The Value of Undergraduate Research:
A Pilot Study of Agribusiness Alumni Perceptions

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Abstract

The benefits of undergraduate research for students, including gains in analytical and critical thinking skills, written communication, and self-assurance, has been well-documented in the natural sciences. However, few studies exist that assess the benefits of undergraduate research in the social sciences and none of these studies reports on undergraduate research experiences in agricultural economics. This research reports on a pilot study designed to assess the value of undergraduate research experiences among agricultural economics students. Over 500 alumni who graduated from California Polytechnic State University over the last few decades responded to the 2013 survey. Results demonstrate the value of undergraduate research in agricultural economics to students' career and personal development as well as the potential for changing perceptions of the benefits over time based on the differences we identified in alumni age group cohorts. A critical issue for agricultural economics departments is how to allocate resources in order to most cost-effectively provide such enrichment in the undergraduate curriculum.

Introduction

The agricultural economics profession has long understood the value of graduate student research. However, little attention has been focused on the value, both short- and long-term, of undergraduate research. Most undergraduate agricultural economics and agricultural business departments require a capstone course that emphasizes independent research projects. Still others require a senior project as part of the curriculum. Faculty in non-land grant universities commonly tap undergraduate students as research assistants for both funded and unfunded projects. The National Survey of Student Engagement determined that on average 33% of college students in the U.S completed or are currently working on a senior project at their University (NSSE, 2012). Faculty who work with undergraduate students as capstone course instructors, senior project advisors and as principal investigators can attest to the intellectual

growth and advancement in critical thinking that they witness in their students. The skills gained from an independent research project or senior project are said to have a beneficial effect on the students after completion and prepare those students for the world after college (Bauer and Bennett, 2003).

Until now, no one has formally assessed these independent research efforts from the students' perspective in agricultural economics or agricultural business. It is important to assess the benefits of undergraduate research given that the cost of providing undergraduate research experiences is quite high in terms of faculty resources. For example, at California Polytechnic State University (Cal Poly) in San Luis Obispo, senior projects are required of all undergraduate students. In the Department of Agribusiness, each student historically was required to conduct an individual senior research project spanning two quarters; a faculty member is assigned one-third of a weighted teaching unit (WTU) per senior project student. Four WTUs result from working with only 12 students per quarter, as opposed to the normal classroom situation of 35 to 80 students, depending on the course. With recent and on-going budget cuts, departments that require such undergraduate projects are devising ways to reduce the cost of providing that experience; moving to group-based projects that span one quarter rather than individual projects that span two quarters is one strategy that has been encouraged in particular circumstances at Cal Poly. In that scenario, the faculty resources necessary to provide the senior project experience are reduced by about fifty percent.

This pilot study surveyed alumni from Cal Poly's Department of Agribusiness, a large, primarily undergraduate agribusiness program that incorporates mandatory senior research projects as well as other undergraduate research opportunities such as capstone courses and faculty-directed projects. The survey was designed to gauge Cal Poly Agribusiness alumni

perceptions of their undergraduate research experiences in order to assess the value of those experiences. This study contributes to the literature by examining the value of undergraduate research in agricultural business which has not previously been studied. In addition, our study incorporates findings from more than 500 alumni across several decades which allows us to examine perceptions of alumni by age cohort. These perceptions demonstrate both the value of undergraduate research and the potential for changing perception of benefits over time.

Literature Review

What Matters in College

Previous research demonstrates that faculty-student interactions—including those that come from engaging in undergraduate research or capstone experiences—influence a multitude of personal and educational outcomes for students including academic skill development, satisfaction with college experiences, self-confidence, and leadership ability (Astin, 1977; Astin, 1993; Kuh, 1995; Pascarella & Terenzini, 1991; Smart, Feldman & Etherington, 2000). Kuh (1995) found that most benefits were related to increases in interpersonal and practical competence which he defined as the students' self-esteem. Kuh and Hu (2001) conclude that "faculty-student interaction encourages students to devote greater effort to other educationally purposeful activities during college" (p.328) which may explain why these personal and educational gains occur.

Evidence from Light (2001) suggests that learning outside of classes is a crucial part of the most important and memorable experiences of students in college (p.8). He found that the social and personal benefits of these experiences occur both in group studies (student-to-student interactions) and in working closely with professors (faculty-to-student interactions), with some

students reporting that a particularly profound experience was a mentored internship not done for academic credit (p.9). His research finds that

> students who get the most out of college, who grow the most academically, and who are the happiest organize their time to include activities with faculty members, or with several other students, focused around accomplishing substantive academic work (p.10).

Benefits of Undergraduate Research

There is a significant literature documenting the impact on student development of undergraduate research that students design and implement with the guidance of a faculty mentor. These recorded benefits typically include clarification of career plans, improved preparation for graduate school, skill development, and personal benefits. For example, Lopatto (2004) reports on a survey of science undergraduates on the benefits of undergraduate research. Student from 41 institutions participated in the online study and indicated gains on 20 potential benefits of undergraduate research. Bauer and Bennett (2003) demonstrate that alumni who had an undergraduate research experience perceived a greater skill set, a more profound sense of accomplishment from their undergraduate degree and were more likely to become a graduate student. The skills that alumni reported gaining through their undergraduate research experience include the ability to analyze literature, work independently, understand scientific studies, work as a leader, and speak proficiently.

Seymour, Hunter, Laursen and Deantoni (2004) interviewed students at four liberal arts colleges about their undergraduate research experiences in the sciences. The researchers found that students were overwhelmingly positive about their experiences and described benefits of several different types, including preparation for graduate school, “thinking and working like a scientist”, shifts in attitudes to learning and working as a researcher, and other benefits. Hunter,

Laursen and Seymour (2007) report faculty perceptions of the benefits student receive from undergraduate research are similar to the benefits that students describe.

A segment of the literature on the benefits of undergraduate research focuses on the so-called "pipeline" benefits associated with a greater likelihood of graduate school enrollment for students who have engaged in hands-on research as undergraduates. Most of this research has been in the natural science fields. Russell, Hancock and McCullough (2007) analyzed surveys of 15,000 students in science, technology, engineering or math (STEM) fields at various types of institutions. They found that undergraduate research opportunities increase understanding of how to conduct a research project, confidence in research skills and awareness of what graduate school is like (p.548). In addition, they found that a key element in increased interest in STEM careers and higher degrees was the "inculcation of enthusiasm" about research. Ward, Bennett and Bauer (2002) conducted a content analysis of free-form evaluation letters from undergraduate research students in engineering and the sciences. They found that students perceived their learning in the out-of-class setting (conducting undergraduate research) to be greater than through ordinary classes. Some of the benefits from undergraduate research identified by these students include skill acquisition, ability to act independently, appreciation of teamwork, and the ability to work with setbacks and/or ambiguity, among others.

Bauer and Bennett (2003) surveyed alumni of the University of Delaware about their perceptions of their well-established, formal undergraduate research program which requires that faculty give undergraduate researchers "a significant role in all phases of the research process" (p.215). They found that alumni who had participated in undergraduate research had greater perceived enhancement of many skills than alumni who did not have undergraduate research experience. These included being able to speak effectively, acquire information on their own, act

as a leader, understand scientific findings, carry out research, analyze literature critically, possess clear career goals, and develop intellectual curiosity.

Until recently, few studies have addressed the effects of undergraduate research experiences in the social sciences and humanities directly. Ishiyama (2002) attributes this to the fact that social scientists and humanists do not often employ the type of experimental research that is conducive to undergraduate participation. Ishiyama studied humanities and social science students at Truman State University who participated in undergraduate research and found that early participation produced significant gains in students' analytical and logical abilities and the ability to learn on their own. Burke and Cummins (2002) report on a student-faculty collaborative research project in management that led to significant benefits for the faculty and student compared to traditional independent study courses. It appears that interest in undergraduate research experiences is expanding in social science fields like Psychology (e.g., Landrum and Nelson, 2002; Wayment and Dickson, 2008). This paper adds to the literature by providing an assessment of the benefits of undergraduate research to agricultural economics/agribusiness students.

Methodology

We developed a survey based on findings in the literature as well as discussions with current Cal Poly students, faculty, and members of the Cal Poly Agribusiness Department Advisory Council. Questions were designed to assess the value of the undergraduate research experience in attaining the first job, in getting promoted, and the alumni's perception of their problem solving, creativity, and critical thinking abilities credited to their undergraduate research effort. We also queried the alumni about the points in their careers in which they found the skills

learned or their research topic beneficial. We asked about the alumni's participation in other aspects of campus life and career preparation, such as academic clubs (those housed in the Department or College, such as the Agribusiness Management Club), internships, athletics, non-internship employment during college, fraternities/sororities and other non-academic clubs. Alumni were asked to rank these experiences based on how each influenced their career success. We asked alumni to provide their college GPA, and we also collected basic demographic data on gender, age, race and income. The survey was pre-tested on a group of 10 alumni at the end of January 2013 to see if there were any problems or issues.

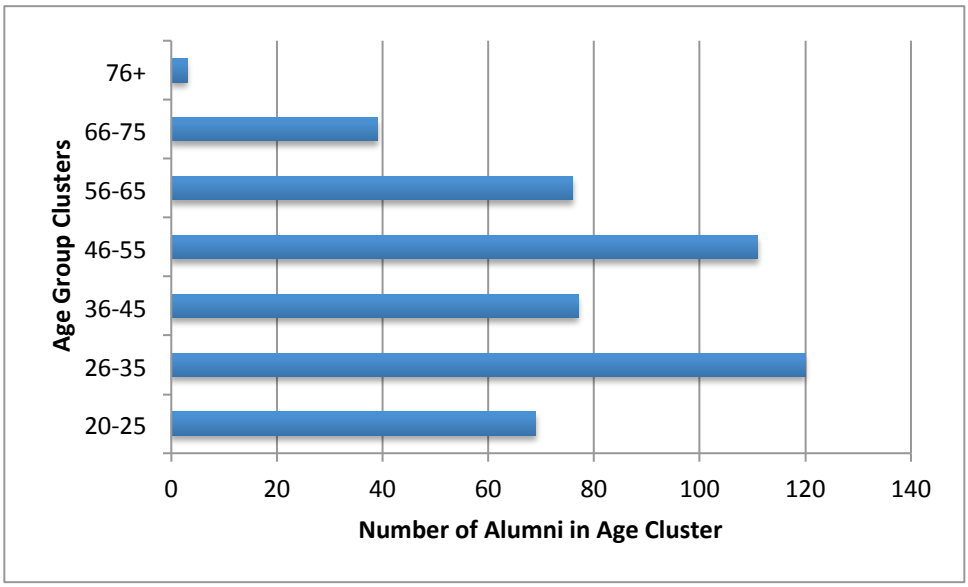
After making minor modifications based on the pre-test feedback and receiving University approval we sent the survey February 15, 2013, via a SurveyMonkey email link to 3,227 Cal Poly Agribusiness Department alumni. This list is administered and maintained by University Advancement and access must be approved by Public Affairs; this step is in addition to human subjects approval by IRB. As this survey was distributed electronically, the contact list is comprised of only living alumni with e-mail addresses who have maintained some type of contact with the University either through Alumni Relations or Advancement. A reminder e-mail was sent out two weeks after the initial distribution. The survey was open for approximately 30 days.

The survey distribution efforts resulted in 553 responses for a response rate of 17.1%. According to institutional statistics from PolyLink, Cal Poly's electronic alumni communication platform, the click-through rates on alumni surveys average 3% (McNally). Clearly Agribusiness alumni were more responsive than is typical.

The data were downloaded from SurveyMonkey into SPSS which was used to analyze the data. Frequency distributions were run on all variables. The respondents were divided into

three age categories to see if their age cohort made a difference in their responses. We grouped the respondents into early career (ages 20 – 35); mid-career (ages 36- 55) and late career/retired (ages 56 and up) categories. The groups were relatively evenly distributed; the youngest age category contained 189 respondents, the middle category had 188 alumni while the late career/retired category included 118 respondents. See Figure 1 for a breakdown of the respondents' age groups.

Figure 1. Age Clusters of Alumni Respondents



We ran cross tabulations on all of the questions to see if the age groups responded differently regarding the value of senior projects and other undergraduate research efforts, as well as the skills learned and benefits gained from the experience. Paired sample t-tests were used on questions that resulted in average values, such as question 10 that asks alumni to rate the benefits gained from their research effort, such as written and verbal communication skills, creativity, data collection and analytical skills and self-confidence.

Results

We wanted to find out how alumni perceived their educational experiences before querying them about senior projects, so we first established how alumni felt about their Cal Poly education as a whole. The results indicated that Cal Poly's Agribusiness alumni were overwhelmingly satisfied with their education. More than half of the respondents rated their education as Excellent, while another 37% rated it Very Good. No respondents rated their education as Poor or Very Poor (Figure 2). The mid-career age group had the highest percentage of Excellent ratings, and these differences were significant, as the p-value was .00.

Figure 2. Alumni's Perception of the Quality of Their Undergraduate Education

Nearly all of the alumni believed their college education had prepared them well for their careers, with 35% responding Strongly Agree and 44% responding Agree to that question, as shown in Table 1. The late career cohort agreed the most with that statement, with nearly 48% strongly agreeing that their education prepared them for their careers; while only 24% in the early career group strongly agreed with that statement. The differences in age group responses were significant at the .001 level.

Table 1. Alumni Responses to Educational Preparation for Careers

Q. 4 My college education prepared me well for my career.

Answer Options	Response Percent	Ages 20 – 35*	Ages 36-55*	Ages 56 and up*
Strongly Agree	35%	24%	40%	48%
Agree	44%	46%	45%	38%
Somewhat Agree	18%	25%	12%	12%
Somewhat Disagree	2%	3%	2%	2%
Disagree	1%	1%	1%	0%
Strongly Disagree	0%	0%	0%	0%

*Significant at the 99% level

We were interested in the types of research experiences alumni had participated in as undergraduates. Though most alumni (86%) had completed an individual senior project, others had completed senior projects during internships (17%), or worked on group senior projects (10%), as shown in Table 2. The mid-career cohort reported the highest percentage of senior project participation (95%). The early career cohort reported a wider variety of research experiences. This is likely because Cal Poly introduced more flexible senior project options in recent years; for example, nearly 20% of the younger respondents reported working on group senior projects. The difference between age groups on these two options was significant, with a p-value of .00. Only about 5% of the alumni had worked on an independent study project outside of their senior project. Respondents may have misunderstood the capstone course option. Only 22% indicated they had taken such courses, but in reality, nearly every alumnus would have been required to complete that type of class. We believe that the term "capstone" may not have been familiar, or they may have forgotten the course names/numbers that were provided as examples. This is evident when analyzing the age group differences: nearly 40% of the early

career alumni noted their participation in these classes, while only 17% of the mid-career and 4% of the late career group responded to the capstone course option. These differences were also statistically significant above the 99% level.

Table 2. Cal Poly Alumni Undergraduate Research Experiences

Q. 6 Which of the following did you participate in at Cal Poly?

Answer Options	Response Percent	Ages 20 – 35	Ages 36-55	Ages 56 and up
Individual Senior Project*	86%	75%	95%	88%
Group Senior Project*	10%	20%	5%	2%
Industry-related senior project	17%	21%	13%	16%
Independent study with faculty	5%	6%	4%	6%
Independent study with industry	5%	7%	6%	3%
Capstone course*	22%	40%	17%	4%
Other	8%	7%	7%	7%

*Significant at the 99% level

Cal Poly has a "Learn by Doing" philosophy of education, and the senior project has been one of the pillars of that philosophy. We were curious to see alumni's perceptions regarding the relationship of their undergraduate research/senior project to their career success. Results were more mixed on this question, as shown in Table 3. Overall, 32% somewhat agreed, with another 25% agreeing more strongly that the senior project positively affected their career success. However, more than 42% disagreed that their project had helped with their careers. Again, there was a split among the age groups; the late-career cohort attributed their senior project more strongly to their career success, while the early career cohort disagreed. The difference was statistically significant, above 99%.

Table 3. Perceptions of Career Success Attributed to Undergraduate Research

Q. 7: I attribute my independent research/senior project to my career progression or success today.

Answer Options	Response Percent	Ages 20 – 35*	Ages 36-55*	Ages 56 and up*
Strongly Agree	9%	4%	9%	16%
Agree	17%	15%	18%	21%
Somewhat Agree	32%	30%	35%	35%
Somewhat Disagree	14%	17%	11%	14%
Disagree	19%	22%	17%	11%
Strongly Disagree	10%	11%	11%	4%

*Significant at the 99% level

Internships have become increasingly popular as students seek out experiential education and companies realize the value of offering internships to 1) identify a talent pool for full-time positions and 2) to find relatively low-cost, short-term employees to fulfill various roles. About 45% of the alumni responding had taken an internship while at Cal Poly, but this percentage was heavily weighted toward the early career cohort, with nearly 65% of that group participating in an internship. Only 16% of the late career group had taken part in an internship, and this difference was statistically significant above 99% (Figure 3). However, most of those alumni who had taken an internship strongly agreed that it was beneficial in their career choice or path (Figure 4).

Figure 3. Participation in Internships, Overall and By Age Group

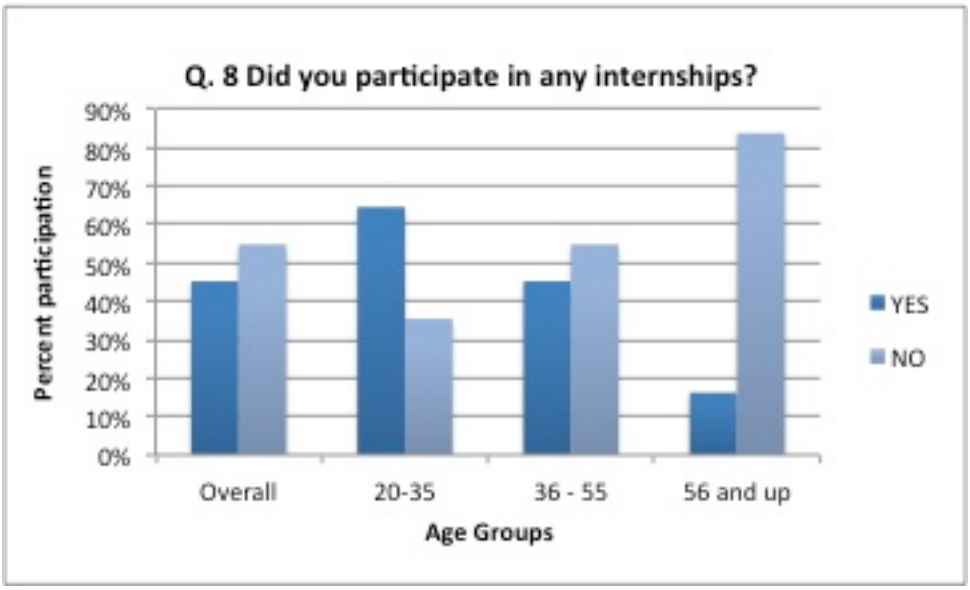
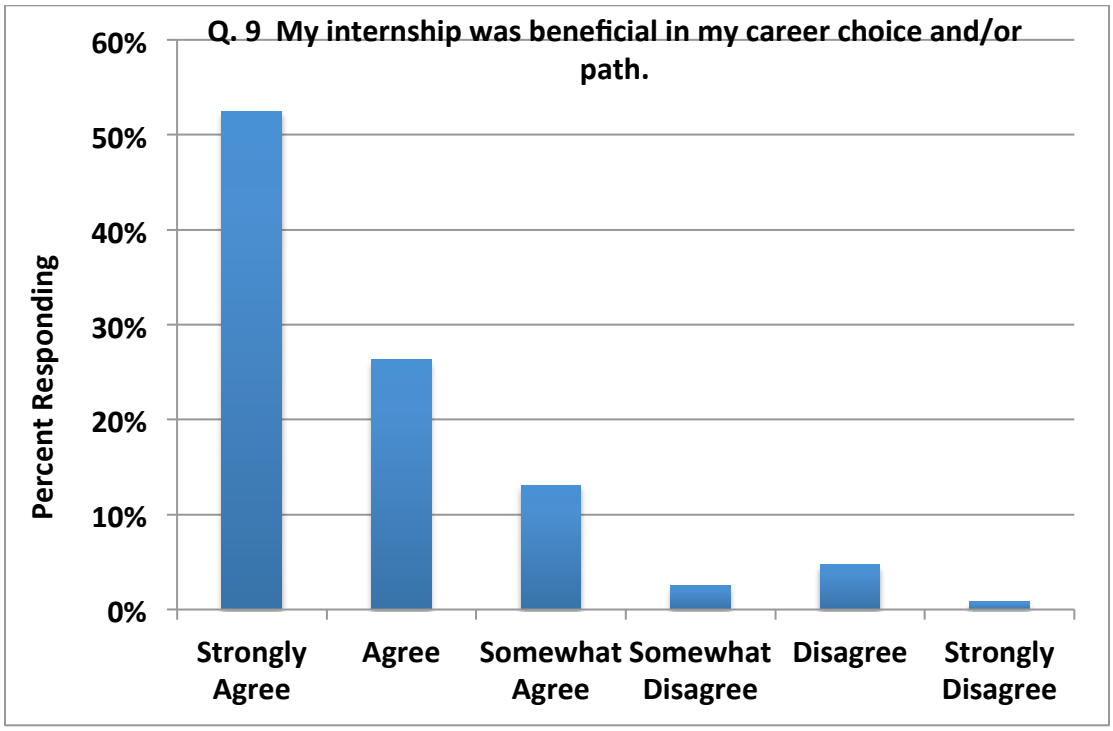
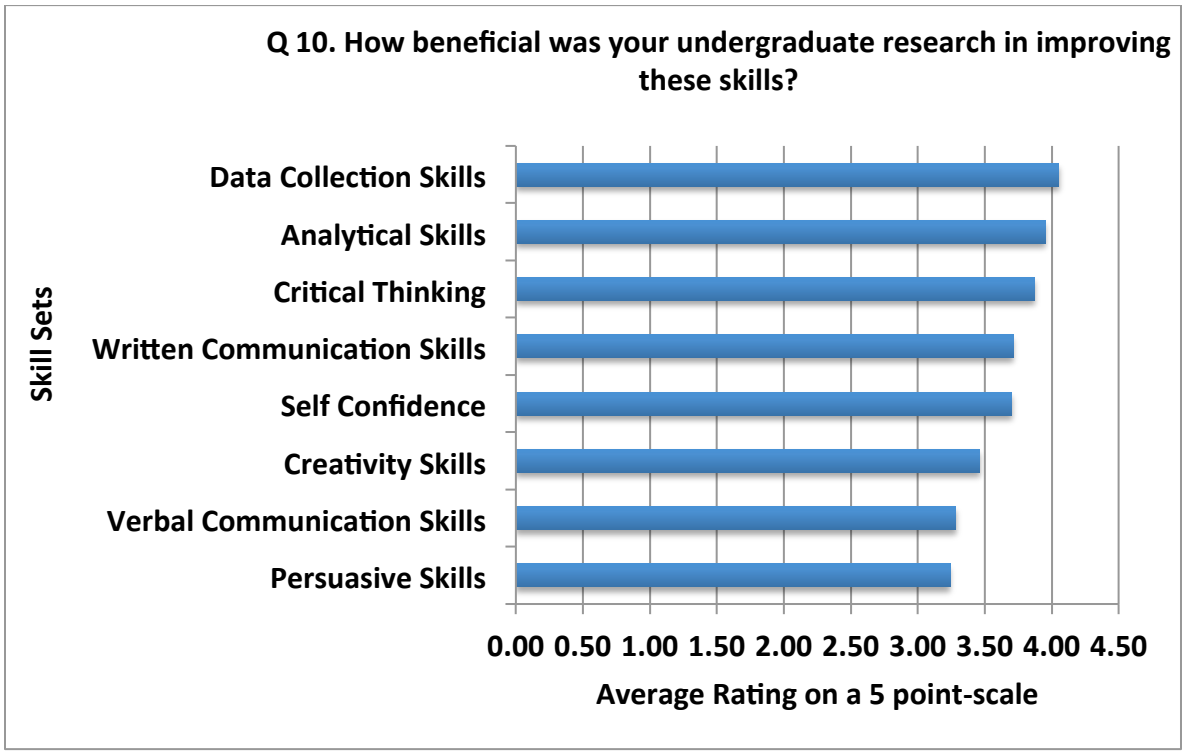


Figure 4. Alumni's perception of internship benefit



Even though alumni did not universally agree on the value of the senior project itself to their career development, we wanted to investigate how the undergraduate research effort helped the alumni develop specific skills. We provided a list of attributes dealing with written and verbal communication, creativity, persuasive skills, critical thinking, analytical skills, data collection skills and self-confidence. Alumni ranked each on a five-point Likert scale. Figure 5 shows the mean rank for each skill set. Data collection, analytical, critical thinking and written communication skills ranked the highest. As the senior project is primarily a written research project, it is not surprising that verbal communication and persuasive skills had the lowest average rating. Paired-sample t-tests were used to test the differences between the averages; the differences were all significant at the 99% level except for Verbal Communication and Persuasive skills.

Figure 5. Skills Gained from Undergraduate Research



The age groups were mostly similar in their rankings, but the various age groups rated several skill sets differently. The ANOVA showed that the late career cohort's higher average ratings for written communication skills, creativity skills and self confidence were significantly different than those of the earlier-career alumni.

Anecdotal evidence from alumni suggested that their senior project had other benefits in their career development. We asked alumni to indicate at what points in their careers they find some benefit from their undergraduate research effort, and what kind of skills did they learn that applied to their careers. As shown in Table 4, working independently, developing problem-solving skills and written communication skills were the most popular responses. These skills also indicated a "rear-view mirror" effect with over 60% of the late-career group noting that problem-solving skills and working independently were important to their careers, while only

Table 4. Alumni's Perceptions of Career and Skill Benefits from Undergraduate Research

Q. 11: At what points in your career have the skills learned from your research project been helpful?

Answer Options	Response Percent	Ages 20 – 35	Ages 36-55	Ages 56 and up
Finding your first job	27%	30%	23%	26%
Getting promoted	9%	7%	7%	13%
Problem solving at work*	**48%**	**42%**	**41%**	**63%**
Verbal communication skills*	**25%**	**30%**	**19%**	**28%**
Written communication skills	45%	45%	39%	52%
Working independently*	**49%**	**44%**	**46%**	**62%**
Gaining a sense of accomplishment*	**42%**	**37%**	**39%**	**51%**
Very little help in my career	18%	18%	16%	18%
No help in my career	9%	10%	11%	4%
Other (please specify)	9%	8%	7%	14%

*Significant at the 99% level

45% of the early and mid-career alumni noted these as important skills garnered from their senior projects. These differences were significant at greater than 99%. Similar age group differences occurred with the attribute of "gaining a sense of accomplishment."

In terms of satisfaction with the senior project or other research experiences, nearly half of the respondents were either Very or Extremely Satisfied. More than a third of the alumni were more ambivalent, responding as Somewhat Satisfied. These opinions also differ by age cohort. Generally, the two older age cohorts were more satisfied with their senior project experiences, though there was some variation, as shown in Table 5. The early career alumni seem a bit more ambivalent about their senior project experience. The differences were significant at the 99% level.

Table 5. Alumni Satisfaction with Their Undergraduate Research Experience

Q. 12 How satisfied were you with your undergraduate research experience?

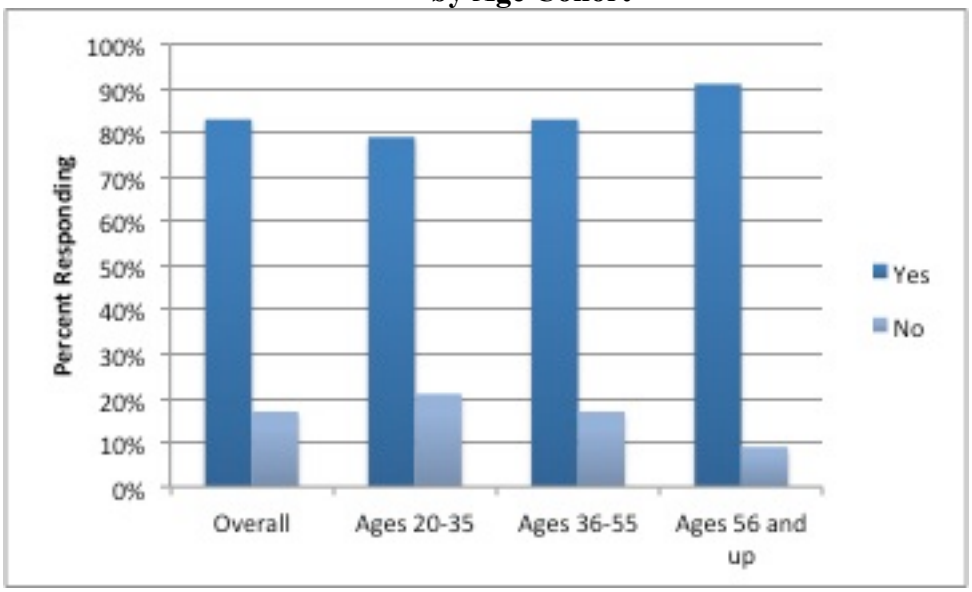
Answer Options	Response Percent	Ages 20 – 35*	Ages 36-55*	Ages 56 and up*
Extremely	18%	19%	15%	23%
Very	31%	26%	35%	31%
Somewhat	36%	38%	34%	33%
Not Very	10%	10%	10%	8%
Not At All	5%	6%	6%	2%
Does Not Apply	1%	0%	0%	3%

*Significant at the 99% level

Despite some ambivalence about the specific benefits or career preparation skills attributed to the senior project, respondents overwhelmingly supported its continuation. More than 83% thought it should be continued, and about half of the respondents (254) weighed in

with specific written comments. This question was also subject to age group differences with the late career group being the most stridently in favor of continuing the senior project – 91%, as compared to 79% the early career alumni. The responses by age category were also statistically significant.

Figure 6. Alumni's Preference Toward Continuing the Senior Project Requirement by Age Cohort



To get a better sense of how alumni's research experience compared with other collegiate activities in terms of career preparation, we asked alumni to rank the top six of nine collegiate experiences in terms of which contributed the most to their career success. Not surprisingly, internships were ranked number one by nearly a third of the alumni. Holding a job during college was ranked number two by 28% of the respondents, and Senior Project was ranked second by 21% and third by another 21 percent. Academic clubs related to students' major or minor field of study were also considered relevant; 21% ranked them as third in importance. We gave respondents up to three options to choose as Not Applicable – we assumed that very few students would have experienced all nine activities. Interestingly, the Senior Project had the

lowest number of N/A rankings – less than 3% of respondents said it was not applicable to their career success, compared to other experiences.

When comparing responses among the cohorts, the late-career group ranked Senior Projects higher than the other age groups (18% ranked it number one, as opposed to 9% and 5% respectively for the mid- and early career groups). This result was statistically significant at the 99% level. Meanwhile, the early career alumni ranked Internships the highest, at 33% versus 16.5 and 7.6% for the mid- and late career groups, respectively. These findings are consistent with the results of previous questions, and reflect the differing educational opportunities available to the age cohorts.

Discussion

Results from this pilot study corroborate and extend the benefits of undergraduate research identified in the previous literature to agricultural economics/agribusiness students. Specifically, Cal Poly alumni responding to our survey indicated the highest ratings to their gains in data collection, analytical and critical thinking skills, written communication and self-confidence. Though only one-quarter (25%) of respondents attributed their career progression/success to the undergraduate research project, there was overwhelming support (83%) to continue the requirement.

It appears from these results that alumni who graduated earlier (that is, the older age cohorts) are relatively more satisfied with their undergraduate research experiences than recent graduates. There are several possible explanations for this difference. First, it could be a case of absence making the heart grow fonder. As one gets greater distance from an experience, you may remember it with greater enthusiasm. Additional life experience may have allowed students in

the older age cohorts to find additional opportunities to reflect on, recognize and make connections with their undergraduate research experiences. It may also be that students who were in college decades ago were less likely to be working while in college or otherwise engaged in significant student activities and thus may have been able to focus more intently on their undergraduate research experiences, thus leading to better perceptions of the experience. A larger percentage of the younger alumni cohort (relatively recent graduates) report doing an internship than the older cohort and this, too, could explain some of the difference in perception by age cohort. Given that the options available to students to satisfy their senior project requirement changed over time, along with the educational culture and economic climate, it is not surprising that the results are not stable across alumni cohorts.

Even as the evidence of the benefits of undergraduate research to students, faculty and institutions mounts (Osborn & Karukstis, 2009), university budgets are more constrained and it is becoming more difficult to offer undergraduate research experiences due to the amount of faculty resources required to effectively supervise the projects. One might then ask if we could (should?) seek more cost-effective ways to deliver these types of experiences such as graduate student or staff supervision of some projects, or group projects. Though already offered as an occasional option, beginning in the fall of 2013, Cal Poly will formally offer a group project option to satisfy the senior project which will increase the faculty-student ratio and thus allow more projects to be supervised per faculty member. While many of the benefits of group projects may be the same as those for individual projects, they may yield a slightly different set of benefits to students including the potential to build teamwork, leadership and/or collaborative writing skills. Faculty may need to develop new skills themselves to facilitate group projects as well as criteria to effectively monitor and evaluate individual contributions to group outcomes.

Another alternative that could be considered is to ask students and alumni if they are willing to pay for undergraduate research experiences for themselves or for future students. Universities could develop a differential tuition charge with fees reflecting the value that students receive from undergraduate research experiences and the higher cost of delivering them much as they currently do with lab and equipment fees. Alumni could be asked to earmark their donations to support undergraduate research activities so that current and future students of their alma matter can realize the benefits they acknowledge as valuable.

It may be that a hybrid internship-research project would provide the most 'bang for the buck' for both students and faculty. This option would require students complete an internship and write a research paper related to the internship that would be supervised by a faculty mentor. This hybrid option could provide students with career preparation benefits while also providing many of the other benefits of undergraduate research such as critical thinking and written communication skills. Faculty time would be reduced compared to the current individual undergraduate research project option, thus conserving departmental resources.

Limitations and Directions for Future Research

While it is very encouraging that Cal Poly's Agribusiness alumni were overwhelmingly satisfied with their education (Figure 2), the fact that no respondent rated their education as Poor or Very Poor suggests that potential for self-selection in our results. If only those that are satisfied are willing to take the time to respond to the survey, the perceptions we learn from their responses may not be an accurate reflection of all alumni experiences.

Another limitation of the study is that all the respondents were alumni from the same department that required them to complete an undergraduate research project. It would be ideal

to extend the study to include departments that do not require a senior research project in order to determine if the benefits of undergraduate research are attributable to the project or to other features of the undergraduate educational experience. It would also be interesting to learn if these results are unique to Agricultural Economics/Agribusiness, where projects may be more applied in nature, or if they hold in general Economics programs as well.

One oversight in the survey was a question to determine whether the alumni's undergraduate research effort helped motivate them to pursue a graduate degree or if it provided any other benefits in succeeding in graduate school. This should be included in any future work regarding the value of undergraduate research.

An additional limitation is that we did not analyze the benefits accruing to students based on the type of project they completed. Given the many different types of undergraduate research or capstone projects are offered across institutions--or even within one institution, if it wishes to offer greater student flexibility--it would also be interesting to learn if alumni perceptions of the benefits are similar across project types. For example, in this study, most alumni who had completed internships reported the internship was beneficial to their career choice or success. Could we expect similar benefits with group research or client-based projects? Additional research is necessary to know for sure.

Conclusion

This research adds to the literature on the benefit of undergraduate research in at least two ways. First, by sampling students in Agricultural Economics/Agribusiness, we offer evidence that some of the same benefits of undergraduate research that accrue to students in other disciplines also are realized by students in the social sciences. Second, because of the long

standing undergraduate research requirement at Cal Poly, we had a large sample of alumni to survey. This allowed us to analyze the stability of alumni perceptions of the undergraduate research experience by age cohort, something that to our knowledge hasn't been previously reported in the literature. Future research will extend this pilot study to include other programs and universities, including those without undergraduate research requirements, to more fully understand the value of undergraduate research and other capstone projects with the ultimate aim of being able to identify how departmental resources can be allocated to most cost-effectively provide such enrichment to the undergraduate curriculum.

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