

# Shepherding Undergraduate Students Through a Research Experience and a Professional Meeting



**John M. Galbraith<sup>1,2</sup>**  
**Virginia Tech**  
**Blacksburg, VA**

## Abstract

Undergraduate research consists of a student working with a faculty or staff member to develop a study plan and objectives. Polls of faculty and students report the benefits of this activity. The goal of this paper is to conduct a survey of six students at Virginia Tech who finished undergraduate research and presented their results at an annual professional meeting of agronomy, soils, and environmental sciences. The students answered a brief set of questions about their expectations before and their experiences after the trip. Even though the time input for students and faculty mentors is high, students who become involved in undergraduate research reported value in the experience. Faculty who supervise undergraduate research must be aware of the constraints and the difficulty in producing published work without much input from the students. However, the time spent in facilitating or shepherding students through the presentation of results at a professional meeting has rewards and benefits in seeing the students mature in their career choices and increase their opportunities for success as they represent the department and school after graduation. The students who attended the meeting to present their results recommend the activity to their peers and to faculty mentors.

## Introduction

Undergraduate research consists of a student working with a faculty or staff member to develop a scientific objective and study plan. The Student Education Resource Center (2011) at Carlton College reported that the Council for Undergraduate Research (CUR) and the National Conferences on Undergraduate Research (NCUR) endorsed a definition of undergraduate research as the formation of a collaborative enterprise between student and faculty member that triggers a four-step learning process (that

includes): 1) identification of and acquisition of a methodology, 2) setting out of a concrete investigative problem, 3) carrying out of the actual project (investigation), and 4) dispersing/sharing of a new scholar's discoveries with peers – a step traditionally missing in most undergraduate educational programs. This list of four steps in learning agrees with the report by Lopatto (2003), who compiled polls of 12 faculty engaged in the practice of undergraduate research at three colleges.

Lopatto (2003) later supplemented his faculty poll by surveying 249 undergraduate students who were working in summer research programs at Grinnell, Harvey Mudd, Hope, and Wellesley Colleges to find out what they thought were the five most important benefits of undergraduate research. The top 10 results were: 1) enhancement of professional or academic credentials, 2) clarification of a career path, 3) understanding the research process in your field, 4) learning a topic in depth, 5) developing a continuing relationship with a faculty member, 6) learning to work independently, 7) learning laboratory techniques, 8) tolerance for obstacles faced in the research process, 9) understanding how scientists think, and 10) understanding how professionals work on real problems. The benefit of presenting or publishing the results is not on the top 10 list, and we do not know if it was a choice on the list presented to the students to choose from. No mention is made about the presentation of the research results in a professional setting. However, the author concluded that even though many undergraduates practice part of the scientific method of asking and answering scientific questions, most are not familiar with or experienced enough to carry out the scientific process by themselves all the way through the final step of communicating their results. Dale et al. (2010) reported that being involved with undergraduate research helped several students

<sup>1</sup>Associate Professor, Department of Soil and Crop Environmental Sciences: john.galbraith@vt.edu

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choose to become veterinary researchers rather than veterinarians, and Coker and Van Dyke (2005) reported that undergraduate research affected student attitudes toward pursuing a career. Woirhaye and Menkhau (1996) reported that involving undergraduates in independent research projects can provide students valuable input in the decision of whether or not to continue their education.

Communication of results is an important part of the overall learning process of the undergraduate research experience. Stukus and Lennox (1995) earlier reported that a number of studies show an overemphasis on science content in undergraduate research and recommended (among other things) an increase in emphasis on effective communication of results. Seago (1992) recommended that students should be expected to communicate the results of their experiment in writing, orally, or both. Hammond et al. (2003) reported that close supervision and constant feedback were essential if undergraduate students were to publish research articles from their project results. Hammond et al., (2003), and Kinkel and Henke (2006), reported that additional input by the mentoring professors are required to help students report their results at meetings or publish their research results as a refereed journal articles.

Kinkel and Henke (2006) conducted a study of students involved in an undergraduate research mentoring program (URMP) initiated at Texas A&M University-Kingsville. The URMP aided students in doing wildlife science research and encouraged students to prepare a manuscript of their findings for scientific publication and present their results at professional and lay audience meetings. Among 50 students who participated in URMP, 31 research projects were completed resulting in 18 peer-reviewed, scientific publications, with 15 oral and 28 poster presentations at scientific meetings. More URMP students graduated with a B.S. degree, graduated sooner, obtained employment within the wildlife profession sooner, and had greater success obtaining wildlife related employment than students of the control group.

Undergraduate research does have some drawbacks as well as benefits for students and faculty mentors as summarized by Kinkel and Henke (2006) and Stukus and Lennox (1995). For faculty, a poll of 900 respondents concluded that undergraduate research experiences can be extremely valuable for students, but can also be very time-consuming for mentors (Coker and Davies, 2006). Ten time-saving tips were developed from the survey that may help both students and faculty mentors operate more efficiently.

The process of guiding undergraduate students through the research process can be challenging and difficult to manage, but shared experiences published in a summary of pedagogical papers can be used for guidance (I'Anson and Smith, 2004).

The National Conferences on Undergraduate Research (NCUR) promotes undergraduate research across fields of study at an annual conference for students. The NCUR conference is different than meetings of academic professional organizations that focus on one or more closely related scientific disciplines. The URMP study asked participants about the benefits they received by taking the program, but did not ask students their perception of the value of the attending the meeting or of the presentation process itself (Kinkel and Henke, 2006).

The goal of this paper is to report the positive value and any negative aspects of preparing and presenting undergraduate research results at a large professional meeting. The perception comes from a group of students who related their expectations before and experiences after the meeting.

## Methods

Numerous undergraduate students enroll in research studies for course credit at Virginia Tech. In the fall semester of 2010, six students who had conducted undergraduate research were invited to Long Beach, California to attend the Students of Agronomy, Soils, and Environmental Sciences (SASES) meetings then stay to attend the Tri-Societies (ASA, SSSA, and CSSA) international annual meeting. No course credit was given for attending the meeting, and attendance was not required for the credits given for doing the undergraduate research. Funds were donated to assist with travel expenses by the Assistant Provost and the college Deans for Undergraduate Education. SASES meetings began on Oct. 29 and ended Nov. 1 and included officer meetings, tours, a harbor cruise (social), student club posters, a moderated graduate school discussion, a national speech contest, a national student research symposium oral contest (two sessions), a national student quiz bowl, a leadership discussion session, a national student research symposium poster contest, and a professionalism discussion session. Four students took part in the oral presentation contest and two in the poster presentation contest. The students were asked what their expectations were for the trip (Table 1). Following the meeting, the students were asked to complete an anonymous on-line survey about their travel experiences, resume building, professional development, personal development, and job opportunities/networking (Tables 2-6) as affected

## Shepherding Undergraduate

by their research and trip experience. In both polls, multiple-choice questions had five possible answers: No Value, Little Value, Cannot (or Could Not) Be Determined (equivalent to “I Do Not Know” or I Cannot Be Sure”), Moderately Valuable, and Very Valuable. One year later, the students were asked several more questions in reflection of their trip (Table 7).

### Results and Discussion

The results of the student expectation poll questions are presented in Table 1. The students felt that preparing for and attending the meeting would be worth their time and effort, but they may not have been sure to what degree since only one had attended a professional meeting. At least half of the responses were in the two “more valuable” responses for each question as opposed to the “undetermined” and “less valuable” responses.

The students felt the trip would be moderately to very valuable for improving their resume, and would be very valuable for their personal and professional development. The responses were split on whether the trip would aid them with job opportunities and in network building. Even though the students were told ahead of time that they would be able to meet potential new employers and interview at the meeting, some may have felt that the distance away from their home reduced the likelihood of a job offer. The students probably did not understand what network building is and how it would benefit them, because the responses were spread across four value categories.

The results of the student experience poll questions are presented in Tables 2 through 6. There were no responses of “No Value.” Overall,

the students’ responses were “more valuable” than “undetermined” and “less valuable.” Overall, the six students who attended the professional meeting thought the experience was valuable, a response that is not surprising. These results agree with those of Kinkel and Henke (2006). The results of the meeting experience poll agree with four of the top 10 benefits reported by students in Lopatto’s (2003) study. Two other benefits can be inferred to be in agreement based on private conversation with the students. However, four of the benefits were not related to questions on the poll answered by the six students in this study. The perceived value of attending and presenting increased during and soon after the meeting. The six students who communicated their research results evidently gained skills and confidence beyond what was learned in their classes, as did those who went through the URMP program (Kinkel and Henke, 2006) and those who were part of the study by Coker and Van Dyke (2005).

The students felt that the travel experience was very valuable in terms of the relationships they developed or strengthened and the absence of financial burden to attend (Table 2). Private discussions during the trip confirmed that the students saw learning value in the travel itself and that it was crucial that they received financial help in paying expenses of the trip. The students did see high value in improving relationships or building new friendships with other students from their school. The students seemed to enjoy going as a group that represented their university.

The resume building poll results show that the students placed higher value on enhancing their resume after attending, compared with their expectations before attending the meeting (Table 3). The trip and meeting provided opportunities they had not anticipated.

Professional development value perception was mixed, but positive in most cases (Table 4). Experiences were evaluated more positively than pre-meeting expectations (Table 1). Four of the students prepared seminars and practiced weekly and two worked independently preparing posters, explaining some, but not all, of the responses

*Table 1. Student expectation poll for six undergraduates before attending a professional meeting. There were no responses of “No Value”.*

Questions	Little Value	Cannot Be Determined	Moderately Valuable	Very Valuable
How valuable will the experience be for improving your resume?	1	1	2	2
How valuable will the experiences be for your professional development?	1	1	1	3
How valuable will the experiences be for your personal development?	2	1	3	
How valuable will the experiences be for providing job opportunities or professional contacts for possible future jobs?	2	1		3
How valuable will the network building be for you?	1	2	1	2

*Table 2. Student travel experience poll for six undergraduates after attending a professional meeting. There were no responses of “No Value” “Little value”, or “could not be determined.”*

Questions	Little Value	Cannot Be Determined	Moderately Valuable	Very Valuable
Travel experiences				
Value of traveling to a professional meeting with a peer group of students			1	5
Importance of receiving substantial funding to offset your expenses			1	5

**Table 3. Resume building poll for six undergraduates after attending a professional meeting. There were no responses of “No Value”, “Little Value”, or “Moderately Valuable”.**

Questions	Little Value	Cannot Be Determined	Moderately Valuable	Very Valuable
Resume building				
Value of having a published abstract on your resume		1		5
Value of having a professional meeting presentation on your resume		1		5

**Table 4. Student professional development poll for six undergraduates after attending a professional meeting. There were no responses of “No Value”.**

Questions	Little Value	Cannot Be Determined	Moderately Valuable	Very Valuable
Professional development				
Value of learning how to make a professional meeting level of seminar compared to an undergrad level of seminar		1		5
Value of getting peer and faculty review of your seminar during development		3	2	1
Value of presenting a seminar in front of peers and judges		2	1	3
Value of getting graded by judges from other universities		3	2	1
Value of answering questions from the audience		1	2	3
Value of preparing a poster presentation		3	1	2
Value of presenting a poster to judges and audience		3	1	2
Value of attending professional meeting seminar sessions of your choice		1	2	3
Value of attending the poster sessions and talking to presenters	1	1	1	3
Value of seeing what a professional society meeting is like			2	4

where the answer regarding a seminar was “Could Not Be Determined.” Highest value was placed on learning how to make a more rigorous seminar, and seeing what a professional meeting was like. Half of the six students could not determine the value of preparing or presenting a poster, and that makes sense since only three have actually presented a poster at a meeting before. More value was placed on attending seminar presentations than poster sessions. The seminar format is the way that students are used to learning in college. Poster sessions are less interesting to students and others if the authors are not present, and undergraduate students may find it uncomfortable talking to poster presenters of subjects outside their research project topics. Questions related to being evaluated or getting review from their faculty or others had the highest number of “undetermined” value responses. The response to having weekly peer feedback and tutoring as they wrote and practiced their seminar was less than expected by the author. Generally students value personal attention and extra help developing projects. It was not a question, but students discussed their gains from critiquing the seminars of the other students beforehand. Five of six students saw value in getting questions from the audience. They were able to answer the questions well and it presumably made them feel more of a subject authority. Each student was asked several standard questions by graders and ad hoc questions from the audience. Of the four seminar presenters, two finished third out of eight presenters (there were two sessions of eight present-

ers). Private discussion revealed that all four of the students enjoyed giving the seminars, regardless of how they were evaluated. The poster presenters did not elaborate on their experience but did state that few people other than the judges asked about their project or results. All students felt that they improved their communication skills and gained confidence concerning their research.

Personal development value perception was mixed (Table 5), although experiences were evaluated more positively than pre-meeting expectations (Table 1). The responses concerning the writing and leadership workshops were mostly “undetermined” and “moderately valuable”, but still seen as more valuable than not. However, there was great value placed in attending the graduate school preparation workshop, and the experience helped several students decide that they wanted to attend graduate school. Two of the six students decided to apply for graduate school after attending the meeting. Dale et al. (2010) reported similar results. Woirhaye and Menkhaus (1996) and Coker and Van Dyke (2005) reported increased interest in attending graduate school by undergraduate researchers. Two students received multiple graduate school offers after returning and applying formally to the schools of their choice, but chose to attend their undergraduate school instead. It was not clear if they received offers from the schools they interviewed with at the meeting. Four of the six students who attended have now either entered or applied for graduate school and one is working as an intern for a private

## Shepherding Undergraduate

**Table 5. Student personal development poll for six undergraduates after attending a professional meeting. There were no responses of “No Value” or “Little Value”.**

Questions	Little Value	Cannot Be Determined	Moderately Valuable	Very Valuable
Personal development				
Value of attending the graduate school preparation workshop		1		5
Value of attending the writing workshop		2	3	1
Value of attending the leadership workshop		2	3	1
Value of attending the plenary (featured) speaker’s presentation			3	3
Value of learning about your future professional possibilities			2	4

**Table 6. Student job opportunities/networking poll for six undergraduates after attending a professional meeting. There were no responses of “No Value” or “Little Value”.**

Questions	Little Value	Cannot Be Determined	Moderately Valuable	Very Valuable
Job opportunities/networking				
Value of meeting students from peer universities		1	3	2
Value of attending social activities with students from other universities		1	2	3
Value of interviewing for graduate school in person at the meeting		1	2	3
Value of viewing commercial and organization exhibits and talking to exhibitors		1	3	2
Value of meeting professionals from other schools/companies/agencies/areas of country			2	4
Value of meeting professors from other schools			2	4
Value of meeting recent Virginia Tech graduates		2	2	2

consultant. The meeting helped one student decide what her career interests were among several related disciplines, revealed by personal communication with the author. All students enjoyed the plenary session and the talk by the speaker concerning environmental change caused by humans. There was much private discussion about the subject, and most were excited that the speaker reinforced what they were learning in the classes. The students saw personal value in learning about their future possibilities. Taking part in the undergraduate research and presenting at the meeting probably brings multiple positive benefits. For example, a common response of URMP students was that they believed they were better prepared for employment, better organized as a student, and better understood the applicability of their schoolwork to jobs in their field (Kinkel and Henke, 2006).

Job opportunities and networking value perception was positively valued, with just a few “undetermined” responses (Table 6). Experiences were evaluated much more positively than pre-meeting expectations (Table 1). Attending the meeting must have answered some of the uncertainty. The students saw value in finding out about professional opportunities through networking at the meetings and attending exhibits, where they could talk to exhibitors about their companies and products. The exhibits were not just commercial companies but other professional associations and federal agencies. Students valued meeting students, professors, professionals, alumni from Virginia Tech, and employees from other universities. The students undoubtedly “compared” their schools, curriculum, and overall satisfaction with other students, and

met and explained their career plan with the others. Several students were not certain how much value there was in meeting alumni because few were in a position to offer jobs or graduate school admission, but most did see some value. The graduate school interview was positively valued but not as much as expected, because several times the students could not find a representative at the school when they went for their interviews. Several students collected business cards. There is no anecdotal evidence that the majority of the six students developed a continuing relationship with a faculty member that directed their research, although most highly recommend the experience to other students and to faculty.

One year after the meeting and presentations, a positive/negative poll was conducted to see if the student perceptions had changed (Table 7). Five of the six students answered the poll. The number and percentage of responders who agreed with the question are indicated. The remainder felt the opposite or did not answer. The values perceived by the students just after the meeting held steady after one year. The responses followed the trends from the experience poll, with a few modifications. The students did not feel that they made new business/academic or professional contacts at the meeting. The students did make contacts at the meeting and were introduced to a number of people. Informal discussion on the trip home included a list of people they had interviewed with and talked to about jobs. However, the students must not have had success with any of the opportunities discussed or had any significant follow-up contact with people they met outside of their peer group. The students who

*Table 7. Post-meeting experience poll answered by up to five of the six undergraduates one year after attending a professional meeting.*

Question	No. of “yes” answers and total responses
I feel that what I gained by going on the trip was worth the extra financial cost	4/4 (100%)
I feel that presenting at a professional meeting was a better learning experience than doing a departmental seminar	4/4 (100%)
I gained a better idea of what I wanted to do with my future	3/4 (75%)
I did not really make any new contacts	3/4 (75%)
I did not learn much more about what my career choices might be	3/4 (75%)
I did not learn about new job opportunities	2/3 (67%)
I benefitted by doing my research project	4/4 (100%)
I benefitted more by presenting the results at a professional meeting than I think I would have otherwise	2/3 (67%)
I learned from the student activities and training sessions	4/4 (100%)
The meeting inspired me in my professional goals	3/4 (75%)
I was more inspired to apply to graduate school after the meeting	2/3 (67%)
I would recommend that other undergrads try to do research and present it	5/5 (100%)
I would recommend that professors mentor undergraduate students in research projects	4/4 (100%)
The entire experience was well worth my time	4/4 (100%)
I would recommend that professors who mentor undergraduate students in research projects accompany them to a professional meeting	4/4 (100%)
I gained a new appreciation for the positive roles that professors can play in mentoring their students	3/4 (75%)

responded that they did not really learn much more about their career choices meant that they had not learned of new opportunities they were not already aware of. In other words, they already knew that their choices would be to go to graduate school, work for a private consultant, or work for an agency. The question was poorly worded, but was meant to ask if attending the meeting had allowed them to find a new school, company, or agency to consider applying to. However, the students also said that they did not learn about new job opportunities at the meeting. This could be because of limited jobs in general or because the students were not looking for a job but graduate school instead. The students may also have limited their job search to their local area, on the opposite side of the United States from the meeting. Students may not benefit much from building a network of contacts at a single professional meeting. However, they should gain from repeated attendance if that is possible. One year later, the lack of making new contacts that directly altered their futures was noted by the students. Even though the students who attended the meeting were made aware of multiple career options, most had already narrowed their choices to graduate school or working in an area local to their family.

## Summary

Undergraduates are required to take courses that teach them scientific writing, some assist with research as part of their employment, and some observe case studies in classes that review scientific studies. Therefore, many undergraduates with aspirations of attending graduate school engage in an internship, work in a lab or in the field assisting graduate students, or enroll in undergraduate research projects. The value of doing the research can go beyond learning about the studied subject and learning the skills used in the research project.

We surveyed six students who presented their undergraduate research results at a professional meeting both before and after the meeting. Dissemination of their research results to peers and professionals was perceived to be a positive and valuable experience by the students and a benefit to

building their resume for graduate school application. Travel to the meeting, meeting peers and professors from other schools, attending seminars, interviewing for graduate school, and learning more about their professional society was a benefit. Even though the time input for students and faculty mentors in high, and the time length of involvement for undergraduate students may be limited to one semester, there was value reported by the students who become involved in and reported their undergraduate research. The departments and programs must also have perceived some benefit or they would not sponsor such activities. Faculty who supervise undergraduate research must be aware of the constraints and the difficulty in producing published work if they do not receive much input from the students. It will require additional input by the mentoring professors to assist the students in this study to publish their research results as a refereed journal articles. However, the time spent in facilitating or shepherding students through the presentation of results at a professional meeting has some professional rewards and personal benefits as the students mature in their career choices and increase their opportunities for success after graduation. The students saw overall value in conducting and disseminating their research, despite the drawbacks, the time and funds spent. They saw value in attending professional meetings to

## Shepherding Undergraduate

present their results and they recommend the experience to their peers.

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