Examining Students’ Experiences and Perceived Skill Attainment in an Agricultural Capstone Course

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Abstract

Utilizing a context-based model for teaching agriculture and qualitative research methodology, a survey of Iowa State University’s Ag 450 students was conducted over the course of two semesters regarding their competence and confidence of certain technical and professional skills expected by agricultural industry experts before and after completion of the Ag 450 capstone course. It was concluded the Ag 450 capstone course is improving student competence of technical skills and on average, students somewhat agreed they were confident regarding professional skills needed for the workplace. It is recommended that this study be replicated for more in-depth analysis and that a longitudinal study regarding how skills learned in the capstone course are being applied in the workforce be utilized as a way to further this research. Furthermore, this study may be replicated utilizing a broader range of skills or focused on the core competencies and outcomes of the course itself. Recommendations for further research and future practice were provided.

Introduction

As many students enter a high-demand and rapidly changing agricultural workforce after graduation, they will be required to possess certain skills to help them become successful in their future positions. A burden has been placed on the shoulders of higher education institutions to ensure students acquire these skills (Coll and Zegwaard, 2006; Dacre Pool and Sewell, 2007; Henard and Roseveare, 2012; Jackson, 2014; Yorke, 2011). Jackson (2014) indicated employability skills are “critical enablers of graduate ability to function effectively in the modern workplace and their development is now considered integral to undergraduate education” (pp. 3-4).

Employers continue to seek individuals who possess competencies referred to as being essential for the 21st century. These competencies were once thought as being only had by seasoned employees but is rather now the expectation of graduates when they enter the workforce (Crawford et al., 2001; Hart Research Associates, 2015). In reviewing the literature, the word competency is used very broadly. Competency focuses on the personal characteristic of an individual and the performance in a specific situation (Spencer and Spencer, 1993). Birkett (1993) refers to competency and attributes either as being cognitive (hard) skills or behavioral (soft) skills. The cognitive or hard skills focus on the technical knowledge and the behavioral or soft skills are the function of one’s personality. Crawford et al. (2011) refers to soft skills as critical thinking, problem solving, collaboration, teamwork and communication. Skill development occurs over a period of time and curricular enhancements need to occur to have graduates meeting these expectations. Pearson and Moore (2017) noted “[p]oor understanding of employment needs coupled with learning objectives that do not adequately address professional skill development may produce graduates that are at a competitive disadvantage when seeking industry employment” (p. 580).

A variety of studies have been conducted to focus on cognitive and behavioral skills. Garton and Robinson (2006) recommended certain employability skills needed curricular enhancement. Peddle (2000), stated quality and preparation of graduates remain important factors in business settings. In a study conducted by Graham (2001) it was found agricultural employers believed general work experience was an influencing factor for graduates or entry-level
employees to be successful. Furthermore, in many previous studies, it has been concluded an array of skills and abilities are important for agricultural capstone course instructors to implement in the classroom and for agricultural graduates to possess upon entering the workforce (Crunkilton et al., 1997; Perry et al., 2007; Litzenberg and Schneider, 1987; Paulsen and Retallick, 2015). Various studies have highlighted the importance and need for graduates to possess professional skills such as communication, teamwork/collaboration, professionalism, written communication, critical thinking / problem solving, and self-management (Casner-Lotto et al., 2006; Crawford et al., 2011; Ricker, 2014). In a study conducted by Ricker (2014), 77% of the hiring managers in the study (n = 2138) indicated professional skills held the same level of importance as technical skills and discipline knowledge.

Previous literature described the importance for agricultural graduates to possess certain skills before entering the workforce; therefore, it is important to gauge students’ acquisition of skills in capstone courses which prepare them for employment in industry. Crunkilton et al. (1997) operationally defined a capstone course as “a planned learning experience that requires students to synthesize previously learned subject matter content and to integrate new information into their knowledge base for solving simulated or real-world problems” (p. 3). Adding to the definition of capstone courses, Crunkilton et al. (1997) noted primary educational outcomes and five learning activities required of capstone courses. Educational outcomes are defined as problem-solving, decision making, critical thinking, collaborative / professional relationships, oral communication, and written communication. Learning activities required in capstone courses, as defined by Crunkilton et al. (1997), entail projects and / or case studies, issue analysis, small group work, oral communication, and industry involvement. Additionally, researchers (Andreasen and Trede, 2000; Crunkilton et al., 1997; Grahe and Hauhart, 2013; Kinzie, 2013) have suggested capstone courses should aid in the transition between academic experiences of students and career entry. Wagenaar (1993) defined the elements of capstone courses to be a central core of theory and methods, contain a range of relevant topics, while advancing knowledge in these topic areas to achieve mastery.

The Ag 450 course at Iowa State University serves as the capstone course for Agricultural Studies majors. Approximately 95% of the Agricultural Studies students who complete Ag 450 will be employed in the agricultural sector within the first six months of graduation (Iowa State University College of Agriculture and Life Sciences Career Services, 2019). Agricultural employers expect graduates to possess certain professional and technical skills and capstone courses are designed to allow students to apply skills learned throughout their educational career in hands-on learning situations, while they prepare to make the transition from academia to the workplace. Thus, it is important for capstone courses such as Ag 450 to recognize or analyze how the course is impacting student preparedness in terms of skills expected by industry professionals.

**Conceptual Framework**

Roberts and Ball’s (2009) content-based model for teaching agriculture served as the conceptual framework for this study (see Figure 1). This model stems from a behaviorist type of educational framework which uses content-centered agricultural education and in turn, provides a more in-depth look at skill acquisition (Roberts and Ball, 2009). More specifically, the portion of the model that focuses on agricultural instruction and skill acquisition was the focal point for this research. This aspect of the model accounts for the needs of agricultural industry, followed by a combination of industry validated curricula and educators that are competent in technical knowledge (Roberts and Ball, 2009). The outcome of all of these pieces is a skilled worker—who is holistically prepared to be successful in the agricultural industry. Roberts and Ball (2009), described a skilled worker in this context as a student who has learned specific traits or skills not only in the classroom but also in practice. For example, Roberts and Ball (2009) discuss the concept of novice-to-expert model identified by Schunk (2004). In summary, in the novice-to-expert model, workers or students identify skills to be learned, identify a novice, identify an expert, and determine how the novice can be moved to an expert in the

![Diagram of Conceptual Framework](image-url)
most efficient manner. More specifically, in terms of skilled workers, Schunk (2004) defined specific skills as abilities that apply to certain disciplines. Therefore, a skilled worker would have the knowledge and skillset that would apply to a specific industry, job, or profession, rather than general skills that are applied to a variety of settings.

In alignment with the model which conceptually framed this study, the skill constructs utilized in this study were industry validated and relevant in time. Secondly, the Ag 450 course is designed for students to practice developing the necessary skills related to farm management and operation. Also, Ag 450 provides students with real-world application as it relates to production agriculture. Therefore, describing students’ perceptions regarding their beliefs in terms of technical and professional skills before and after completing the Ag 450 course can be an indicator of the agricultural instruction and skill acquisition aspect of the Ag 450 course, utilizing Robert and Ball’s (2009) model for teaching agriculture. Furthermore, by describing students’ experiences before and during the Ag 450 course, the workplace application aspect of the capstone course may be further validated for relevancy. Students that are enrolled in the Ag 450 course bring various backgrounds and work experiences with them. By collecting data from students in terms of their prior work experience and comparing their experiential learning experiences gained through the Ag 450 course to their previous work, Ag 450 course facilitators may be able to determine how the Ag 450 course is adding value to the student’s portfolio of work experiences.

**Purpose and Objectives**

The purpose of this study was to describe students’ agricultural experiences before and during the Ag 450 course and determine students’ perceived attainment / growth associated with professional and technical skills which were deemed important by agricultural industry experts. The following three objectives guided this research study:

1. Describe students’ professional and agricultural academic experiences before and during the Ag 450 course.
2. Determine Ag 450 students’ self-perceived competence associated with industry-identified technical skills at the beginning and end of their enrollment in the capstone course.
3. Determine students’ levels of agreement with their attainment of industry-identified professional skills.

**Methods**

Descriptive survey research was used to describe students’ experiences and perceptions of technical and professional skills before and after completing an agricultural capstone course. The tailored design method as described in Dillman et al. (2014) and a directly administered survey, as described by Ary et al. (2010) served as the foundation for the data collection process used in this study. Ary et al. (2010) describe directly administered surveys as a questionnaire “given to a group of people assembled at a certain place for a specific purpose” (p. 387). In this specific study, the desired population, current Ag 450 students, meet together on Tuesday afternoons for their exams, committee work, and business meetings. The survey was administered to the Ag 450 students on their last scheduled Tuesday class meeting of the semester, during the fall 2018 and spring 2019 semesters. Prior to the students arriving to the class meeting, an informational email was sent to the students as a means to deliver a link to the survey and to thank them for their time and participation. When the students arrived in class, they were provided a verbal overview of the research study, instructions on how to fill out the instrument, and informed about the voluntary nature of this study. Students were also provided time to ask any questions they had about the process. Students who volunteered to complete the instrument were given as much time as needed within the single class session to participate in the study.

**Instrumentation**

The survey instrument contained three major sections which was guided by the three main research objectives. Students were asked to respond to 18 industry validated technical skill items, 34 industry validated professional skill items, and seven demographic / background characteristic items. The industry validated professional and technical skill items were derived from findings of a previous study related to professional and technical skills agricultural industry employers expect graduates to possess. The aforementioned study used a modified Delphi to determine Midwest agricultural industry experts’ perceptions of the most important technical and professional skills needed to gain employability in their companies. The skills which met the consensus of agreement threshold in the Delphi process were included on this needs assessment instrument.

Technical skills were operationalized as “the ability, coming from one’s knowledge, practice, and aptitude, to do something well: competent excellence in performance; and a craft, trade, or job requiring manual dexterity or special training” (Robles, 2012, p. 457).

For each technical skill item, the students were asked to assess their current perceived level of competence and retrospectively evaluate their competence of each skill at the start of the semester an a double-matrix, six-point scales (1 = no competence [Real Limits = 0 -1.49], 2 = fundamental awareness [Real Limits = 1.50 - 2.49], 3 = novice (limited experience) [Real Limits = 2.50 - 3.49], 4 = intermediate competence [Real Limits = 3.50 - 4.49], 5 = advanced competence [Real Limits = 4.50 - 5.49], 6 = expert [Real Limits = 5.50 - 6.00]).

Professional skills were operationalized as “character traits, attitudes, and behaviors-rather than technical aptitude of knowledge” (Robles, 2012, p. 457). Students were asked to review the list of professional skills and indicate your level of agreement with each statement, which was prompted with “I consider myself to be….” Each professional skill item was coupled with a five-point scale (1 = strongly disagree [Real Limits = 0 -1.49], 2 = somewhat disagree [Real Limits = 1.50 - 2.49], 3 = neither agree nor disagree [Real Limits = 2.50 - 3.49], 4 = somewhat agree [Real Limits = 3.50 - 4.49], 5 = strongly agree [Real Limits = 4.50 - 5.0]). The instrument also included
multiple choice and open-ended items to inquire about the students’ demographic and background characteristics (e.g., age, gender, academic classification, description of previous internship experiences, Ag 450 Course committee involvement, and description of Experiential Learning Activities [ELA’s]).

Data Analysis
The IBM Statistical Package for Social Sciences (SPSS®), Version 23, was used to analyze the quantitative data for this study. Descriptive statistics and measures of central tendency and dispersion (i.e., frequency, %, means, and standard deviations) were calculated to interpret students’ perceptions of perceived preparedness related to technical skills.

Table 1. Students’ Perceptions of Competence of Technical Skills Before and After Ag 450

<table>
<thead>
<tr>
<th>Technical Skills</th>
<th>n</th>
<th>Before</th>
<th>After</th>
<th>M</th>
<th>ΔM</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain Management</td>
<td>104</td>
<td>Before</td>
<td>3</td>
<td>17</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>Commodity production knowledge</td>
<td>104</td>
<td>Before</td>
<td>2</td>
<td>16</td>
<td>26</td>
<td>38</td>
</tr>
<tr>
<td>Farm management</td>
<td>104</td>
<td>Before</td>
<td>3</td>
<td>10</td>
<td>22</td>
<td>48</td>
</tr>
<tr>
<td>Project management</td>
<td>104</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>37</td>
<td>47</td>
</tr>
<tr>
<td>Understanding of commodity markets</td>
<td>103</td>
<td>Before</td>
<td>3</td>
<td>6</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>Soil fertility programs</td>
<td>104</td>
<td>Before</td>
<td>2</td>
<td>14</td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>Written Communication Skills</td>
<td>104</td>
<td>Before</td>
<td>1</td>
<td>7</td>
<td>8</td>
<td>46</td>
</tr>
<tr>
<td>Assessing needs of farmers</td>
<td>103</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>Soil data management and application</td>
<td>104</td>
<td>Before</td>
<td>2</td>
<td>15</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>General knowledge of the agricultural industry</td>
<td>103</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>46</td>
</tr>
<tr>
<td>4R agronomic principles of management</td>
<td>104</td>
<td>Before</td>
<td>2</td>
<td>13</td>
<td>28</td>
<td>43</td>
</tr>
<tr>
<td>Experience working with producers</td>
<td>103</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>53</td>
</tr>
<tr>
<td>Verbal Communication Skills</td>
<td>103</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>Livestock marketing</td>
<td>103</td>
<td>Before</td>
<td>3</td>
<td>11</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>General crop scouting knowledge</td>
<td>104</td>
<td>Before</td>
<td>3</td>
<td>9</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>Livestock management</td>
<td>103</td>
<td>Before</td>
<td>2</td>
<td>4</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td>Basic knowledge of computer operations</td>
<td>102</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>32</td>
</tr>
<tr>
<td>General livestock production</td>
<td>103</td>
<td>Before</td>
<td>2</td>
<td>3</td>
<td>11</td>
<td>38</td>
</tr>
</tbody>
</table>

Note. 1 = no competence (Real Limits = 0 - 1.49), 2 = fundamental awareness (Real Limits = 1.50 - 2.49), 3 = novice (limited experience) (Real Limits = 2.50 - 3.49), 4 = intermediate competence (Real Limits = 3.50 - 4.49), 5 = advanced competence (Real Limits = 4.50 - 5.49), 6 = expert (Real Limits = 5.50 - 6.00).
to the industry validated technical and professional skills before and after completing the Ag 450 course. Moreover, descriptive statistics were calculated for the background and demographic characteristics of the agricultural students (i.e., gender, age, academic classification, previous internships, experiential learning experiences, and Ag 450 committee involvement).

Results

The first objective in this study sought to describe students’ professional and academic experiences before and during the Ag 450 course. The average student enrolled in this capstone course were male ($n = 76; 71.7\%$), classified as a senior ($n = 100, 94.3\%$), had an average age of 21.80 (SD = 1.13), and had previously engaged in an internship experience ($n = 89; 84\%$). Students reported engaging in a wide context of internships, which included: agronomy, agricultural technology, animal nutrition, agricultural cooperatives, seed, agricultural research, animal science, cooperate farming operations, custom farming operations, university extension, soil and water conservation, and general livestock. In terms of professional and agricultural experiences during the Ag 450 course, students also reported a wide array of Experiential Learning Activities (ELA’s). Those activities included harvest equipment operations (e.g., grain cart, combine, anhydrous ammonia application, tillage, etc.), farm equipment precision technology (e.g., GPS), grain marketing, swine management, swine management, welding, and working with industry representatives (i.e., seed).

As part of the requirements for the Ag 450 course, all students enrolled in the course served as member on one committee. In regard to Ag 450 committee involvement, 18.9\% of the students served on the Finance and Marketing Committee, 17.0\% served on the Buildings and Grounds Committee, 17.0\% served on the Crops Committee, 16.0\% served on the Machinery Committee, 16.0% served on the Public Relations Committee, and 15.1\% of the students served on the Customs and Swine Committee.

The second objective of this study sought to determine students’ perceptions of their perceived competence associated with technical agricultural skills before and after completing the Ag 450 course. On the retrospective assessment of competence, the students perceived themselves to have intermediate competence [Real Limits = 3.50 - 4.49] on 17 of the 18 professional skill items on the instrument. In fact, “Grain management” (M = 3.32, SD = 0.93) was the only technical skill item where students, on average, retrospectively perceived themselves to be a novice [Real Limits = 2.50 - 3.49]. In regard to the students’ current assessment of technical skill competence, the students reported intermediate competence for 10 items and advanced competence [Real Limits = 4.50 - 5.49] on eight items (see Table 1 on previous page). The technical skill items with the largest dispersion between students retrospective and current assessments were: “Grain management” ($\Delta = 0.83$), “Commodity production knowledge” ($\Delta = 0.74$), “Farm management” ($\Delta = 0.72$), “Project management” ($\Delta = 0.65$), and “Understanding of commodity markets” ($\Delta = 0.62$). On average, students reported an increase in their competence of all technical skills included on the instrument.

The third objective was to determine students’ perceived level of attainment of important professional skills identified by industry leaders. Of the 34 industry validated professional skills presented on the instrument, students indicated they strongly agreed (Real Limits = 4.50 - 5.0) they possessed 19 of the professional skills and somewhat agreed (Real Limits = 3.50 - 4.49) with their attainment of 15 professional skills. The professional skills which students reported the highest average levels of agreement on (pertaining to their acquisition of the professional skills) was being trainable (M = 4.77, SD = 0.65), "respectful" (M = 4.76, SD = 0.68), “accountable” (M = 4.74, SD = 0.65), “demonstrating positive work ethic” (M = 4.73, SD = 0.65), “demonstrating integrity” (M = 4.69, SD = 0.67), and “dressing appropriately” (M = 4.69, SD = 0.73). While the student’s overall agreement levels with their attainment of professional skills ranged from a 4 (somewhat agree; RL = 3.50 - 4.49) to a 5 (strongly agree; RL = 4.50 - 5.00), the professional skill items with the lowest levels of agreement were: being safety-minded (M = 4.20; SD = 0.89), being “organized” (M = 4.26; SD = 0.84), “working out of my comfort zone” (M = 4.26; SD = 0.77), being “inclusive” (M = 4.30; SD = 0.88), and “adjusting to various communication styles” (M = 4.37; SD = 0.80).

Conclusions, Limitations, Implications, and Recommendations

Previous literature points to the importance of employability skill development in post-secondary programs (Henard and Roseveare, 2012; Jackson, 2014; Dacre Pool and Sewell, 2007; Yorke, 2011) and indicated the burden placed on higher education to ensure students’ acquire these skills to enhance their employability (Coll and Zegwaard, 2006). Specifically, Jackson (2014) noted “These employability skills, among others, are deemed critical enablers of graduate ability to function effectively in the modern workplace and their development is now considered integral to undergraduate education” (pp. 3-4). Based on the need to ensure that our post-secondary curriculum of our capstone course, Ag 450, is preparing undergraduate students for employment, this study sought to determine students’ preparedness and describe the professional experiences they have engaged in.

While this research study provided insight on the development of technical and professional skills in the Ag 450 course at Iowa State University, the absence of a probabilistic sample used in this study served as a limitation to generalize the results to the larger population. However, this study provides the profession with an instrument which can be leveraged to evaluate students’ perceived technical and professional skill attainment in similar capstone courses in neighboring institutions. The results of this study also provide a source of baseline data for the sake of comparison in future studies. The agriculture industry experts who contributed to the list of important technical and professional skills were hiring managers of companies located in the Midwest region of the United States. Based
on the variance of various agricultural sectors across this country, the skill items provided in this instrument might not represent a comprehensive list of skill which would be important in each region.

Students within the Ag 450 course indicated they perceived themselves to have intermediate competence [Real Limits = 3.50 - 4.49] on 17 of the 18 professional skill areas. In regard to the students' current assessment of technical skill competence, the students reported intermediate competence for 10 items and advanced competence [Real Limits = 4.50 - 5.49] on eight items Results of this study are connected to the Roberts and Ball's (2009) model for teaching agriculture. The growth identified within the course connects to the model for teaching agriculture with the agricultural industry connecting to the technical knowledge and validated curricula. The combination of this attribute to the agricultural instruction and skill acquisition through a capstone course is highlight by Crunkilton et al. (1997) with defining a capstone course as "a planned learning experience that requires students to synthesize previously learned subject matter content" (p. 3). Students within this course are able to apply prior agriculture content in this capstone course focusing on the technical skills.

A variety of researchers (Crunkilton et al., 1997; Perry et al., 2007; Litzenberg and Schneider, 1987; Paulsen and Retallick, 2015) have also highlighted an array of skills and abilities as being important for graduates entering the workforce and for agricultural capstone course instructors to implement in the classroom. In the case of this capstone course, the technical skills highlighted were not only learned by students in the classroom, but also were applicable in practice (Roberts and Ball, 2009). A positive increase in mean was seen for each of the technical skills in this study which validates the instruction and student experiences in the course have increase the students perceived competence in the technical areas. This increase is supported by previous literature on capstone courses as defined by Andreasen and Trede (2000) and Wagenaar (1993).

Future research needs to focus on the technical skills attainment within this capstone course. Data needs to be collected on students over multiple semesters and a follow up studies conducted on the graduates once out in the workforce regarding preparedness for the agricultural industry on the identified technical skills. This study could be replicated in similar agriculture capstone courses to see the growth of students in the technical skills areas.

Previous employer surveys have indicated college graduates have inadequate levels of professional skills (Crawford et al., 2011; Hart Research Associates, 2015; O'Brien, 1997; Ricker, 2014) and the higher education institutions have been criticized for failing to help students develop these needed professional skills (Campbell, 1998; National Research Council, 2009). The professional development skills which were included on the instrument in this study were predicated from industry employers who hire students from the Iowa State University Agricultural Studies program. The Ag 450 students in this study indicated they strongly agreed (Real Limits = 4.50 - 5.0) they possessed 19 of the professional skills and somewhat agreed (Real Limits = 3.50 - 4.49) with their attainment of 15 professional skills. These professional skills align with various skills (e.g., self-management, problem solving, teamwork, and communication skills) which were deemed as important in the study conducted by Crawford et al. (2011).

It is important to note that this study provided a means to gauge students’ perceptions of their professional skills. We did not use a retrospective item to determine if these professional skills have been further developed in this class, and we are not purporting that students have enhanced each of these skills based on their enrollment in Ag 450. Their experience in previous post-secondary coursework, internship experiences, and other experiences could be factors which have served to enhance the students' professional skills. Based on this shortcoming, it is recommended that future studies on capstone students’ attainment of professional skills use a pre-test, post-test design to control for students' level of professional skills before beginning the course.

While students felt they had adequate competency of professional skills, adjustment could still be made to bolster their employability. Pearson and Moore (2017) recommended that course instructors should consider the inclusion of professional skills in their course objectives. Moreover, Pearson and Moore (2017) noted that these should not be separate objectives for higher educational environments, and “professional skill development should be integrated into discipline-oriented content for it to be impactful to students and acknowledged as equally important for their career success” (p. 581). Based on these recommendations, it is recommended that Ag 450 course instructors at Iowa State University evaluate the current learning objectives and make augmentations to highlight professional skills within the discipline-oriented content. Pearson and Moore (2017) also recommended the use of service learning as a methodology to provide hands-on, group learning experiences where students are given the opportunity to practice communication skills with community members. The integration of a service-learning component or other teaching methods which focus on professional skill development should be considered by the instructors of the course.

Further research in this area is needed to better understand how the instruction and materials of the Ag 450 course may be altered to improve the growth of students' professional and technical skills set. This study is currently limited to two semesters of Ag 450 students and the researchers recommend it should be replicated for more in-depth data analysis. Although the results of this study show that students are rating themselves as possessing intermediate to advanced confidence levels, it should be noted that by no means should an agricultural graduate from a four-year program be an expert in their wheelhouse. While the students perceived themselves to have acquired professional skills and grown in respect to technical skills in Ag 450, it is implied that students will not achieve mastery of certain skills until more experience or on-the-job learning takes place for a certain amount of time.

The exact amount of time it takes to achieve mastery of certain skills would depend on the skill, industry,
and individual. This study may be replicated at other universities and agricultural programs in order to address the effectiveness of capstone course curricula. This study may also be broadened to look at a larger range of technical and professional skills that may be more relevant in different parts of the country. Furthermore, there would be value in assessing students longitudinally throughout their college career, in the capstone course, and while working in industry after graduation. A longitudinal study would allow instructors to see where students are, in regard to technical and professional skill development, at different points in their preparation. The perspective of graduates who are currently working in industry would also help to paint the picture associated with the importance and transferability of the skills and knowledge they acquired at the post-secondary setting.

**Literature Cited**


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