# The Effect of an Integrated Course Cluster Learning Community on the Oral and Written Communication Skills and Technical Content Knowledge of Upper-Level College of Agriculture Students

***Cynthia Barnett, 4-H Youth Development Advisor***
University of California Cooperative Extension

***Greg Miller, Professor***
***Thomas A. Polito, Director of Student Services***
***Lance Gibson, Associate Professor***
Iowa State University

## Abstract

The purpose of this quasi-experimental study was to determine if upper-level college students who participated in AgPAQ, an integrated course cluster learning community, would demonstrate enhanced learning in the areas of oral communication, written communication, and agronomic/economic technical content knowledge. The population (N = 182) consisted of students who participated in AgPAQ and five comparison groups: students in a farm management class; students in a stand-alone soil, fertilizer, and water management class; students in a soil, fertilizer, and water management class linked with an English course; and students in a paid volunteer group who had not previously participated in AgPAQ. Instruments included three rubrics that measured performance on written communication, oral communication, and agronomic/economic technical content knowledge. Analyses revealed that AgPAQ participants scored higher than non-AgPAQ participants on measures of oral and written communication in all comparisons. Also, AgPAQ participants scored higher on measures of agronomic/economic technical content knowledge than students in the non-AgPAQ paid volunteer group and students in the stand-alone soil, fertilizer, and water management class. AgPAQ participants also scored higher, but not significantly higher, than students in an English and agronomy linked integration. AgPAQ fostered enhanced learning in oral communication, written communication, and agronomic/economic technical content knowledge.

## Introduction

In the past, college and university curricula focused on delivering information to students through lectures and other pedagogies that involved little or no social interaction on the part of the students. Though lectures and other didactic strategies still dominate many college courses, highly structured, rote learning pedagogy does not appropriately take into account the individual experiences and goals students bring to classrooms and lecture halls. The concept that learners bring prior knowledge and experiences to learning environments is the basis of educational philosopher John Dewey's (1933, 1938) notion of "development from within" (Dewey, 1938, p. 1), the idea that education is meaningful when it includes interaction between the learner's prior knowledge and experience and what is being learned. Dewey and others (Cremin, 1962; Ravitch, 1983; Zilversmit, 1993) proposed *progressive education*—education that encourages integrated understanding through unrestricted investigation. Some contemporary pedagogy now offers progressive learning experiences that privilege experience over rote learning, interaction over silence, applied learning over isolated experimentation and lecture, and courses that integrate rather than isolate the academic disciplines to make learning more meaningful.

Higher education should provide opportunities for students to actively use as well as formally demonstrate the knowledge and skills they learn in their courses (Boyer Commission on Educating Undergraduates in the Research University [Boyer Commission], 1998; Kolb, 1984;

Taylor, Moore, MacGregor, & Lindblad, 2003). Parents and employers join faculty and administrators in calling for a higher education environment that effectively challenges students and better prepares them for the rapidly changing world (Smith, MacGregor, Matthews, and Gabelnick, 2004).

To keep up with the quickly changing nature of the workplace, employers need employees to come to them directly from colleges and universities ready to use their knowledge and skills (Secretary's Commission on Achieving Necessary Skills [SCANS], 1991). In the context of such change and compounded by stiff competition within the worldwide employment market, employers demand a high level of competence. They expect recent graduates to combine information with practical experience (SCANS).

Major agricultural employers recruit and seek employees who have experience and are accomplished at teamwork, critical thinking, problem solving, and oral and written communication skills (Boyer Commission, 1998). Colleges of agriculture must offer courses that effectively teach these skills.

## Theoretical Framework

In 1984, Kolb asserted that experience provides "the foundation for an approach to education and learning as a lifelong process that is soundly based in intellectual traditions of social psychology, philosophy, and cognitive psychology" (p. 3-4). Simply put, experiential learning can help students "achieve higher levels of thought and retain information longer than students who work quietly as individuals" (Gokhale, 1995, p. 22).

Kolb (1984) defines experiential learning as a means "for examining and strengthening the critical linkages among education, work, and personal development" (p. 4). Learning takes place when an individual reflects on a direct experience. Next, they generalize how what they have learned may apply to other situations. Finally, they apply this learning through additional related experiences.

Cove and Love (1996) observed that higher education has struggled with "increasing fragmentation of the learning process, disciplines and knowledge, administrative structure, and community" (p. 2). The learning community concept developed in response to this fragmentation, and it provides a means of implementing experiential learning theory. Learning communities are "a variety of curricular approaches that intentionally link or cluster two or more courses, often around an interdisciplinary theme or problem, and enroll a common cohort of students" (Smith et al., 2004, p. 20).

Learning community scholars have identified five major models. Models relevant to this study are the linked courses model and the integrated course clusters model (Gabelnick, MacGregor, Matthews, & Smith, 1990).

Linked courses are two courses—perhaps from different departments—that are connected, such as a skills building class (e.g., a writing course) and a class that is more discipline specific (e.g., an agronomic course). In this model, faculty members meet frequently as a team before and during the semester to coordinate syllabi, develop joint assignments, and plan activities focused on the learning community's common educational goals (Gabelnick et al., 1990).

Integrated course clusters are an "expanded form of the linked course model" (Gabelnick et al., 1990, p. 21) in which three or four separate courses are linked by "common themes, historical periods, issues or problems" (Gabelnick et al., p. 32) and are scheduled together to form a "cluster." A learning community course cluster is usually composed of students who register for the learning community, meaning that an integrated course cluster may comprise the entire course load for those students.

Although scholarship about learning communities has proliferated in the past decade, most of that research has focused on learning community models that do not involve agricultural courses. In several cases, the design of learning communities has included a writing course linked to other discipline-specific courses such as engineering, medicine, history, or the humanities (Taylor et al., 2003; Tinto, 2000). Because of past research, there is reason to believe that learning communities can positively affect student learning of technical content (Hanson and Rawlinson, 2003; Lichtenstein, 2005; Seels, Campbell, and Talsma, 2003; Smith and Bath, 2006; Sterba-Boatwright, 2000; Zhao and Kuh, 2004), oral communication skills (Cowen, 2000; Cyphert, 2002; Thompson, 1990), and written communication skills (Cowen; Cyphert; Lichtenstein; Thompson). These are high-priority outcomes for agricultural employers. Even so, no studies have been conducted on integrated course cluster learning communities in agriculture. We do not know whether students who participate in agricultural learning communities develop improved technical content knowledge, oral communication skills, and written communication skills.

## Purpose and Hypotheses

The purpose of this study was to determine whether students who participated in an integrated, four-course-cluster, agriculture-related learning community demonstrated enhanced learning in oral communication, written communication, and agronomic/economic technical content knowledge compared with students who did not participate in the integrated, four-course-cluster, agriculture-related learning community. This quasi-experimental study was guided by the following research hypotheses:

1. Students who participated in the integrated, four-course-cluster, agriculture-related learning community will attain higher scores on a measure of oral communication skills than students who participated in an agricultural capstone farm management course.
2. Students who participated in the integrated, four-course-cluster, agriculture-related learning community will attain higher scores on a measure of written communication skills than students who participated in an agricultural capstone farm management course.
3. Students who participated in the integrated, four-course-cluster, agriculture-related learning community will attain higher scores in the area of written communication skills than students who participated in a stand-alone soil, fertilizer, and water management course, students in an English and agronomy linked integration, and a self-selected paid volunteer group of agriculture students who did not participate in the integrated, four-course cluster, agriculture-related learning community.
4. Students who participated in the integrated, four-course-cluster, agriculture-related learning community will attain higher scores in the area of agronomic/economic technical content knowledge than students who participated in a stand-alone soil, fertilizer, and water management course, students in an English and agronomy linked integration, and a self-selected paid volunteer group of agriculture students who did not participate in the integrated, four-course-cluster, agriculture-related learning community.
5. A self-selected paid group of past participants from the integrated, four-course-cluster, agriculture-related learning community will attain higher written communication scores and agronomic/economic technical content knowledge scores when solving a multidisciplinary problem than a self-selected paid volunteer group of agriculture students who did not participate in the integrated, four-course-cluster, agriculture-related learning community.

## Procedures

### Design

Two of Campbell and Stanley's (1963) research designs were used in this quasi-experimental study. The nonequivalent control group design was used to test hypotheses 1 and 2. A modified static-group comparison design was used to test hypotheses 3 and 4. In the modified static group comparison design, neither treatments nor dependent variable measures were administered concurrently across comparison groups. The static-group comparison design was used to test hypothesis 5.

## Population

The target population was junior and senior undergraduate students in the College of Agriculture at Iowa State University. The accessible population ($N$ = 182) consisted of all students who participated in the integrated, four-course-cluster, agriculture-related learning community during the fall semesters of 2004 and 2005 ($n$ = 33) and students from the following comparison groups: an agricultural capstone farm management course during the fall semesters of 2004 and 2005 ($n$ = 57); a stand-alone soil, fertilizer, and water management course during the fall semesters of 1996, 1997, and 2003 ($n$ = 36); and an English course integrated and linked with a soil, fertilizer, and water management course during the fall semesters of 1999, 2000, and 2002 ($n$ = 35). To test hypothesis 5, a self-selected paid group of past participants from the integrated, four-course-cluster, agriculture-related learning community ($n$ = 7) and a self-selected paid volunteer group of students who did not participate in the integrated, four-course-cluster, agriculture-related learning community ($n$ = 14) were used. Comparison groups were chosen on the basis of their shared emphasis on enhancing communication skills and real-world problem solving skills.

## Experimental Group

The integrated, four-course-cluster, agriculture-related learning community was named AgPAQ (**Ag**riculture students **P**roviding integrated solutions to **A**gronomy and farm business management **Q**uestions) and was developed for junior and senior students. AgPAQ was initiated in the fall of 2004 at Iowa State University.

AgPAQ integrated an English class, an agricultural economics class, and two agronomy classes. AgPAQ's mission was to integrate knowledge and skills from each of the linked courses to enable students to successfully solve professional, work-based, agriculture problems. A major aspect of the AgPAQ learning community was the consultant relationship students developed while identifying problems and opportunities and recommending improvements for a local farmer.

## Comparison Groups

Students in the farm management capstone classes participated in the management and operation of a diversified farm. This required them to make decisions regarding planning, record keeping, and buying and selling the farm's livestock, crops, and equipment. Farm management capstone students carried out team activities similar to the multidisciplinary integration activities performed by AgPAQ team members. The farm management capstone course was not formally linked to or integrated with any other course. Written communication and oral communication variables were measured in this group as a comparison to the AgPAQ group. Data were collected from committee reports generated at the beginning of each semester and state-of-the-farm reports generated by the same teams at the end of each semester.

Students in the Agronomy 356 course learned basic principles related to tillage, soil drainage, soil erosion and erosion control, soil fertility, and nutrient application while making management recommendations that directly affected economic viability and environmental sustainability for a farmer client. These students worked in teams that participated in activities similar to the multidisciplinary integration activities performed by AgPAQ team members. In 1996, 1997, and 2003, Agronomy 356 was not formally linked to or integrated with any other course.

Agronomy 356 and English 309 were linked and integrated in 1999, 2000, and 2002. English 309 covered the theory and practice of writing reports and proposals. Agronomy 356 students learned basic principles related to tillage, soil drainage, soil erosion and erosion control, soil fertility, and nutrient application while making management recommendations that directly affected economic viability and environmental sustainability for a farmer client. These students worked in teams that participated in activities similar to the multidisciplinary integration activities performed by AgPAQ team members.

In 2005 and 2006, members of the paid AgPAQ volunteer comparison group were recruited by AgPAQ instructors. All students who had previously participated in AgPAQ were invited to participate. Past AgPAQ students who became part of this group addressed a professional, work-related multidisciplinary problem similar to the problem they had addressed in AgPAQ. Students worked in teams for 12 hours per week for 6 weeks and were paid $500 each.

The paid non-AgPAQ volunteer comparison group consisted of two groups of students who did not participate in AgPAQ and were not associated with any courses in the integration. Students were recruited from within the College of Agriculture at Iowa State University. The volunteers were randomly assigned to work teams to address a set of real multidisciplinary problems similar to the problems addressed by the paid AgPAQ volunteer group. Non-AgPAQ students worked 12 hours per week for 6 weeks and were paid $500 each.

For the Agronomy 356, agronomy/English linked course, AgPAQ volunteer, and non-AgPAQ volunteer groups, written communication and agronomic/economic technical content variables were measured as a comparison to the AgPAQ groups. Data sources were the client recommendation reports generated by students at the end of the semester or work period.

**Instrumentation**

Pretest and posttest instruments used in this study included three rubrics that measured performance on written communication, oral communication, and agronomic/economic technical content knowledge. A 4-point, Likert-type scale was used for scoring each rubric. Each level was given a numeric value for statistical analysis: 3 = exemplary, 2 = proficient, 1 = marginal, and 0 = unacceptable. Face and content validity for each rubric—written, oral, and agronomic/economic—was established by a panel of experts within each area. Each panel performed a two-round evaluation to verify that each instrument contained the correct criteria to accurately measure elements of written and oral communication as well as agronomic/economic technical knowledge. At the conclusion of the second round of evaluation, 80% ($n$ = 4) of the experts determined the written communication tool was face and content valid, 100% ($n$ = 5) of the experts determined the oral communication rubric was face and content valid, and 100% ($n$ = 5) of the experts determined the agronomic/economic technical knowledge rubric was face and content valid.

The written communication rubric had five criteria: content, development, organization, sentence structure (grammar, spelling, and mechanics), and style (voice, tone, and word choice). A panel of experts ($n$ = 9) used the written communication rubric to score the written communication pieces. Each member of the panel worked individually on a random sample of the pieces. After 2 weeks, the same experts individually scored the same written communication pieces with the same rubric. The two sets of scores were correlated. The intra-rater reliability coefficient was .83. To determine inter-rater reliability, two different groups of raters also scored the reports. Scores from group one were correlated with scores from group two. The correlation yielded a reliability coefficient of .28. First-round posttest data were used to assess internal consistency and yielded a Cronbach's alpha coefficient of .92.

The oral communication rubric had six criteria: organization, style (verbal and nonverbal), content (depth and accuracy), oral language conventions (use of language and grammar and word choice), group interaction (responsiveness to audience and body language), and use of communication aids. A panel of experts (*n* = 15) used the oral communication rubric to score the oral communication pieces. Each member of the panel worked individually on a random sample of the pieces. After 2 weeks, the same experts individually scored the same oral communication pieces with the same rubric. The two sets of scores were correlated. The intra-rater reliability coefficient was .89. To determine inter-rater reliability, two different groups of raters also scored the reports. Scores from group one were correlated with scores from group two. The correlation yielded a reliability coefficient of .46. First-round posttest data were used to assess internal consistency and yielded a Cronbach's alpha coefficient of .90.

The agronomic/economic technical content assessment rubric had 13 criteria: identification of problem and formulation of questions, conceptual framework, soil sampling, nutrient recommendations, drainage, soil conservation, geographic information system and mapping, crop management, analysis and interpretation of data gathered, farm records, budgets, and economic management recommendations. A panel of experts (*n* = 15) used the agronomic/economic rubric to score the recommendation reports. Each member of the panel worked individually on a random sample of the pieces. After 2 weeks, the same experts individually scored the same recommendation reports with the same rubric. The two sets of scores were correlated. The intra-rater reliability coefficient was .75. To determine inter-rater reliability, two different groups of raters also scored the reports. Scores from group one were correlated with scores from group two. The correlation yielded a reliability coefficient of .78. First-round posttest data were used to assess internal consistency and yielded a Cronbach's alpha coefficient of .88.

### Data Collection

Professional communication experts—teachers, editors, industry specialists, and graduate students who were pursuing communication degrees—scored the reports individually with the oral communication and written communication rubrics. Professional agronomic/economic experts—professors and industry specialists—scored the recommendation reports with the technical content knowledge rubric. Each rater participated in a training session on how to score the reports with the appropriate rubric. At the conclusion of the training, each evaluator was given a packet that included randomly assigned reports and enough rubrics to score all of the pieces individually.

### Data Analysis

Data analysis was performed with SPSS 14.0 for Windows. Data were collected, coded, and analyzed by the authors. Data analysis included frequencies, means, standard deviations, Pearson correlations, general linear models (ANOVA and ANCOVA), and the Tukey post hoc procedure. The alpha level was set a priori at 0.05.

## Results

### Hypothesis 1

Analysis of covariance (ANCOVA) was used to adjust the AgPAQ and farm management comparison group oral communication posttest scores on the basis of group differences observed on the pretest. The ANCOVA procedure revealed that the AgPAQ group had significantly higher adjusted posttest means ($F = 54.75$, $p < .001$, Table 1). To illustrate the magnitude of the difference, each adjusted posttest mean score was divided by the highest possible score on the rubric (18 points for the oral communication rubric). AgPAQ participants achieved posttest oral communication scores that were 31% higher than scores of the farm management comparison group.

Table 1
*AgPAQ/Farm Management Pretest/Posttest Oral Communication Mean Scores*

| | | | | 95% Confidence interval for adjusted posttest means | |
|---|---|---|---|---|---|
| Groups | Pretest mean | Posttest adjusted mean | *SE* | Lower bound | Upper bound |
| AgPAQ | 14.88 | 15.88 | .53 | 14.83 | 16.93 |
| Farm management | 9.59 | 10.27 | .44 | 9.39 | 11.16 |

The data support the hypothesis that students who participated in the AgPAQ integrated course cluster would attain higher scores on a measure of oral communication skills than students who participated in the farm management comparison group.

**Hypothesis 2**
Analysis of covariance (ANCOVA) was used to adjust the AgPAQ and farm management comparison group written communication posttest scores on the basis of group differences observed on the pretest. The ANCOVA procedure revealed that the AgPAQ group had significantly higher adjusted posttest means ($F = 93.32$, $p < .001$, Table 2). To illustrate the magnitude of the difference, each adjusted posttest mean score was divided by the highest possible score on the rubric (15 points for the oral communication rubric). AgPAQ participants achieved posttest written communication scores that were 46% higher than scores of the farm management comparison group.

Table 2
*AgPAQ/Farm Management Pretest/Posttest Written Communication Mean Scores*

| | | | | 95% Confidence interval for adjusted posttest means | |
|---|---|---|---|---|---|
| Groups | Pretest mean | Posttest adjusted mean | *SE* | Lower bound | Upper bound |
| AgPAQ | 7.82 | 12.69 | .52 | 11.66 | 13.72 |
| Farm management | 5.07 | 5.87 | .44 | 4.98 | 6.75 |

The data support the hypothesis that students who participated in the AgPAQ integrated course cluster would attain higher scores on a measure of written communication skills than students who participated in the farm management comparison group.

**Hypothesis 3**
Table 3 shows means and standard deviations for written communication scores by group. The ANOVA procedure revealed significant differences between the groups' written communication scores ($F = 23.46$, $p < .001$, one-tailed). The Tukey post hoc procedure revealed that the AgPAQ group mean score for written communication was significantly higher than scores of all other groups.

Table 3
*Written Communication Mean Scores by Group*

| Group | *M* | *SD* | *N* |
|---|---|---|---|
| AgPAQ | 12.52 | 1.68 | 33 |
| Soil, fertilizer, water management | 7.47 | 2.77 | 36 |
| Agronomy 356/English 309 | 8.86 | 3.17 | 35 |
| Paid non-AgPAQ volunteer group | 8.21 | 2.52 | 14 |

Results support the hypothesis that AgPAQ participants would attain higher scores on a measure of written communication skills than students who participated in a stand-alone soil, fertilizer, and water management course, an English and agronomy linked integration, and a self-selected paid volunteer group of agriculture students who did not participate in AgPAQ.

**Hypothesis 4**
Table 4 shows means and standard deviations for the agronomic/economic technical content knowledge scores by group. The ANOVA procedure revealed significant differences between the groups' agronomic/economic technical content knowledge scores ($F = 12.94$, $p < .001$). The Tukey post hoc procedure revealed that group mean differences between AgPAQ and the 356 stand-alone course as well as the paid non-AgPAQ volunteer group were significant. Results partially support the hypothesis that AgPAQ participants would attain higher scores on a measure of agronomic/economic technical content knowledge than students who participated in a stand-alone soil, fertilizer, and water management course, an English and agronomy linked integration, and a self-selected paid volunteer group of agriculture students who did not participate in AgPAQ.

Table 4
*Agronomic/Economic Technical Content Knowledge Mean Scores by Group*

| Group | *M* | *SD* | *N* |
|---|---|---|---|
| AgPAQ | $23.42_a$ | 7.76 | 33 |
| Soil, fertilizer, water management | $17.00_b$ | 5.04 | 36 |
| Agronomy 356/English 309 | $21.86_a$ | 4.81 | 35 |
| Paid non-AgPAQ volunteer group | $13.43_b$ | 6.81 | 14 |

*Note*. Means with different subscripts differ significantly at $p < 0.05$.

**Hypothesis 5**
Table 5 shows that AgPAQ paid volunteer participants scored significantly higher on written communication and agronomic/economic technical content knowledge than a self-selected paid volunteer group of agriculture students who did not participate in AgPAQ. The research hypothesis was supported.

Table 5
*Written Communication and Technical Content Mean Scores by Group*

| | | | 95% Confidence interval for adjusted posttest means | |
|---|---|---|---|---|
| Dependent variable | Mean | *SE* | Lower bound | Upper bound |
| Written communication score | | | | |
| AgPAQ | 15.00 | .00 | 4.77 | 8.80 |
| Non-AgPAQ | 8.21 | .67 | | |
| Technical content score | | | | |
| AgPAQ | 21.86 | 1.82 | 2.37 | 14.48 |
| Non-AgPAQ | 13.43 | 1.82 | | |

## Conclusions and Recommendations

Participation in an integrated, four-course-cluster learning community grounded in agriculture—specifically agronomy and agricultural economics—made a significant, positive difference in written communication skills, oral communication skills, and agronomic/economic technical content knowledge attained by upper-level college of agriculture students. This conclusion is consistent with previous work supporting the theory that participation in learning communities can improve communication as well as technical content knowledge (Cowen, 2000; Cyphert, 2002; Lichtenstein, 2005; Seels et al., 2003; Smith & Bath, 2006; Thompson, 1990). Earlier studies determined that learning community participation makes a significant difference in "academic competence, especially in writing" (Lichtenstein, p. 352). Moreover, Smith and Bath's results add weight to the importance of learning communities when measuring the whole of communication development.

Smith and Bath (2006) also measured the effect of learning community participation on discipline knowledge—disciplinary-specific knowledge or technical content knowledge—and found that development of discipline knowledge was significant when measured within learning community environments.

Faculty interested in enhancing students' oral communication skills, written communication skills, and technical content knowledge should consider organizing an integrated course cluster learning community that features a common theme across courses. Course instructors should meet as a team to coordinate syllabi, develop joint assignments, and plan activities focused on the learning community's common educational goals.

Because of the limited scope and focus of this study, caution should be exercised in generalizing results. Further research is needed to more definitively evaluate the effect of upper-level integrated course cluster learning communities. Focusing on the degree of integration may show that a full four-course integration may not be necessary to make a significant difference on written communication skills, oral communication skills, or technical content knowledge.

Future research could include parallel studies that incorporate qualitative methods to complement quantitative results. Researchers might also consider situating learning communities in different major areas of study in agriculture, and incorporating variables such as learner and instructor satisfaction, group dynamics, problem-solving skills, levels of participation, and leadership skills.

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CYNTHIA BARNETT is a 4-H Youth Development Advisor with the University of California Cooperative Extension, 777 E. Rialto Avenue, San Bernardino, CA, 92415. E-mail: ccbarnett@ucdavis.edu.

GREG MILLER is a Professor in the Department of Agricultural Education and Studies at Iowa State University, 201 Curtiss Hall, Ames, IA 50011. E-mail: gsmiller@iastate.edu.

THOMAS A. POLITO is the Director of Student Services in the College Agriculture and Life Sciences at Iowa State University, 23 Curtiss Hall, Ames, IA 50011. E-mail: tpolito@iastate.edu.

LANCE GIBSON is an Associate Professor in the Department of Agronomy at Iowa State University, 1126 Agronomy Hall, Ames, IA 50011. E-mail: lgibson@iastate.edu.

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