

Perspectives on the Agricultural and Life Sciences Undergraduate Research Experience at the University of Florida

*Wendy J. Dahl¹, Amanda L. Ford
and R. Elaine Turner
University of Florida
Gainesville, FL*



Abstract

Although many undergraduate students participate in research, little is known about how their expectations compare to those of faculty overseeing the research. This study explored the attitudes, perceptions and expectations of undergraduate students enrolled in the College of Agricultural and Life Sciences, University of Florida and of faculty supervisors overseeing undergraduate research. Students (n=3,933) and faculty (n=506) were contacted and 317 (8%) students and 81 (16%) faculty members completed questionnaires through SurveyMonkey®. Student responders agreed or strongly agreed that they play an important role in research (60%), are actively engaged (66%), are satisfied with the research experience received (77%), believe the tasks and projects they are assigned showcase their strengths and interests (55%) and are primarily motivated to participate in research due to a genuine interest (65%). Faculty agreed or strongly agreed that they believe the undergraduates feel they play an important role in research (79%), are actively engaged (79%), are satisfied with the research experience received (90%), assign tasks that showcase their students strengths and interests (72%) and are primarily motivated to participate in research due to a genuine interest (54%). In general, faculty had more positive perceptions of undergraduate student research experiences than did the students themselves. Further research is needed to identify specific outcomes for undergraduate research experiences, as well as methods for assessment of these outcomes.

Introduction

Research institutions and the National Science Foundation have long recognized the importance of the involvement of undergraduate students in research (National Science Foundation, 1989). Providing undergraduate students with engaging research experiences is becoming increasingly important as studies suggest participation may increase graduate student enrolment and student achievement (Bauer and Bennett, 2003; Russell, 2008). However, it must be emphasized that once students choose to engage in undergraduate research, they already may have made plans regarding their future involvement in research (Lopatta, 2007). The impact of undergraduate research on student achievement is also less than clear, as it has been reported that participation in undergraduate research is more common for students with higher grades (Russell, 2008). Self-selection and competition for undergraduate research opportunities, particularly those that are funded, may bias studies reporting improved achievement (Taraban and Logue, 2012). As approximately 19% of undergraduate students participate in research (Webber et al, 2013), it may be most important to consider the direct impacts on students such as skill development and enhancement of the undergraduate experience.

Students' perceptions of their undergraduate research experiences have been explored, specifically with respect to learning outcomes and skill gains. Kardash (2000) surveyed undergraduate science students who self-reported their ability to perform 14 research skills before and after participating in a research experience,

¹Corresponding author, Food Science and Human Nutrition Department; Ph: 352 392 1991; Email: wdahl@ufl.edu

including the ability to formulate a hypothesis, analyze data, orally communicate research results and think critically. Students perceived a significant increase in their ability to perform these skills after completing the research experience and their perceptions of their skill levels were consistent with their mentors' ratings at the end of the research experience. Mabrouk and Peters (2000) surveyed 126 undergraduates majoring in chemistry and biology who had participated in research. These undergraduates reported significant increases in their technical skills and in their problem solving ability. More recently, Lopatto (2007) reported gains in many research-related skills as the result of participating in undergraduate research.

Osborne and Karukstis (2009) summarized that participants in undergraduate research experienced significant personal growth beyond the development of research knowledge and skills. Zydney et al (2002a) surveyed alumni of the University of Delaware's College of Engineering and found that those who participated in undergraduate research perceived the benefit received from the undergraduate experience as "very important" or "extremely important." Similarly, Bauer and Bennett (2003) reported that alumni believed that participation in research was one of the most useful experiences they pursued as undergraduates. Regardless of discipline, undergraduate students should be involved in research experiences that are engaging and involve discovery-based learning methods to promote higher level learning outcomes (Boyer Commission, 1998).

Although an estimated 57% of faculty in American post-secondary institutions supervise undergraduate research activities (Webber et al, 2013), little is known about how their perceptions compare to those of the students participating in the research. Light (2001) provides some insight, suggesting that students and their supervising faculty are in relative agreement on enhancement of analytical and critical thinking skills. In addition, Zydney (2002b) found that the educational benefits of undergraduate research reported by alumni generally agreed with results of a survey of their science and engineering faculty. Further research is needed to determine if undergraduates involved in research are being offered engaging and academically-enhancing experiences (Boyer Commission, 1998) from both the student and supervising faculty perspectives. The purpose of this study was to explore the attitudes, perceptions and expectations of undergraduate students enrolled in the College of Agricultural and Life Sciences (CALs) at the University of Florida, as well as those of faculty members in the Institute of Food and Agricultural Sciences (IFAS) that supervise undergraduate students involved in research.

Methods

To explore the attitudes, perceptions and expectations of undergraduate students and faculty involved in research, a questionnaire was developed. The questionnaire was initially administered in a pilot study during the fall 2010 semester. Faculty members in the Department of Food Science and Human Nutrition (FSHN) at the University of Florida ($n = 5$) were contacted and asked to provide a contact list of any undergraduate students currently participating in research activities with them. These students included both volunteers and students receiving course credits. Fifty students were contacted through email and 34 (68.0%) completed a 43-item questionnaire through SurveyMonkey®. As a result of the pilot study, the questionnaire was revised to include demographic items from the CALs student database. In addition, a second questionnaire was developed to target faculty supervising undergraduate research.

During the spring 2012 semester, all students enrolled ($n = 3,933$) in CALs and all current tenured and tenure-accruing faculty ($n = 506$) in the Institute of Food and Agricultural Sciences (including CALs) were contacted through email listservs. A link was provided and students and faculty were asked to complete a voluntary questionnaire online through SurveyMonkey®. Students were asked to respond if they were currently involved in or had previously participated in research activities while at the University of Florida. Faculty were asked to respond only if they were currently supervising or had previously supervised undergraduates in research activities. Tenured and tenure-accruing faculty were asked to complete a 46-item questionnaire and students, a 55-item questionnaire. The University of Florida's Institutional Review Board 2 approved the study protocol and all participants provided informed consent online prior to completing the questionnaire. Participants answered questions at their discretion and could quit the questionnaire at any point.

Results and Discussion

The response rate of CALs students was 8.1% and for IFAS faculty, 16.0%. However, it is not known how many students and faculty participate in undergraduate research in CALs and IFAS, respectively, thus the specific response rates of the sub-groups are not known. Webber et al (2013), reporting data from 450 universities, noted that typically 19% of undergraduate students participate in undergraduate research experiences compared to 57% of faculty. If research participation is similar in CALs/IFAS, the response rate is estimated at 44% and 30% for students and faculty, respectively.

IFAS faculty are housed in 18 different academic units and faculty respondents represented 15 of those

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units. Faculty in the Department of Animal Sciences had the highest response rate at 13.6% (Table 1). Thirty-five percent of faculty classified themselves as Professor, 37.0% Associate Professor and 28.4% Assistant Professor and almost all respondents (95.0%) reported some percentage of their appointment attributed to research (Table 2). This ratio of participation is similar to that reported by Webber et al (2013), where full, associate and assistant professors were equally likely to supervise undergraduate research.

Table 1. Tenure Department Reported by IFAS Faculty Respondents

Tenure Department	Percent of Respondents	Response Count
Agricultural and Biological Engineering	3.7%	3
Agricultural Education and Communication	4.9%	4
Agronomy	3.7%	3
Animal Sciences	13.6%	11
Entomology and Nematology	8.6%	7
Environmental Horticulture	4.9%	4
Family, Youth and Community Sciences	7.4%	6
Food and Resource Economics	4.9%	4
Food Science and Human Nutrition	8.6%	7
Forest Resources and Conservation	9.9%	8
Horticultural Sciences	9.9%	8
Microbiology and Cell Science	9.9%	8
Natural Resources and Environment	0.0%	0
Plant Pathology	1.2%	1
Soil and Water Science	6.2%	5
Statistics	0.0%	0
Veterinary Medicine	0.0%	0
Wildlife Ecology and Conservation	2.5%	2

Table 2. Demographics of Faculty Respondents

Faculty Classification	Percent of Respondents	Response Count
Assistant Professor	28.4%	23
Associate Professor	37.0%	30
Professor	34.6%	28
Current Appointment		
Research	95.0%	76
Teaching	91.3%	73
Extension	57.5%	46
Sex		
Male	59.3%	48
Female	40.7%	33

Sixty percent of students enrolled in CALS during the spring 2012 semester were female, with the largest percentage of students majoring in Food Science and Human Nutrition (18.4%) followed by Biology (15.2%). Sixty-eight percent of respondents who completed the questionnaire were female, with the largest percentage (19.6%) of students majoring in Food Science and Human Nutrition followed by Biology (16.1%). This suggests that the undergraduate respondents were representative of the CALS student body for that semester. This predominance of women is in disagreement with Webber et al (2013) who reported that men more commonly participate in undergraduate research. However, Lopatto (2007) reported that 65% of their respondents were women, suggesting higher participation in

undergraduate research by females. Student respondents were primarily upper-classmen, 35.9% were juniors and 43.3% were seniors (Table 3). This finding is similar to Russell (2008), who reported that primarily juniors and seniors were involved in undergraduate research. Similarly, Lopatta (2007) reported that 48% and 34% of the students participating in undergraduate research experiences were entering their third and fourth years, respectively.

Undergraduate Research Commitment and Expectations

Faculty respondents were asked about their experiences and expectations and many (62.5%) reported participating in research activities as undergraduate students themselves. This finding is supported by Russell (2008) who found that faculty engage undergraduates in research because they had participated in undergraduate research and found it valuable.

Students participated in diverse roles during their undergraduate research experiences, assisting faculty in research for course credit, for pay without course credit and as a volunteer without course credit (Table 3). Faculty respondents reported, on average, supervising two undergraduate students for course credit at the time of the questionnaire and expected students to dedicate five hours per week to research activities per credit hour. Faculty also reported supervising, on average, two undergraduate students as volunteers and expected these students to dedicate eight hours per week to research activities. Student respondents, on average, reported that they participated in eight hours per week of research activities and 50.6% had volunteered or worked with their supervisor during two or more semesters; 8.0% reported five or more semesters of research activity. Dolan and Johnson (2010) indicated that one of the less positive outcomes of pursuing undergraduate research was the pressure from graduate students to work long hours. This factor was not studied in the present study.

Attitudes and Perceptions of Undergraduates and Faculty

Students were asked a series of questions about their research experiences and responded using a 6-point Likert scale with responses ranging from strongly disagree to strongly agree. The statements were adjusted in the faculty questionnaire and faculty were asked about their perceptions and beliefs regarding the students' experiences (Table 4). Satisfaction and engagement were areas where faculty and students shared similar perceptions. Undergraduate student respondents agreed or strongly agreed (60.6%) that they maintained a strong relationship with their supervising professor(s). Student

Table 3. Demographics of Undergraduate Respondents

Student Classification	Percent of Respondents	Response Count
Freshman	8.3%	26
Sophomore	12.2%	38
Junior	35.9%	112
Senior	43.3%	135
Post-Baccalaureate	0.6%	2
Sex		
Male	31.6%	99
Female	68.4%	214
College where student reported participating in undergraduate research		
College of Agricultural and Life Sciences	71.6%	139
College of Medicine	12.9%	25
College of Liberal Arts and Sciences	10.3%	20
Roles of Students in Research Activities (mark all that apply)		
Assist faculty in research with course credit	39.3%	116
Assist faculty in research for pay without course credit	26.4%	74
Assist faculty in research as a volunteer without course credit	50.9%	147

respondents agreed or strongly agreed that they play an important role in research (59.7%), are actively engaged (66.3%), are satisfied with the research experience received (76.6%), believe the task and projects they are assigned showcase their strengths and interests (54.8%), are motivated to participate in research due to a genuine interest in the research area (64.5%) and to gain experience in the field of study (78.9%). Faculty respondents agreed or strongly agreed that they believe that undergraduate students feel they play an important role in research (79.4%), their students are actively engaged (78.8%), undergraduate students are satisfied with the research experience received (89.9%), they assign tasks that

showcase their students strengths and interests (72.2%), undergraduates are primarily motivated to participate in research due to a genuine interest in the research area (54.3%) and that undergraduate students are primarily motivated to participate in research to gain experience in the field of study (71.4%).

The results of the present study are novel as they explore factors that may contribute to enhancement of the undergraduate experience. Previous research has focused on examining the role of faculty as perceived by the student or on outcomes of the experience. For example, Dolan and Johnson (2010), in their case study report, noted that students involved in undergraduate research view their faculty supervisor as “funder”, “big picture” and “absolute mentor”, whereas their faculty supervisors reported their involvement involved time and effort for funding and mentoring, tension and little recognition. Hunter et al (2006) described perspectives of both students and faculty following a summer undergraduate research experience. Their perspectives were similar with respect to student outcomes such as “thinking and working like a scientist” and “becoming a scientist.” However, faculty saw the experiences as a process to socialize the students into the sciences whereas students emphasized personal growth. From the student perspective, the present study supports a goal of undergraduate experience enhancement, perhaps intermingled with skill development.

In the present study, faculty reported more positive perceptions of the undergraduate research experience than did students. Faculty believed their students were more actively engaged than students reported, whereas students reported being more genuinely interested than faculty perceived. These findings confirm the previous findings of Zydney et al (2002a) and Bauer and Bennett (2003) that undergraduate research experiences significantly enhance the undergraduate experience. As not all student respondents reported positive perspectives, the present study provides evidence that the undergraduate experience may not be beneficial for all participating students as speculated by Taraban and Logue (2012).

Table 4. Undergraduate and Faculty Attitude and Perceptions

	Strongly Agree or Agree	Neither agree nor disagree	Disagree	Strongly disagree
I feel that I play an important role in the research.	59.7%	27.4%	11.7%	1.3%
I believe that my undergraduate research students feel that they play an important role in the research.	79.4%	16.4%	2.7%	1.4%
I am actively engaged in my research activities.	66.3%	24.2%	5.7%	3.8%
My undergraduate research students are actively engaged in their research activities.	78.8%	18.2%	3.0%	0.0%
Overall, I am satisfied with the research activities I have received.	76.6%	17.8%	4.2%	1.4%
I believe that my students feel that, overall, they are satisfied with the research experience that they have received.	89.9%	8.7%	1.4%	0.0%
I feel that the tasks and projects I am assigned by my research supervisor showcase my strengths and interests.	54.8%	30.7%	11.0%	3.5%
The tasks and projects that I have assigned to my undergraduate research students showcase their strengths and interests.	72.2%	25.0%	1.4%	1.4%
I am primarily motivated to participate in research due to a genuine interest in the research area.	64.5%	18.4%	13.2%	3.9%
I believe that my undergraduate research students are primarily motivated to participate in research due to a genuine interest in the research area.	54.3%	28.6%	14.3%	2.9%
I am primarily motivated to participate in research to gain experience in the field of study	78.9%	11.8%	9.2%	0.0%
I believe that my undergraduate research students are primarily motivated to participate in research so they can gain experience in the field of study.	71.4%	17.1%	8.6%	2.9%

Higher Learning Goals

Undergraduate respondents also were motivated to participate in research to aid future career goals; 48.2% had applied or planned to apply to graduate school and 50.2% had applied or planned to apply to a professional school (e.g. medicine, dentistry, pharmacy and veterinary medicine). Undergraduate respondents felt that research experience is important to include on a resume if one is to be a competitive candidate for a professional school (75.3%) or graduate school (82.9%). However, as Lopatto et al (2007) pointed out, it is difficult to discern whether students pursue research to support their goals or whether the research experience directs their goals.

Role of Graduate Students

It is common for graduate students to assist faculty by supervising and assisting undergraduate students involved in research activities. In the present study, faculty respondents frequently (53.2%) reported having graduate students oversee undergraduate students doing research under their supervision. Faculty, on average, had two graduate students supervising and assisting undergraduates. Undergraduate respondents also were also asked about their experiences and perceptions of graduate students when participating in research activities. Students agreed or strongly agreed (80.5%) that working with graduate students enhanced their research experience. Although the present study did not explore the factors contributing to this positive interaction, Dolan and Johnson (2010) noted that graduate students were more approachable than faculty, helpful and served as role models. In addition, they provided insight into the graduate student experience, transition to independent work and exposure to other research.

Areas of Further Analysis and Improvement

There were some areas that suggest a need for improvement or deeper analysis of the research experiences being offered to undergraduates. Some undergraduates (29.7%) reported that the research tasks they completed were monotonous and highly repetitive and 35.3% of students reported studying for other courses during their scheduled laboratory/research time. Some faculty (37.5%) reported that there were times when their students go into the laboratory to participate in research activities and there are no tasks to be completed. Also, some faculty (36.6%) reported that their students sometimes studied for other courses during their scheduled laboratory/research time. Undergraduate students also reported going into the laboratory or scheduled research time and having no tasks to complete (36.0%) and some (30.3%) are currently looking

for another undergraduate research position. These findings suggest that although both students and faculty reported that, overall, the undergraduate experience was positive, there is room for improvement to maximize benefits. Webber et al (2013) suggested that the benefits from undergraduate research may reflect the extent of involvement in the research process, or in other words, tasks versus full involvement or more so, labor versus learning.

Summary

The results of this study suggest that, overall, undergraduate students and faculty members share positive perceptions of the undergraduate research experience. Undergraduate students at CALS, University of Florida, reported high levels of satisfaction and engagement with the research experience being provided to them by faculty. Further research is needed to identify specific outcomes of the undergraduate research experience. Institutional outcomes may include retention rate, graduate and professional school acceptance and retention in science fields. In addition, exploration of learning outcomes and the evaluation of these outcomes is needed. Undergraduate students involved in research consist of many pre-professional and aspiring graduate students; the impact of the research experiences in which undergraduate students participate and whether they promote these aspirations or alter their career plans is worthy of study.

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