course selection will be made--and of course, again at the start of the Senior year. Preliminary indications are encouraging in this respect, but are presented here with caution. A survey of student "intentions" in six schools revealed that 57 IPSE students intended to take 44 mathematics courses and 42 science courses next year. This is to be compared with the actual registration data obtained for the Junior control students in those same schools (the pre-IPSE control group) obtained at the beginning of the Fall, 1975 semester. In the control group, 48 students registered for 27 mathematics and 28 science courses. These results are summarized in the table below.

COMPARISON OF IPSE STUDENT'INTENTIONS'AND CONTROL GROUP REGISTRATION IN MATHEMATICS AND SCIENCE COURSES FOR JUNIOR YEAR IN SIX HIGH SCHOOLS

	# STUDENTS	# MATH COURSES	# SCIENCE COURSES	# MATH & SCIENCE COURSES/STUDENT
IPSE	57	44	42	1.51
CONTROL	48	27	28	1.15

It must be emphasized that the most meaningful comparison will be that of courses actually completed at the end of each year. Whether "intention" will be translated into "achievement" remains to be seen.

In addition to the behavioral criteria, attitudes and interests concerning science in general and scientific occupations is deemed important. Whereas the behavioral measures can be obtained from archival sources (e.g., student records) at the appropriate time, the attitudinal measures must be carefully constructed, keeping in mind concerns of validity, reliability, and available testing time.

Situational constraints imposed a maximum of 50 minutes allotted to testing each student. In the present case, it seemed advisable to maximize fidelity (i.e., measure scientific interests and attitudes) at the cost of wide bandwidth (i.e., measuring a broad spectrum of abilities and personality traits) (cf., Cronbach & Gleser, 1965).

Another constraint was the probable heavy concentration of minority group members in both the IPSE and the control groups. The standard interest inventories (e.g., SVIB, KOIS) are not normed on minority groups, and thus might lead to misinterpretations when used with minority members (cf., Gynther, 1972, for problems in applying the MMPI, a widely used personality test, to Blacks). The only interest inventory found which has norms for Blacks, the Field Interest Inventory, does not include scales for scientific occupations. Moreover, the formality and structure (e.g., computer scored answer sheets) of the interest inventories raise the probability of evaluation apprehension and thus potentially undermine the validity of the instrument.

In the present program, the types of attitudinal and interest information desired were (1) general attitudes toward science, (2) specific attitudes and perceptions of a sample of scientific and non-scientific occupations, and (3) the students' perception of their own future occupations relative to various scientific and non-scientific occupations. These three types of data were deemed suitable for establishing baselines from which any changes might be

detected over the course of the IPSE program.

The measurement of general attitudes toward science was achieved through use of a 10-item attitude scale. The specific attitudes and perceptions of various occupations were measured using a semantic differential format containing 15 concepts (occupations) and 7 scales for each concept. Finally, the students' perceptions of their future occupations relative to other occupations was assessed by using multidimensional scaling of similarity judgements of the various occupations (a copy of the complete questionnaire is attached).

The final questionnaire was condensed from a longer original version administered to a group of 65 college freshmen who were asked to complete the questionnaire according to one of three sets of instructions: one group completed it as if they were humanities majors, another group as if they were science majors, and a third group without accompanying role-playing instructions. Responses on the attitude items and the semantic differential scales were then compared across the three groups, and those items which did not statistically differentiate among the groups were dropped from the questionnaire. This resulted in eliminating 11 attitude statements from the original 21 and 5 semantic differential scales from the original 12. In addition, 3 of the original 18 occupations were eliminated as being redundant on the basis of the multidimensional scaling analysis.

In the original timetable, data analyses and interpretation were planned for the summer months. However, some of the analyses are already completed. In what follows, results of the general scientific attitude scale and semantic differential will be discussed. In the remainder of the summer, post-hoc analyses of these results will be performed, as well as the multidimensional scaling of the vocational perceptions portion of the questionnaire.

The analyses revolve around completed questionnaires from 3 groups: the normal IPSE group (131 students), the pre-IPSE control group which indicated they would be interested in participating in a program like IPSE (129 students), and the pre-IPSE control group which indicated they would not be interested in a program like IPSE (88 students). The cohort control group, consisting of high school sophomores from a control high school to whom information only was sent (see "Description" section), has not yet been analyzed, due to inadequate response rate to the questionnaire.

In terms of the attitude measures, total scores on the 10-item scale indicate that the three groups had significantly different ($p < .01$) attitudes toward science, with IPSE and interested pre-IPSE groups having the most favorable attitude toward science. The same pattern of results held for 8 of the 10 items as well. Two other findings of note concerning the attitude measure were (a) students in the 15 different high schools did not differ significantly one from the other on total scores and (b) the reliability of the instrument (internal consistency) for the total group of students was 0.76.

The existence of these pre-treatment differences is important for planning future analyses to check the effectiveness of the IPSE program. Specifically, covariance analysis would be one way of statistically dealing with these differences. As indicated earlier, these differences are likely due to several biasing factors inherent in obtaining students to be in the IPSE program.

The analyses of the semantic differential are not as complete as those on the attitude scale at this time, but the key findings thus far are as follows: (a) the IPSE and the interested pre-IPSE students generally rated the scientific occupations (Biologist, Chemist, Physicist, Physician, Mathematician, and Engineer) more favorably on the Good-Bad scale than did the uninterested pre-IPSE students. Many of these scientific occupations were also rated as more

interesting, more valuable, and easier by the IPSE and interested pre-IPSE group than by the uninterested pre-IPSE group. In contrast to the many differences in the ratings of the scientific occupations, there were very few differences in the ratings of the nonscientific occupations. Finally, the IPSE and interested pre-IPSE students rated "My Future Occupation" as better paying and of higher status than did the uninterested pre-IPSE group.

In addition to the substantive findings, some difficulties with some of the occupations and one of the scales became apparant. Specifically, approximately 16% of the IPSE group and 6% of the pre-IPSE group omitted responses to the Status scale, indicating some difficulties in comprehending this concept. Furthermore, approximately 8% of the students had difficulties with the word "Physicist" and about 5% of the IPSE group had difficulties with "Physical Therapist". Although bothersome, these problems are not large enough to invalidate the use of these terms. Synonyms of these words will be considered in next year's instrument, however.

In summary, the progress of the program evaluation of IPSE is roughly on schedule. Tasks to be completed early this fall include analyses of the IPSE cohort control group, multidimensional scaling of the vocational perception data, and various post-hoc tests on the attitudinal and semantic differential data. In addition, coordination with the field coordinator will result in obtaining the behavioral data not now available.

Appendix B

INCENTIVE PROGRAM IN SCIENCE AND ENGINEERING

A Progress Report for 1975-1976*

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I. INTRODUCTION

This report is the second annual report of the Incentive Program in Science and Engineering (IPSE), a three-year National Science Foundation Funded program to test mechanisms for increasing the flow of minority students into the sciences. A description of the program is contained in the original proposal and will not be repeated here, as this is intended as an interim report only. Further, the first year's annual report contains a detailed discussion of the basic activities of the program, and the reader is referred to that report for details of the program itself. This report is concerned primarily with a discussion of the evaluative aspects of the program as they have proceeded thus far, and to present data relating to both attitudinal and behavioral measures of IPSE students and appropriate control groups. The most significant data, from the point of view of the success of the project, will not be available until the third year is complete - that is, a comparison between IPSE students and control groups on attendance in college and the choice of majors. The first control group (Pre-IPSE) has now finished high school, and we are in the process of collecting data relating to their present activities: Are they in college? If so, what are they studying?, etc. The IPSE students themselves are now in the process of applying to college, or otherwise making post-high school plans. Present preliminary indications are that the vast majority (perhaps more than 90%) of them are intending to go to college and a sizeable number seem to be making plans to start a career of study in the sciences. However, this data is, as yet, far from complete, and the control data very marginal. These analyses will be presented in

the final report, next year, by which time we intend to have complete data.

A. Evaluation Goals for the Second Year of IPSE

The primary goal for the evaluation of the second year of IPSE was to broaden the scope of the evaluation to include data other than that obtained on the basis of paper and pencil instruments. Related to this was the desire to obtain more detailed evaluation of the various components of IPSE. The first year was actually a hybrid one: base line data was obtained and the overall reactions of the participants to the program and to science in general was evaluated. The second year of IPSE involved a wider variety of experiences on the part of the participants of IPSE (i.e., completion of science projects), and we tried to focus on the various components of the IPSE program.

B. Data Collection Techniques

The data for the second year of IPSE was primarily collected during March through June of 1976. A major part of the data consisted of the Colorado State University Job Interest Questionnaire, which contained: (1) a ten item attitude toward science scale; (2) fifteen various occupations rated on seven semantic differential type scales; (3) background information, such as parents' occupations; (4) open-ended questions concerning interests in such things as books, television programs, magazines, and courses in high school; (5) questions about components of the IPSE program [for IPSE students only], i.e., the Field Coordinator, the science project, etc.; (6) questions about plans they had made for college

[for pre-IPSE only]; (7) a question asking if they would be interested in taking part in a program like IPSE, if one were available (this was used to break down the control group into two sub-groups) [for pre-IPSE only]. A copy of the Colorado State University Job Interest Questionnaire is in Appendix A.

A second major data gathering effort consisted of interviews with various people associated with the IPSE program. Specifically, the following people were interviewed: 43 students in the IPSE program, 18 dropouts from the program, 13 high school counselors, 16 high school administrators, and 12 science consultants. In most cases, the interviews were done *in vivo*; in only a few cases, the interviews were done via telephone (this occurred for some of the science consultants and some IPSE dropouts). Separate structured interview sheets were constructed for the IPSE students, IPSE dropouts, science consultants, and high school administrators and guidance counselors. A copy of each of these interview sheets is in Appendix B.

The third type of data obtained was related to course work. The number of science and math courses attempted, and performance in these courses, were obtained for each of the treatment groups. Twenty-one science and math courses were considered: consumer math, mathematics, algebra, geometry, algebraic functions, trigonometry, computer math, zoology, biology, botany, physiology, medical science, chemistry, geology, physics, physical science, science, electronics, ecology, astronomy, and miscellaneous science or math. It should be recalled that a stipulation of being in the IPSE program is to take

a math or science course each semester. However, students were not dropped from the program for failure to do so. (In fact, no students were dropped from the program - all attrition occurred voluntarily.)

C. Summary

The synthesis of evaluation goals and data gathering techniques is outlined in Table 1. It can be seen that everything but the course performance and the attitudes of personnel related to IPSE was gauged by at least two separate approaches.

TABLE 1. Evaluation Goals and Types of Data Gathered During the Second Year.

Types of Data	Evaluation Goals				
	Students' attitudes toward science future occupation	IPSE Students' attitude towards program in general	IPSE Students' attitude towards components of program	Attitudes of related personnel	Course performance
Attitude Scale	X				
Semantic Differential	X	X			
Open Ended Question (Paper & Pencil)	X	X	X		
Structured Interview	X	X	X	X	
Review of Transcripts					X

II. ATTRITION DATA

A. IPSE Students

Of the original 141 students in IPSE, 102 still remain (95 were present during administration of the questionnaire for the second year evaluation). This represents an attrition rate of 27.7% between the first and second year of IPSE. The reason for dropping out of the program was ascertained for 30 of these cases. Of the 30, nine had moved or dropped out of school, representing an involuntary detachment from IPSE. Seven other students indicated that they were not interested in the program, while the remaining 14 either had no desire to take math and science courses each semester, or found them to be too difficult.

B. Control Groups

The original evaluation design called for a cohort control group composed of students in the same grade as IPSE but in different (but similar) schools. Due to administrative problems, this group was never formed. Thus, this group "dropped out" before it was even defined. Present plans call for forming such a group on a post hoc basis and using them for purposes of comparing science and math course performance only. Thus, this group will not be formed until the end of the program. (The possibility exists that it may never be formed, due to the administrative problems of gaining entree into new high schools for the sole prupose of examining grades of the control group.)

One-hundred forty-one of the original 217 pre-IPSE group were available for retesting the second year. These students were seniors

at the time of testing. Finally, 88 sophomores were added to form the post-IPSE control group.

III. ATTITUDINAL DATA

A. Groups

For the purpose of analyses, five distinct groups were considered. These are the IPSE students, who were juniors at the time of this questionnaire; the pre-IPSE students who had indicated that they would be interested in participating in a program like IPSE; the pre-IPSE students who had indicated they would not be interested in a program like IPSE; the post-IPSE students who had indicated they would be interested in a program like IPSE; and the post-IPSE group who had indicated they would not be interested in a program like IPSE. The pre-IPSE students were seniors at the time of this questionnaire, and they had also been questioned as juniors. The post-IPSE students were sophomores at the time of the questionnaire, and this was the first time they had been questioned. The reason for the breakdown of the control groups into those who were interested and those who were not interested in a program like IPSE was to try to gauge the effect of self-selection of the IPSE students. Specifically, it was assumed that those students who volunteered for IPSE would be different from those who chose not to join the program. In comparing the IPSE group to a control group, we tried to define a control group that would have comparable interests in a program like IPSE. (Hereafter, these control groups will be called the pre-IPSE:yes group, for those who were interested in a program like IPSE; the pre-IPSE:no group, for those who were not interested in a program like IPSE; and a similar division for the post-IPSE group.)

B. Attitude Toward Science Scale

The ten item attitude toward science scale, adapted from Silance and Remmers (1934), constituted the first part of the Colorado State University Job Interest Questionnaire. The means and standard deviations for each of the ten items for five definable groups are shown in Table 1 of Appendix C. The statistical analyses of these data consisted of a one way analysis of variance for each of the items as well as for the total score on the attitude scale. Table 2 summarizes these analyses, as well as indicating which groups were significantly different from one another. The groups differed significantly on nine of the ten items, as well as on the total score. Moreover, on each of the ten items, as on the total score, the IPSE group had the most favorable attitude toward science. In some cases, the post hoc analyses showed the IPSE group not differing significantly from some of the other groups. On the total score, however, which is the most important pschometrically (in terms of reliability and validity), the IPSE group had a significantly more positive attitude toward science (mean = 16.2) than did all other groups, and the pre-IPSE: yes and post-IPSE:yes had significantly more positive attitudes than the pre-IPSE:no and post-IPSE:no groups (means = 12.7, 10.2, 4.9, and 2.7, respectively).

These results indicate that the IPSE students are generally interested in scientific work. Of course, this might be due to several factors. The most compelling reasons are that these differences are due to the students' experiences in the IPSE program; or that the students who volunteered for IPSE had positive attitudes toward science

TABLE 2. Analysis of Variance for Each of the Ten Attitude Items and Total Score.

Item Number	F-ratio	Significantly Different Groups
1	5.07***	1 vs 3,5
2	1.00(ns)	
3	2.58*	1 vs 4
4	4.05**	1,4 vs 3
5	11.36***	1,2 vs 3,4,5; 3,4, vs 5
6	22.17***	1 vs 2,3,4,5; 2,4 vs 3,5
7	5.11***	1,2,3,4 vs 5
8	17.34***	1 vs 3,4,5; 2,4 vs 3,5
9	12.46***	1,2 vs 3,4,5
10	12.34***	1 vs 3,4,5; 2 vs 3,5; 4 vs 3
Total	22.43	1 vs 2,3,4,5; 2,4 vs 3,5

* - PL .05

** - PL .01

*** - PL .001

Note: df = 4,320 (approx.) for all tests.

Neuman-Keuls test was used to determine which groups differed significantly from one another. Group 1 = IPSE; Group 2 = Pre-IPSE: Yes; Group 3 = Pre-IPSE:No; Group 4 = Post-IPSE:Yes; Group 5 = Post-IPSE:No.

to begin with; or that somehow the students felt obligated to report favorable attitudes (demand characteristics of the situation). The second alternative can be discounted because the IPSE students had more favorable attitudes than the pre-IPSE:yes and the post-IPSE:yes groups, both of which assumedly had a high interest in science to begin with. The third alternative is more difficult to discount, since there are no controls for this potential effect in the present program. However, as indicated in Table 1, several different approaches have been taken to measuring this construct. This might serve as a guard against undue influences of demand characteristics.

C. Semantic Differential Ratings of Occupations

Fifteen occupations were rated on seven semantic differential scales. The occupations were "being a biologist" (chemist, physicist, doctor, mathematician, social worker, engineer, guidance counselor, dentist, physical therapist, veterinarian, artist, writer, and business executive), as well as "my future occupation". The scales were Good:Bad, Difficult:Easy, Interesting:Boring, Worthless:Valuable, Free:Limited, Pays Well:Pays Poorly, and Low Status:High Status. The means and standard deviations of the semantic differential ratings for each of the five goups are shown in Table II of Appendix C. The statistical analyses are also summarized in Table II of Appendix C. Table 3 is a condensation of Table II and shows only those analyses on which statistical significance beyond $p = .05$ was obtained. It should be noted that there were 105 statistical analyses in all, and 29 of these were statistically significant at the predetermined level. This is many more than would be expected by chance alone.

TABLE 3. Statistically Significant Semantic Differential Items.

Occupation	Scale[1]	Rank Order of Means	Significant Post-hoc Differences in Mean[2]
Biologist	Good:Bad	1>4>2>3>5	1>3,5;4>5
	Interesting:Boring	1>2>4>3>5	ns
Chemist	Good:Bad	1>2>4>3>5	ns
	High Status:Low Status	1>3>2>4>5	1>5
Physicist	High Status:Low Status	1>2>3>4>5	1,2>5
Mathematician	Easy:Difficult	4>5>1>3>2	4>2
	Interesting:Boring	1>4>2>5>3	1>3
Doctor	High Status:Low Status	2>1>3>4>5	2>4,5;1>5
Engineer	Good:Bad	1>2>4>5>3	ns
	Easy:Difficult	5>4>3>2>1	ns
	Interesting:Boring	1>2>5>4>3	1>3
	Valuable:Worthless	1>2>3>4>5	1>4,5;2>5
	Free:Limited	1>2>5>4>3	ns
	Pays Well:Pays Poorly	1>2>5>4>3	ns
	High Status:Low Status	1>2>3>4>5	1,2>5
Dentist	High Status:Low Status	1>2>3>4>5	ns
Veterinarian	Easy:Difficult	4>3>5>2>1	4>1
	Interesting:Boring	1>5>2>4>3	ns
	Valuable:Worthless	1>5>2>3>4	1>4
	Pays Well:Pays Poorly	1>5>2>3>4	1>3,4
Social Worker	Valuable:Worthless	5>2>3>1>4	ns
Guidance Counselor	Pays Well:Pays Poorly	4>3>5>1>2	4,3>2
Artist	Pays Well:Pays Poorly	4>5>1>3>2	4>2
Writer	Easy:Difficult	4>1>5>2>3	ns
	Free:Limited	1>5>3>2>4	1>4
Business Executive	High Status:Low Status	2>3>1>4>5	ns
My Future Occupation	Easy:Difficult	3>4>5>2>1	3,4>1
	Interesting:Boring	5>1>4>2>3	ns
	Pays Well:Pays Poorly	1>5>4>2>3	1>2,3

[1]The scales have been rearranged such that the first term represents the high point of the scale.

[2]All tests are Scheffe post-hoc tests ($\alpha = .05$).

Group 1 = IPSE; Group 2 = Pre-IPSE:Yes; Group 3 = Pre-IPSE:No; Group 4 = Post-IPSE:Yes; Group 5 = Post-IPSE:No.

There are several interesting things to note in Table 3. One of the most striking findings is that the IPSE group had the most extreme ratings of the science related fields (chemist, biologist, physicist, doctor, mathematician, engineer, dentist, physical therapist, and veterinarian), on almost all the scales in which significant differences occurred. Specifically, the IPSE students rated biologist, chemist, and engineer higher on the Good:Bad scale; they rated mathematician, engineer and veterinarian higher on the Interesting:Boring scale; they rated engineer and veterinarian higher on the Valuable: Worthless and Pays Well:Pays Poorly scales; they rated chemist, physicist, dentist, and engineer as having higher status than did all the other groups, and doctor as having higher status than did all but one of the other groups; and they rated engineer as being more "free" than did the other groups. The ratings of the science related occupations on the Easy:Difficult scale revealed that the IPSE students thought that engineer and veterinarian are more difficult occupations than did the other groups. Thus, the IPSE students realize that these occupations are difficult, but nonetheless, evaluate them highly. The only scale in which the IPSE group does not make extreme ratings of scientific occupations is for the rating of mathematician on the Easy:Difficult scale.

The ratings of the non-scientific occupations present an entirely different pattern of results. In only one of the six statistically significant cases does the IPSE group rate non-scientific occupations more extremely than do the other groups. They rate writers as being more free than did the other groups. Table II in Appendix C shows

that even for the cases in which statistical significance was not obtained, the above pattern of results were found. That was, the IPSE groups tended to give the most extreme ratings of the scientific occupations (with the exception of the Easy:Difficult and Pays Well: Pays Poorly scales and for all ratings of physical therapist). These extreme ratings do not carry over to the ratings of the non-scientific occupations.

Finally, the ratings of "My Future Occupation" are of interest. The IPSE students rated their future occupations as more difficult and paying better than did the other groups, and also rated their future occupations as more interesting than did all the other groups with the exception of the Post-IPSE:No group.

In sum, the IPSE students differed significantly from the control groups in many of their ratings of most of the scientific occupations: they found them more interesting, more rewarding in terms of both status and money, and more free. However, they did not seem to have a distorted view of these professions, since they also rated these occupations as being more difficult than did the control groups. This was also true for the ratings of their own future occupation, i.e., they saw it as more interesting and monetarily rewarding, but also more difficult, than did the control groups. These differences did not appear for the ratings of the non-scientific occupations. These findings are all the more surprising in light of the rather vague conceptions most high school students have of various technical occupations.

IV. INTERVIEWS

A. Interviews with IPSE Dropouts

When asked what their favorite and least favorite courses were, seven students indicated that math and science were their favorites, another seven students said art and art related courses (e.g., drama) and five more indicated social science or humanties courses. Math and science were the least favorite of ten of the students, whereas social science and humanities courses were listed as least favorite by seven of the students. Only four of the students said they thought a career in science and engineering would be of interest to them, and another two students said it would be interesting if they were better at it. The rest of the students expressed negative opinions about such a career.

With specific reference to why they dropped from the IPSE program, 12 of the students indicated that they did not want to take the math and science courses each semester, usually because they said it was too difficult. The other six students expressed either a lack of interest or lack of time. When asked about their specific likes and dislikes about the IPSE program, five students expressed no opinion either way, six of the students said they enjoyed the discussions and contacts with the field coordinator and four said they liked the field trips best of all. With reference to their specific dislikes, five students again cited the math and science requirements, another three cited lack of time or interest, and one student each cited the science project requirement and the lack of

help the project gave them. When queried specifically about the field coordinator, 12 of the students said she was helpful, three of them expressed dissatisfaction, and the other two students were noncommital.

In sum, the students interviewed from the dropout sample (this did not include students who had moved away) generally found the math and science requirements to be too difficult or uninteresting. A minority of these students had really enjoyed the program, but found the requirements of continual math and science courses to be too difficult to live up to.

B. Interviews with IPSE Students

A sample of 43 IPSE students (chosen mostly by availability) were interviewed concerning their opinions of IPSE and related topics. The results of these interviews are summarized in Table 4. It can be seen that almost half the students said that math or science was their favorite course, whereas less than one-third of them listed a math or science course as their least favorite. Although the majority of the courses which were given as being the most difficult were math and science courses, 36 of the courses listed as those in which the students do best were also math and science courses. These results partially confirm some of the conclusions drawn on the basis of the attitudinal data, namely, that the IPSE students like math and science, but they do see it as being difficult. The present data indicate that their perceptions are probably based on their course taking experiences in high school.

TABLE 4. Summary of Interviews with IPSE Students (N = 43).

"What is your favorite subject?"

Math	- 13
Science	- 20
Social Science	- 5
Humanities	- 3
Arts	- 8
Other	- 2

"What is your least favorite subject?"

Math	- 11
Science	- 1
Social Science	- 9
Humanities	- 12
Other	- 1

"What courses are you best in?"

Math	- 14
Science	- 22
Social Science	- 18
Humanities	- 20
Arts	- 6
Other	- 3

"What courses do you find most difficult?"

Math	- 26
Science	- 13
Social Science	- 4
Humanities	- 6
Other	- 2

"What do you like most about the IPSE program?"

Caroline (The Field Coordinator)	- 13
Field trips	- 11
Science project	- 8
Working with others	- 7
Information available	- 5
Math and science	- 3
Help me get into college	- 1

"What do you like least about the IPSE program?"

Too few visits	- 4
Do not accomplish enough	- 2
Other	- 10

"How would you improve the IPSE program?"

Have more contact with field coordinator	- 16
More field trips	- 11
Start program earlier in high school	- 3
More information	- 2
More varied projects	- 2
Other	- 6

"How has Caroline Urvater (Field Coordinator) been helpful to you?"

Influences and encourages	- 20
Guidance and information	- 17
She is concerned about me	- 9
Easy to talk to - treats us like adults	- 6

"Why did you choose (your particular) science project?"
"How will it help you?"

Knowledge of topic	- 17
Gives me idea of what college work is like	- 15
It seemed easy	- 14
It was a challenge	- 14
Good scientific experience	- 5

"How have the science consultants helped you?"

Haven't consulted with him/her	- 19
Been helpful	- 17
Not helpful	- 3
Unavailable	- 3
Not needed	- 3

Note: Multiple responses, and/or no response, were given to many of the questions.

As compared to the number of responses volunteered to what they like best about IPSE, there were very few responses given to what they like least about the program. Most students said they thought it was adequate as is. The things they liked best about the program were the field trips and the visits of the field coordinator. In fact, these two catagories are the same ones which were volunteered in response to how they would improve IPSE, i.e., they would like to have even more of these experiences. With respect to the role of the field coordinator, most students saw her as being supportive and easy to talk to. In contrast, the majority of the students either did not need the help of their science project consultant or found him or her not to be helpful.

In sum, the interviews with the IPSE students both reinforce the prior conclusions about the attitudes of these students toward science, and also add new insight into their opinions of the IPSE program and its components. These students seem satisfied with the IPSE program and they are generally convinced that math and science courses will be helpful to them in college (only one student said that he was not planning to go on to college). They find the field coordinator to be very helpful, and in fact, one senses that this position is instrumental in the relative success of the program. On the other hand, the role of the science project and the science consultant is still ill-defined for these students.

C. Interviews with Science Consultants

Interviews took place with 12 science consultants; five of these interviews were via telephone. In general, the consultants saw their

role *vis a vis* IPSE as coordinators between the field coordinator and the students. When asked about what they thought the good aspects of the program were, the predominant responses were the field coordinator's interest in and meetings with the students (12 responses). Other responses included the structural aspects of the program, such as the field trips (3 responses), the math and science requirement (2 responses), and the science project (1 response). No negative comments were proffered to the question concerning poor aspects of the program. The counselors were asked specifically about their perceptions of the field coordinator's role, and how well she was fulfilling that role. The counselors had an accurate perception of her role - as a source of information, as someone to "win the kids over" and to encourage and support them, and to serve a "public relations" function. The counselors were extremely positive in their evaluation of how well the field coordinator had been performing her function. Finally, with respect to how they would improve the IPSE program, the counselors suggested more involvement with parents and community (6 responses), more contact with the field coordinator or more field coordinators (7 responses), starting the program earlier (4 responses) as well as better selection of students (3 responses), more orientation of associated high school staff (3 responses), more field trips (3 responses), and exposure to professional scientists (3 responses). All of the counselors said they would like to see the program expanded in their schools in response to the question of whether they would like to see the program continued.

E. Interviews with High School Administrators

Sixteen administrators, representing 12 different high schools, were interviewed as part of the program evaluation. Generally, these people had only limited involvement with IPSE. The variety of responses with respect to their roles vis a vis the IPSE program confirm this. Several said their role was coordination, some said it was merely supportive, and some said it had to do with the selection of staff contacts and students for the program. All admitted, however, rather circumscribed roles. Although not very familiar with the intricacies of the program, this group of people generally supported the program, would like to see it expanded to include more students, and thought it was serving a useful function. Several expressed the need for more parental involvement, more contacts with the students, and for better communication and orientation with the relevant high school staff.

F. Summary

Several common themes are apparent from the various sources of interview data. First, the IPSE students themselves are taking the math and science courses and liking them in many instances. They also admit to finding them difficult. Second, in terms of the structural aspects of the IPSE program, the importance of the field coordinator in the success of the program is apparent. This position is much more than an administrative one; it is primarily a counseling position. The fact that the field coordinator is not affiliated with the local high school seems to

enhance her effectiveness. Both students and counselors held the strong belief that contacts with the Field Coordinator were among the best aspects of the program, and there was a strong desire to see more of them.

One problem,which was mentioned regularly, was the lack of co-ordination of the IPSE program with local high school staff and with parents. Several counselors and administrators expressed this need. (There have been several meetings with parents to introduce them to the program; it is clear that at least some of the administrators and counselors were unaware of them.) There is no doubt that the administration of the science projects was poorly planned. However, in spite of obvious problems associated with the functioning of the science consultants, 51 students have completed their projects. At present, these are in the process of being graded and evaluated by the project developers. Preliminary indications are that about 75% of them were done with sufficient competency to warrant receiving credit* for the effort. The need for closer coordination between the IPSE staff and the science consultants with respect to the role of the science consultants is apparent.

V. COURSE PERFORMANCE

Table 5 contains a summary of the math and science courses attempted and performance in these courses by the IPSE and control groups. As can be seen in this table, the IPSE students took more math and science courses

*Students completing the projects with competence will receive one college credit through CSU's Continuing Education Program.

TABLE 5. Course Performance.

Group	Year	Subject Matter	Mean G.P.A.	Number of Courses/Student
IPSE (N = 95)	Sophomore	Math	2.335	2.011
		Life Science	2.602	1.242
		Physical Science	2.719	.337
		Total Math & Science	2.44	3.590
IPSE	Junior	Math	2.006	1.768
		Life Science	2.245	1.032
		Physical Science	2.457	.989
		Total Math & Science	2.22	3.79
Pre-IPSE	Junior	Math	2.470	1.253
		Life Science	2.500	.493
		Physical Science	2.457	.989
		Total Math & Science	2.46	2.34
Pre-IPSE (N = 146)	Senior	Math	2.351	.801
		Life Science	2.692	.178
		Physical Science	2.514	.493
		Total Math & Science	2.46	1.47
Post-IPSE (N = 88)	Sophomore	Math	2.193	1.239
		Life Science	1.877	.557
		Physical Science	2.412	.193
		Total Math & Science	2.12	1.99

than did the other groups. The interesting comparisons are the IPSE students as sophomores with the post-IPSE group as sophomores; and the IPSE students as juniors with the pre-IPSE group as juniors. The IPSE students took an average of 3.59 math and science courses as sophomores, with an average GPA of 2.44, whereas the post-IPSE students took an average of 1.99 math and science courses, for an average GPA of 2.12. As juniors, the IPSE students took an average of 3.79 math and science courses, with an average GPA of 2.22, whereas the pre-IPSE students took an average of only 2.34 math and science courses, for a mean GPA of 2.46. These figures indicate clearly that IPSE has fulfilled one of its principal goals, namely, to achieve a sharp increase in the utilization of the math and science program available at the high schools. These data indicate that many IPSE students are approaching a factor of two in science and math course utilization as compared with the appropriate control group. The IPSE program "requires" that each student take a math and science course each semester. There is clearly some slippage from this requirement (if all students fulfilled this requirement, we would expect a minimum of 4.00 math and science courses each year). However, our experience indicates that this ideal requirement cannot be met in every case, with some students not able, for scheduling reasons or competing course requirements, to take both a math and science course every semester. However, the fact that the averages are reasonably close to 4.00 indicate that the ideal is not an unreasonable goal. Some of the slippage in the sophomore year can be attributed to the fact that IPSE did not start until the students already were deeply into their first semester, and some students

did not enter IPSE until after they had made their course selections for the second semester.

The higher GPA on the part of the pre-IPSE students as juniors, as compared to the junior IPSE students, although at first somewhat surprising, probably reflects the fact that these courses are purely optional on the part of the control group, whereas the IPSE students are required to take math and science.

VI. SUMMARY

The attitudinal and interview data indicate that the IPSE program is successful thus far in instilling positive attitudes toward science and scientific occupations. Most students are living up to the requirement of taking math and science courses each semester, and thus are gaining important experiences in science as well.

When one looks at the various structural components of the IPSE program - the field trips, the science projects, the meetings with the field coordinator - the importance of the field coordinator in the success of the program stands out. Several sources cited this role as being important in motivating and informing the students. This is important information, for any future program like IPSE must be concerned with defining the role of the field coordinator very carefully and must be able to select the "right" field coordinator with considerable accuracy. On the basis of the interviews, it would be a mistake to define this position as primarily an administrative one (although there are many administrative details to attend to); the field coordinator must be a person who can develop rapport with students and is also knowledgeable about careers in science.

A major weakness in administration has become apparent in the supervision of the science project. In the future, specific attention should be given to expanding the role of the science consultants from that of passive advisor to the students to that of active "colleague" in doing research that is interesting to both the student and the consultant.

Finally, the field trips proved to be very enjoyable for the participants and seemed to increase their participation in the program.

The administrative support of the program in the high schools was good in most cases (although the field coordinator cites anecdotal evidence of some cases of non-cooperation on the part of high school personnel). Since no program of this sort can be successful without entree into the high school, the high school administrative support is very important. This also relates to the job requirements of the field coordinator - he or she must be familiar with high school organizational systems. The field coordinator must know how to gain entry into the high school and how to stay on good terms with the high school staff. This can be a delicate matter for an "outsider" of the organization and to the educational system in general.

In sum, the students in the IPSE program and the related high school staff have positive attitudes toward the program, and in fact, would like to see it expanded (i.e., more visits with the field coordinator, more field trips, more staff, more students involved, etc.). Moreover, the students are taking the math and science courses in high school which are essential to eventual careers in science and engineering. As discussed in the Introduction, the principle test of the success of the program

will be made next year when career choices of the IPSE students become more evident.

VII. WORK IN PROGRESS

In addition to preparing for the third year evaluation, the following work is still being done on the second year evaluation: 1) coding and interpretation of the open-ended questions; 2) longitudinal analyses of the attitudinal data for the IPSE and control groups; 3) scoring of the semantic differential given to IPSE students to tap their overall attitude towards the IPSE program; 4) re-analysis of the course performance data to allow sub-groupings of the control groups into those who were interested in a program like IPSE and those who were not, and also to allow for tests of statistical significance; 5) collection of pre-IPSE career-status data.

Results of this work will be reported in the final report.

APPENDIX A.

Colorado State University Job Interest Questionnaire

COLORADO STATE UNIVERSITY

JOB INTEREST QUESTIONNAIRE

SECTION 1

In this section, we would like you to indicate your agreement or disagreement in the space provided. Use the following scale for making your responses:

+3: STRONGLY AGREE
+2: MODERATELY AGREE
+1: MILDLY AGREE
-1: MILDLY DISAGREE
-2: MODERATELY DISAGREE
-3: STRONGLY DISAGREE

Put your response in the blank preceding the statement for which it is made.

BEGIN IF THERE ARE NO QUESTIONS

1. _____ I have no desire to do scientific work.

2. _____ Science will bring benefits to everyone who does it.

3. _____ An intelligent person wouldn't be satisfied in science very long.

4. _____ Scientific work is more enjoyable than most play.

5. _____ Science is a good job.

6. _____ Scientific work gives me a great deal of pleasure.

7. _____ Only a very stupid person could be satisfied with scientific work.

8. _____ Scientific work fascinates me.

9. _____ To me, science is more or less boring.

10. _____ Under no conditions would I like scientific work.

SECTION 2

In this section, please put a check mark (✓) on the blank which you feel best indicates the proper value of each word pair continuum for the occupation at the top of each list.

For example,

BEING A CARPENTER

Weak _____: _____: _____: _____: _____: _____: _____: Strong

If you feel that being a carpenter is very strong, you would place your check mark on a blank nearer to the word strong. If you feel being a carpenter is weak, you would place your mark nearer to weak. If you feel being a carpenter is neither weak or strong, then you would place your mark in the middle.

EXAMPLE 1:

BEING A PLUMBER

Weak _____: ___✓___: _____: _____: _____: _____: _____: Strong

If you feel being a plumber is <u>somewhat</u> weak, then you would place your check in a blank <u>nearer</u> to weak, as indicated above.

EXAMPLE 2:

BEING A PLUMBER

Weak _____: _____: _____: _____: _____: _____: ___✓___: Strong

If you feel being a plumber is <u>very</u> strong, you would place your check in the blank <u>near</u> strong, as indicated above.

TURN PAGE AND BEGIN IF THERE ARE NO QUESTIONS

BEING A BIOLOGIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____: BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____: EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____: BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____: VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____: LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____: PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____: HIGH STATUS

BEING A CHEMIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____: BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____: EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____: BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____: VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____: LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____: PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____: HIGH STATUS

BEING A PHYSICIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____: BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____: EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____: BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____: VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____: LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____: PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____: HIGH STATUS

BEING A PHYSICIAN (DOCTOR)

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A MATHEMATICIAN

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A SOCIAL WORKER

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING AN ENGINEER

GOOD	____:	____:	____:	____:	____:	____:	____:	BAD
DIFFICULT	____:	____:	____:	____:	____:	____:	____:	EASY
INTERESTING	____:	____:	____:	____:	____:	____:	____:	BORING
WORTHLESS	____:	____:	____:	____:	____:	____:	____:	VALUABLE
FREE	____:	____:	____:	____:	____:	____:	____:	LIMITED
PAYS WELL	____:	____:	____:	____:	____:	____:	____:	PAYS POORLY
LOW STATUS	____:	____:	____:	____:	____:	____:	____:	HIGH STATUS

BEING A GUIDANCE COUNSELOR

GOOD	____:	____:	____:	____:	____:	____:	____:	BAD
DIFFICULT	____:	____:	____:	____:	____:	____:	____:	EASY
INTERESTING	____:	____:	____:	____:	____:	____:	____:	BORING
WORTHLESS	____:	____:	____:	____:	____:	____:	____:	VALUABLE
FREE	____:	____:	____:	____:	____:	____:	____:	LIMITED
PAYS WELL	____:	____:	____:	____:	____:	____:	____:	PAYS POORLY
LOW STATUS	____:	____:	____:	____:	____:	____:	____:	HIGH STATUS

BEING A DENTIST

GOOD	____:	____:	____:	____:	____:	____:	____:	BAD
DIFFICULT	____:	____:	____:	____:	____:	____:	____:	EASY
INTERESTING	____:	____:	____:	____:	____:	____:	____:	BORING
WORTHLESS	____:	____:	____:	____:	____:	____:	____:	VALUABLE
FREE	____:	____:	____:	____:	____:	____:	____:	LIMITED
PAYS WELL	____:	____:	____:	____:	____:	____:	____:	PAYS POORLY
LOW STATUS	____:	____:	____:	____:	____:	____:	____:	HIGH STATUS

BEING A PHYSICAL THERAPIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A VETERINARIAN (ANIMAL DOCTOR)

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING AN ARTIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A WRITER

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A BUSINESS EXECUTIVE

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

MY FUTURE OCCUPATION

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BACKGROUND AND INTERESTS

NAME_____ DATE_____

STUDENT #_____ AGE_____ SEX: M F

CLASS: Sophomore_____ Junior_____ Senior_____

ETHNIC AFFILIATION:

_____Spanish Surname
_____Black
_____Asian-American
_____Native-American
_____Other

HOME ADDRESS_____ HOME PHONE NO._____

_____

_____

What are your parent's occupations?

Father_____ Mother_____

What courses in school do you like most?

What courses do you like least?

What course(s) do you find easy?

What course(s) do you find difficult?

What types of books do you like to read?

What types of books do you dislike reading?

What magazines do you read?

Would you watch a T.V. special on the following subject matter?

Mathematics	_____Yes	_____No
Medicine	_____Yes	_____No
Sports	_____Yes	_____No
Drama	_____Yes	_____No
Science	_____Yes	_____No
Geography	_____Yes	_____No
Politics	_____Yes	_____No

PRE-IPSE ONLY

Are you planning to go to college? _____Yes _____No _____Undecided

If you are planning to go to college, in what colleges or universities are you interested?

_____

_____

_____

Why are you interested in these schools?

In what do you plan to major at college?

Why have you chosen this as your major?

Whether or not you are planning to attend college, what type of work do you hope to do?

On what science project have you been working?

Rate this science project on the following scales:

EASY	_____: _____: _____: _____: _____: _____: _____:	DIFFICULT
UNINTERESTING	_____: _____: _____: _____: _____: _____: _____:	INTERESTING
GOOD	_____: _____: _____: _____: _____: _____: _____:	BAD
WORTHLESS	_____: _____: _____: _____: _____: _____: _____:	VALUABLE

What other comments do you have about the science project on which you have been working?

Caroline Urvater's involvement in IPSE is an important part of the total program. We would like to know how you feel about Caroline Urvater concerning your contact with her. Please feel free to say what you really think because your comments will be kept private. Caroline Urvater will not read your comments:

What do you like about Caroline Urvater?

How do you feel that Caroline Urvater could improve?

Would you like to see the number of Caroline's visits changed? (check one)

_____She should visit more often.

_____She should visit less often.

_____She should not change the number of her visits.

Do you think the way in which the visits are conducted should be changed?

_____Yes _____No

If you think the visits should be changed, how would you change them?

Rate your overall feelings about the IPSE program.

LIKE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	DISLIKE
BAD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	GOOD
VALUABLE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	WORTHLESS
NEGATIVE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	POSITIVE

What do you like about the IPSE program?

What do you dislike about the IPSE program?

Have you benefited from the IPSE program? _____Yes _____No

If yes, in what way(s) have you benefited?

If no, how do you think the program should be changed?

POST-IPSE ONLY

It is well known that there is a shortage of certain qualified people for good jobs in science and engineering. If you could participate in a program in which you would agree to take math and science every semester until you graduated, and in return we would give you information on different jobs and pay in the areas of science and engineering and take you on one or two trips a year to see scientific installations and laboratories, would you be interested in participating?

Yes_____ No_____

Do you have any comments?

APPENDIX B.

Structured Interview Sheets

IPSE DROPOUT STUDENTS

What do you like most about school?_____

_____

What is your favorite subject?_____

What is your least favorite subject?_____

What courses are you best in?_____

What courses do you find difficult?_____

What would you like to do when you finish high school?_____

_____

How has the guidance counselor helped you in making this choice?_____

_____

Who or what has influenced you most in your job choice?_____

_____

How do you feel about a career in science or engineering?_____

_____

Why were you in IPSE?_____

_____

Do you think participating in the IPSE program will help you get a job?___

What kind of job?_____

What did you like most about the IPSE program?_____

_____

What did you like least about the IPSE program?_____

_____

How would you improve the IPSE program?_____

_____

How has Caroline Urvater been helpful to you?_____

_____

Why did you drop out of the IPSE program?_____

IPSE STUDENTS

What do you like most about school?_____

_____

What is your favorite subject?_____

What is your least favorite subject?_____

What courses are you best in?_____

_____

What courses do you find most difficult?_____

_____

What would you like to do when you finish high school?_____

_____

_____

How has your guidance counselor helped you in making this choice?_____

_____

Who, or what, has influenced you most in your job choice?_____

_____

How do you feel about a career in science or engineering?_____

_____

_____

Why are you in IPSE?_____

_____

Do you think participating in the IPSE program will help you get a job?

What kind of job?_____

What do you like most about the IPSE program?_____

_____

What do you like least about the IPSE program?_____

_____

How would you improve the IPSE program?_____

_____

How has Caroline Urvater been helpful to you?_____

_____

How could she be more helpful?_____

_____

On what science project are you working?_____

_____

Why did you choose that science project?_____

_____

How will doing the science project benefit you?_____

_____

How have the science consultants helped you?_____

_____

PRINCIPALS AND COUNSELORS

What are the main functions of your position?_____

_____

What role do you play in the IPSE program?_____

_____

Do you think the IPSE program, as it is presently set-up, can achieve these goals?_____

What aspects of the IPSE program do you think are good?_____

_____

Not good?_____

How would you approach this problem?_____

_____

What difference do you see in IPSE versus non-IPSE students?_____

_____

What do you see as Caroline Urvater's function in the IPSE program?_____

_____

_____

How well does she fulfill that function?_____

_____

Can you make suggestions for improvement?_____

_____

What do you think of the IPSE program?_____

_____

Would you like to see a program such as IPSE continued in your school?_____

_____

SCIENCE CONSULTANTS

What is your normal function in this school?_____

What is your role in the IPSE program?_____

What do you think of the science projects?_____

How would you improve them?_____

How do the students feel about the projects?_____

Do the students actually do the science projects?_____

What differences, if any, do you see in IPSE versus non-IPSE students?____

What do you think of the IPSE program, in general?_____

In what ways would you improve the program?_____

Do you think your role in IPSE should be handled differently?_____

How?_____

APPENDIX C.

Statistical Summaries

TABLE I. Means, Standard Deviations, and Statistical Analyses for Attitude Towards Science Questionnaire.

Item	Mean Group Standard Deviation 1[1]	2	3	4	5	F Ratio	df	Probability Value
1.	-.95 2.16	-.44 2.06	.39 2.16	-.48 2.02	.53 2.13	5.07	4,322	.001
2.	1.37 1.60	1.21 1.62	.91 1.65	1.05 1.53	.90 1.81	1.00	4,321	ns
3.	-2.05 1.55	-1.70 1.73	-1.86 1.56	-1.24 1.99	-1.33 1.56	2.58	4,321	.037
4.	- .01 1.73	- .38 1.76	-1.07 1.69	- .21 1.75	- .97 2.21	4.05	4,320	.003
5.	2.35 .78	2.16 .96	1.72 1.16	1.64 1.32	.97 1.75	11.36	4,321	.001
6.	1.36 1.41	.66 1.79	- .86 1.75	.57 1.61	-1.00 1.89	22.17	4,321	.001
7.	-2.86 .38	-2.65 1.04	-2.63 1.01	-2.67 .94	-1.90 2.04	5.11	4,321	.001
8.	1.83 1.45	1.41 1.59	.14 2.01	1.00 1.56	- .53 1.94	17.30	4,321	.001
9.	-1.48 1.60	-1.37 1.68	.09 1.87	- .29 1.68	- .07 2.00	12.46	4,321	.001
10.	-1.98 1.41	-1.47 1.84	.00 1.96	-1.14 1.91	- .57 2.06	12.34	4,320	.001
Total	16.20 8.21	12.40 9.25	4.78 8.40	9.88 7.94	2.73 12.10	22.43	4,324	.001

[1] Group 1 = IPSE; Group 2 = Pre-IPSE:Yes; Group 3 = Pre-IPSE:No; Group 4 = Post-IPSE:Yes; Group 5 = Post-IPSE:No.

Note: Refer to Appendix A for content and directionality of items.

TABLE II. Means, Standard Deviations and Statistical Analyses for Semantic Differential Responses

Occupation/ Scale	Mean / Standard Deviation Group 1	2	3	4	5	F Ratio	df	Probability Value
Biologist								
1.	2.82 1.30	2.97 1.56	3.72 1.56	2.93 1.31	4.13 1.68	7.53	4,324	.001
2.	2.76 1.29	2.72 1.38	2.48 1.25	2.61 1.03	2.80 1.27	.57	4,323	ns
3.	2.25 1.13	2.41 1.37	2.98 1.45	2.84 1.45	3.10 1.69	4.56	4,323	.001
4.	6.01 1.09	5.92 1.05	5.74 1.26	5.71 1.39	5.33 1.47	2.16	4,324	.074
5.	3.88 1.44	3.91 1.59	4.05 1.42	4.00 1.59	4.07 1.39	.19	4,323	ns
6.	2.77 1.11	3.01 1.35	2.81 1.32	2.53 1.20	2.57 1.28	1.55	4,324	ns
7.	5.34 1.06	5.28 1.06	5.31 1.29	5.26 1.28	4.73 1.01	1.74	4,324	ns
Chemist								
1.	2.65 1.55	2.83 1.66	3.36 1.58	3.07 1.68	3.48 1.55	2.75	4,323	.028
2.	1.93 1.04	1.89 1.04	2.02 1.26	2.16 1.04	2.43 1.33	1.73	4,324	ns
3.	2.44 1.37	2.68 1.75	3.03 1.66	2.55 1.25	3.13 1.81	2.04	4,324	.089
4.	6.05 1.18	5.89 1.33	5.81 1.23	5.67 1.16	5.73 1.20	1.03	4,323	ns
5.	3.97 1.78	4.05 1.84	4.24 1.47	4.21 1.55	4.23 1.48	.39	4,322	ns
6.	2.34 1.20	2.57 1.35	2.66 1.40	2.29 1.18	2.63 1.22	1.09	4,324	ns
7.	5.68 1.18	5.49 1.35	5.60 1.28	5.34 1.19	4.80 1.21	3.14	4,323	ns

Physicist								
1.	2.76	2.66	3.11	2.78	3.30	1.39	4,318	ns
	1.59	1.60	1.51	1.58	1.58			
2.	2.11	2.26	2.32	2.57	2.83	2.25	4,317	.064
	1.21	1.31	1.35	1.30	1.72			
3.	2.47	2.82	2.86	2.69	3.23	1.84	4,317	ns
	1.32	1.54	1.38	1.42	1.72			
4.	5.81	5.71	5.75	5.64	5.17	1.60	4,317	ns
	1.16	1.30	1.15	1.25	1.44			
5.	4.34	4.00	4.34	3.97	3.94	1.04	4,315	ns
	1.63	1.70	1.37	1.54	1.70			
6.	2.35	2.67	2.54	2.24	2.55	1.21	4,315	ns
	1.10	1.45	1.40	1.14	1.53			
7.	5.63	5.61	5.44	5.26	4.73	3.30	4,317	.011
	1.25	1.28	1.32	1.32	1.55			
Doctor								
1.	1.87	2.05	2.14	2.07	2.17	.47	4,324	ns
	1.31	1.47	1.38	1.44	1.37			
2.	1.92	1.97	2.03	2.50	2.37	2.26	4,324	.062
	1.25	1.20	1.45	1.50	1.54			
3.	2.06	2.03	2.00	1.88	1.97	.24	4,324	ns
	1.34	1.30	1.06	.97	1.07			
4.	6.52	6.59	6.55	6.43	6.30	.56	4,324	ns
	.98	1.02	.90	.99	1.37			
5.	4.51	4.51	4.45	4.40	4.50	.05	4,323	ns
	1.92	1.90	1.91	1.83	1.83			
6.	1.28	1.56	1.71	1.48	1.50	2.23	4,322	.066
	.54	1.04	1.24	.80	.94			
7.	6.39	6.48	6.05	5.84	5.50	6.53	4,322	.001
	.95	.83	1.16	1.41	1.66			
Mathematician								
1.	2.92	3.20	3.41	2.90	3.40	1.20	4,324	ns
	1.60	1.83	1.78	1.82	1.89			
2.	2.72	2.11	2.34	3.14	3.00	4.82	4,324	.001
	1.67	1.22	1.45	1.73	1.98			
3.	3.17	3.86	4.21	3.33	3.90	4.04	4,323	.003
	1.70	1.83	1.79	1.71	2.01			
4.	5.64	5.26	5.28	5.53	5.17	1.40	4,323	ns
	1.16	1.54	1.36	1.29	1.66			

5.	4.49 1.61	4.16 1.72	4.29 1.32	4.53 1.45	4.30 1.76	.73	4,321	ns
6.	3.53 1.31	3.63 1.30	3.57 1.24	3.50 1.35	3.77 1.72	.25	4,323	ns
7.	4.96 1.26	4.68 1.34	4.79 1.20	4.76 1.34	4.33 1.56	1.41	4,323	ns
Social Worker								
1.	2.58 1.43	2.47 1.43	2.19 1.43	2.79 1.75	2.17 1.37	1.63	4,324	ns
2.	3.73 1.68	3.99 1.64	3.84 1.68	4.21 1.68	4.00 1.84	.82	4,324	ns
3.	2.42 1.46	2.33 1.35	2.10 1.41	2.83 1.77	2.03 1.27	2.32	4,324	.057
4.	5.62 1.26	5.88 1.09	5.86 1.21	5.28 1.52	5.93 1.23	2.67	4.324	.032
5.	3.51 1.66	3.47 1.65	3.91 1.79	3.62 1.68	3.47 1.74	.75	4,323	ns
6.	3.71 1.34	3.98 1.20	3.69 1.29	3.67 1.51	3.80 1.49	.76	4,324	ns
7.	4.62 1.32	4.47 1.32	4.90 1.04	4.55 1.44	4.40 1.30	1.20	4,324	ns
Engineer								
1.	2.22 1.41	2.45 1.57	2.95 1.65	2.62 1.41	2.93 1.78	2.66	4.324	.033
2.	2.21 1.41	2.33 1.39	2.69 1.42	2.83 1.40	3.03 1.67	3.35	4,324	.010
3.	2.05 1.29	2.55 1.29	3.19 1.47	2.71 1.43	2.70 1.68	6.38	4,323	.000
4.	6.11 1.08	5.86 1.12	5.69 1.11	5.34 1.36	5.03 1.45	6.82	4,324	.000
5.	3.83 1.72	3.85 1.65	4.52 1.27	4.40 1.47	4.00 1.51	2.80	4.321	.026
6.	1.91 1.15	2.11 1.28	2.55 1.44	2.38 1.40	2.13 1.11	2.64	4,323	.034
7.	5.66 1.32	5.58 1.14	5.31 1.26	5.16 1.14	4.73 1.46	4.27	4,323	.002

Guidance Counselor								
1.	2.96	2.76	2.50	2.90	2.37	1.31	4,324	ns
	1.54	1.62	1.39	1.89	1.50			
2.	3.85	3.80	3.50	3.81	3.63	.49	4,324	ns
	1.49	1.74	1.64	1.74	1.87			
3.	2.85	3.10	2.47	2.75	2.29	2.14	4.320	.076
	1.58	1.67	1.45	1.76	1.51			
4.	5.40	5.53	5.55	5.29	5.63	.51	4,323	ns
	1.25	1.54	1.16	1.49	1.27			
5.	4.10	3.85	3.98	4.26	3.77	.81	4,323	ns
	1.44	1.65	1.65	1.58	1.83			
6.	3.86	4.22	3.45	3.41	3.60	5.40	4,324	.000
	1.15	1.23	1.23	1.33	1.25			
7.	4.60	4.52	4.74	4.48	4.53	.40	4,324	ns
	1.22	1.30	1.05	1.34	1.17			
Dentist								
1.	2.54	2.50	2.43	2.34	2.63	.22	4,324	ns
	1.61	1.65	1.53	1.57	1.67			
2.	2.59	2.32	2.38	2.66	2.37	.81	4,324	ns
	1.49	1.21	1.31	1.42	1.52			
3.	3.15	3.20	3.19	2.88	2.60	.98	4,324	ns
	1.69	1.88	1.62	1.63	1.77			
4.	5.73	5.89	5.81	5.78	5.90	.24	4,323	ns
	1.25	1.20	1.08	1.23	1.03			
5.	4.63	4.57	4.47	4.43	4.37	.88	4.323	ns
	1.50	1.51	1.39	1.35	1.65			
6.	1.67	2.06	2.09	2.02	1.63	2.37	4,324	.052
	.80	1.32	1.19	1.25	.96			
7.	5.76	5.70	5.62	5.33	5.10	2.66	4,324	.033
	1.06	1.21	1.14	1.30	1.37			
Physical Therapist								
1.	2.45	2.56	2.57	2.43	2.47	.13	4,324	ns
	1.37	1.61	1.62	1.34	1.28			
2.	3.01	2.67	2.71	2.81	3.10	.88	4,323	ns
	1.63	1.57	1.45	1.42	1.60			
3.	2.58	2.76	2.75	2.41	2.47	.68	4,323	ns
	1.52	1.60	1.65	1.30	1.17			

4.	5.85 1.18	5.85 1.38	5.78 1.16	5.38 1.60	5.83 1.09	1.49	4,324	ns
5.	4.29 1.52	4.38 1.66	4.16 1.48	4.60 1.18	4.03 1.22	1.04	4,322	ns
6.	2.52 1.28	2.76 1.41	2.62 1.20	2.48 1.17	2.50 1.07	.64	4,324	ns
7.	5.21 1.20	5.16 1.32	5.28 1.06	5.21 1.18	4.77 1.30	.97	4,324	ns
Veterinarian								
1.	2.54 1.48	2.48 1.49	2.88 1.50	2.78 1.53	2.43 1.36	1.00	4,324	ns
2.	2.32 1.38	2.66 1.51	3.04 1.51	3.22 1.46	3.00 1.58	4.31	4,323	.002
3.	2.36 1.34	2.49 1.56	3.00 1.51	2.98 1.83	2.40 1.54	2.68	4,324	.032
4.	5.87 1.11	5.70 1.37	5.60 1.23	5.02 1.44	5.83 1.23	4.48	4,324	.002
5.	4.10 1.60	4.03 1.52	4.07 1.37	4.05 1.50	3.83 1.80	.17	4,323	ns
6.	2.22 1.02	2.42 1.18	2.91 1.19	2.97 1.54	2.33 1.09	5.30	4,324	.000
7.	5.21 1.23	5.17 1.28	4.78 1.04	4.71 1.40	4.97 1.33	2.33	4,324	.056
Artist								
1.	3.02 1.86	2.91 1.60	3.00 1.64	3.02 1.88	2.47 1.50	.67	4,322	ns
2.	3.36 1.91	3.22 1.59	3.75 1.98	3.39 1.78	3.20 2.19	.84	4,322	ns
3.	2.59 1.75	2.42 1.63	2.59 1.64	2.58 1.88	1.93 1.28	1.03	4,321	ns
4.	4.80 1.63	4.90 1.50	5.04 1.41	4.86 1.62	5.37 1.52	.87	4,321	ns
5.	2.44 1.80	2.41 1.82	2.46 1.62	3.21 2.05	2.90 2.02	2.25	4,320	.063
6.	3.71 1.51	4.19 1.53	3.75 1.43	3.26 1.49	3.33 1.42	4.05	4,321	.003
7.	4.31 1.55	4.32 1.40	4.58 1.19	4.67 1.47	4.57 1.65	.88	4,321	ns

Writer								
1.	3.14	3.03	3.00	2.93	2.60	.63	4,324	ns
	1.71	1.71	1.63	1.65	1.48			
2.	2.97	2.41	2.33	3.14	2.97	4.10	4,324	.003
	1.56	1.41	1.16	1.47	1.79			
3.	3.14	2.89	3.26	2.84	2.50	1.17	4,324	ns
	1.89	1.76	1.93	1.68	1.80			
4.	4.95	5.05	5.21	5.10	5.37	.59	4,324	ns
	1.48	1.45	1.44	1.57	1.54			
5.	2.63	2.88	2.82	3.66	2.80	3.54	4,322	.008
	1.50	1.77	1.72	1.95	1.40			
6.	3.49	3.68	3.47	3.05	3.23	2.22	4,323	.067
	1.25	1.39	1.35	1.22	1.43			
7.	4.64	4.65	4.86	4.74	4.97	.61	4,324	ns
	1.31	1.32	1.16	1.33	1.22			
Business Executive								
1.	2.71	2.50	2.60	2.53	2.33	.43	4.324	ns
	1.52	1.58	1.47	1.49	1.42			
2.	3.13	3.26	2.95	3.24	2.93	.57	4,324	ns
	1.51	1.55	1.55	1.41	1.70			
3.	3.37	3.22	3.26	3.10	2.67	.94	4,323	ns
	1.81	1.91	1.78	1.67	1.58			
4.	5.03	5.27	5.52	5.26	5.20	1.11	4,323	ns
	1.44	1.44	1.31	1.32	1.47			
5.	4.60	4.36	4.53	4.36	4.07	.74	4,322	ns
	1.55	1.76	1.61	1.61	1.72			
6.	2.29	2.08	2.10	2.38	2.37	.91	4,323	ns
	1.14	1.09	1.19	1.34	1.19			
7.	5.47	5.66	5.48	5.12	4.83	3.10	4.323	.016
	1.33	1.27	1.17	1.34	1.42			
My Future Occupation								
1.	1.55	1.49	1.84	1.71	1.63	1.71	4,318	ns
	.80	.75	1.07	.95	.85			
2.	2.27	2.61	3.26	3.11	2.90	4.60	4,318	.001
	1.42	1.53	1.71	1.67	1.79			
3.	1.28	1.70	1.82	1.69	1.20	5.17	4,317	.000
	.54	1.15	1.18	.96	.41			

4.	6.48 .70	6.23 .95	6.11 1.21	6.17 1.06	6.33 .80	1.88	4,318	ns
5.	3.38 1.91	3.22 1.72	3.71 1.71	3.86 1.78	3.72 1.89	1.47	4,314	ns
6.	1.92 1.02	2.53 1.35	2.68 1.30	2.30 1.31	2.17 1.32	4.29	4.318	.002
7.	5.78 1.30	5.45 1.29	5.30 1.13	5.61 1.25	5.43 1.55	1.55	4,318	ns

Appendix C

COLORADO STATE UNIVERSITY

JOB INTEREST QUESTIONNAIRE

1977

COLORADO STATE UNIVERSITY
JOB INTEREST QUESTIONNAIRE
1977

NAME:__________ SCHOOL:__________

CLASS: Soph____ Junior____ Senior____ SEX: M F

Ethnic Affiliation:

_____Spanish Surname _____Native American

_____Black _____Anglo

_____Asian-American _____Other

Home Address:

Street:__________ Home Telephone No.:__________

City: __________

What kind of work does your Father do for a living?__________

What kind of work does your Mother do for a living?__________

- -

SECTION A

1. What one course in school do you like most? __________
2. What one course in school do you like least? __________
3. What one course do you find easiest? __________
4. What one course do you find most difficult? __________
5. WOULD YOU WATCH A T.V. SPECIAL ON THE FOLLOWING SUBJECT MATTER?

Mathematics	_____YES	_____NO
Medicine	_____YES	_____NO
Sports	_____YES	_____NO
Drama	_____YES	_____NO
Science	_____YES	_____NO
Geography	_____YES	_____NO
Politics	_____YES	_____NO

SECTION B: Your Feelings About Caroline Urvater

You will soon be completing your third and final year of participation in the IPSE program. We would like you now to think back over these past three years in high school and answer the following questions:

First, we are very interested in hearing about how you felt about Caroline Urvater. Please write what you really feel. Caroline will not read your comments.

6. What specific things in the past 3 years has Caroline done that were especially helpful to you?

   a.

   b.

   c.

7. What specific things could Caroline have done to be more helpful to you? (Nobody is perfect! Try to think of at least one thing):

   a.

   b.

8. Do you think Caroline should have visited your school:

   _____More often

   _____Less often

   _____The amount she did was best

SECTION C: Your Feelings About IPSE

9. Rate your overall feelings about the IPSE program:

LIKE	_____:_____:_____:_____:_____:_____:_____:	DISLIKE
BAD	_____:_____:_____:_____:_____:_____:_____:	GOOD
VALUABLE	_____:_____:_____:_____:_____:_____:_____:	WORTHLESS
NEGATIVE	_____:_____:_____:_____:_____:_____:_____:	POSITIVE

10. Below are listed some of the activities of the IPSE program. As you look back over the past 3 years, please rate on the scale next to each activity how valuable you felt each was to you, as a participant in IPSE. If you did not do or use some activity, just leave that one scale blank.

a. Science VALUABLE____:____:____:____:____:____:____:WORTHLESS

b. The science teacher who was supposed to help you on your science project VALUABLE____:____:____:____:____:____:____:WORTHLESS

c. Visit to CSU Engineering Days VALUABLE____:____:____:____:____:____:____:WORTHLESS

d. Visit to CU Planetarium VALUABLE____:____:____:____:____:____:____:WORTHLESS

e. School visits by Caroline Urvater VALUABLE____:____:____:____:____:____:____:WORTHLESS

f. Personal contacts (letters, phone calls, etc.) with Caroline VALUABLE____:____:____:____:____:____:____:WORTHLESS

g. The experience of taking one math and one science course each semester VALUABLE____:____:____:____:____:____:____:WORTHLESS

h. Being tutored by other IPSE students VALUABLE____:____:____:____:____:____:____:WORTHLESS

11. What were the two (2) very best parts of the IPSE program for you?

a.

b.

12. What were the two (2) worst parts of the IPSE program for you?

a.

b.

13. Do you feel you have personally benefited from IPSE? _____YES _____NO

If YES, name one or more ways in which you have benefited:

a.

b.

14. Finally, please tell us how, in your opinion, the overall IPSE program could be made more helpful to students (Try to think of at least one or more ways):

a.

b.

SECTION D: Future Plans

15. Are you planning to go to college next year? _____YES _____NO _____UNDECIDED

IF NO, THEN GO IMMEDIATELY TO QUESTION 16.

IF YES: To which colleges did you apply?

_____( ) _____( )

_____( ) _____( )

Have you been ACCEPTED or REJECTED from any of the above colleges yet? Please show which ones (above) by putting an "A" if accepted, and "R" if rejected, or "?" if you have not heard yet next to each college in the ( ) space provided.

Have you decided yet where you will attend? _____YES _____NO WHERE:_____

What do you plan to major in at college?_____

Do you think that IPSE influenced your decision to:

a) attend college? _____YES _____NO

b) choose the major you did? _____YES _____NO

16. If you are NOT planning on going to college, what do you plan to do after high school?

SECTION E

In this section, we would like you to indicate your agreement or disagreement in the space provided. Use the following scale for making your responses:

+3: STRONGLY AGREE
+2: MODERATELY AGREE
+1: MILDLY AGREE
-1: MILDLY DISAGREE
-2: MODERATELY DISAGREE
-3: STRONGLY DISAGREE

Put your response in the blank preceding the statement for which it is made.

BEGIN IF THERE ARE NO QUESTIONS

1. _____ I have no desire to do scientific work.
2. _____ Science will bring benefits to everyone who does it.
3. _____ An intelligent person wouldn't be satisfied in science very long.
4. _____ Scientific work is more enjoyable than most play.
5. _____ Science is a good job.
6. _____ Scientific work gives me a great deal of pleasure.
7. _____ Only a very stupid person could be satisfied with scientific work.
8. _____ Scientific work fascinates me.
9. _____ To me, science is more or less boring.
10. _____ Under no conditions would I like scientific work.

SECTION F

In this final section, please put a check mark (✓) on the blank which you feel best indicates the proper value of each work pair continuum for the occupation at the top of each list.

EXAMPLE 1:

BEING A CARPENTER

DIFFICULT _____:_____:_____:_____:_____:_____:_____: EASY

If you feel that being a carpenter is very difficult, you would place your check mark on a blank nearer to the word DIFFICULT. If you feel being a carpenter is easy, you would place your mark nearer to EASY. If you feel being a carpenter is neither easy nor difficult, then you would place your mark in the middle.

EXAMPLE 2:

BEING A PLUMBER

GOOD _____:_____:__✓__:_____:_____:_____:_____: BAD

If you feel being a plumber is <u>somewhat</u> good, then you would place your check in a blank nearer to GOOD, as indicated above.

EXAMPLE 3:

BEING A LAWYER

INTERESTING __✓__:_____:_____:_____:_____:_____:_____: BORING

If you feel being a lawyer is <u>very</u> interesting, you would place your check in the blank <u>near</u> INTERESTING, as indicated above.

TURN PAGE AND BEGIN IF THERE ARE NO QUESTIONS

BEING A BIOLOGIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____: BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____: EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____: BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____: VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____: LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____: PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____: HIGH STATUS

BEING A CHEMIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____: BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____: EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____: BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____: VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____: LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____: PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____: HIGH STATUS

BEING A PHYSICIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____: BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____: EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____: BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____: VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____: LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____: PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____: HIGH STATUS

BEING A PHYSICIAN (DOCTOR)

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A MATHEMATICIAN

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A SOCIAL WORKER

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING AN ENGINEER

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A GUIDANCE COUNSELOR

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A DENTIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A PHYSICAL THERAPIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A VETERINARIAN (ANIMAL DOCTOR)

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING AN ARTIST

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A WRITER

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

BEING A BUSINESS EXECUTIVE

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

MY FUTURE OCCUPATION

GOOD	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BAD
DIFFICULT	_____:	_____:	_____:	_____:	_____:	_____:	_____:	EASY
INTERESTING	_____:	_____:	_____:	_____:	_____:	_____:	_____:	BORING
WORTHLESS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	VALUABLE
FREE	_____:	_____:	_____:	_____:	_____:	_____:	_____:	LIMITED
PAYS WELL	_____:	_____:	_____:	_____:	_____:	_____:	_____:	PAYS POORLY
LOW STATUS	_____:	_____:	_____:	_____:	_____:	_____:	_____:	HIGH STATUS

Appendix D

IPSE STUDENTS AND

PRINCIPALS AND COUNSELORS QUESTIONNAIRE

1977

IPSE STUDENTS - 1977

What do you like best about high school?_____

_____

What do you plan to be doing next year?_____

IF COLLEGE:

Have you decided yet where you want to go?_____

Have you been accepted anywhere yet?_____ Where?_____

What do you hope to major in?_____

What was the role of IPSE in your decision to attend college; to choose your major?_____

_____

What role did your Guidance Counselor play?_____

_____

IF WORK (NOT COLLEGE):

What type of work do you hope to do next year?_____

Do you think that having participated in IPSE will help you get a job? How?

_____

Why have you decided not to go to college?_____

How do you feel about a career in sciences or engineering?_____

_____

Has IPSE lived up to what you hoped/expected it would be when you first got into it 3 years ago?_____

Looking back over the past 3 years:

What do you think was the best part of the IPSE program?_____

_____

Worst part?_____

You are in touch with what high schoolers need and want from a program like IPSE. How could it be improved to be more helpful to you?_____

_____

How do you feel about the job Caroline did as Field Coordinator? CONFIDENTIAL!

_____

How has she been helpful to you?_____

How could she have been even more helpful?_____

_____

If IPSE were to become more widespread - let's say into other states - certainly Caroline could not be field coordinator for the whole program. If we had to choose other people to be field coordinators, what qualities should we look for? (What exactly made Caroline so good/effective?)_____

_____

_____

IPSE DROPOUT STUDENTS - 1977

What do you like best about high school?_____

_____

What do you plan to do next year?_____

IF COLLEGE:

Have you decided yet where you want to go?_____

Have you been accepted anywhere yet?_____ Where?_____

What do you hope to major in?_____

Did IPSE play a role in your decision to go to college; to choose your major?

_____

What role did your Guidance Counselor play?_____

_____

IF WORK (NOT COLLEGE):

Do you think that having participated in IPSE will help you get a job? How?

_____

Why have you decided not to go to college?_____

How do you feel about a career in sciences or engineering?_____

_____

Why did you drop out of IPSE?_____

_____

_____

What was the best part of IPSE for you?_____

What was the worst part of IPSE for you?_____

Can you offer any suggestions as to how IPSE could be improved?_____

_____

PRINCIPALS AND COUNSELORS - 1977

What role did you play in IPSE?_____

_____

Do you think that IPSE, in its present form, can reach its goals?_____

_____

What aspects of the IPSE program do you think are good (strong)?_____

_____

What are the weakest aspects of IPSE?_____

How could the program be improved so as to better meet its goals?_____

_____

What differences so you see in the IPSE vs. the non-IPSE students?_____

_____

What do you see as Caroline Urvater's function in the IPSE program?_____

_____

How well does she fulfill that function?_____

Can you suggest any ways in which she could improve?_____

_____

What do you personally think of the IPSE program?_____

_____

Would you like to see a program such as IPSE continued in your school?_____

_____

Are there any other comments you would like to make concerning the IPSE program?_____

_____

_____

Appendix E

TABLES 1E - 6E

TABLE 1E: Means and Standard Deviations on Attitude Towards Science Scale.

Item	Group # valid cases year	(132) IPSE 75	(95) IPSE 76	(84) IPSE 77	(117) PRE YES 75	(87) PRE YES 76	(83) PRE NO 75	(57) PRE NO 76	(58) POST YES 76	(50) POST YES 77	(30) POST NO 76	(22) POST NO 77
1	$\bar{X}$	- .939	- .947	-1.500	- .402	- .437	.735	.386	- .483	- .620	.533	.636
	S	1.976	2.156	1.936	2.166	2.056	2.300	2.161	2.020	2.059	2.129	2.083
2	$\bar{X}$	1.061	1.368	1.405	.855	1.209	.232	.912	1.052	.863	.900	.727
	S	1.905	1.598	1.687	1.872	1.617	1.907	1.651	1.527	1.662	1.807	1.778
3	$\bar{X}$	-1.985	-2.053	-2.107	-2.043	-1.698	-1.795	-1.860	-1.241	-1.804	-1.333	-1.273
	S	1.568	1.553	1.621	1.499	1.729	1.591	1.563	1.994	1.549	1.561	1.956
4	$\bar{X}$	- .147	- .011	- .083	- .409	- .384	-1.085	-1.070	- .207	- .431	- .966	-1.091
	S	1.953	1.729	1.903	1.969	1.757	1.841	1.689	1.755	1.781	2.212	1.688
5	$\bar{X}$	2.000	2.347	2.214	1.974	2.163	1.253	1.719	1.638	1.588	.967	1.364
	S	1.314	.782	.777	1.256	.956	1.614	1.161	1.321	1.283	1.752	1.364
6	$\bar{X}$	.977	1.358	1.143	.487	.663	-1.361	- .860	.569	.039	-1.000	-1.046
	S	1.659	1.406	1.716	2.028	1.793	1.778	1.747	1.613	1.766	1.894	1.812
7	$\bar{X}$	-2.654	-2.863	-2.762	-2.641	-2.651	-2.723	-2.632	-2.672	-2.569	-1.900	-2.091
	S	.993	.375	.770	.885	1.038	.831	1.011	.944	.985	2.040	1.743
8	$\bar{X}$	1.379	1.832	2.012	1.359	1.407	- .193	.140	1.000	.706	- .533	- .136
	S	1.660	1.449	1.331	1.845	1.590	2.051	2.013	1.556	1.858	1.943	2.077
9	$\bar{X}$	-1.181	-1.484	-1.702	- .974	-1.372	- .085	.088	- .293	- .588	- .067	- .091
	S	1.620	1.604	1.495	1.959	1.681	1.834	1.874	1.676	1.639	1.999	1.925
10	$\bar{X}$	-1.779	-1.979	-2.071	-1.239	-1.465	.217	.000	-1.138	-1.255	- .567	- .136
	S	1.604	1.406	1.421	1.955	1.839	2.153	1.964	1.914	1.875	2.063	1.935
Totals	$\bar{X}$	13.669	16.200	16.833	11.573	12.400	2.476	4.776	9.879	9.588	2.733	2.773
	S	8.764	8.215	8.550	10.097	9.251	7.921	8.400	7.936	9.190	12.097	10.967

TABLE 2E: Means and Standard Deviations for Semantic Differential Responses (1975 and 1977)

Occupation/Scale		1975 Mean Group Standard Deviations IPSE75	PreY75	PreNo75	1977 Mean Group Standard Deviations IPSE77	PostY77	PostNo77
Biologist	1	3.17	2.98	3.98	2.48	2.88	3.45
		1.36	1.44	1.58	1.29	1.28	1.34
	2	2.80	2.74	2.32	2.73	3.02	2.68
		1.26	1.35	1.19	1.29	1.16	1.36
	3	2.58	2.54	3.58	2.26	2.31	2.73
		1.38	1.44	1.76	1.35	1.46	1.42
	4	6.08	5.90	5.45	5.93	5.55	5.82
		.95	1.32	1.50	1.18	1.25	1.26
	5	3.97	3.75	4.28	3.77	3.80	4.23
		1.67	1.74	1.71	1.52	1.44	1.41
	6	2.71	2.85	2.73	2.99	2.67	3.27
		1.30	1.45	1.41	1.24	1.19	1.32
	7	5.34	5.43	5.04	5.31	5.25	5.09
		1.17	1.23	1.29	1.10	1.09	1.31
Chemist	1	3.00	2.78	3.83	2.13	2.84	3.36
		1.54	1.54	1.78	1.19	1.47	1.50
	2	2.50	2.18	1.92	1.95	2.18	2.00
		1.30	1.36	1.04	1.23	.99	.82
	3	2.67	2.73	3.59	2.27	2.45	3.32
		1.47	1.63	1.87	1.41	1.29	1.94
	4	5.80	5.84	5.39	6.30	5.47	5.32
		1.22	1.35	1.50	.82	1.33	1.49
	5	3.90	4.00	4.56	3.87	4.29	4.59
		1.69	1.83	1.60	1.74	1.54	1.71
	6	2.60	2.51	2.42	2.29	2.67	2.68
		1.25	1.39	1.31	.99	1.54	1.21
	7	5.37	5.69	5.32	5.64	5.33	4.91
		1.24	1.34	1.34	1.29	1.26	1.48
Physicist	1	2.94	2.57	3.31	2.26	2.63	2.95
		1.46	1.55	1.70	1.16	1.31	1.25

	2	2.81	2.41	2.51	2.12	2.43	2.27
		1.34	1.43	1.42	1.31	1.01	1.28
	3	2.90	2.87	3.36	2.42	2.59	2.73
		1.39	1.73	1.74	1.42	1.33	1.32
	4	5.53	5.61	5.19	6.02	5.71	5.41
		1.20	1.50	1.47	.97	1.08	1.01
	5	4.02	3.93	4.24	3.81	4.24	4.23
		1.54	1.77	1.47	1.70	1.50	1.31
	6	2.66	2.41	2.71	2.39	2.45	2.18
		1.41	1.46	1.41	1.10	1.22	1.22
	7	5.23	5.38	5.19	5.60	5.06	5.45
		1.24	1.41	1.39	1.15	1.17	1.22
Doctor	1	2.43	1.79	2.54	1.40	1.69	2.05
		1.47	1.20	1.60	.75	.99	.95
	2	2.61	2.25	2.32	1.83	2.25	1.77
		1.39	1.31	1.41	1.35	1.20	.92
	3	2.42	2.09	2.67	1.69	1.98	2.05
		1.45	1.30	1.65	1.08	1.10	1.25
	4	6.17	6.50	6.15	6.81	6.35	6.59
		1.07	.89	1.17	.50	.89	.59
	5	4.16	4.28	4.60	4.37	4.67	4.73
		1.82	1.96	1.66	1.97	1.77	1.78
	6	1.80	1.55	1.83	1.43	1.55	1.45
		1.15	.95	1.06	.83	1.03	.60
	7	5.84	6.31	5.73	6.51	6.08	6.18
		1.31	1.15	1.46	.84	1.09	1.30
Mathematician	1	2.84	2.71	3.55	2.46	3.00	3.27
		1.60	1.69	1.56	1.39	1.77	1.49
	2	2.84	2.59	2.71	2.35	2.78	2.36
		1.67	1.67	1.64	1.52	1.57	1.40
	3	3.25	3.50	4.06	3.24	3.59	4.27
		1.75	1.90	1.93	1.79	1.92	1.88
	4	5.63	5.57	5.37	5.38	4.84	5.00
		1.44	1.48	1.35	1.41	1.59	1.41
	5	4.02	3.92	4.52	4.17	4.33	4.50
		1.61	1.76	1.69	1.63	1.32	1.41
	6	3.18	3.19	3.40	3.37	3.69	4.05
		1.31	1.40	1.30	1.2/	1.26	1.17

	7	5.10	5.04	4.46	4.89	4.53	4.36
		1.36	1.49	1.21	1.38	1.22	1.59
Social Worker	1	2.79	2.52	2.34	2.39	2.61	1.95
		1.53	1.59	1.46	1.41	1.79	1.09
	2	3.94	4.26	3.68	3.85	4.24	2.86
		1.74	1.87	1.64	1.68	1.85	1.28
	3	2.76	2.56	2.31	2.97	2.65	2.05
		1.65	1.63	1.44	1.56	1.71	.95
	4	5.53	5.62	5.76	5.38	5.51	5.86
		1.31	1.29	1.21	1.38	1.46	1.28
	5	3.62	3.55	3.60	3.70	3.57	3.82
		1.62	1.75	1.77	1.60	1.65	1.40
	6	3.91	3.97	3.77	4.01	3.78	3.73
		1.91	1.34	1.49	1.28	1.38	1.35
	7	4.47	4.48	4.35	4.35	4.29	4.50
		1.31	1.30	1.30	1.28	1.38	1.50
Engineer	1	2.37	2.44	3.22	1.71	2.24	2.73
		1.44	1.50	1.82	.84	1.37	1.03
	2	2.76	2.56	2.57	1.98	2.76	2.32
		1.47	1.57	1.53	1.39	1.46	1.17
	3	2.41	2.66	3.51	1.96	2.45	2.77
		1.50	1.60	1.67	1.11	1.33	1.51
	4	5.95	5.68	5.10	6.13	5.65	5.36
		1.13	1.36	1.50	1.03	1.21	1.18
	5	3.95	3.99	4.23	4.00	4.17	4.27
		1.59	1.71	1.56	1.71	1.40	1.42
	6	2.08	1.97	2.25	1.81	2.35	2.41
		1.19	1.21	1.15	1.19	1.47	1.05
	7	5.60	5.46	5.10	5.92	5.43	5.27
		1.28	1.29	1.35	.96	1.19	1.24
Guidance Counselor	1	2.92	2.71	2.43	2.57	2.61	2.95
		1.60	1.59	1.44	1.45	1.55	1.13
	2	3.71	4.16	3.43	3.58	4.02	3.45
		1.50	1.65	1.80	1.64	1.66	1.37
	3	2.89	2.86	2.31	2.89	2.71	3.00
		1.66	1.59	1.35	1.58	1.32	1.48
	4	5.37	5.39	5.59	5.31	5.25	5.09
		1.20	1.41	1.30	1.41	1.35	1.48

	5	3.87	4.09	3.95	3.94	3.69	4.23
		1.41	1.67	1.60	1.50	1.35	1.57
	6	3.55	3.91	3.63	3.92	3.67	3.59
		1.18	1.19	1.37	1.19	1.19	1.18
	7	4.33	4.57	4.47	4.51	4.51	4.55
		1.14	1.17	1.31	1.20	.92	1.01
Dentist	1	2.74	2.48	2.85	1.99	2.10	2.55
		1.59	1.58	1.81	1.11	1.28	1.47
	2	2.72	2.61	2.39	2.21	2.41	2.05
		1.37	1.38	1.26	1.44	1.31	1.00
	3	3.46	3.41	3.59	2.75	2.75	3.55
		1.78	1.74	1.73	1.66	1.70	1.53
	4	5.45	5.41	5.37	5.98	5.80	5.59
		1.35	1.46	1.51	1.10	1.11	1.40
	5	4.61	4.37	4.71	4.35	4.59	4.68
		1.50	1.44	1.60	1.59	1.34	1.55
	6	1.98	1.86	1.99	1.60	1.86	1.95
		1.26	1.16	.98	.89	1.20	.84
	7	5.49	5.58	5.30	5.88	5.39	5.32
		1.23	1.22	1.41	1.13	1.31	1.21
Physical Therapist	1	2.62	2.53	2.67	2.12	2.33	2.45
		1.41	1.52	1.47	1.24	1.23	1.30
	2	3.00	2.97	2.42	2.79	2.71	2.59
		1.31	1.70	1.25	1.51	1.19	1.33
	3	2.89	2.91	2.79	2.52	2.53	3.00
		1.54	1.73	1.65	1.54	1.39	1.90
	4	5.61	5.59	5.70	5.90	5.53	5.86
		1.21	1.46	1.17	1.18	1.33	1.25
	5	4.14	4.09	4.16	3.99	4.12	4.50
		1.38	1.60	1.52	1.56	1.19	1.26
	6	2.54	2.68	2.73	2.73	2.27	2.82
		1.31	1.51	1.21	1.35	1.08	1.33
	7	5.03	5.18	4.96	5.25	5.02	5.09
		1.18	1.36	1.23	1.19	1.29	1.02
Veterinarian	1	2.77	2.71	3.04	2.14	2.67	2.82
		1.59	1.66	1.62	1.24	1.47	1.68
	2	3.08	2.86	2.86	2.11	2.82	2.27
		1.54	1.54	1.37	1.39	1.21	1.08

	3	2.80	2.84	3.07	2.15	2.67	2.73
		1.51	1.75	1.68	1.32	1.61	1.55
	4	5.44	5.27	5.02	5.96	5.37	5.23
		1.26	1.58	1.47	1.18	1.48	1.57
	5	3.	4.05	4.41	4.01	4.16	4.36
		1.41	1.56	1.59	1.69	1.43	1.50
	6	2.65	2.53	2.94	2.04	2.59	2.64
		1.26	1.32	1.34	1.12	1.10	1.14
	7	4.93	4.96	4.46	5.51	4.98	4.82
		1.23	1.31	1.11	1.22	1.05	1.33
Artist	1	2.84	2.98	2.94	3.01	2.73	2.41
		1.82	1.75	1.49	1.75	1.52	1.22
	2	3.77	3.55	3.71	3.49	3.47	2.36
		1.99	1.98	1.93	1.68	1.70	1.53
	3	2.69	2.65	2.37	2.75	2.57	2.23
		1.78	1.71	1.52	1.80	1.53	1.48
	4	5.06	4.92	4.96	4.77	4.84	5.36
		1.62	1.66	1.39	1.58	1.21	1.29
	5	3.06	2.57	2.93	2.26	2.73	3.27
		1.87	1.78	1.84	1.58	1.60	1.93
	6	3.45	4.14	3.96	3.87	3.45	3.36
		1.57	1.63	1.48	1.54	1.32	1.65
	7	4.49	4.41	4.14	4.29	4.61	4.68
		1.60	1.55	1.35	1.49	.94	1.32
Writer	1	3.11	2.92	3.00	2.95	2.73	2.64
		1.54	1.58	1.63	1.45	1.55	1.00
	2	3.22	2.70	2.96	2.74	2.86	2.09
		1.47	1.49	1.73	1.60	1.50	1.23
	3	3.13	2.99	3.25	3.10	3.06	2.45
		1.76	1.86	1.97	1.79	1.85	1.30
	4	4.86	5.05	4.98	4.88	5.25	4.95
		1.41	1.52	1.44	1.41	1.28	1.36
	5	3.15	2.64	3.[illegible]	2.61	3.00	[illegible].00
		1.61	1.65	1.81	1.65	1.69	1.45
	6	3.37	3.55	3.44	3.77	3.06	3.36
		1.34	1.48	1.24	1.41	1.29	1.18
	7	4.72	4.68	4.54	4.61	4.80	4.91
		1.24	1.41	1.23	1.36	1.28	1.38

Business Executive	1	2.77 1.52	2.34 1.50	2.67 1.63	2.38 1.35	2.49 1.59	2.23 1.23
	2	3.31 1.42	3.29 1.61	3.04 1.31	3.00 1.42	3.35 1.49	2.59 1.50
	3	3.66 1.69	3.27 1.85	3.18 1.64	3.02 1.70	3.02 1.58	2.64 1.50
	4	5.06 1.24	5.08 1.50	5.24 1.31	5.31 1.26	5.22 1.32	5.41 1.10
	5	4.43 1.44	4.62 1.70	4.39 1.50	4.15 1.44	4.75 1.32	4.45 1.26
	6	2.53 1.24	2.17 1.14	2.27 1.18	2.13 1.07	2.12 1.03	2.41 1.10
	7	5.24 1.32	5.59 1.17	5.24 1.30	5.58 1.29	5.33 1.24	5.36 1.22
My Future Occupation	1	1.46 .84	1.50 .87	1.64 .86	1.54 .87	1.69 .97	1.59 .80
	2	2.81 1.75	2.88 1.77	3.25 1.76	2.27 1.41	3.22 1.58	2.32 .89
	3	1.41 .81	1.53 .93	1.63 .86	1.46 .86	1.61 .85	1.55 .86
	4	6.34 1.07	6.38 .86	6.14 .98	6.38 .94	6.20 .98	6.18 .73
	5	3.29 2.01	3.64 1.88	3.87 1.81	3.56 1.73	3.78 1.87	3.82 1.47
	6	2.11 1.31	2.34 1.29	2.65 1.43	1.99 1.01	2.14 1.23	2.64 1.33
	7	5.96 1.15	5.62 1.21	5.08 1.37	5.68 1.24	5.57 1.12	5.41 1.10

TABLE 3E: Semantic Differential: Repeated Measures

Sophomore-Junior

Variable	Group	Trial	GxT
B1	.005	.012	ns
B3	ns	.001	ns
B4	.032	ns	ns
C1	ns	.021	ns
C2	ns	.000	.027
C3	.027	ns	ns
C4	.024	ns	ns
C7	ns	.026	ns
P1	ns	.024	ns
P2	ns	.000	.020
P3	ns	.001	ns
P4	ns	.002	ns
P6	ns	.049	ns
P7	ns	.006	ns
DR1	ns	.001	ns
DR2	ns	.000	ns
DR4	ns	.003	ns
DR6	ns	.002	.005
DR7	ns	.000	ns
M2	ns	.016	ns
M4	.007	.040	ns
M6	ns	.011	ns
SW2	.036	ns	ns
SW3	ns	.043	ns
E1	ns	.037	ns
E2	ns	.000	ns
E3	ns	.014	ns
E4	.003	.005	ns
GC6	ns	.017	ns
D3	ns	ns	.011
D4	ns	ns	.011
D7	ns	.026	ns
PT5	ns	ns	.015

V2	ns	.000	ns
V4	ns	.027	.010
V6	ns	.006	.037
A2	.012	.017	ns
A5	ns	.017	ns
W2	ns	.008	ns
W5	ns	.002	.042
BE3	.013	ns	ns
BE7	ns	.024	ns
MY2	.028	.006	.040
SCI1	ns	.005	ns
SCI2	ns	.000	ns
SCI3	ns	.007	.038
SCI4	ns	.012	ns
SCI6	ns	ns	.046
SCI7	ns	.001	ns
NONSCI2	.008	.010	ns
NONSCI3	.038	ns	ns

TABLE 4E: Semantic Differential: Repeated Measures

Junior - Senior

Variable	Group	Trial	GxT
B1	.0000	ns	ns
B3	.0000	ns	ns
C1	.0000	.007	ns
C3	.000	.05	ns
C4	.02	ns	ns
P1	.003	.05	ns
P2	.05	ns	ns
P3	.02	ns	ns
P4	ns	.004	ns
DR1	.001	ns	.004
DR2	ns	.05	ns
DR3	.05	.001	.05
DR4	.05	.01	ns
DR6	.01	ns	ns
DR7	.01	.02	ns
M1	.01	ns	.02
M2	ns	.01	ns
M3	.01	ns	ns
M4	ns	.04	ns
M6	ns	ns	.02
M7	ns	ns	.05
SW3	ns	ns	.01
SW4	ns	ns	.05
SW7	ns	ns	.01
E1	.001	.02	ns
E3	.001	.05	ns
E4	.001	.01	.01
E6	.01	ns	ns
E7	.01	ns	ns
GC3	.05	ns	ns
GC6	.01	ns	ns
D1	ns	.02	.05
D2	ns	.05	ns
D3	ns	.05	ns
D4	ns	.01	ns

D6	.02	ns	ns
V1	.01	ns	ns
V2	.01	ns	ns
V3	.001	ns	ns
V4	.005	.005	ns
V6	.001	ns	ns
V7	.001	.005	ns
W2	.005	ns	ns
BE4	ns	.02	ns
BE5	ns	.05	ns
BE7	ns	.05	ns
MY1	.05	ns	ns
MY2	.001	ns	ns
MY3	.01	ns	ns
MY4	.02	ns	ns
MY6	.001	ns	ns
MY7	.01	ns	ns
SCI1	.001	.005	.02
SCI2	ns	.03	ns
SCI3	.001	.005	ns
SCI4	.005	.005	ns
SCI6	.05	ns	ns
SCI7	.01	.05	ns
NOSCI2	ns	.05	ns
NOSCI7	ns	.04	.02

TABLE 5E: Semantic Differential: Repeated Measures

1976 - 1977

Variable	Group	Trial	GxT
B1	.001	.02	ns
B3	.05	ns	.05
B6	ns	.02	ns
C1	.001	.01	ns
C3	.01	ns	ns
C4	.001	ns	ns
C7	.05	ns	ns
P1	.05	.01	ns
P4	.05	.05	ns
P5	ns	ns	.05
P7	.05	ns	ns
DR1	ns	.01	ns
DR2	.05	ns	ns
DR4	.04	ns	ns
DR7	.01	.02	ns
M2	ns	.01	ns
M4	ns	.01	ns
SW2	.05	ns	ns
E1	.001	.005	ns
E2	.005	.05	ns
E3	.01	ns	ns
E4	.001	ns	ns
E6	.01	ns	ns
E7	.01	.05	ns
GC1	ns	ns	.05
D1	ns	.01	ns
D2	ns	.02	ns
D3	ns	ns	.002
D4	ns	ns	.05
D6	.05	ns	ns
D7	.01	ns	ns
PT1	ns	.05	ns
PT5	ns	.05	ns
V2	.005	.005	ns

V3	.05	ns	ns
V4	.005	ns	.05
V6	.005	ns	ns
V7	.02	ns	ns
A2	.05	ns	ns
A5	.05	ns	ns
W2	ns	.05	ns
W5	.01	ns	.02
W6	.005	ns	ns
BE5	ns	ns	.05
MY2	.002	ns	ns
MY3	.01	ns	.02
MY6	.05	ns	ns
SCI1	.005	.001	ns
SCI2	ns	.001	ns
SCI3	.02	ns	ns
SCI4	.001	ns	ns
SCI7	.005	ns	ns
NOSCI1	ns	.02	ns
NOSCI2	.02	ns	ns

TABLE 6E: Semantic Differential: Repeated Measures

IPSE years 1-2-3

B1	.001	D3	.01
C1	.001	D4	.005
C2	.005	D6	.01
C4	.005	D7	.001
C6	.05	PT1	.05
C7	.005	PT4	.05
P1	.001	PT7	.05
P2	.001	V1	.02
P3	.005	V2	.001
P4	.005	V3	.005
P6	.05	V4	.002
P7	.005	V6	.001
DR1	.001	V7	.001
DR2	.001	A5	.005
DR3	.001	W5	.005
DR4	.001	BE3	.02
DR6	.001	BE6	.05
DR7	.001	BE7	.02
E1	.001	MY2	.005
E2	.001	SCI1	.001
E3	.02	SCI2	.001
E7	.01	SCI3	.001
GC6	.05	SCI4	.001
D1	.005	SCI6	.05
D2	.05	SCI7	.001