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ABSTRACT

Critical incidents were used to collect faculty ratings of graduate student performance in the departments of chemistry, English, and psychology. Separate factor analyses in each of three fields produced eight factors that were fairly consistent with respect to item loadings across fields. Factors were labeled independence and initiative, conscientiousness, critical facility, enthusiasm, research and experimentation, communication, teaching skills, and persistence. In addition to ratings of students, faculty were asked to rate each incident with respect to its importance or relevance for success. Importance ratings were most similar for psychology and chemistry and least similar for chemistry and English. The implications for future studies of graduate student performance are discussed. (Author)

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RESEARCH BULLETIN

FACTORS IN GRADUATE STUDENT PERFORMANCE

Richard R. Reilly

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Educational Testing Service
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Richard R. Reilly

Abstract

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Factors in Graduate Student Performance[1]

Richard R. Reilly

The critical incident technique, a method which has been used for many years in studying the performance of workers in industry, has been described by Flanagan (1954) as

> ... essentially a procedure for gathering certain important facts concerning behavior in defined situations.... the critical incident technique does not consist of a single rigid set of rules governing such data collection. Rather it should be thought of as a flexible set of principles which must be modified and adopted to meet the specific situation at hand.

Usually the procedure begins with the questioning of experts familiar with a specific job or task. The experts are asked to describe incidents from their experience which they consider indicative of unusually effective performance or unusually ineffective performance. The critical incidents are collected and collated and may be put to a variety of uses. They may be categorized judgmentally and used to guide item writers in test development, for example. Critical incidents may also be used, as in the present study, as valuable tools in the development of criteria.

The present study was the second phase of a project which began with the collection of a large number of critical incidents of graduate student performance (Reilly, 1971). During this first phase a representative sample of graduate faculty from the fields of chemistry, English, and psychology were asked to provide several incidents or examples of behavior which caused them to "...raise or lower their estimate of the competence of a graduate student" (Reilly, 1971). The large number of critical

incidents which resulted from this survey was reduced to a final list of 52 incidents or examples of graduate student performance through the elimination of items which were inappropriate, too vague, or redundant. The present report describes an attempt to derive empirical factors or dimensions of graduate student performance by examining the factor structure of the critical incidents when used to describe the performance of actual graduate students. The underlying rationale for the method used in this study may be summarized in the following set of premises.

1. An evaluation of the performance of a graduate student, like the evaluation of any other performance, is usually based on a series of behaviors manifested by the students and known to the evaluator. Thus, an overall rating is an attempt by the evaluator to summarize this series of behaviors, very often with a single number.
2. Only certain behaviors matter. These are the critical incidents which cause the evaluator to shift his judgment as to the competency of the student. Actually, most behaviors encountered by an evaluator are probably irrelevant in that they do not cause any shift in judgment.
3. Since opinions may vary as to what behaviors characterize an exceptional graduate student one reasonable approach is to ask a representative sample of experts (i.e., faculty) to describe behaviors which have, in the past, caused them to raise or lower their estimate of a graduate student's competence.
4. Once a representative sample of incidents has been collected they may be used to describe the performance of specific students. By determining which kinds of incidents tend to co-occur, specific

scales might be suggested for use as criteria. At the same time, faculty members can provide some indication as to the importance of each incident for performance in their field.

Purpose and Method

The major objective of the present investigation was to define, empirically, a set of criterion dimensions upon which graduate faculty base judgments of student performance. A second goal was to examine differences among faculty with respect to how important they regard various incidents of student performance. Since the critical incidents had been collected from the fields of chemistry, English, and psychology it was decided to sample the same three fields for the second phase of the study. These three fields were originally chosen because they represented a broad range of the disciplines in which graduate degrees are offered and, in addition, were three of the largest areas of study (Cartter, 1965).

A faculty rating booklet (see Appendix) was prepared and sent to all department chairmen for the three fields in member institutions of the Council of Graduate Schools (CGS). In addition, a letter was sent to the chairmen explaining the project and inviting their participation. The letter explained that participation meant asking their faculty members to cooperate by filling out the booklets and then returning the questionnaires to ETS. At the same time another letter was mailed to the Graduate Deans of all CGS institutions explaining the project and requesting their support.

The faculty rating booklet was composed of four separate sections. In each of the first three sections the faculty member was asked to describe the performance of three specific graduate students chosen by the professor by indicating whether he observed a particular behavior

(OB), observed its opposite (NEG), or observed both the behavior and its opposite (if both boxes were blank it was assumed that neither the behavior nor its opposite was observed). The raters were asked to rate a below average student in the first section, an average student in the second section, and an above average student in the last section to ensure some variation in the overall level of ratee performance. In the fourth section faculty were asked to rate the importance or relevance of each incident for performance in their field.

Results

Data were collected from a total of 227 departments and 1299 faculty members across the three fields. Table 1 gives the number of departments and faculty members participating for each field. Since each faculty member rated 3 students the total number of students rated was 3897. For the first 3 sections each item was scored 1 if the box labeled OB was checked, -1 if the box labeled NEG was checked, and 0 if either no check was made or if both boxes were checked. The fourth section was scored on a 4 point scale ranging from 1 for an incident which had little or no importance to a 4 for an item which was considered extremely important.

Insert Table 1 about here

Ratings of Students

Frequency distributions for each item were produced for students rated below average, average, and above average in each discipline. Tables 2, 3, and 4 present the means and standard deviations for each item. Inspection of the tables is rather tedious but, in general, the item means are in logical order with negatively stated items having highest means for the below average student, while positively stated items have highest means for the above average student. Some of the

items having to do with research, particularly laboratory research, have small standard deviations within English departments and small mean differences between the above and below average category.

Insert Tables 2, 3, and 4 about here

A separate factor analysis of performance ratings was performed within each field. Initial computations were done using the method of principal components, and factors with eigenvalues exceeding 1.0 were retained for the rotational step. All rotations were done using Kaiser's varimax method (Kaiser, 1958) which rotates the original factors orthogonally to a more interpretable solution. The method yielded 8 factors for both chemistry and psychology and 7 factors for the English departments. In general, there was a fair degree of similarity in the solutions obtained. Tables 5 through 12 present each of the eight factors, matched across fields with respect to the highest item loadings (see Appendix A for complete factor patterns). The items included in the tables were the 5 items loading highest on each factor within each discipline. Items with loadings below .40 were not included.

Insert Table 5 about here

The first factor was quite similar across disciplines (see Table 5) and has been called an Independence and Initiative factor since most of the items appear to reflect these two related traits. Since it emerged first this factor accounted for more of the variance than any remaining factor in all three disciplines. This suggests that graduate students are probably more heterogeneous in their independence and initiative than in any other aspect of performance.

A "conscientiousness" factor emerging second for data collected from chemistry departments appeared quite similar to factors emerging for English departments and for psychology departments (see Table 6). Conscientiousness was the term chosen to describe this factor because many of the items reflect care and responsibility in professional work. It is worth noting that the item, "Became distracted by non-academic, non-professional interests," also loaded highly on this factor suggesting that the element of professional commitment may underlie the behaviors listed in Table 6.

Insert Table 6 about here

For want of a better term the name Critical Facility was given to the second factor emerging in English departments (see Table 7). Similar factors were found in both psychology and chemistry departments. Taken together, the items with high loadings in all three departments (i.e., items 29, 16, 28, 25, and 39) seem to suggest an underlying personality trait. An individual scoring high on this factor, and thus consistently exhibiting this pattern of behaviors, would appear to be an individual who holds strong opinions and is aggressive but lacks the ability or desire to separate what is relevant from what is irrelevant in his work. In addition, such an individual would perform rather poorly in the normal give-and-take criticism occurring in a graduate department.

Insert Table 7 about here

Involvement was the term given to the factor presented in Table 8. The item with the uniformly highest loading was "seldom if ever engages in informal contacts with faculty or fellow graduate students." This

underscores the importance of the informal socialization process in graduate education.

Insert Table 8 about here

The Ph.D. is by definition a research degree and thus a factor loading on items related to research might be expected. Table 9 shows the items with highest loadings on the Research and Experimentation factor. As might be expected more of the items loaded highly in the pyschology and chemistry analysis than that for English. Curiously, however, items having to do with laboratory research had high loadings for factor V for the English departments. "Laboratory" may have been interpreted differently by English faculty than by psychology or chemistry professors, but enough variance did occur in these items for it to be statistically related to the research factor.

Insert Table 9 about here

The ability to communicate both verbally and in writing is a factor of some importance in all three fields. A Communications factor emerged second in psychology and third in chemistry. As mentioned previously, only 7 factors emerged for the English departments but the second factor for English could be viewed as a combination of the Critical Facility factor discussed earlier and the Communications factor presented in Table 10.

Insert Table 10 about here

The final two factors are presented in Tables 11 and 12. The Teaching Skills factor consists of only three items the first two of

which clearly reflect an interest and ability in teaching. The last item "devoted considerable time to helping other students with problems" had lower loadings but is both logically and statistically related to the teaching skills factor.

Insert Tables 11 and 12 about here

The last factor consisted of only two similar items reflecting persistence. The only other item which might logically be related to this factor was item 40, "Did not hesitate to repeatedly ask questions of faculty until he fully understood an issue," which had higher loadings on the involvement factor discussed earlier.

Importance Ratings

The mean importance ratings of each incident for each discipline are shown in Table 13. The most similar disciplines in terms of mean importance ratings were chemistry and psychology, while the least similar were chemistry and English. Table 14 presents the correlations between disciplines obtained when items were treated as observations and the mean importance ratings as scores. In general, the largest differences in judged importance occurred for those items related to empirical research, with such items rated much higher by chemistry and psychology faculty than English faculty. One other item on which there was a large difference is noteworthy. The item "submitted a paper which merely summarized what he had read" was judged to be a highly relevant behavior by English faculty who gave it a mean rating of 3.41 as contrasted with 2.34 for chemistry and 2.64 for psychology. A report which is a mere summarization is probably more acceptable in

departments of chemistry and to some extent, psychology, where empirical results of mathematical formulae are discussed, with extensive interpretation and conjecture either not appropriate or not possible.

Insert Tables 13 and 14 about here

Two definitions of "importance" might be distinguished for purposes of this study. One type is the importance of various behaviors as judged by experts, which was the definition used for Section IV of the Faculty Rating Booklet (see Appendix B). A second definition is related to the statistical properties of an item. An item becomes "important" in defining a particular factor, for example, because it co-varies with other items. It should be recognized that these two different kinds of importance are not necessarily related. A good example would be a behavior which everyone agreed was highly important but which, in practice, had little variation. The ability to read and speak English would probably be judged important for success in graduate study but would have little statistical importance since there would be almost no variation.

One way of relating the two types of importance is by looking at the judged relevance of items loading highest on each of the factors. Accordingly, the mean importance ratings for the sets of items listed in Tables 5 through 12 were used to compute average item importances for each factor. Table 15 presents the results.

Insert Table 15 about here

Independence and Initiative which was the first factor to emerge in all three disciplines received almost identical mean item importances.

In all cases the mean rating was slightly above the "moderately important" category on the scale. As might be expected the Communications and Critical Facility factor are rated much higher in importance by English faculty than by either chemistry or psychology faculty. The reverse was true for the Research and Experimentation factor which was moderately important for psychology and chemistry but moderately unimportant for English. The only other factor which showed large differences in importance was the Teaching Skills factor which was judged less important by chemistry faculty than by English or psychology.

Conclusions and Recommendations

The results presently described suggested a number of potential criteria which might be used in studying graduate student performance. Of the eight factors identified initiative and independence accounted for the most variance in each of the three disciplines. The remaining factors were labeled conscientiousness, critical facility, involvement, research and experimentation, communication, teaching skills and persistence. Importance ratings of the items were most similar for chemistry and psychology and least similar for chemistry and English.

The relatively consistent factors which emerged in each of the three disciplines studied suggest that the present results might be a first step in the development of a set of rating scales which could be used as criteria of graduate student performance. Such scales could take several forms but two approaches are suggested. The first would involve developing more critical incidents specifically for the factors identified, particularly those with only 2 or 3 items with high loadings. The incidents could then be used in a check list fashion to rate students, and scores could be derived separately for each of the factors. A

second approach would be to develop behaviorally anchored rating scales similar to those devised by Hilton, Kendall, and Sprecher (1970) for graduate study in business. Since factors have been identified and named, some of the developmental steps outlined by Hilton, Kendall and Sprecher could presumably be eliminated. More incidents would have to be written particularly for the mid-points on the scales. Either approach could lead to a useful set of criterion measures for research in graduate schools.

As a final cautionary note it is important to recognize that the present data were based on behaviors or incidents that in practice distinguish the successful from the unsuccessful graduate student. Though it is well-known (and often lamented by researchers) that graduate students are relatively homogeneous with respect to variables such as intelligence, it is important to bear this in mind in interpreting the present results. Aspects of performance highly correlated with the "explicit selectors" (Gulliksen, 1950, p. 130) in graduate admissions might be perceived as normative or go unnoticed in graduate school where selection is extreme, while in other less selective contexts these same aspects of performance might be critical in separating the more effective performers from the average or below par.

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Footnote

[1]The research reported herein was supported by the Graduate Record Examinations Board.

Table 1

Total Numbers of Departments and Faculty Participating by Field

Field	Departments	Faculty
Chemistry	81	397
English	64	443
Psychology	82	459

TABLE 2

Item Means and Standard Deviations Rated Average, Above Average and Below Average in Departments of Chemistry

	Below Average		Average		Above Average	
Item	M	S.D.	M	S.D.	M	S.D.
1[a]	.27	.87	-.18	.91	-.78	.52
2	-.70	.63	-.05	.92	.71	.63
3	-.70	.57	-.12	.85	.54	.72
4	-.62	.68	.22	.85	.75	.55
5	-.57	.71	-.01	.90	.72	.59
6	-.04	.92	.64	.69	.84	.45
7[a]	-.03	.90	-.45	.79	-.72	.58
8[a]	.11	.84	-.19	.88	-.69	.59
9[a]	.06	.91	-.27	.87	-.67	.64
10[a]	.31	.85	-.40	.84	-.62	.67
11	-.34	.68	.22	.76	.54	.63
12[a]	.17	.87	.83	.83	-.67	.61
13	-.58	.69	.03	.88	.70	.58
14[a]	.36	.81	-.18	.87	-.62	.65
15	.06	.90	.53	.75	.64	.67
16[a]	-.28	.79	-.68	.54	-.82	.38
17[a]	.16	.79	-.31	.78	-.70	.58
18	-.59	.70	.07	.89	.68	.62
19	-.44	.74	.15	.83	.73	.55
20	-.33	.82	.09	.89	.50	.73
21[a]	.35	.84	-.21	.90	-.60	.69
22[a]	.54	.77	-.36	.85	-.83	.46
23	-.25	.84	.15	.88	.46	.79
24[a]	-.16	.90	-.55	.75	-.74	.56
25[a]	-.03	.78	-.34	.75	-.72	.48
26	-.41	.66	-.16	.74	.10	.68
27[a]	-.47	.78	-.75	.59	-.81	.51
28[a]	-.12	.86	-.48	.77	-.79	.50
29[a]	-.38	.77	-.75	.50	-.85	.37
30	-.54	.75	.09	.91	.67	.66
31[a]	.19	.84	-.41	.78	-.71	.55
32	-.73	.53	-.15	.86	.55	.70
33[a]	.08	.89	-.61	.70	-.78	.52
34	-.49	.76	.23	.85	.74	.57
35	-.20	.69	-.04	.72	.25	.64
36	-.25	.87	.34	.86	.74	.57
37	-.50	.70	.29	.83	.79	.51
38	-.24	.89	.41	.83	.77	.56
39[a]	-.39	.81	-.68	.63	-.79	.50
40	-.10	.86	.44	.81	.71	.60
41[a]	-.07	.74	-.53	.66	-.74	.48
42	-.22	.68	-.06	.71	.17	.66
43	-.44	.78	.24	.84	.68	.64
44[a]	-.01	.87	-.58	.71	-.80	.48
45[a]	-.07	.71	-.45	.66	-.65	.52
46[a]	.34	.80	-.34	.82	-.75	.52
47	.07	.84	.67	.60	.74	.53
48[a]	-.30	.79	-.63	.66	-.81	.45
49[a]	.08	.74	-.26	.76	-.62	.58
50	-.37	.74	.21	.80	.71	.56
51	-.61	.60	-.22	.82	.23	.77
52[a]	.19	.85	-.49	.75	-.79	.49

[a]Negatively stated item

TABLE 3

Item Means and Standard Deviations Rated Average, Above Average and Below Average in Departments of English

	Below Average		Average		Above Average	
Item	M	S.D.	M	S.D.	M	S.D.
1[a]	.02	.81	-.12	.87	-.80	.46
2	-.76	.56	-.11	.90	.85	.46
3	-.70	.55	-.10	.84	.59	.68
4	-.67	.65	.25	.84	.84	.45
5	-.65	.52	-.23	.69	.50	.62
6	.09	.89	.71	.60	.91	.34
7[a]	.16	.86	-.44	.72	-.82	.44
8[a]	.32	.72	-.03	.80	-.67	.52
9[a]	.28	.89	-.62	.69	-.85	.47
10[a]	.01	.94	-.44	.83	-.69	.65
11	-.37	.67	.02	.75	.48	.67
12[a]	.31	.77	.80	.80	-.69	.55
13	-.59	.60	.01	.80	.67	.56
14[a]	.05	.39	-.11	.40	-.23	.43
15	-.12	.69	.32	.69	.59	.56
16[a]	-.05	.84	-.61	.60	-.84	.39
17[a]	.16	.57	-.12	.54	-.32	.57
18	-.64	.57	-.29	.75	.50	.66
19	-.74	.52	.08	.85	.88	.38
20	-.34	.61	-.03	.69	.38	.66
21[a]	.10	.77	-.24	.79	-.65	.60
22[a]	.40	.79	-.31	.84	-.85	.44
23	-.29	.56	-.07	.61	.16	.66
24[a]	-.03	.23	-.05	.25	-.09	.30
25[a]	-.03	.64	-.10	.71	-.63	.52
26	-.26	.61	-.03	.59	-.09	.53
27[a]	-.28	.77	-.60	.68	-.74	.56
28[a]	.01	.83	-.57	.71	-.85	.42
29[a]	-.04	.85	-.69	.58	-.87	.37
30	-.64	.67	-.18	.90	.75	.60
31[a]	.04	.84	-.54	.68	-.79	.46
32	-.67	.53	-.26	.76	.48	.69
33[a]	.35	.71	-.36	.67	-.62	.58
34	-.58	.63	-.05	.84	.68	.60
35	-.11	.43	.06	.47	.27	.49
36	-.45	.55	-.07	.63	.38	.58
37	-.58	.68	.42	.79	.88	.41
38	-.18	.81	.35	.77	.82	.45
39[a]	-.29	.82	-.74	.56	-.83	.45
40	-.16	.77	.34	.80	.64	.62
41[a]	.23	.82	-.49	.70	-.81	.44
42	-.11	.38	.06	.44	.20	.48
43	-.54	.69	.35	.78	.82	.50
44[a]	-.03	.77	-.53	.68	-.85	.40
45[a]	-.05	.33	-.11	.36	-.17	.40
46[a]	.38	.68	-.31	.70	-.63	.49
47	.00	.67	.35	.63	.29	.59
48[a]	.25	.75	-.49	.67	-.77	.46
49[a]	.37	.80	.40	.78	-.81	.45
50	-.57	.65	.22	.82	.82	.47
51	-.57	.59	-.48	.64	-.02	.77
52[a]	.61	.71	-.50	.74	-.83	.44

[a]Negatively stated item

TABLE 4

Item Means and Standard Deviations Rated Average, Above Average and Below Average in Departments of Psychology

	Below Average		Average		Above Average	
Item	M	S.D.	M	S.D.	M	S.D.
1[a]	.12	.80	-.21	.79	-.74	.51
2	-.74	.59	-.06	.88	.83	.47
3	-.68	.58	-.07	.82	.61	.63
4	-.69	.63	.08	.84	.74	.55
5	-.52	.62	-.03	.75	.56	.61
6	.05	.94	.65	.68	.93	.31
7[a]	.09	.85	-.44	.73	-.80	.44
8[a]	.14	.70	-.08	.77	-.58	.60
9[a]	.39	.83	-.32	.82	-.73	.58
10[a]	.37	.84	-.22	.86	-.58	.71
11	-.32	.72	.21	.78	.70	.57
12[a]	.36	.74	-.15	.76	-.54	.64
13	-.51	.67	.12	.79	.66	.59
14[a]	.07	.70	-.28	.70	-.64	.53
15	-.14	.81	.41	.75	.64	.65
16[a]	.03	.80	-.54	.66	-.78	.44
17[a]	.23	.80	-.34	.77	-.65	.64
18	-.46	.67	-.01	.81	.63	.60
19	-.60	.60	.11	.78	.79	.46
20	-.19	.75	.15	.78	.55	.63
21[a]	.28	.79	-.15	.85	-.63	.66
22[a]	.50	.77	-.18	.85	-.83	.45
23	-.36	.66	.03	.80	.40	.73
24[a]	-.17	.62	-.44	.60	-.61	.50
25[a]	.00	.68	-.07	.76	-.67	.56
26	-.30	.62	-.07	.65	.12	.64
27[a]	-.27	.86	-.66	.67	-.79	.52
28[a]	.15	.81	-.40	.77	-.73	.53
29[a]	.05	.83	-.58	.62	-.79	.44
30	-.55	.71	.06	.87	.76	.56
31[a]	.27	.77	-.34	.73	-.68	.57
32	-.53	.58	-.10	.76	.60	.61
33[a]	.08	.75	-.39	.65	-.57	.63
34	-.44	.73	.26	.79	.81	.45
35	-.18	.53	.05	.59	.32	.57
36	-.31	.69	.14	.75	.63	.56
37	-.63	.58	.26	.80	.83	.45
38	-.17	.83	.32	.79	.76	.50
39[a]	.00	.87	-.54	.69	-.76	.50
40	-.08	.79	.44	.75	.72	.57
41[a]	.22	.76	-.39	.67	-.70	.50
42	-.11	.49	.01	.52	.23	.56
43	-.49	.74	.20	.80	.80	.53
44[a]	.16	.83	-.48	.72	-.80	.46
45[a]	-.05	.66	-.33	.64	-.51	.55
46[a]	.26	.71	-.32	.69	-.70	.51
47	.11	.69	.45	.62	.61	.55
48[a]	.18	.72	-.33	.70	-.65	.54
49[a]	.34	.68	-.02	.81	-.63	.57
50	-.42	.65	.30	.76	.76	.52
51	-.50	.64	-.23	.77	.25	.77
52[a]	.58	.66	-.36	.75	-.75	.50

[a] Negatively stated item

TABLE 5

Loadings for Each Discipline Area on the Independence and Initiative Factor[a]

	Incident	Chemistry (I)	English (I)	Psychology (I)
18.	Developed an original way of handling a research problem.	.70	.71	.67
32.	Independently planned and executed a study which made a worthwhile contribution to his field.	.71	.71	.66
36.	Learned an important research skill on his own.	.54	.62	.63
2.	This student's willingness to pursue unassigned readings was reflected by a broader than average knowledge of most topics.	.68	.70	.59
5.	Was able to master a difficult research technique in an unusually short period of time.	.51	.65	.59
3.	Consistently offered well founded and constructive criticism of other students' presentations.	.64	.61	.47
13.	Was able to consider several markedly different approaches to a research problem and view them objectively before choosing one.	.63	.62	.53
22.	Was heavily dependent on direction from faculty and appeared unable to undertake any independent investigation.	-.59	-.48	-.53
19.	When presenting a paper handled a difficult topic with considerable skill.	.54	.68	.46
30.	This student usually did more than the required work.	.55	.66	.48

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 6

Loadings for Each Discipline Area on the Conscientiousness Factor[a]

	Incident	Chemistry (II)	English (III)	Psychology (IV)
15.	Handles even the most menial assignment (e.g., paper grading) with care and responsibility.	.60	.51	.62
21.	Became distracted by non-academic, non-professional interests.	-.58	-.53	-.60
10.	Failed on one or more occasions to complete a major assignment on time.	-.55	-.70	-.57
7.	Was careless in reporting data.	-.53	-.40	-.36
24.	Exhibited carelessness with laboratory equipment.	-.53	-.03	-.35
30.	This student usually did more than the required work.	.47	.34	.57
44.	Avoided challenging courses or work.	-.28	-.28	-.47
31.	Submitted a report which was incomplete.	-.49	-.54	-.44

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 7

Loadings for Each Discipline Area on the Critical Facility Factor[a]

Incident	Chemistry (V)	English (II)	Psychology (V)
29. Repeatedly made irrelevant remarks during class or seminar discussion.	-.58	-.72	-.45
16. Talks at great length in class but exhibits little understanding of material on papers and tests.	-.51	-.68	-.50
28. Was often unable to consider new ideas objectively because of strongly held prejudices.	-.64	-.65	-.64
41. Submitted a paper or report which failed to address the assigned issues.	-.25	-.65	-.21
52. Presented ideas in a seminar, paper, or test in a poorly organized and disjointed fashion.	-.10	-.64	-.18
39. Was unwilling or unable to accept criticism.	-.64	-.54	-.60
25. Although able to criticize studies with facility was unable to suggest better alternatives.	-.43	-.30	-.57

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 8

Loadings for Each Discipline Area on the Involvement Factor[a]

	Incident	Chemistry (VI)	English (IV)	Psychology (VII)
27.	Seldom, if ever engages in informal contacts with faculty or fellow graduate students.	-.60	-.66	-.70
6.	During informal discussions with faculty this student displayed a genuine interest in and commitment to his field.	.59	.62	.50
38.	Became quickly and enthusiastically involved in a research project.	.49	.46	.37
40.	Did not hesitate to repeatedly ask questions of faculty until he fully understood an issue.	.43	.53	.41
44.	Avoided challenging courses or work.	-.43	-.39	-.28

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 9

Loadings for Each Discipline Area on the Research and Experimentation Factor[a]

	Incident	Chemistry (IV)	English (V)	Psychology (III)
45.	Conducted a data analysis which was inappropriate for the experiment as designed.	.38	.69	.68
14.	Performed an experiment without making proper checks.	.44	.55	.68
46.	Attempted to carry out poorly planned research.	.49	.23	.65
33.	Was unable to effectively apply a research technique.	.48	.22	.62
24.	Exhibited carelessness with laboratory equipment.	.29	.77	.54
12.	Showed himself to be unfamiliar with a major research tool in his field.	.60	.14	.51
8.	In conducting research this student relied too heavily on one particular research tool.	.54	.13	.42
1.	Rigidly followed a research plan when more flexibility would have been advantageous.	.53	.05	.27
17.	Was unable to formulate a testable hypothesis from a theoretical analysis.	.43	.38	.31

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 10

Loadings for Each Discipline Area on the Communication Factor[a]

	Incident	Chemistry (III)	English (II)	Psychology (II)
52.	Presented ideas in a seminar, paper, or test in a poorly organized and disjointed fashion.	-.62	-.64	-.61
9.	Displayed an inability to write competently.	-.34	-.62	-.59
37.	When this student asked a question it was always relevant and usually perceptive.	.33	.56	.59
43.	Was able to articulately defend his position and ideas.	.32	.46	.57
19.	When presenting a paper handled a difficult topic with considerable skill.	.41	.43	.55
48.	Was unprepared for a seminar.	-.64	-.51	-.39
41.	Submitted a paper or report which failed to address the assigned issues.	-.54	-.65	-.49
16.	Talks at great length in class but exhibits little understanding of material on papers and tests.	-.50	-.68	-.44
49.	Submitted a paper which merely summarized what he had read.	-.45	-.57	-.41

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 11

Loadings for Each Discipline Area on the Teaching Skills Factor[a]

Incident	Chemistry (VII)	English (VI)	Psychology (VI)
42. Stimulated great interest and enthusiasm in undergraduate courses in which he was an instructor.	.80	.78	.88
35. Showed imagination and originality in teaching a traditionally dull topic to an undergraduate class.	.80	.76	.84
23. Devoted considerable time to helping other students with problems.	.37	.40	.31

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 12

Loadings for Each Discipline Area on the Persistence Factor[a]

Incident	Chemistry (VIII)	English (VII)	Psychology (VIII)
47. Despite one or more setbacks continued to work on research until it was successfully completed.	.53	.59	.60
26. Despite discouraging advice from faculty this student pursued his interest or ideas and was successful.	.50	.66	.64

[a]Roman numerals in parentheses refer to rank order in which factor was extracted for each discipline.

TABLE 13

Means and Standard Deviations for Importance Ratings

of Critical Incidents Within Discipline Area

	Chemistry		English		Psychology			Chemistry		English		Psychology	
Item	M	S.D.	M	S.D.	M	S.D.	Item	M	S.D.	M	S.D.	M	S.D.
1	3.03	1.10	2.94	1.05	2.96	1.04	27	2.31	1.07	2.41	1.01	2.32	1.00
2	3.27	.97	3.63	.82	3.32	.87	28	3.05	1.19	3.45	1.02	3.27	.99
3	2.48	1.01	3.02	.92	2.78	.90	29	2.11	1.06	3.03	1.15	2.51	.98
4	3.54	.98	3.67	.80	3.47	.86	30	2.98	.97	2.80	1.08	3.18	.95
5	3.07	1.00	2.60	.96	2.69	.89	31	2.41	1.15	3.03	1.13	2.63	.97
6	3.29	1.05	3.35	.91	3.27	.92	32	3.41	1.06	3.37	1.02	3.54	.86
7	3.49	1.11	3.29	1.17	3.57	.94	33	3.16	1.15	2.83	1.25	2.97	1.02
8	2.69	1.08	2.71	1.14	2.65	.91	34	3.33	1.05	3.27	.91	3.32	.84
9	3.05	1.11	3.76	.90	3.32	.90	35	2.14	1.15	2.79	1.42	2.66	1.01
10	2.38	1.05	2.79	.97	2.51	.90	36	3.18	1.08	2.77	1.12	2.94	.93
11	2.66	1.16	2.73	1.08	3.03	.88	37	3.19	.98	2.97	1.11	3.47	.88
12	2.94	1/14	3.11	1.04	2.82	.99	38	3.30	1.08	3.21	.97	3.11	.91
13	3.44	1.03	3.26	1.06	3.39	.85	39	2.90	1.14	3.37	1.02	3.10	.98
14	3.28	1.18	1.44	1.19	3.33	1.05	40	2.94	1.09	3.21	1.00	3.01	.92
15	2.50	1.13	2.85	1.15	2.60	.96	41	2.63	1.23	3.43	1.05	2.89	1.02
16	2.38	1.30	3.16	1.18	2.81	1.13	42	2.08	1.11	2.76	1.44	2.54	1.06
17	3.09	1.23	2.07	1.38	3.41	.93	43	2.97	1.08	3.65	.84	3.32	.88
18	3.39	1.01	3.01	1.03	3.30	.88	44	2.87	1.20	3.25	1.18	3.04	1.02
19	2.90	.99	3.65	.89	3.21	.82	45	2.77	1.32	1.24	1.12	3.06	1.04
20	2.72	1.06	2.68	1.08	2.69	.94	46	3.15	1.25	3.03	1.30	3.24	1.04
21	2.47	1.16	2.59	1.18	2.37	1.02	47	3.38	1.16	3.08	1.19	3.35	.89
22	3.26	1.17	3.27	1.07	3.20	1.01	48	2.39	1.16	3.09	1.16	2.43	.97
23	2.06	.95	1.99	1.00	2.14	.89	49	2.34	1.16	3.41	1.09	2.64	.94
24	2.96	1.20	1.10	.75	2.53	1.06	50	3.31	1.13	3.73	.84	3.51	.84
25	2.53	1.16	2.56	1.04	2.78	.95	51	2.21	1.16	2.33	1.10	2.36	.96
26	2.66	1.23	2.59	1.21	2.75	.99	52	2.77	1.18	3.54	1.06	2.98	.96

TABLE 14

Correlations Among Mean Department Ratings of Importance

	English	Psychology
Chemistry	.27	.87
English		.42

TABLE 15

Mean Item Ratings for Items Loading Highest on Factors Emerging for All Three Disciplines[a]

Factor	Chemistry	English	Psychology
Independence and Initiative	3.14	3.14	3.16
Conscientiousness	2.76	2.69	2.97
Critical Facility	2.62	3.22	2.91
Research and Experimentation	3.01	2.26	3.00
Involvement	2.94	3.09	2.95
Communications	2.74	3.41	3.01
Teaching	2.09	2.51	2.45
Persistence	3.02	2.84	3.05
Overall Item Mean	2.86	2.94	2.97

[a]All item means for factors are based on items listed in Tables 5 through 12. The overall item mean is based on ratings for all 52 items.

APPENDIX A

PRINCIPAL COMPONENTS ... DEPTS. OF PSYCHOLOGY
VARIMAX ROTATION OF FACTORS ASSOCIATED WITH EIGENVALUES > 1.0

VARIMAX FACTORS

	1	2	3	4	5	6	7	8	COMMUNALITIES
1	-0.6833	0.0526	0.2698	-0.0153	0.4089	0.0561	-0.1774	0.2394	0.5691
2	0.5597	-0.3596	-0.0316	-0.3591	-0.0428	0.0825	0.1140	-0.0366	0.6337
3	0.6564	-0.4470	-0.0235	-0.1710	-0.0944	0.1790	0.1635	0.0953	0.5220
4	0.6017	-0.4397	-0.2559	-0.3242	-0.1203	0.0256	0.0370	-0.0022	0.5461
5	0.5397	-0.1591	-0.2581	-0.1077	-0.0679	0.1183	-0.0802	0.0860	0.4979
6	0.3062	-0.3663	0.0337	-0.3562	-0.1437	-0.0297	0.5317	0.0691	0.5255
7	-0.1056	0.3673	0.4255	0.3563	0.1176	-0.0592	-0.1315	-0.0823	0.6510
8	-0.3957	0.0123	0.4200	0.0012	0.3442	0.0057	-0.1528	0.1701	0.5039
9	-0.2047	0.5562	0.2112	0.1264	0.0594	-0.0376	-0.1077	0.1112	0.4397
10	-0.1108	0.1821	0.2255	0.5726	0.1947	-0.0040	0.0549	-0.1066	0.4765
11	0.4966	-0.3530	-0.0945	-0.1410	-0.0359	0.0816	0.0737	0.1350	0.4398
12	-0.3034	0.1351	0.6363	0.2174	0.0910	-0.1544	-0.0292	0.1472	0.4957
13	0.5299	-0.2633	-0.1656	-0.0606	-0.3253	0.0161	0.0269	0.1205	0.5139
14	-0.1944	0.1697	0.6963	0.2126	0.0569	-0.0511	0.0335	-0.0612	0.5839
15	0.0799	-0.1600	-0.1925	-0.6166	-0.0664	0.0582	0.0924	0.1275	0.6454
16	-0.0607	0.4410	0.2808	0.2135	0.4967	-0.0073	0.0585	-0.0539	0.5802
17	-0.7476	0.4019	0.3098	-0.0434	0.2661	0.0488	-0.0896	-0.1439	0.6735
18	0.6591	-0.1816	-0.1292	-0.0019	-0.2268	0.1449	0.0280	0.1056	0.5309
19	0.6032	-0.5656	-0.1627	-0.1905	-0.1067	0.1703	0.1125	0.0475	0.6314
20	0.5708	-0.3657	-0.0228	-0.1532	-0.0726	0.0145	0.2554	0.2076	[illegible]
21	-0.1616	0.3576	0.1945	0.6038	0.2145	0.0103	-0.0609	0.1254	0.5610
22	-0.5304	0.3543	0.2132	0.1390	0.2046	-0.0431	-0.1138	0.0420	0.5299
23	0.1939	-0.1268	0.0190	-0.1692	0.0417	0.3109	0.3024	0.0803	0.3932
24	0.5018	0.0652	0.5389	0.3495	0.1774	-0.0345	-0.0742	0.0036	0.4552
25	-0.2258	0.1676	0.1691	0.2269	0.5576	-0.0522	0.1097	0.0115	0.4776
26	0.3173	-0.0461	0.0156	-0.0238	0.0125	0.1353	-0.0306	0.6433	0.5665
27	-0.0349	0.1541	0.1911	0.0193	0.1365	-0.0814	-0.7033	0.0473	0.5629
28	-0.1628	0.2352	0.2051	0.1453	0.6410	-0.0299	-0.1737	-0.0162	0.5916
29	-0.0230	0.6695	0.2562	0.1804	0.4946	-0.0310	-0.1314	-0.1439	0.5654
30	0.4330	-0.2075	-0.0552	-0.5715	-0.0350	0.0955	0.1994	0.0517	0.6673
31	-0.5959	0.3635	0.4524	0.4292	0.1664	-0.0141	-0.0195	-0.0249	0.6679
32	0.6502	-0.2326	-0.2355	-0.1158	-0.0775	0.1608	-0.0133	0.1621	0.5752
33	-0.1621	0.1358	0.6160	0.0171	0.1683	0.0309	-0.1203	-0.1460	0.5060
34	0.5516	-0.3271	-0.2758	-0.2566	-0.0617	-0.0062	0.1447	-0.0193	0.5548
35	0.2293	-0.1410	-0.0169	-0.0744	-0.0703	0.6465	0.0203	0.0340	0.7042
36	0.5331	-0.0779	-0.2236	-0.7004	-0.0472	[illegible]	0.0810	0.2265	0.5947
37	0.4035	-0.5510	-0.1374	-0.2156	-0.2275	0.1245	0.0885	0.3556	0.6493
38	0.4355	-0.0159	-0.1575	-0.3661	-0.0674	0.1245	0.3654	0.1214	0.4772
39	-0.0532	0.1539	0.1949	0.2504	0.5385	-0.0514	-0.2956	-0.1131	0.5899
40	0.2523	-0.2518	-0.1166	-0.1776	-0.0186	0.0192	0.4128	0.2717	0.4171
41	-0.0743	0.4839	0.4725	0.2124	0.2357	0.3093	-0.1187	-0.0470	0.5721
42	0.1878	-0.0527	-0.0515	-0.0433	-0.0367	0.8010	0.0793	0.0371	[illegible]
43	0.4153	-0.5565	-0.1365	-0.0196	-0.1116	0.3707	0.2135	-0.2152	[illegible]
44	-0.2123	0.2137	0.2397	0.4722	[illegible]	-0.0327	-0.2751	-0.0715	[illegible]
45	-0.1292	0.1563	0.6323	0.0725	0.1306	-0.0399	-0.0603	-0.0764	0.6450
46	-0.2775	0.2537	0.5540	0.1486	0.1590	-0.0626	-0.0630	-0.0510	0.6269
47	0.2283	0.0137	-0.2513	-0.1739	-0.1226	-0.0042	0.1540	0.5965	0.5359
48	-0.0509	0.3850	0.3811	0.4454	0.1758	-0.0352	-0.0206	-0.0885	0.5349
49	-0.3535	0.4119	0.2906	0.1333	0.1549	-0.0397	-0.0176	0.1021	0.4355
50	0.4772	-0.5234	-0.2334	-0.1677	-0.1337	0.0296	0.0627	0.0399	0.5775
51	0.4305	-0.0126	0.0609	-0.4808	0.0811	0.2221	0.1692	0.1026	0.5227
52	-0.1946	0.6056	0.3390	0.3078	0.1799	-0.0570	-0.1141	-0.0622	0.6625
********	6.8904	4.9761	4.6784	3.8623	2.7544	1.8939	1.8229	1.3735	28.2519

PRINCIPAL COMPONENTS ON DEPTS. OF ENGLISH
VARIMAX ROTATION OF FACTORS ASSOCIATED WITH EIGENVALUES > 1.0

VARIMAX FACTORS

	1	2	3	4	5	6	7	COMMUNALITIES
1	-0.3985	0.4034	-0.1[illegible]05	-0.0374	0.0538	-0.1440	0.3309	0.4[illegible]
2	0.6930	-0.2333	-0.1556	0.1704	0.01[illegible]6	0.0750	-0.0619	0.5[illegible]
3	0.6[illegible]44	-0.25[illegible]	+0.0934	0.2471	0.0[illegible]64	0.1301	0.0228	0.5317
4	0.5340	-0.4401	-0.7198	0.0[illegible]73	-0.0352	-0.3526	0.0773	0.59[illegible]6
5	0.6532	-0.2432	-0.1139	-0.0159	-0.1024	0.0736	-0.0232	0.5154
6	0.2626	-0.7549	-0.2210	0.6231	-0.0774	0.0644	0.1257	0.[illegible]47
7	-0.2712	0.4[illegible]24	0.[illegible]12	-0.1[illegible]	0.11[illegible]	-0.[illegible]19	-0.[illegible]23	0.4[illegible]72
8	-0.4[illegible]	0.4218	0.0[illegible]5	0.[illegible]17	0.1265	-0.1404	0.3016	[illegible]
9	-0.27[illegible]	0.574[illegible]	0.1656	-0.0741	0.0323	-0.0037	-0.0934	0.5[illegible]76
10	-0.13[illegible]	0.2134	0.5989	-0.0107	0.0053	-0.0755	0.0117	0.[illegible]75
11	0.554[illegible]	-0.2[illegible]13	-0.0762	0.0412	-0.0514	0.1504	0.0419	0.3[illegible]8
12	-0.3435	0.4774	0.2215	-0.1151	0.1374	0.0315	0.1096	0.4445
13	0.6234	-0.3781	[illegible]74	0.1450	-0.0662	0.0572	-0.0225	0.5571
14	-0.15[illegible]	0.1[illegible]0	[illegible]1[illegible]8	0.[illegible]24	0.554[illegible]	-0.1559	0.0087	0.4274
15	0.2[illegible]43	-0.22[illegible]3	-0.5[illegible]	0.1[illegible]37	-0.0460	0.1432	0.1820	0.40[illegible]7
16	-0.1035	0.6774	0.1807	-0.0312	0.0668	-0.1706	-0.0070	0.5359
17	-0.3126	0.2[illegible]37	+0.0240	0.0376	0.3733	-0.0958	0.0530	0.3418
18	0.7[illegible]1	-0.1642	-0.[illegible]93	0.0166	-0.3957	0.1323	-0.0186	0.5[illegible]6
19	0.6753	-0.4[illegible]8	-0.1569	0.1655	-0.0534	0.0455	0.0293	0.7[illegible]
20	0.5605	-0.0[illegible]40	-0.0329	0.11[illegible]7	-0.0500	0.24[illegible]	0.1264	0.41[illegible]4
21	-0.1634	0.3326	0.5316	-0.0[illegible]57	0.1149	-0.0252	0.1419	0.4[illegible]
22	-0.4813	0.4447	0.0[illegible]9	-0.1170	0.0326	-0.0605	0.0731	0.5[illegible]9
23	0.3[illegible]72	0.[illegible]20	-0.0703	0.1856	0.14[illegible]9	0.4031	0.1585	0.3775
24	-0.0175	0.0203	0.0258	-0.1053	0.7660	0.0742	0.0277	0.6[illegible]4
25	-0.2[illegible]8	0.2[illegible]	0.1392	-0.1[illegible]07	0.1854	-0.2387	0.3543	0.3[illegible]7
26	0.1525	-0.1115	0.0135	-0.0[illegible]32	0.0696	0.2463	0.6630	0.5[illegible]6
27	-0.1214	0.1[illegible]14	-0.0090	-0.6597	0.0536	-0.1264	0.1281	0.[illegible]162
28	-0.0[illegible]78	0.6[illegible]32	0.[illegible]404	-0.28[illegible]9	0.0537	-0.1699	0.0868	0.55[illegible]1
29	-0.1153	0.71[illegible]2	0.12[illegible]9	-0.0770	0.0727	-0.1160	-0.0793	0.5726
30	0.[illegible]14	-0.14[illegible]	-0.[illegible]1	0.2351	-0.0561	0.0626	-0.0641	0.6[illegible]9
31	-0.11[illegible]4	0.4743	0.5393	-0.1[illegible]33	0.0673	-0.0694	0.0264	0.5[illegible]4
32	0.7112	-0.1777	-0.1[illegible]37	0.0[illegible]17	-0.1231	0.0587	0.0392	0.5774
33	-0.2[illegible]	0.5674	0.1530	-0.1275	0.2229	-0.0127	-0.1163	0.505[illegible]
34	0.6544	-0.3075	-0.1660	0.1540	-0.1086	0.0576	0.0254	0.5[illegible]
35	0.22[illegible]	-0.1534	-0.0605	0.1013	-0.0961	0.7631	0.0965	0.[illegible]75
36	0.52[illegible]	-0.1530	-0.[illegible]11	0.0376	-0.1493	0.7339	0.1168	0.51[illegible]
37	0.5[illegible]47	-0.5[illegible]7	-0.1269	0.1999	-0.0155	0.0269	0.1114	0.5[illegible]
38	0.4[illegible]1	-0.2741	-0.2394	0.4612	-0.1065	0.0691	0.0945	0.5[illegible]33
39	0.0137	0.5438	0.0459	-0.3895	0.0713	-0.1580	-0.0582	0.[illegible]31
40	0.3748	-0.1425	-0.1023	0.5276	-0.0467	0.0445	0.1433	0.4[illegible]11
41	-0.2585	0.6477	0.2012	-0.1275	0.1165	-0.0662	-0.0387	0.5[illegible]25
42	0.2041	-0.1403	-0.0975	0.6[illegible]8	0.0026	0.7757	0.0578	0.6[illegible]9
43	0.5535	-0.4606	-0.0736	0.2244	0.0402	-0.0008	0.0876	0.5[illegible]36
44	-0.2665	0.3927	0.2811	-0.3902	0.0876	-0.0625	0.0450	0.4700
45	-0.0527	0.1157	0.0098	-0.0676	0.6851	0.0358	-0.0612	0.4953
46	-0.3764	0.5673	0.2259	-0.1007	0.2251	-0.0199	0.0168	0.5775
47	0.1329	-0.1729	-0.0218	0.2339	-0.1921	0.0843	0.5942	0.5027
48	-0.3003	0.5099	0.3456	-0.2115	0.1394	-0.0167	-0.0491	0.5365
49	-0.3840	0.5707	0.0766	-0.1462	0.0817	-0.0975	-0.0349	0.5177
50	0.5912	-0.4776	-0.0842	0.1542	-0.0186	0.0063	0.0959	0.6199
51	0.5420	0.2065	-0.2237	0.1365	-0.0358	0.1015	0.0392	0.418[illegible]
52	-0.4076	0.6418	0.2395	-0.1202	0.0870	0.0128	-0.0826	0.6644
********	9.1656	8.0909	2.5796	2.4892	1.9724	1.9455	1.4371	27.6834

PRINCIPAL COMPONENT [illegible] DEPTS. OF CHEMISTRY
VARIMAX ROTATION OF FACTORS ASSOCIATED WITH EIGENVALUES > 1.0

VARIMAX FACTORS

	1	2	3	4	5	6	7	8	COMMUNALITIES
1	-0.4546	[illegible]	-0.3140	0.3353	0.2147	-0.0737	0.0450	0.0643	[illegible]
2	[illegible]	[illegible]	-0.1649	-0.1341	-0.0550	0.1476	0.0550	-0.0137	[illegible]
3	0.5473	[illegible]	-0.1416	-0.1256	-0.1125	0.1435	0.1578	-0.0019	[illegible]
4	0.4934	-0.4631	[illegible]	-0.2329	-0.1378	0.0418	0.1057	-0.0467	[illegible]
5	[illegible]	-0.2174	-0.1359	-0.2851	-0.0411	0.0239	0.0466	0.2014	0.4442
6	0.3359	-0.2470	-0.0745	-0.1268	-0.0218	0.5926	0.0677	0.0403	0.5616
7	-0.0275	0.5349	0.1465	0.3295	0.1617	-0.0016	-0.1061	-0.0246	0.4545
8	-0.2381	0.0472	0.0005	0.5423	0.2451	-0.2211	0.0336	0.0625	0.4723
9	-0.1925	0.2222	0.3416	0.1676	0.1323	-0.0112	-0.2130	0.3262	0.4019
10	-0.2515	0.5465	0.2788	0.0574	0.1373	-0.2687	0.1277	0.0166	0.4490
11	0.5317	0.3378	-0.2335	-0.1068	-0.0971	0.0847	0.1517	0.0478	[illegible]
12	-0.2147	0.1151	0.2355	0.5972	0.3388	-0.1886	-0.0506	-0.0237	0.5145
13	0.5341	-0.1470	-0.0980	-0.3587	-0.0554	0.0452	0.0590	-0.0725	0.5879
14	-0.1449	0.4546	0.2627	0.4449	0.1336	0.0973	-0.0574	-0.0748	0.5674
15	[illegible]	-0.6020	-0.1448	0.0272	-0.1048	0.1444	0.2584	0.0839	0.5121
16	-0.1412	0.1464	0.4930	0.0531	0.5101	0.0085	0.0818	-0.0555	0.5516
17	-0.3296	0.1011	0.2628	0.4304	0.0819	-0.1161	-0.0658	0.0241	0.4071
18	0.7048	-0.0341	-0.0569	-0.2117	-0.1606	0.0868	0.0094	0.1828	[illegible]
19	0.5374	-0.1720	-0.4063	-0.1358	0.0019	0.1003	0.2207	-0.1168	0.5745
20	0.5644	[illegible]	-0.0679	0.0207	-0.1352	0.1312	0.1155	0.1785	0.4174
21	-0.2567	0.5750	0.0679	0.0789	0.1356	-0.1769	0.1728	-0.0926	0.4129
22	-0.5843	0.1423	0.1262	0.4108	0.1881	-0.1297	-0.0098	-0.0358	0.5147
23	0.4466	0.0177	0.0186	0.0732	-0.1559	0.2366	0.3668	0.0444	0.4274
24	0.0360	0.5296	0.7088	0.2854	0.1613	-0.0021	-0.2570	-0.2048	0.5411
25	-0.3157	0.1424	0.2213	0.1737	0.4318	0.0685	0.0837	-0.0663	0.4017
26	0.3457	-0.1245	0.0778	-0.0033	-0.0168	-0.0347	0.1304	0.5001	0.4478
27	-0.0441	-0.0959	0.1709	0.2233	0.1979	-0.4016	-0.2097	-0.0102	0.5331
28	-0.1641	0.1390	0.0622	0.2407	0.6368	-0.1145	-0.0694	0.1437	0.5903
29	-0.0437	0.1772	0.4354	0.0868	0.5792	-0.0505	0.0039	-0.1122	0.5617
30	0.5532	-0.4651	-0.0691	0.0004	-0.0336	0.2004	0.0473	0.1410	0.5406
31	-0.2442	0.4321	0.3767	0.1117	0.2195	-0.0801	0.0085	0.1287	0.5245
32	0.7360	-0.1713	-0.0324	-0.1890	-0.0368	0.0007	0.0418	0.1321	0.5149
33	-0.1330	0.2812	0.2570	0.4798	0.0988	-0.1399	-0.0428	-0.3111	0.5441
34	0.5772	-0.2347	-0.1920	-0.2860	0.0656	0.2026	0.0744	0.0345	0.5476
35	0.2745	-0.0137	-0.0529	-0.0337	-0.0213	0.0797	0.8013	0.0134	0.7233
36	0.5373	-0.0558	-0.1978	-0.2020	-0.0489	0.1442	0.0842	0.2500	0.4672
37	0.5209	-0.2840	-0.3319	-0.1996	-0.1186	0.0227	0.1145	-0.1189	0.5593
38	0.4122	-0.3502	0.0536	-0.1697	-0.0357	0.4863	-0.0645	0.1403	0.5859
39	-0.0764	0.2128	0.0800	0.1099	0.6381	-0.2569	-0.1609	-0.0400	0.5592
40	0.3395	-0.1882	-0.2077	-0.0323	-0.0597	0.4337	0.1739	0.0254	0.4027
41	-0.1450	0.2538	0.5400	0.2125	0.2537	-0.1007	0.0053	-0.0199	0.4972
42	0.2339	-0.1133	-0.0150	-0.0164	-0.0007	0.0768	0.8008	0.0094	0.7162
43	0.5180	-0.1415	-0.3151	-0.1357	-0.0233	0.1011	0.1672	-0.1581	0.4427
44	-0.2539	0.2784	0.3246	0.0534	0.1309	-0.4283	0.0156	-0.0458	0.4531
45	-0.1534	0.1146	0.4292	0.3798	0.2301	0.0147	0.0966	-0.1933	0.4649
46	-0.2581	0.4389	0.2691	0.4875	0.1621	0.0380	-0.0098	-0.0965	0.6044
47	0.2158	-0.2157	-0.2564	-0.1577	-0.0672	0.3047	-0.0146	0.5311	0.5543
48	-0.0947	0.2286	0.6399	0.0402	0.0491	-0.2165	-0.0415	-0.0760	0.5311
49	-0.3160	0.0164	0.4490	0.2644	0.1930	-0.0651	0.0207	-0.0630	0.4175
50	0.5482	-0.1321	-0.3659	-0.2579	-0.0285	0.0196	0.1529	-0.0277	0.5437
51	0.5412	-0.3533	0.0686	0.1421	-0.0737	0.1855	0.0404	0.0595	0.4881
52	-0.2910	0.2632	0.6171	0.1288	0.1006	-0.1493	-0.1248	0.0590	0.6028
********	8.2832	4.1131	3.7508	3.4115	2.3598	2.1427	2.0384	1.2570	27.3624

APPENDIX B

FACULTY RATING BOOKLET

The members of the Graduate Record Examinations Board, which formulates policies guiding the Graduate Record Examinations, have for some time been aware that research findings on the validity of our examinations are inadequate, being few and not representative. We would like to see that more studies are accomplished, but in attempting to do so encounter problems arising from both the scarcity of suitable data and inadequate criteria of graduate performance. Hence we are conducting a study of complex regression systems, both Bayesian and least squares, which will allow us to pool the experience of many graduate departments in a way not feasible with existing methods. We have also developed plans for the very crucial criterion research which is needed in order to best relate the Examinations to graduate school performance. We are therefore requesting your participation in an attempt to determine the importance and frequency of occurrence of various kinds of observations that might be made with respect to a student's performance. We would like to use data reflecting your experience and can do so based on your responses to the items in this booklet. The need for better research information in graduate admissions is urgent and this study may in part help us to provide it.

You will notice that this booklet is composed of four sections, each utilizing the same list of fifty-two observations. In each of the first three parts you are asked to use the list to describe the performance of a graduate student with whom you have had contact in the recent past. In choosing the students to describe we ask that you choose one student whom you considered to be above average, one average student, and one below average student. For each student check the box labeled OB if you made the observation described. If you made an observation opposite to that described, check the box labeled NEG (if both the observation and its opposite occurred, you may check both of these categories). If you had no opportunity to make the observation described or its opposite or if the item is not applicable to your field, leave the item blank.

In the final section of this booklet you are asked to rate each observation in terms of what you consider to be its importance for your discipline. If you think that there are additional observations which are important for your field and should have been included on our list, you may describe these on the final page of the booklet. You may also use this page to give us any comments you may have regarding this study.

Your efforts to provide us with data based on your experience are sincerely appreciated and we hope that the results of our program of study will be of some use to your institution, and graduate education in general, in the near future.

Faculty Member Name _____

Department _____

Section I

For this first section please use the list of observations below to describe the performance of a specific graduate student whom you consider to be <u>below average</u> relative to other graduate students you have encountered.

Consider each observation in terms of your experience with the student being described. If you made an observation such as the one described, check the box labeled OB. If you made an observation opposite to that described, check the box marked NEG, and if both the observation and its opposite were made, check both boxes. If the observation is not applicable to your field, or if you had no opportunity to make an observation such as the one described, leave the item blank.

Student Name* _____

Year of Graduate Study (check one):

1st ____	3rd ____	5th or more ____
2nd ____	4th ____	Graduated ____

OB	NEG		
☐	☐	1.	Rigidly followed a research plan when more flexibility would have been advantageous.
☐	☐	2.	This student's willingness to pursue unassigned readings was reflected by a broader than average knowledge of most topics.
☐	☐	3.	Consistently offered well founded and constructive criticism of other students' presentations.
☐	☐	4.	When making a judgment or reaching conclusions, this student supported his position with carefully documented research.
☐	☐	5.	Was able to master a difficult research technique in an unusually short period of time.
☐	☐	6.	During informal discussions with faculty this student displayed a genuine interest in and committment to his field.
☐	☐	7.	Was careless in reporting data.
☐	☐	8.	In conducting research this student relied too heavily on one particular research tool.

*If for any reason you wish to preserve the anonymity of the ratee, you may leave this blank.

OB	NEG		
☐	☐	9.	Displayed an inability to write competently.
☐	☐	10.	Failed on one or more occasions to complete a major assignment on time.
☐	☐	11.	In writing a report this student synthesized material from two independent fields.
☐	☐	12.	Showed himself to be unfamiliar with a major research tool in his field.
☐	☐	13.	Was able to consider several markedly different approaches to a research problem and view them objectively before choosing one.
☐	☐	14.	Performed an experiment without making proper checks.
☐	☐	15.	Handles even the most menial assignment (e.g., paper grading) with care and responsibility.
☐	☐	16.	Talks at great length in class but exhibits little understanding of material on papers and tests.
☐	☐	17.	Was unable to formulate a testable hypothesis from a theoretical analysis.
☐	☐	18.	Developed an original way of handling a research problem.
☐	☐	19.	When presenting a paper handled a difficult topic with considerable skill.
☐	☐	20.	Became more proficient in a useful outside field under his own initiative.
☐	☐	21.	Became distracted by non-academic, non-professional interests.
☐	☐	22.	Was heavily dependent on direction from faculty and appeared unable to undertake any independent investigation.
☐	☐	23.	Devoted considerable time to helping other students with problems.
☐	☐	24.	Exhibited carelessness with laboratory equipment.
☐	☐	25.	Although able to criticize studies with facility was unable to suggest better alternatives.
☐	☐	26.	Despite discouraging advice from faculty this student pursued his interest or ideas and was successful.
☐	☐	27.	Seldom, if ever engages in informal contacts with faculty or fellow graduate students.

OB	NEG		
☐	☐	28.	Was often unable to consider new ideas objectively because of strongly held prejudices.
☐	☐	29.	Repeatedly made irrelevant remarks during class or seminar discussion.
☐	☐	30.	This student usually did more than the required work.
☐	☐	31.	Submitted a report which was imcomplete.
☐	☐	32.	Independently planned and executed a study which made a worthwhile contribution to his field.
☐	☐	33.	Was unable to effectively apply a research technique.
☐	☐	34.	This student displayed a familiarity with the latest developments in his field.
☐	☐	35.	Showed imagination and originality in teaching a traditionally dull topic to an undergraduate class.
☐	☐	36.	Learned an important research skill on his own.
☐	☐	37.	When this student asked a question it was always relevant and usually perceptive.
☐	☐	38.	Became quickly and enthusiastically involved in a research project.
☐	☐	39.	Was unwilling or unable to accept criticism.
☐	☐	40.	Did not hesitate to repeatedly ask questions of faculty until he fully understood an issue.
☐	☐	41.	Submitted a paper or report which failed to address the assigned issues.
☐	☐	42.	Stimulated great interest and enthusiasm in undergraduate courses in which he was an instructor.
☐	☐	43.	Was able to articulately defend his position and ideas.
☐	☐	44.	Avoided challenging courses or work.
☐	☐	45.	Conducted a data analysis which was inappropriate for the experiment as designed.
☐	☐	46.	Attempted to carry out poorly planned research.
☐	☐	47.	Despite one or more setbacks continued to work on research until it was successfully completed.
☐	☐	48.	Was unprepared for a seminar.

OB	NFG		
☐	☐	49.	Submitted a paper which merely summarized what he had read.
☐	☐	50.	Showed an ability to examine carefully an author's premises and frame of reference before accepting conclusions.
☐	☐	51.	Asked for more work when none was assigned.
☐	☐	52.	Presented ideas in a seminar, paper, or test in a poorly organized and disjointed fashion.

Section II

For this second section please use the list as you did in Section I but this time for a specific student whom you consider to be about <u>average</u> relative to other students whom you have encountered.

Student Name* _____

Year of Graduate Study (check one):

1st ____	3rd ____	5th or more ____
2nd ____	4th ____	Graduated ____

OB	NEG		
☐	☐	1.	Rigidly followed a research plan when more flexibility would have been advantageous.
☐	☐	2.	This student's willingness to pursue unassigned readings was reflected by a broader than average knowledge of most topics.
☐	☐	3.	Consistently offered well founded and constructive criticism of other students' presentations.
☐	☐	4.	When making a judgment or reaching conclusions, this student supported his position with carefully documented research.
☐	☐	5.	Was able to master a difficult research technique in an unusually short period of time.
☐	☐	6.	During informal discussions with faculty this student displayed a genuine interest in and committment to his field.
☐	☐	7.	Was careless in reporting data.
☐	☐	8.	In conducting research this student relied too heavily on one particular research tool.

*If for any reason you wish to preserve the anonymity of the ratee, you may leave this blank.

OB	NE		
☐	☐	9.	Displayed an inability to write competently.
☐	☐	10.	Failed on one or more occasions to complete a major assignment on time.
☐	☐	11.	In writing a report this student synthesized material from two independent fields.
☐	☐	12.	Showed himself to be unfamiliar with a major research tool in his field.
☐	☐	13.	Was able to consider several markedly different approaches to a research problem and view them objectively before choosing one.
☐	☐	14.	Performed an experiment without making proper checks.
☐	☐	15.	Handles even the most menial assignment (e.g., paper grading) with care and responsibility.
☐	☐	16.	Talks at great length in class but exhibits little understanding of material on papers and tests.
☐	☐	17.	Was unable to formulate a testable hypothesis from a theoretical analysis.
☐	☐	18.	Developed an original way of handling a research problem.
☐	☐	19.	When presenting a paper handled a difficult topic with considerable skill.
☐	☐	20.	Became more proficient in a useful outside field under his own initiative.
☐	☐	21.	Became distracted by non-academic, non-professional interests.
☐	☐	22.	Was heavily dependent on direction from faculty and appeared unable to undertake any independent investigation.
☐	☐	23.	Devoted considerable time to helping other students with problems.
☐	☐	24.	Exhibited carelessness with laboratory equipment.
☐	☐	25.	Although able to criticize studies with facility was unable to suggest better alternatives.
☐	☐	26.	Despite discouraging advice from faculty this student pursued his interest or ideas and was successful.
☐	☐	27.	Seldom, if ever engages in informal contacts with faculty or fellow graduate students.

DB	NEG		
☐	☐	28.	Was often unable to consider new ideas objectively because of strongly held prejudices.
☐	☐	29.	Repeatedly made irrelevant remarks during class or seminar discussion.
☐	☐	30.	This student usually did more than the required work.
☐	☐	31.	Submitted a report which was imcomplete.
☐	☐	32.	Independently planned and executed a study which made a worthwhile contribution to his field.
☐	☐	33.	Was unable to effectively apply a research technique.
☐	☐	34.	This student displayed a familiarity with the latest developments in his field.
☐	☐	35.	Showed imagination and originality in teaching a traditionally dull topic to an undergraduate class.
☐	☐	36.	Learned an important research skill on his own.
☐	☐	37.	When this student asked a question it was always relevant and usually perceptive.
☐	☐	38.	Became quickly and enthusiastically involved in a research project.
☐	☐	39.	Was unwilling or unable to accept criticism.
☐	☐	40.	Did not hesitate to repeatedly ask questions of faculty until he fully understood an issue.
☐	☐	41.	Submitted a paper or report which failed to address the assigned issues.
☐	☐	42.	Stimulated great interest and enthusiasm in undergraduate courses in which he was an instructor.
☐	☐	43.	Was able to articulately defend his position and ideas.
☐	☐	44.	Avoided challenging courses or work.
☐	☐	45.	Conducted a data analysis which was inappropriate for the experiment as designed.
☐	☐	46.	Attempted to carry out poorly planned research.
☐	☐	47.	Despite one or more setbacks continued to work on research until it was successfully completed.
☐	☐	48.	Was unprepared for a seminar.

OB	NEG		
☐	☐	49.	Submitted a paper which merely summarized what he had read.
☐	☐	50.	Showed an ability to examine carefully an author's premises and frame of reference before accepting conclusions.
☐	☐	51.	Asked for more work when none was assigned.
☐	☐	52.	Presented ideas in a seminar, paper, or test in a poorly organized and disjointed fashion.

Section III

For this third section please use the list as you did in Section I but this time for a specific student whom you consider to be above average relative to other students whom you have encountered.

Student Name* _____

Year of Graduate Study (check one):

1st _____	3rd _____	5th or more _____
2nd _____	4th _____	Graduated _____

OR	NEG		
☐	☐	1.	Rigidly followed a research plan when more flexibility would have been advantageous.
☐	☐	2.	This student's willingness to pursue unassigned readings was reflected by a broader than average knowledge of most topics.
☐	☐	3.	Consistently offered well founded and constructive criticism of other students' presentations.
☐	☐	4.	When making a judgment or reaching conclusions, this student supported his position with carefully documented research.
☐	☐	5.	Was able to master a difficult research technique in an unusually short period of time.
☐	☐	6.	During informal discussions with faculty this student displayed a genuine interest in and committment to his field.
☐	☐	7.	Was careless in reporting data.
☐	☐	8.	In conducting research this student relied too heavily on one particular research tool.

*If for any reason you wish to preserve the anonymity of the ratee, you may leave this blank.

OB	NEG		
☐	☐	9.	Displayed an inability to write competently.
☐	☐	10.	Failed on one or more occasions to complete a major assignment on time.
☐	☐	11.	In writing a report this student synthesized material from two independent fields.
☐	☐	12.	Showed himself to be unfamiliar with a major research tool in his field.
☐	☐	13.	Was able to consider several markedly different approaches to a research problem and view them objectively before choosing one.
☐	☐	14.	Performed an experiment without making proper checks.
☐	☐	15.	Handles even the most menial assignment (e.g., paper grading) with care and responsibility.
☐	☐	16.	Talks at great length in class but exhibits little understanding of material on papers and tests.
☐	☐	17.	Was unable to formulate a testable hypothesis from a theoretical analysis.
☐	☐	18.	Developed an original way of handling a research problem.
☐	☐	19.	When presenting a paper handled a difficult topic with considerable skill.
☐	☐	20.	Became more proficient in a useful outside field under his own initiative.
☐	☐	21.	Became distracted by non-academic, non-professional interests.
☐	☐	22.	Was heavily dependent on direction from faculty and appeared unable to undertake any independent investigation.
☐	☐	23.	Devoted considerable time to helping other students with problems.
☐	☐	24.	Exhibited carelessness with laboratory equipment.
☐	☐	25.	Although able to criticize studies with facility was unable to suggest better alternatives.
☐	☐	26.	Despite discouraging advice from faculty this student pursued his interest or ideas and was successful.
☐	☐	27.	Seldom, if ever engages in informal contacts with faculty or fellow graduate students.

OB	NEG		
☐	☐	28.	Was often unable to consider new ideas objectively because of strongly held prejudices.
☐	☐	29.	Repeatedly made irrelevant remarks during class or seminar discussion.
☐	☐	30.	This student usually did more than the required work.
☐	☐	31.	Submitted a report which was imcomplete.
☐	☐	32.	Independently planned and executed a study which made a worthwhile contribution to his field.
☐	☐	33.	Was unable to effectively apply a research technique.
☐	☐	34.	This student displayed a familiarity with the latest developments in his field.
☐	☐	35.	Showed imagination and originality in teaching a traditionally dull topic to an undergraduate class.
☐	☐	36.	Learned an important research skill on his own.
☐	☐	37.	When this student asked a question it was always relevant and usually perceptive.
☐	☐	38.	Became quickly and enthusiastically involved in a research project.
☐	☐	39.	Was unwilling or unable to accept criticism.
☐	☐	40.	Did not hesitate to repeatedly ask questions of faculty until he fully understood an issue.
☐	☐	41.	Submitted a paper or report which failed to address the assigned issues.
☐	☐	42.	Stimulated great interest and enthusiasm in undergraduate courses in which he was an instructor.
☐	☐	43.	Was able to articulately defend his position and ideas.
☐	☐	44.	Avoided challenging courses or work.
☐	☐	45.	Conducted a data analysis which was inappropriate for the experiment as designed.
☐	☐	46.	Attempted to carry out poorly planned research.
☐	☐	47.	Despite one or more setbacks continued to work on research until it was successfully completed.
☐	☐	48.	Was unprepared for a seminar.

OB	NEG		
☐	☐	49.	Submitted a paper which merely summarized what he had read.
☐	☐	50.	Showed an ability to examine carefully an author's premises and frame of reference before accepting conclusions.
☐	☐	51.	Asked for more work when none was assigned.
☐	☐	52.	Presented ideas in a seminar, paper, or test in a poorly organized and disjointed fashion.

Section IV

On this final listing of observations you are asked to consider each carefully in terms of its importance for your particular discipline and check the number beside it which you think is most appropriate, where:

4 = an example of an instance which is extremely important for performance in your field;

3 = an example of an instance which has moderate importance for performance in your field;

2 = an example of an instance which, though not completely irrelevant, carries little real importance for performance in your field; and

1 = an example of an instance which has no importance at all in your field and/or is totally irrelevant to it.

On the last page of this booklet you can, if you wish, describe observations which you think are important for performance in your field, but which were not included in the list. You may also feel free to make any comments you have concerning this study.

4	3	2	1	
☐	☐	☐	☐	1. Rigidly followed a research plan when more flexibility would have been advantageous.
☐	☐	☐	☐	2. This student's willingness to pursue unassigned readings was reflected by a broader than average knowledge of most topics.
☐	☐	☐	☐	3. Consistently offered well founded and constructive criticism of other students' presentations.
☐	☐	☐	☐	4. When making a judgment or reaching conclusions, this student supported his position with carefully documented research.
☐	☐	☐	☐	5. Was able to master a difficult research technique in an unusually short period of time.
☐	☐	☐	☐	6. During informal discussions with faculty this student displayed a genuine interest in and committment to his field.
☐	☐	☐	☐	7. Was careless in reporting data.
☐	☐	☐	☐	8. In conducting research this student relied too heavily on one particular research tool.

4	3	2	1		
☐	☐	☐	☐	9.	Displayed an inability to write competently.
☐	☐	☐	☐	10.	Failed on one or more occasions to complete a major assignment on time.
☐	☐	☐	☐	11.	In writing a report this student synthesized material from two independent fields.
☐	☐	☐	☐	12.	Showed himself to be unfamiliar with a major research tool in his field.
☐	☐	☐	☐	13.	Was able to consider several markedly different approaches to a research problem and view them objectively before choosing one.
☐	☐	☐	☐	14.	Performed an experiment without making proper checks.
☐	☐	☐	☐	15.	Handles even the most menial assignment (e.g., paper grading) with care and responsibility.
☐	☐	☐	☐	16.	Talks at great length in class but exhibits little understanding of material on papers and tests.
☐	☐	☐	☐	17.	Was unable to formulate a testable hypothesis from a theoretical analysis.
☐	☐	☐	☐	18.	Developed an original way of handling a research problem.
☐	☐	☐	☐	19.	When presenting a paper handled a difficult topic with considerable skill.
☐	☐	☐	☐	20.	Became more proficient in a useful outside field under his own initiative.
☐	☐	☐	☐	21.	Became distracted by non-academic, non-professional interests.
☐	☐	☐	☐	22.	Was heavily dependent on direction from faculty and appeared unable to undertake any independent investigation.
☐	☐	☐	☐	23.	Devoted considerable time to helping other students with problems.
☐	☐	☐	☐	24.	Exhibited carelessness with laboratory equipment.
☐	☐	☐	☐	25.	Although able to criticize studies with facility was unable to suggest better alternatives.
☐	☐	☐	☐	26.	Despite discouraging advice from faculty this student pursued his interest or ideas and was successful.
☐	☐	☐	☐	27.	Seldom, if ever engages in informal contacts with faculty or fellow graduate students.

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☐	☐	☐	☐	45.	Conducted a data analysis which was inappropriate for the experiment as designed.
☐	☐	☐	☐	46.	Attempted to carry out poorly planned research.
☐	☐	☐	☐	47.	Despite one or more setbacks continued to work on research until it was successfully completed.
☐	☐	☐	☐	48.	Was unprepared for a seminar.

4	3	2	1		
☐	☐	☐	☐	49.	Submitted a paper which merely summarized what he had read.
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Suggestions and Comments