Future Curriculum Emphasis For Colleges

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Considerable emphasis is being placed on efforts to update college of agriculture curriculums so graduates will be better prepared for the changing roles they will be expected to play in their jobs after graduation. Experts tell of the changing roles graduates will be expected to fill as they take jobs in the agricultural sector of our society. These same experts tell of the trend requiring college of agriculture graduates with more than technical competence in their major. Attention is focused on the increased requirement for competence in communications, business, etc. for the future graduates of colleges of agriculture.

In 1984 the University of Idaho established, in its Long-Range Plan, 15 goals with corresponding strategies to promote positive institutional development. The University's Long-Range Plan suggested the following strategies to attain Goal V, **Produce Graduates Who Possess the Technical and Professional Knowledge Needed by a Changing Society:**

> Encourage more formal review of courses and curricula to ensure currency. Revise and update courses using input from agencies, business and industry, practicing professionals, alumni and students. (p. 18) According to Webb, et al. (1978), periodic follow-up studies are needed to maintain contact with former students and to evaluate departmental curriculums. Drueckhammer (1985) reported that the use of a follow-up survey of graduates as a means of evaluating an instructional program, can be very beneficial. He also stated that:
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> Due to the diversity of the College of Agriculture and the changes in the types of agricultural employment, better information is needed as to the areas of employment of College of Agriculture graduates, the skills needed by the graduates in their employment, salaries and benefits received from employment and changes needed in the instructional program and job placement program... (p. 3)

Educational systems, like colleges and universities, are facing more responsibilities in terms of accountability for programs. The literature provides rationales for these institutions to gather the information needed for program accountability. The literature also suggests that institutions, themselves, take the initiative to develop evaluation programs rather than having them developed by another entity and imposed on the institution. Several recommendations are provided for public institutions of education to have a systematic, continuous form of evaluation. The follow-up study is one method described and strongly suggested as a means to gather information for the accountability question.

If the competence required for colleges of agriculture graduates has changed, past graduates surely are aware of the changes and should be able to recommend changes in curriculum to respond to those changes. By gathering information from past graduates, colleges of agriculture will be using a valuable and viable source of information for the purpose of setting program direction.

Purpose of the Study

The purpose of the study was to follow-up the 1973-1985 Bachelor of Science graduates of the College of Agriculture, University of Idaho. The specific objectives of the study were to:

1. determine the graduates' perceptions of the future emphasis to be placed on selected curriculum areas in the College of Agriculture at the University of Idaho.
2. determine if a significant difference exists in the graduates' perceptions of the future emphasis to be placed on selected curriculum areas in the College of Agriculture at the University of Idaho based on the undergraduate major of the respondent.

Procedure

The population selected for this study consisted of University of Idaho College of Agriculture Bachelor of Science graduates from the years 1973-1985. One thousand twenty-two (1022) graduates were identified by the University of Idaho Alumni Office.

The instrument used in this study was developed by the faculty in the Department of Agricultural and Extension Education. The instrument was reviewed by faculty in the Departments of Agricultural and Extension Education, Agricultural Economics and Animal Sciences. In addition, the instrument was field-tested with 15 senior students majoring in Agricultural and Extension Education at the University of Idaho.

The instrument and cover letter were mailed to the 1,022 1973-1985 College of Agriculture Bachelor of Science graduates. A follow-up postcard, a second cover letter and instrument and a third cover letter and instrument were used in the data collection process. Twenty-eight (28) of the original 1,022 questionnaires had undeliverable addresses and could not be forwarded. Ten (10) of the returned questionnaires could not be coded because they were incomplete and were not included in the totals.

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Data were analyzed using the Statistical Package for Social Sciences (SPSSx, Version 2.1), with sub-programs, Frequency, Friedman, Kruskal-Wallis and Mann-Whitney. Non-parametric statistical tests were used to analyze the data of this study because the data were collected using a 3-point Likert scale and, therefore, the data were at the ordinal level of measurement and did not satisfy the requirements for parametric tests.

Findings and Discussion

Of the 1,022 graduates in the study, 811 returned a survey instrument and 801 were accepted for use in the analysis of the study. The study had a usable response rate of 78.4 percent.

The respondents were classified according to the departmental major under which they received their first Bachelor of Science degree from the College of Agriculture. This classification was chosen because curriculum is basically a departmental function. Table 1 lists the departmental majors of the respondents with corresponding frequencies and percentages in descending order.

Table 1. Departmental Major of the College of Agriculture Follow-up Study Respondents (1973-1985).

Departmental Major	Frequency	Percentage
Plant, Soil and Ent. Sc.	206	25.7
Animal Sciences	182	22.7
Agricultural Economics	170	21.2
Agricultural Education	88	11.1
Agricultural Mechanization	49	6.1
General Agriculture	41	5.1
Bacteriology	34	4.2
Veterinary Sciences	26	3.2
Missing Values	5	0.6
Total	801	100.0

Objective 1

The graduates were asked to indicate, based on the job(s) they have held since graduation, if the College of Agriculture should require more, the same or less emphasis on selected curriculum areas. Table 2 displays the curriculum areas, frequencies and percentages of the responses by emphasis categories.

Over 65 percent of the respondents indicated more emphasis should be placed on decision-making capabilities, accounting, business & economics and agricultural marketing.

Over 50 percent of the respondents indicated that the area of communications, both oral and written, should receive more emphasis.

The respondents indicated the emphasis on production agriculture, mathematics, chemistry, biology & botany and foreign languages should remain the same, or increase slightly. Of these, the area of production agriculture received the largest number of responses indicating more emphasis.

Of the selected curriculum areas, only humanities & social sciences should receive the same to less emphasis according to the respondents. This indication was not unexpected, given the widely perceived image graduates from technical colleges have of the humanities and social sciences as not being an important and useful part of their curriculum. This may also be a result of the respondents indicating most of the curriculum areas should receive more emphasis; unknowingly, the respondents may have lowered the emphasis on the humanities & social science to allow for the increased emphasis on the other areas.

Table 2. Respondents' Indications of the Future Emphasis to be Placed on Selected Areas of the College of Agriculture Curriculum.

Curriculum Areas	Mean Rank[1]	Emphasis Categories: More	Same	Less
Decision-making capabilities	3.88	585[2]	197	2
		73.0	24.6	0.3
Accounting, business & economics	3.94	572	201	6
		71.4	25.1	0.7
Agricultural marketing	4.26	523	246	12
		65.3	30.7	1.5
Written communications	4.81	429	347	8
		53.6	43.3	1.0
Oral comm. & public speaking	4.86	428	336	21
		53.4	41.9	2.6
Production agriculture	5.82	278	444	49
		34.7	55.4	6.1
Mathematics	6.39	181	566	36
		22.6	70.7	4.5
Chemistry, biology & botany	6.69	149	569	66
		18.6	71.0	8.2
Foreign languages	6.79	194	420	168
		24.2	52.4	21.0
Humanities & social sciences	7.57	76	510	194
		9.5	63.7	24.2

[1]Based on Friedman's two-way anova, more = 1, same = 2 and less = 3. [2]Frequency Percent of 801 respondents

Objective 2

To test for differences in response patterns based on major, the Kruskal-Wallis statistical test was applied to the responses. Table 3 lists the Chi-square values and probabilities generated for each curriculum area.

Table 3. Kruskal-Wallis Analysis of the Respondents' Indications of the Future Emphasis to be Placed on Selected Areas of the College of Agriculture Curriculum by Major.

Curriculum Areas	Chi-square	Probability
Decision-making capabilities	9.0134	0.2517
Accounting, business & economics	18.8595	0.0086
Agricultural marketing	39.8563	0.0000
Written communications	17.8386	0.0127
Oral comm. & public speaking	8.8345	0.2648
Production agriculture	40.4566	0.0000
Mathematics	11.8219	0.1066
Chemistry, biology & botany	25.4675	0.0006
Foreign languages	24.5260	0.0009
Humanities & social sciences	27.7848	0.0002

Using alpha of ◄0.05, the curriculum areas of decision-making capabilities, mathematics and oral communication & public speaking did not yield large enough Chi-square values, and therefore, it is assumed no significant difference exists in the response patterns of the graduates, based on major, for those three areas.

The respondents differed significantly, by major, in their responses for the other curriculum areas. In order to investigate this difference further, Mann-Whitney was applied to all possible pairs of contrasts. Alpha was set at ◄0.01 in accordance with postfactum analysis procedures. The results of the analyses are shown in Table 4.

More differences between majors occurred at alpha ◄0.05, but differences were not cited unless they satisfied alpha of ◄0.01. No discernible patterns were noted. The differences among the majors as to the future emphasis to be placed on accounting, business & economics, agricultural marketing, and written communications may not be important because of the overwhelming indication for more emphasis on these areas by all majors. However, the differences among majors for the areas of chemistry, biology & botany, foreign languages and humanities & social sciences should be recognized because of the overall difference of opinion as to the emphasis to be placed on these areas.

It should be noted that the Agricultural Education majors probably indicated less emphasis on foreign languages and humanities & social sciences more than did any other major. This indication may stem from two facts. The majority of Agricultural Education majors are currently teaching secondary Vocational Agriculture. In 1984 the Idaho State Board of Education increased the graduation requirements for high school students; as a result, high school students no longer receive credit toward graduation for Vocational Agriculture and had to complete increased requirements in humanities and social sciences.

The curriculum area of production agriculture generated the highest Chi-square value for the kruskal-Wallis test. If this value can be considered an indication of the magnitude of disagreement, it is more interesting to note the majors that did not differ from each other significantly.

Conclusions

The respondents to the follow-up study of the graduates of the College of Agriculture at the University indicated the College should require more emphasis on the curriculum areas of decision-making capabilities, accounting, business & economics, agricultural marketing, written communications, and oral communications & public speaking. The respondents were less decisive about the areas of production agriculture, mathematics and chemistry, biology & botany. The responses for these three areas could be interpreted as an indication to keep the emphasis the same. However, the respondents indicated a reduction in emphasis on foreign languages and humanities & social sciences.

No significant difference in response patterns, based on undergraduate major, was found for the areas of decision-making capabilities, oral communications & public speaking and mathematics. For each of the other areas, significant disagreement existed based on major. However, no discernible patterns were found. The largest disagreements, based on the Chi-square values generated by Kruskal-Wallis, were in the areas of production agriculture and agricultural marketing. The next largest disagreements were in humanities & social sciences, chemistry, biology & botany and foreign languages. The smallest disagreements were in the areas of accounting, business & economics and written communications.

Table 4. Pairwise Contrasts of Respondents' Indications of the Future Emphasis to be Placed on Selected Areas of the College of Agriculture Curriculum by Major.[1]

Accounting, Business & Economics							
Vet Sci	Bac-T	An Sci	Ag Econ	Ag Ed	Gen Ag	PSES	Ag Mech
334.65[2]	366.06	369.33	370.96	375.12	392.95	420.79	441.01
Agricultural Marketing							
Vet Sci	Gen Ag	Ag Mech	Ag Ed	Ag Econ	An Sci	PSES	Bac-T
340.90	350.50	356.88	359.45	361.61	375.99	442.81	496.73
Written Communications							
Gen Ag	Ag Econ	Bac-T	An Sci	Vet Sci	PSES	Ag Ed	Ag Mech
361.46	362.51	376.76	386.53	389.92	391.44	416.74	487.80
Production Agriculture							
Ag Mech	An Sci	PSES	Gen Ag	Ag Econ	Ag Ed	Vet Sci	Bac-T
282.20	365.35	379.44	386.12	393.59	395.53	494.60	533.13
Chemistry, Biology & Botany							
Vet Sci	Gen Ag	Bac-T	PSES	Ag Ed	Ag Mech	An Sci	Ag Econ
341.25	347.09	353.56	360.24	393.57	394.92	398.07	439.84
Foreign Languages							
Bac-T	PSES	Ag Mech	An Sci	Ag Econ	Gen Ag	Vet Sci	Ag Ed
334.92	344.97	393.03	394.34	395.68	428.17	449.27	454.62
Humanities & Social Sciences							
Bac-T	Gen Ag	PSES	Ag Econ	An Sci	Vet Sci	Ag Mech	Ag Ed
300.06	356.26	376.28	380.08	381.20	409.73	423.13	470.76

[1]Those majors with common underlines did not differ significantly in their response patterns with Alpha at ◄0.01

[2]Kruskal-Wallis mean rank: 1 = more emphasis, 3 = less emphasis

Recommendations

The faculty of the College of Agriculture bears ultimate responsibility for its curriculums, but information provided by graduates should be used to review and refine curriculums. Based on the findings of this study, the College of Agriculture, in conjunction with its major disciplines, should consider the following recommendations.

1. Emphasize the curriculum areas of decision-making capabilities, accounting, business & economics, agricultural marketing, written communications, and oral communications & public speaking.
2. Determine if the statistically significant differences, based on major, in the respondents' indications of the emphasis to be placed on the areas of accounting, business & economics, agricultural marketing, written communications, and oral communications & public speaking are also of practical significance and determine the consequences of those differences.
3. Further investigate the difference, based on major, in the respondents' indication of the future emphasis to be placed on the area of production agriculture and the implications for curriculum change.
4. Further investigate the respondents' indications of the future emphasis to be placed on the areas of mathematics, chemistry, biology & botany, foreign languages and humanities & social sciences. Determine if the apparent indication of reduced emphasis on these areas is a biased judgment on the part of the graduates or if the indications merit consideration.

References

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A NOTE

Accuracy of Microcomputer Regression Software

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With microcomputers and accompanying software becoming more accessible, the frequency of use by faculty and students in colleges of agriculture has increased. In addition to course specific applications, increased availability of statistical software has prompted a substitution of microcomputers for mainframes for statistical analyses, both for classroom exercises and research.

Objectives

The overall objective of this note is to document that it may be important for users of microcomputer statistical software, specifically of regression, to be aware of the computational accuracy of these programs. Since there are several regression packages available for microcomputers, it is impossible to check every program for its accuracy in this note. Thus, a simple procedure for testing the accuracy of regression programs is outlined and demonstrated using three anonymous routines. The purpose here is not to make recommendations with respect to specific regression packages; that decision is reserved to the individual user. The primary concern addressed in this note is with regard to computational accuracy which should provide input for selecting a regression package for use in the classroom and/or research.

Procedures

The procedure employed in this paper is that used by Wampler and demonstrated by Boehm, et al. Two problems defined by the following equations were used for the test. Values of the dependent variables (Y_1 and Y_2) for the test were calculated from the following equations.

$$Y_1 = 1 + 1X + 1X^2 + 1X^3 + 1X^4 + 1X^5$$

$$Y_2 = 1 + 0.1X + 0.01X^2 + 0.001X^3 + 0.0001X^4 + 0.00001X^5$$

Both equations are fifth degree polynominals. The values of the variable X were the integers, 0, 1, 2 —, 20. True values for the parameters are, of course, the values used to calculate the Y's, i.e., 1, 1, 1, 1, 1, and 1 for Y_1 and 1, 0.1, 0.01, 0.001, 0.0001, and 0.00001 for Y_2. There are no error terms incorporated into the equations and therefore the $R^2 = 1$ for each equation.

Simple correlation coefficients among the independent variables were all greater than 0.816, six of the ten were greater than 0.958, and three were greater than 0.986. The high linear association between the regressors and the large variation in the data partially explain why consistently accurate parameter estimates for the above equations are difficult to obtain (Boehm, et al., p. 757).

The two test problems have been classified by Wampler as being highly "ill-conditioned," with equation Y_1 slightly more ill-conditioned than the Y_2 equation.[1] Suffice it to say that the test problems are difficult to estimate. If computer routines successfully handle these problems, computational accuracy should not be a serious issue for less ill-conditioned cases. Five regression routines are reported. The regression packages were tested using an IBM-PC compatible microcomputer.

Results and Discussion

The computational accuracies of the regression routines tested were varied (Table 1). In most cases the estimated regression coefficients (B's) were reasonably accurate, with the exception of the estimate of B_0 for Y_1 from routine 2. The R^2 value is reported correctly in each of the routines for each equation estimated. As expected, the overall results tend to be better for equation Y_2 as compared to equation Y_1. This is due to the slightly more ill-conditioned nature of equation Y_1.

Estimates of the coefficient standard errors and the standard error of regression exhibit the greatest variation (Table 1). Each of these estimates should be equal to zero. While most estimates of the coefficient standard errors are close to zero, some were larger than their corresponding coefficient estimates, notably from routines 2 and 3 for equation Y_1. Thus, the B's using the classical t-test would be incorrectly judged non-significant. Routines 2 and 3 incorrectly estimated the standard error of regression for the Y_1 equation and, for some reason S^2 was estimated to be negative using routine 2.

Summary and Concluding Remarks

The primary purpose of this note was to document that it is important to check the computational accuracy of microcomputer regression software. A simple procedure for testing the accuracy of regression programs is provided and illustrated.

The results reported in this note suggest that there is some variation in computational accuracy among

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[1]The concept of an "ill-conditioned matrix" focuses on the expected severity of round-off errors generated in inversion. Several numbers have been proposed to measure the degree of ill-conditioning; however, empirical results have shown them to be inadequate (Ling). Newman discusses a commonly used measure, the P-condition.