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PREDICTING SCORES OF BEGINNING AGRICULTURAL EDUCATION TEACHERS ON THE PRAXIS II EXAMINATION

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Abstract

This descriptive-correlational study predicted performance of beginning agricultural education teachers on principles of learning and teaching (PLT) and Agriculture content (AgC) tests of the PRAXIS II examination using demographic and academic variables. Performance on the PRAXIS II was used for issuing initial teaching licenses to the agricultural education teachers. The study used existing records from the Department Agricultural Education at Iowa State University. Professional education GPA explained significant variability in PLT scores. Males scored higher than females on the AgC test. Agriculture GPA did not explain significant variability in AgC scores. Additional research should be conducted to determine whether similar results would be obtained with other licensure areas. Further research should explore the relationship between gender and performance on the AgC test of the PRAXIS II examination.

Introduction/Theoretical Framework

Improving public education has gained much political attention since publication of the 1983 educational reform report, "A Nation at Risk." One of the recommendations of the report was that teacher education programs should prepare prospective teachers who demonstrated an aptitude for teaching and competence in an academic discipline (National Commission on Excellence in Education, 1983; Nyirenda, 1994). Recently, the No Child Left Behind (NCLB) legislation has re-emphasized the importance of a quality teaching force (U.S. Department of Education, 2002). NCLB requires that students achieve high standards and that schools be accountable (Brownell, Sindelar, Bishop, Langley & Seo, 2002; Halloway, 2002). It also requires that teachers be highly qualified by 2005-2006 (Brownell et al.; Haycock, 2003; U.S. Department of Education, 2002). Teacher quality is thus regarded as an important factor in enhancing public education (Arhar, 2003).

There are several professional attributes that define teacher quality. One is teachers' educational credentials (Kaplan & Owings, 2003; Rotherham & Mead, 2003). Teacher credentials refer to the teachers' subject matter knowledge, pedagogical skills, and understanding of cultural and psychological factors that affect student learning (Halloway, 2002). Educational credentials depend on the type of professional preparation that teachers undergo. Teacher preparation however, is an elusive phenomenon (Wilson, Floden & Ferrini-Mundy, 2001). Modes and models of teacher preparation vary from institution to institution, and it means "many different things across the United States" (Wilson et al., p. 5).

Teacher preparation models are borne out of somewhat different philosophic viewpoints in regards to the kind and depth of subject matter knowledge that teachers should have; the kind and extent of pedagogical training that teachers should undergo; the kind, timing, and length of prospective teachers' field experiences; the states', universities' and districts' educational policies and strategies that pre-service teacher education programs should conform to; and modes of prevailing teacher certification programs (Wilson et al. 2001). Grossman (1992) found that while

researchers of teacher education "see the process of learning to teach through the lens of subject matter" (p. 171), others view it from an explicitly moral and ethical stance. Grossman's assertion underscores Wilson et al.'s findings that all teacher preparation models are centered on subject matter and pedagogical knowledge.

Subject matter and pedagogical knowledge are thus important factors in determining teacher quality (Halloway, 2002; Kaplan & Owings, 2003; Rotherham & Mead, 2003); however, questions that address the minimum level of subject matter knowledge and pedagogical knowledge have to be answered. For example, how much and what types of pedagogical training, knowledge, and skills must teachers attain in order to teach students effectively (Rotherman & Mead)? Does obtaining a Master's or Ph.D. degree translate into one being an effective teacher (Lakdawalla, 2002)? Does studying a subject as a major as opposed to a minor help teachers to be effective (Rotherman & Mead)?

In the backdrop of the questions about teacher quality, the NCLB legislation set the minimum attributes of a highly qualified teacher at having a bachelor's degree, having full state certification or a teaching license, and demonstrating competence in each subject they teach (U.S. Department of Education, 2002). A survey by the National Center for Education Statistics (NCES, 2001) revealed that virtually all public school teachers in the nation had a bachelor's degree, and 45% held a Master's degree. Literature did not reveal whether satisfying the minimum attributes can practically translate to high performance in teaching. From the NCLB perspective, possession of a teaching license is the most reliable measure of high quality teaching (U.S. Department of Education, 2002).

Nationally, 44 states use pre-service teachers' performance on external examinations to offer teaching licenses. The states rely on assessments by two testing companies, namely, National Evaluation Systems (NES) and The Educational Testing Services (ETS) (U.S. Department of Education, 2005). In 39 of the states, the licensing examinations assess subject matter knowledge, pedagogical knowledge, and actual classroom competence. A few examples of such states are Georgia, Arizona, Indiana, and Hawaii (U.S. Department of Education, 2000). Most of the states use ETS's PRAXIS test series as the licensing examinations (Flippo, 2002). The PRAXIS series includes three tests. PRAXIS I (Academic Skill Assessments) is a qualifying test for individuals entering teacher education programs. PRAXIS II (Subject Assessments) is a test offered prior to issuance of initial teaching license. The examinations assess subject matter and pedagogical knowledge of pre-service teachers. PRAXIS III (Classroom Performance Assessments) is an observation-based evaluation of beginning teachers' classroom performance (ETS, 2005b).

Even though NCLB legislation encourages teacher licensing, it does not regulate the teacher licensing examinations. What to test, when to test, and which examination agency to contract are left to the discretion of individual states, so consistency for teacher licensing might be somewhat questionable (Kaplan & Owings, 2003; U.S. Department of Education, 2005). Also, researchers continue to have doubts about reliability and validity of teacher licensure tests. Berk (1999) asserted that among other concerns, teacher licensure tests need special attention in regards to their reliability and validity evidence related to construction of response items and in their reliability and validity evidence related to cut-score decisions. Wise and Leibbrand (2001) argued that teacher licensing is one of the facets of teacher preparation which does not have set standards. Different teacher quality assurance systems work independently (Wise & Leibbrand), which leads to licensure examination not being reliable across different licensure systems and states.

The decision by some states to contract ETS might have been in response to the NCLB's recommendation that on top of holding a bachelor's degree, highly qualified teachers should have a state license and should have demonstrated strong subject area competency (Arhar, 2003). However, it is not yet established whether high performance on the state licensing

examination translates to high performance in the teaching job.

Iowa does not use Praxis II for initial teacher licensing. To get such a license, the state requires that individuals must have graduated from

> approved teacher preparation programs with a baccalaureate degree and have completed coursework equivalent to a major for the endorsements needed for specific teaching assignments. Each teacher candidate must be recommended by the college and complete a background check in order to obtain initial teacher license (Iowa Department of Education, 2005, p. 1).

While in college, candidates must have demonstrated proficiency on rigorous standards and competencies through performance on multiple assessments of content knowledge, professional knowledge, and pedagogy (Iowa Department of Education). Iowa's licensing requirements conform to the subject matter knowledge, pedagogical knowledge, and teaching competence model common nationally, but in the case of Iowa, the model standards are based on the internal college assessments.

The Iowa Board of Educational Examiners administered the PRAXIS II examination as a pilot study in 2002 and 2003 (Iowa Board of Educational Examiners, 2003). According to the Board, the two-year pilot program would determine validity, reliability, cut scores, and the need for the PRAXIS II examination. The pilot-study included tests for pedagogy and one content area for each individual who was applying for an initial teaching license; it was administered to individuals graduating during the 2001/02 and 2002/03 academic years. Fifty graduating seniors majoring in agricultural education at Iowa State University (ISU) who were seeking initial teaching license between September 2001 and March 2003 participated in the pilot-study. For the agricultural education majors, the examination included an agriculture content (AgC) test and the principles of learning and teaching (PLT) test for grades 7 through 12.

The Board decided not to use the PRAXIS II test for initial teacher licensing. It argued that there were multiple benchmarks against which institutions prepared teachers in Iowa thus rendering the PRAXIS II tests unnecessary (Hawkins, 2006). Also, the Board did not report whether PRAXIS II tests were found to be valid and reliable for use as determinants for initial teacher licensing. Iowa's educators regard the state's program for prospective teachers as more comprehensive and balanced than the PRAXIS II examination (Rossi, 2006). However, the U. S. Department of Education continues to demand that beginning teachers need to pass a standardized content area test before being issued teaching licenses (Hawkins). As a result, beginning 2007 new elementary school teachers in Iowa will have to take PRAXIS II content area examination before being issued initial teaching license (Rossi). Use of college academic measures shall be continued for secondary school teachers (Hawkins). It is plausible, though, to expect the Iowa Board of Educational Examiners to consider extending the PRAXIS II examination requirement to secondary school teachers in the future. If the Board makes the consideration, knowledge of the association between the college academic measures and the PRAXIS II pilot-test scores may inform the decision. Therefore, a need exists to examine the correlation between performance on the PRAXIS II pilot examination and existing college academic measures. If academic measures like number of credits earned and grade point average (GPA) in specific college courses could predict beginning teachers' content and pedagogical knowledge, then the PRAXIS II examination would be a redundant measure of currently available information.

Purpose and Objectives

The purpose of this study was to predict the performance of pre-service agriculture teachers on PRAXIS II tests using selected demographic and academic variables. Specific objectives were:

1. To describe the 2001/02 and 2002/03 pre-service agriculture teachers in terms of age, gender, ACT score, type of matriculation (transfer status), transfer credits, college major, college minor, professional education GPA, agriculture content GPA, teaching status, and PRAXIS II examination scores.
2. To predict performance on the principles of learning and teaching (PLT) (PRAXIS II) test using professional education GPA, age, gender, ACT score, type of matriculation (transfer status), transfer credits, college major, college minor, and agriculture GPA.
3. To predict performance on the Agriculture content (AgC) (PRAXIS II) test using agriculture GPA, age, gender, ACT score, type of matriculation (transfer status), transfer credits, college major, college minor, and professional education GPA.

Methods

The population for this descriptive-correlational study consisted of 50 seniors majoring in agricultural education at Iowa State University. The 50 subjects graduated during the 2001/02 and 2002/03 academic years and were required by Iowa Board of Educational Examiners to take the PRAXIS II tests to qualify for initial teacher licensing.

The PRAXIS II test scores for each candidate were obtained from ETS. For each candidate, there was a single overall score for AgC and PLT. Scores for individual test categories were not available. The AgC test categories included social and historical perspectives of agriculture; plant and soil science; animal science; agricultural mechanization and technology; agricultural business and economics; natural resources and environment; and program planning and management (ETS, 2005a). The PLT test categories included students as learners, instruction and assessment, teacher professionalism, and communication techniques (ETS, 2002).

ETS did not specifically report validity and reliability for AgC and PLT tests in question. However, in their report, titled "Validity for Licensing Tests: A Brief Orientation," ETS (2004) asserted that validity for the PRAXIS series was accomplished through "a systematic analysis of job requirements (knowledge and/or skill level)" (p. 3). According to ETS, the analysis involves gaining input of representative samples of educators and reviewing national disciplinary standards. Test development committees then worked with ETS's subject experts to conduct reviews for test content appropriateness and fairness. Each state or licensing agency then sets standards or passing scores by evaluating job-relatedness of the test for the state's entry-level teachers (ETS, 2004). Regarding reliability, ETS (2006) reported that their assessments are rigorously tested to check whether they are reliable and as free as possible of errors caused by random variation and external factors.

The demographic and college academic data were obtained from existing departmental records. The data included: number of credit hours for animal science, agronomy; agribusiness, horticulture, agricultural mechanics, and professional education courses. Agriculture content and professional education GPAs were calculated using the course grades and total number of credit hours for each course. Descriptive statistics were used to summarize the data. Step-wise regression analyses were conducted to identify factors that could predict PLT and AgC scores of the pre-service teachers.

Before step-wise regression was conducted, intercorrelations were computed among all dependent and independent variables. Independent variables that were significantly correlated with PLT scores and AgC scores were included in the step-wise analyses. The decision to include only variables with significant correlations was based on the theory by Ferguson (1971), which states that having a significant correlation between two variables implies that predicting one from the other is possible, and it is better than a random guess.

Leaving out variables with non-significant correlations also helped reduce the risk of collinearity in the regression model. Cohen, Cohen, West, and Aiken (2003) warned that in situations of small sample size, the risk of collinearity could be reduced by minimizing the number of independent variables. Berry and Feldman (1985) stated that "one must avoid regression analysis when the number of independent variables is greater or equal to the number of cases in the sample; as such situations necessarily lead to perfect collinearity" (p. 38). In the present study, there were 50 cases. By leaving out independent variables with non-significant correlations, it was ensured that the case to independent variable ratio remained high, thus reducing the risk of collinearity. To further ensure that the regression analysis was at no risk of collinearity, the intercorrelation coefficients were examined to find out whether there were any perfect or near perfect correlations between any pair of independent variables. Any such correlation would pose a problem of collinearity in the regression model (Berry & Feldman).

Results

Table 1 shows that 46% (n = 23) of the pre-service teachers were male. Thirty-six percent (n = 18) of the pre-service teachers entered the university straight from high school. Only 12% (n = 6) of the pre-service teachers had a second major. Three of them double majored in animal science, one in agronomy, and two in other majors. Twenty-two percent (n = 11) of pre-service teachers had a minor. Five of them had a minor in agronomy, one had a minor in animal science, one minored in agricultural business, two students minored in horticulture, and the other two took subjects in other colleges. Table 2 shows that the mean age for the pre-service teachers involved in the study was 23.1 years (SD = 3.96). The mean ACT score for the pre-service teachers was 22.9 (SD = 2.88). The highest ACT score was 30, and the lowest was 19. The mean number of transfer credits was 23.0 (SD = 29.18). The number of transfer credits ranged from 0 to 118. The mean GPA for agriculture coursework was 3.00 (SD = .50), and the mean GPA for professional education coursework was 3.63 (SD = .22). The average AgC score for the Praxis II examination was 578.8 (SD = 64.70). Scores ranged from 450 to 720. The PLT scores ranged from 134 to 183 with a mean of 168.4 (SD = 9.42).

Table 1
Frequencies for Selected Demographic and Academic Variables

Variable	*f*	%
Gender		
Male	23	46.0
Female	27	54.0
Type of matriculation		
Straight from high school	18	36.0
Transfer student	32	64.0
Double major		
Yes	6	12.0
No	44	88.0
Minor		
Yes	11	22.0
No	39	78.0

Table 2
Means and Standard Deviations for Selected Demographic and Academic Variables

Variables	*n*	*M*	*SD*	Min	Max
Age at graduation	50	23.10	3.96	21.00	49.00
ACT score	47	22.90	2.88	19.00	30.00
Transfer credits	50	23.00	29.18	0.00	118.00
Agriculture GPA	50	3.00	0.50	2.17	4.00
Professional ed. GPA	50	3.63	0.22	3.23	4.00
Ag. content score	50	578.80	64.70	450.00	720.00
PLT score	50	168.40	9.42	134.00	183.00

The intercorrelations (Table 3) show that collinearity was not a problem. None of the correlation coefficients were very high or perfect (Davis, 1971). Correlations between PLT scores and the independent variables revealed that PLT scores were significantly correlated with professional education GPA (EGPA), $r = .56$; Agriculture GPA (AGPA), $r = .51$; and ACT score, $r = .29$ (Table 3). Professional education GPA, Agriculture GPA, and ACT score were therefore included in the step-wise regression analysis. Agriculture content score was significantly correlated with Agriculture GPA, $r = .30$; gender, $r_{pb} = -.45$; ACT score, $r = .46$; and transfer credits (TCr), $r = -.31$ (Table 3). Agriculture GPA, gender, ACT score, and transfer credits were therefore included in the step-wise regression analysis. The correlation between PLT and AgC, though significant ($r = .40$), was ignored because the two variables involved are the main dependent variables of the study.

Table 3
Intercorrelations Among Dependent and Independent Variables

	AGPA	EGPA	Age	Gen	ACT	TSt	TCr	Maj	Min	AgC	PLT
AGPA	1.00										
EGPA	.69*	1.00									
Age	-.01	-.22	1.00								
Gen	-.05	.16	-.16	1.00							
ACT	.16	.18	.23	-.02	1.00						
TSt.	-.07	-.23	-.16	-.02	-.43*	1.00					
TCr	.02	-.12	-.04	.01	-.40*	.59*	1.00				
Maj	-.16	-.18	.48*	.09	.19	-.24	-.26	1.00			
Min	.14	-.04	-.05	-.09	-.13	00	-.09	-.05	1.00		
AgC	.30*	.18	.10	-.45*	.46*	-.27	-.31*	.03	-.17	1.00	
PLT	.51*	.56*	-.17	.20	.29*	-.27	-.24	.08	.05	.40	1.00

Note. AGPA = Agriculture GPA, EGPA = professional education GPA, Age = age at graduation, Gen = gender, ACT = ACT score, TSt = transfer status, TCr = transfer credits Maj = double major, Min = college minor, AgC = Agriculture content score, PLT = principles of learning and teaching score.
Gender, 0 = male, 1 = female; Double major, 0 = no, 1 = yes; Minor, 0 = no, 1 = yes;
Transfer status, 0 = freshman, 1 = transfer student.
* $p < .05$

A step-wise regression analysis was conducted to identify a subset of independent variables that could be used to predict PLT and AgC scores of the pre-service teachers. The step-wise procedure automatically selects independent variables to include in the regression model based on the variable's individual contribution to the variability in the dependent variable (Cohen et al., 2003).

Table 4 shows that EGPA made a significant, unique contribution to the variability in PLT scores. EGPA accounted for 28.7% ($p = < .001$) of the variability in PLT scores. ACT scores and gender made significant, unique contributions to the variability in AgC scores. ACT scores uniquely accounted for 21.4% ($p = .001$) and gender uniquely accounted for 18.9% ($p = .001$) of the variability. The two variables collectively accounted for a significant proportion ($R^2 = .403$, $p = .001$) of the variability in AgC scores.

Table 4
Step-wise Regression of PLT and AgC Scores on Selected Independent Variables

Variables	R^2	R^2 Change	Significance
PLT Scores			
EGPA	.287	.287	<.001
AgC scores			
ACT score	.214	.214	.001
Gender	.403	.189	.001

Conclusions/Implications

EGPA explained a significant proportion (28.7%) of variability in PLT scores. It is plausible to conclude that EGPA could substitute for the PLT requirement when considering pre-service teachers for initial teaching license. However, caution should be exercised because still 71.3% of the variability in PLT scores was not explained, an outcome that raises questions about PLT test. Does the test cover appropriate professional education content? Is the test an accurate reflection of what teachers should know in professional education? If so, do the secondary education core requirements at ISU cover appropriate professional education content? Is the content effectively delivered?

ACT scores and gender collectively and individually explained significant proportions of the variability in AgC scores. Gender explained 18.9% of the variability in AgC. The correlation between gender and AgC scores indicated that males scored higher than females on the AgC test. This result was surprising and needs to be studied further. Perhaps it was due to the different ways males and females were socialized. The differential socialization of males and females perpetuates the stereotype that agriculture and science are male domains (Sutphin & Newson-Stewart, 1995). Males might enroll in agricultural science and work hard at it due to social pressure, while females are encouraged to pursue different occupational opportunities. Additionally, parents may view agriculture and science careers as not suited for females (George, 2000).

Agriculture coursework requirements at ISU and the agriculture content tests of the PRAXIS II examination did not provide equal emphasis on the academic domains of Agricultural Science (ISU, 2005; ETS, 2005a). The agriculture coursework content required at least six credits of agronomy, seven credits of animal science, and 12 credits farm business and accounting, while agricultural mechanics and horticulture requirements could be satisfied with three credits each (ISU). The PRAXIS II examination gave each of the agriculture content domains relatively equal emphasis. The test had 15 – 17% from each of the following areas; plant and soil science, animal science, agricultural mechanization and technology, agricultural business and economics, and program planning and management. Also, 9-11% of the examination focused on social and historical perspectives of agriculture and natural resources and environment.

The disparity between Agriculture content in the course work and the PRAXIS II Agriculture content test might imply that agricultural education pre-service teachers at the ISU were likely to have learned less horticulture and agricultural mechanization content through their college courses (ISU), yet the PRAXIS II examination gave

horticulture and agricultural mechanization the same weight in the AgC test. Therefore, the discrepancy between males' and females' performance on the AgC test might be related to the fact that the pre-service agriculture coursework curriculum was not well aligned with the PRAXIS II agriculture content test. Males might have acquired knowledge, particularly related to agricultural mechanics and horticulture, outside their college curriculum, a phenomenon that might also be attributed to differences in socialization and prior life experiences of males and females.

AGPA did not explain a significant proportion of the variability in AgC scores. This result was not surprising given the disparities in coverage of the PRAXIS II AgC test and the agriculture coursework content. It is likely that the disparity caused the low association between AgC and AGPA. The agriculture content area licensure test must match the agriculture coursework content of the teacher certification curriculum. Otherwise, the licensure test may lead to inappropriate discrimination between males and females. In the future, if PRAXIS II tests are required of pre-service teachers, teacher educators in agriculture must provide leadership in selecting or developing an appropriate content area licensure examination.

Recommendations

1. Further research should explore the relationship between gender and performance on the AgC test of the PRAXIS II examination.
2. This study focused only on agricultural education majors. The study should be repeated using other licensure areas. This would provide Iowa Board of Educational Examiners with a more reliable conclusion regarding the necessity for the PRAXIS II examination.
3. Because the PRAXIS II examination assesses content and pedagogical knowledge for beginning teachers, further research should establish whether the teachers transfer this knowledge to effective classroom teaching. Thus, future research should establish the relationship between teachers' performance on PRAXIS II tests and PRAXIS III assessments.

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