

Evaluation of Criteria Being Used in the Selection of Students for Graduate Study in Agronomy*

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INTRODUCTION

Success of students in graduate programs depends upon both academic and non-academic abilities. Evaluation of students for admission to graduate programs involves integration of many kinds of information obtained from several sources. Indications of relative academic abilities of students are obtained from transcripts of previous academic work and from scores on standardized examinations. Observations on students' non-academic characteristics — maturity, motivation, work habits, emotional stability, etc. — are obtained through letters of recommendation and through personal interviews.

In a study of criteria used by a sample of American graduate departments to assess qualifications of students for admission to graduate study, Lannholm⁴ found that undergraduate records, test scores, and letters of recommendation were the most commonly used admission criteria. The undergraduate record was the most widely used admission criterion. Most departments required more than one type of information on applicants for graduate study.

Lannholm, Marco, and Schrader⁵ tested the value of undergraduate grade point averages and Graduate Record Examination test scores (Verbal, Quantitative, and Advanced) as predictors of success in graduate study. The relationship between each of these predictors and success, as measured by grades received in graduate courses, was variable indicating that prediction of success in graduate study is difficult. A portion of this difficulty was attributed to the fact that graduate course grades are usually restricted in range. Lannholm reviewed studies of the relationships of Graduate Record Examination test scores (Verbal, Quantitative, Verbal plus Quantitative, and Advanced) with success as measured by graduate grades and faculty ratings for various disciplines. Generally these correlations were positive and most of the values ranged from .30 to .40. Besco¹ reported a significant correlation of .30 between Quantitative scores and success of agronomy graduate students at Purdue University.

Regardless of the true relationship between the various admission criteria and success in graduate study, the value placed upon the criteria by graduate admission committees is important to applicants.

Objectives of the present study were: (1) to determine which admission criteria are being used in selected graduate programs, and (2) to determine the relative value which admission committees place upon these criteria.

PROCEDURES

In the winter of 1971-1972 a questionnaire was developed and mailed to agronomy or related departments in 49 Land-Grant Universities. The questionnaire was designed to provide information on the usage of letters of recommendation, transcript information, standardized tests, and personal interviews in the evaluation of students for graduate study in agronomy. Efforts were made to determine the frequency and the extent to which these admission criteria are being used, and to estimate the value which department heads and/or departmental graduate admissions committees place upon these criteria.

Questionnaire respondents were requested to give their opinion of the value of the four admission criteria as predictors of success in their graduate programs. Predictive value was estimated on a subjective scale of 1 to 5, where 1 indicated a low predictive value, and 5 indicated a high predictive value. These values were used to make statistical comparisons of the four admission criteria.

Questions were limited to master of science and doctor of

philosophy programs, but were concerned with both admission to the programs and granting of assistantships. In the discussions that follow, when no distinction is made between admission to the programs and granting of assistantship, both are included.

Respondents were asked to compare admission requirements of the agronomy department with those of other departments within the college of agriculture, and to make general comparisons of admission requirements of the college of agriculture with those of the liberal arts college at their university. Questionnaires were returned by 41 departments.

RESULTS AND DISCUSSION

Letters of Recommendation

Most departments required three letters of recommendation for admission to either the M.S. or Ph.D. program, and for granting of either the M.S. or Ph.D. assistantship (Table 1). Some departments did not require any letters of recommendation except when granting a Ph.D. assistantship. Five was the maximum number of letters required by any department. The mean number of letters required was less for admission to the programs than for granting of an assistantship at both the M.S. and Ph.D. levels.

TABLE 1
Number of letters of recommendation required

| Application | Departments responding | Number of letters required | | | |
|---------------------|------------------------|----------------------------|------|-------|----------------|
| | | Mean | Mode | Range | Standard error |
| M.S. program | 40 | 2.18 | 3 | 0-3 | .20 |
| Ph.D. program | 40 | 2.48 | 3 | 0-5 | .18 |
| M.S. assistantship | 41 | 2.73 | 3 | 0-3 | .09 |
| Ph.D. assistantship | 41 | 2.90 | 3 | 2-5 | .08 |

The estimated values of letters for predicting success ranged from 1 (low) to 5 (high) at the M.S. level and from 2 to 5 at the Ph.D. level (Table 2). The mode value of letters was 3 for the M.S. program and 4 in all other cases. The mean estimated predictive value of letters was slightly lower at the M.S. than at the Ph.D. level. The value of letters was rated lower for predicting academic success in the programs than for predicting success as an assistant at both the M.S. and Ph.D. levels.

TABLE 2
Value of letters of recommendation for predicting success

| Application | Departments responding | Estimated value* | | | |
|---------------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | Standard error |
| M.S. program | 41 | 3.13 | 3 | 1-5 | .16 |
| Ph.D. program | 40 | 3.39 | 4 | 2-5 | .16 |
| M.S. assistantship | 40 | 3.45 | 4 | 1-5 | .15 |
| Ph.D. assistantship | 39 | 3.62 | 4 | 2-5 | .14 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

Most departments preferred to have letters of recommendation from one or more faculty members who had taught the student (Table 3). The second most preferred source of letters of recommendation was the student's department head. Some departments indicated that employers and counselors were important sources of recommendations.

TABLE 3
Preferred source of letters of recommendation

| Source | Frequency checked* |
|--|--------------------|
| Student's department head | 20 |
| Faculty who have taught the student | 40 |
| Non-college acquaintances of the student | 2 |
| Other (employers, counselors, etc.) | 18 |

*Respondents were asked to check any or all sources believed to be critical.

Transcripts of Previous College Work

Type of undergraduate courses was given a relatively high predictive value by most departments (Table 4). The mode value was 4 for predicting success at both the M.S. and Ph.D. levels. Estimated values of type of course ranged from a low of 1 and 2 to a high of 5. Although the differences were not statistically significant, mean values were slightly higher for predicting academic success than for predicting success as an assistant.

TABLE 4
Value of considering type of undergraduate courses when predicting success.

| | Departments responding | Estimated value* | | | Standard error |
|---------------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | |
| M.S. program | 41 | 4.06 | 4 | 2-5 | .14 |
| Ph.D. program | 40 | 4.04 | 4 | 1-5 | .18 |
| M.S. assistantship | 40 | 3.90 | 4 | 1-5 | .15 |
| Ph.D. assistantship | 39 | 3.87 | 4 | 1-5 | .17 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

When asked to indicate areas of undergraduate preparation receiving special consideration, all 41 departments included basic science courses, 36 included mathematics courses, and 26 included undergraduate agronomy courses (Table 5). Thirty-five of the departments indicated that special emphasis was given to work completed during the junior and senior years.

TABLE 5
Areas of undergraduate preparation which receive special consideration.

| Areas | Frequency checked* |
|---|--------------------|
| Undergraduate courses in agronomy | 26 |
| Basic science courses (chemistry, biology, geology, etc.) | 41 |
| Mathematics courses | 36 |
| English and communications courses | 20 |
| Senior year of work | 13 |
| Junior and senior years of work | 35 |

*Respondents were asked to check the areas to which special consideration is given.

Most departments required a 3.0/4.0 undergraduate grade point average for admission to graduate study or for granting of an assistantship (Table 6). However, the range in minimum undergraduate grade point average was from 2.0/4.0 to 3.25/4.0 at the M.S. level, and 2.50/4.0 to 3.25/4.0 at the Ph.D. level. The required grade point average for granting of an M.S. assistantship was significantly higher than that required for admission to the M.S. program. There was no significant difference in the grade point averages required for admission to the Ph.D. program and for granting of a Ph.D. assistantship.

TABLE 6
Undergraduate grade point average required

| | Departments responding | Grade point average required* | | | Standard error |
|---------------------|------------------------|-------------------------------|------|-----------|----------------|
| | | Mean | Mode | Range | |
| M.S. program | 39 | 2.66 | 3.0 | 2.00-3.25 | .04 |
| Ph.D. program | 38 | 2.86 | 3.0 | 2.50-3.25 | .03 |
| M.S. assistantship | 39 | 2.81 | 3.0 | 2.00-3.25 | .04 |
| Ph.D. assistantship | 38 | 2.90 | 3.0 | 2.50-3.25 | .03 |

*Based upon a 4.0 grading system.

Several departments reported that they did not use the undergraduate grade point average as reported on the transcript. Nine departments indicated that they calculate a new average excluding such courses as freshman assembly and physical education. Some colleges permit undergraduate students to repeat courses and count only the better grade. In these cases, eight departments indicated that they calculated a new grade point average based upon total quality points divided by the total number of hours attempted.

Estimated predictive value of the undergraduate grade point average ranged from 1 to 5 with mode values being 4 for success

in academic programs and 3 for success as an assistant (Table 7). Mean values were approximately 3.5, slightly above average of the scale.

TABLE 7
Value of undergraduate grade point average for predicting success.

| | Departments responding | Estimated value* | | | Standard error |
|-----------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | |
| M.S. program | 41 | 3.58 | 4 | 1-5 | .14 |
| Ph.D. program | 40 | 3.62 | 4 | 1-5 | .15 |
| M.S. assistant | 40 | 3.39 | 3 | 1-5 | .15 |
| Ph.D. assistant | 39 | 3.44 | 3 | 1-5 | .15 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

The mode value of considering type of courses taken at the master's level for predicting success at the Ph.D. level was 4 (Table 8). The mean estimated value of type of master's courses was slightly, but not significantly, lower than the estimated value of type of undergraduate courses for predicting success at the Ph.D. level. Most departments required a minimum grade point average of 3.0 for work done at the master's level for admission to a Ph.D. program or for granting of a Ph.D. assistantship (Table 9). Three departments had minimum grade point average requirements below 3.0/4.0 which most, but not all colleges, require for successful completion of the master's degree.

TABLE 8
Value of considering type of master's courses when predicting success.

| | Departments responding | Estimated value* | | | Standard error |
|-----------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | |
| Ph.D. program | 39 | 3.95 | 4 | 2-5 | .14 |
| Ph.D. assistant | 39 | 3.74 | 4 | 2-5 | .14 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

TABLE 9
Master's grade point average required

| | Departments responding | Grade point average required* | | | Standard error |
|---------------------|------------------------|-------------------------------|------|-----------|----------------|
| | | Mean | Mode | Range | |
| Ph.D. program | 38 | 3.02 | 3.0 | 2.50-3.30 | .02 |
| Ph.D. assistantship | 37 | 3.03 | 3.0 | 2.50-3.40 | .02 |

*Based upon a 4.0 grading system.

With regard to predicting success at the Ph.D. level, grade point average for master's courses was rated higher (Table 10) than that for undergraduate courses (Table 7).

TABLE 10
Value of master's grade point average for predicting success.

| | Departments responding | Estimated value* | | | Standard error |
|-----------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | |
| Ph.D. program | 40 | 3.88 | 4 | 1-5 | .17 |
| Ph.D. assistant | 39 | 3.68 | 4 | 1-5 | .14 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

Graduate Record Examination

Approximately one-third of the responding departments required the Graduate Record Examination (GRE) Aptitude Test (Table 11) at both the M.S. and Ph.D. levels. Most of the departments required that the test be taken before admission or before the granting of an assistantship. Although the Aptitude Test was required in 13 M.S. programs and 14 Ph.D. programs, only nine departments had minimum score requirements (Table 12). Minimum Aptitude Test scores ranged from 700 to 1100 with a mean value slightly above 900. Some departments specified minimum scores on the verbal and quantitative areas of the Aptitude Test, but this separation was not pursued in the present study. There

are no statistical tables available for comparing combined scores (verbal plus quantitative). Burns² reported that male students who took the Aptitude Test from 1968 to 1971 averaged 499 ± 125 on the verbal and 549 ± 132 on the quantitative areas. It appears that departments which require minimum GRE Aptitude Test scores of 700 to 1100 are selecting students that are slightly below average, average, or better.

TABLE 11
Number of departments requiring the Graduate Record Examination Aptitude Test

| | Departments responding | Departments requiring Aptitude Test | Departments requiring Aptitude Test before admission or granting of assistantship |
|---------------------|------------------------|-------------------------------------|---|
| M.S. program | 40 | 13 | 10 |
| Ph.D. program | 39 | 14 | 13 |
| M.S. assistantship | 40 | 13 | 8 |
| Ph.D. assistantship | 39 | 14 | 10 |

TABLE 12
Graduate Record Examination Aptitude Test scores required

| | Departments requiring minimum scores | Scores required | | | Standard error |
|---------------------|--------------------------------------|-----------------|------|----------|----------------|
| | | Mean | Mode | Range | |
| M.S. program | 9 | 906 | 1000 | 700-1100 | .39 |
| Ph.D. program | 9 | 928 | 1000 | 700-1100 | .45 |
| M.S. assistantship | 9 | 894 | 900 | 700-1100 | .38 |
| Ph.D. assistantship | 9 | 928 | 1000 | 700-1100 | .45 |

About two-thirds of the departments gave an evaluation of GRE Aptitude Test scores for predicting success (Table 13). No department gave the GRE Aptitude Test a predictive value of 5. The mean value was approximately 3.0 or the average for the scale. Although Besco¹ reported a significant positive correlation of .30 between GRE Quantitative scores and success of agronomy graduate students, the coefficient of determination ($r^2 \times 100$ or $.30^2 \times 100$) indicates that only nine percent of the variation in success in the graduate program was associated with variation in the GRE Quantitative scores. Only three departments indicated a requirement for any of the GRE Advanced Tests, and two departments indicated a requirement for standardized examinations in addition to or in lieu of the Graduate Record Examination.

TABLE 13
Value of Graduate Record Examination Aptitude Test scores for predicting success.

| | Departments responding | Estimated value* | | | Standard error |
|-----------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | |
| M.S. program | 26 | 3.06 | 4 | 1-4 | .19 |
| Ph.D. program | 25 | 3.10 | 4 | 1-4 | .21 |
| M.S. assistant | 26 | 2.98 | 3 | 1-4 | .17 |
| Ph.D. assistant | 25 | 2.90 | 3 | 1-4 | .18 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

Personal Interviews

Most departments interviewed less than 25 percent of the graduate students before they were admitted (Tables 14 and 15). Departments interviewed a higher percentage of Ph.D. than M.S. students. Estimated values of faculty interviews of students and campus visits by students were variable ranging from a low of 1 and 2 to a high of 5 (Table 16). Mode values were 3, and the mean values ranged from 3.26 to 3.52.

TABLE 14
Percentage of students from other schools who are interviewed by faculty before being admitted.

| Number of departments interviewing students | | Percentage of students interviewed |
|---|---------------|------------------------------------|
| M.S. program | Ph.D. program | |
| 1 | 3 | 76 or more |
| 3 | 7 | 51-75 |
| 8 | 9 | 26-50 |
| 29 | 21 | 25 or less |

TABLE 15
Percentage of students from other schools who visit the campus before being admitted

| Number of departments receiving visits | | Percentage of students visiting the campus |
|--|---------------|--|
| M.S. program | Ph.D. program | |
| 1 | 1 | 76 or more |
| 0 | 4 | 51-75 |
| 13 | 11 | 26-50 |
| 27 | 24 | 25 or less |

TABLE 16
Value of faculty interviews and campus visits for predicting success.

| | Departments responding | Estimated value* | | | Standard error |
|---------------------------|------------------------|------------------|------|-------|----------------|
| | | Mean | Mode | Range | |
| Faculty interviews | | | | | |
| M.S. program | 39 | 3.49 | 3 | 2-5 | .14 |
| Ph.D. program | 38 | 3.52 | 3 | 1-5 | .16 |
| Campus visits | | | | | |
| M.S. program | 39 | 3.26 | 3 | 1-5 | .17 |
| Ph.D. program | 38 | 3.37 | 3 | 1-5 | .18 |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value.

Comparison of Criteria

Comparisons of the values which department heads and/or admission committees gave the various criteria are summarized in Tables 17 and 18. Type of undergraduate courses was rated higher than any other criterion for predicting success as an assistant or in the academic program at both the M.S. and Ph.D. levels. The weight which these graduate admission committees placed upon type of undergraduate courses stresses the importance of course of study and undergraduate advisement. Type of master's courses was rated second highest for predicting success at the Ph.D. level. Undergraduate grade point average was rated as the second most important criterion for predicting success in the master's program, and the third most important criterion for predicting success as an M.S. assistant. Undergraduate grade point average ranked fourth and fifth in importance in predicting success in the Ph.D. program and as a Ph.D. assistant, respectively. Considering that both the grade point average and type of courses were derived from the transcript, the transcript was the most important admission criterion. Lannholm found that the undergraduate record was the most widely used graduate admission criterion.

TABLE 17
Comparisons of estimated values of various criteria for predicting success at the M.S. level

| Criteria | Average estimated value* | |
|-----------------------------------|--------------------------|--------------|
| | M.S. assistant | M.S. program |
| Letters of recommendation | 3.45 b | 3.13 c |
| Type of undergraduate courses | 3.90 a | 4.06 a |
| Undergraduate grade point average | 3.39 b | 3.58 b |
| GRE Aptitude Test scores | 2.98 c | 3.06 c |
| Faculty interviews | — | 3.49 bc |
| Campus visits | — | 3.26 c |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value. Within a column the differences between averages followed by the same letter do not exceed the sum of their standard errors.

TABLE 18
Comparisons of estimated values of various criteria for predicting success at the Ph.D. level

| Criteria | Average estimated value* | |
|-----------------------------------|--------------------------|---------------|
| | Ph.D. assistant | Ph.D. program |
| Letters of recommendation | 3.62 ab | 3.39 cd |
| Type of undergraduate courses | 3.87 a | 4.04 a |
| Undergraduate grade point average | 3.44 b | 3.62 bc |
| Type of master's courses | 3.74 a | 3.95 a |
| Master's grade point average | 3.68 ab | 3.88 ab |
| GRE Aptitude Test scores | 2.90 c | 3.10 d |
| Faculty interviews | — | 3.52 c |
| Campus visits | — | 3.37 cd |

*Based upon a scale of 1 to 5, where 1 indicates a low, and 5 indicates a high predictive value. Within a column the differences between averages followed by the same letter do not exceed the sum of their standard errors.

All the criteria, except letters of recommendation, received higher average ratings for predicting success in the academic programs than for predicting success as an assistant at both the M.S. and Ph.D. levels. In comparison with the other criteria, letters of recommendation ranked near the top in estimated value for predicting success as an assistant and near the bottom for predicting academic success. Graduate Record Examination Aptitude Test scores received the lowest rating of any of the criteria included in the study.

The difficulty involved in matching the student's interest, training, and ability with graduate program requirements was evidenced by the facts that the departments utilized several criteria in evaluating students, and that values assigned by different departments to the various criteria were variable and ranged across the complete scale (1 to 5) in most instances.

Agronomy vs. Other Departments

Respondents were requested to compare admission requirements of the agronomy department with those of other departments within the college of agriculture. For letters of recommendation and grade point averages, requirements were reported to be similar (Table 19). This similarity among departmental requirements perhaps reflects to a large degree college-wide admission requirements. However, there was diversity among departments within colleges of agriculture regarding utilization of Graduate Record Examination as an admission criterion.

TABLE 19
Comparisons of admission requirements of the agronomy departments with those of other departments within colleges of agriculture.

| Comparison | Departments responding | Do they differ? | |
|-----------------------------|------------------------|-----------------|----|
| | | Yes | No |
| Letters of recommendation | 40 | 0 | 40 |
| Grade point average | 38 | 2 | 36 |
| Graduate Record Examination | 27 | 7 | 20 |

Agriculture vs. Liberal Arts

General comparisons were made between admission requirements of the college of agriculture and those of the college of liberal arts. With regard to letters of recommendation and grade point averages, admission requirements were similar for the two colleges at most institutions (Table 20). Several respondents indicated that graduate school regulations generally standardized those requirements across colleges. Approximately one-half of the respondents indicated that the two colleges differed in their utilization of the Graduate Record Examination as an admission criterion. From the available information, it was not evident as to how the colleges differed.

TABLE 20
Comparisons of admission requirements of the agricultural college with those of the liberal arts college within universities.

| Comparison | Departments responding | Do they differ? | |
|-----------------------------|------------------------|-----------------|----|
| | | Yes | No |
| Letters of recommendation | 31 | 3 | 28 |
| Grade point average | 35 | 4 | 31 |
| Graduate Record Examination | 26 | 11 | 15 |

SUMMARY

The purpose of this study was to determine which criteria are being used in evaluating students for admission to graduate programs and for granting of assistantships, and to determine the value which department heads and/or department admission committees place upon these criteria.

There was considerable variation in requirements for admission and for assistantships. Most of the departments required three letters of recommendation preferably from faculty who

have taught the student. Most departments required a 3.0/4.0 grade point average in undergraduate work for admission or an assistantship at both the M.S. and Ph.D. levels, and a 3.0/4.0 in the master's work for admission or an assistantship at the Ph.D. level. Approximately one-third of the responding departments required students to take the Graduate Record Examination Aptitude Test, and most of the departments required a combined score (Verbal plus Quantitative) of approximately 1000. In a majority of the departments, less than 25 percent of the students were interviewed before being admitted or being granted an assistantship.

Estimated values of the criteria indicated that the transcript information — types of courses and grade point averages — were most valuable and Graduate Record Examination Aptitude Test scores were least valuable for predicting success in agronomy graduate programs.

In general, respondents reported similarity in requirements for letters of recommendation and grade point averages, but dissimilarity in requirements concerning the Graduate Record Examination, among departments within the college of agriculture.

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