

The USDA Scholars Program: Innovations in a Summer Undergraduate Research Program¹



**Deborah J. Good², Christina M. McIntyre³
and Mary A. Marchant⁴
Virginia Tech
Blacksburg, VA**

Abstract

The USDA Scholars Program is an innovative summer undergraduate research program at Virginia Tech, funded by the United States Department of Agriculture (USDA), that integrates undergraduate research with peer mentoring, grantsmanship, a specialized summer course and a summer multi-institutional symposium. The results of a qualitative and quantitative assessment of the USDA Scholars Program, which consisted of 42 undergraduates over a 5-year period from 2007-2011, are presented. Students participating in the program were co-authors on eight peer-reviewed publications and three additional articles in preparation, as well as 17 posters at national and international scientific meetings. USDA Scholars self-assessed themselves with a 65-68% gain in perceived confidence in research ability and in one of the assessed years, a slight, but significant increase in perceived public speaking ability. Seventy-five percent of USDA Scholars continued research in the following academic year and the department hosting the program showed a significant increase in the total number of students (including non-Scholars) engaged in undergraduate research. Overall, the USDA Scholars Program can serve as a model for other departments interested in designing a comprehensive summer undergraduate research program.

Introduction

Since the publication of the Boyer Report (1998), a number of institutions have identified the value of undergraduate research in their educational objectives.

However, in the current climate of tenure and promotion, along with reduced federal funding, faculty struggle with the time and financial commitment required to support undergraduates in their laboratories, even though they fully understand the value of this type of active learning. The Council on Undergraduate Research (CUR) has identified several key learning outcomes of undergraduate students involved in an undergraduate research experience (NCUR, 2005). Undergraduate researchers gain specific skills in using literature, formulating hypotheses, interpreting data and communicating results. They also show measurable gains in reflection, independence and self-confidence, career clarification and career preparation. Undergraduate researchers obtain undergraduate and graduate degrees at a higher rate than comparison groups. As alumni, they report higher gains in skills such as carrying out research, acquiring information and speaking effectively (Karukstis, 2006, Kinkel and Henke, 2006, Levis-Fitzgerald et al., 2005, NCUR, 2005).

Undergraduates who are drawn to the Department of Human Nutrition, Foods and Exercise (HNFE) at Virginia Tech often have career goals requiring graduate and professional school studies, with most of the graduating seniors heading to either a dietetic internship, medical school, physical therapy clinical PhD (DPT) and science-based PhD programs, or other graduate schools. The HNFE major provides a strong foundation in both basic and applied sciences in the area of nutrition, exercise and obesity. However, as is true at many universities,

¹Acknowledgements: The authors thank Ms. Sophia Leedy and Ms. Sherry Saville in the Department of Human Nutrition, Foods and Exercise for help in collecting student enrollment and course evaluation data. They also thank Dr. Stella Volpe and University of Pennsylvania, for hosting the 2010 USDA Scholars Conference. This project was financially supported by a grant from the Virginia Tech Provost Summer Session Awards (2007), a USDA NIFA Higher Education Challenge Grant Program Award #2007-02458, and matching money from the Department of Human Nutrition, Foods and Exercise, the College of Agriculture and Life Sciences, the Fralin Life Sciences Institute and the Provost's Office at Virginia Tech (2008-2011).

²Associate Professor, Department of Human Nutrition, Foods and Exercise, 1981 Kraft Drive (0913); Email: goodd@vt.edu

³Associate Director, University Honors, 133 Hillcrest Hall; Email: cmcintyre@vt.edu

⁴Professor, Department of Agricultural and Applied Economics, 313 Hutcheson Hall (0401); Email: Mary.Marchant@vt.edu

most HNFE students are not exposed to undergraduate research and often do not possess an awareness of what a career in research entails. A formal undergraduate research program, called the USDA Scholars Program, was developed and funded by a United States Department of Agriculture (USDA) Higher Education Challenge Grant. This program provided structure and oversight to the selection, training and funding of students, allowing faculty time to truly mentor and train students in their research field. More specifically, faculty were freed from providing individual training on such topics as animal and human welfare, grantsmanship, library and scientific reading skills, scientific writing skills, poster preparation and oral presentation skills. In addition, students acted as peer mentors for a variety of HNFE classes, thereby transferring their knowledge to additional students within the HNFE department.

The USDA Scholars Program was designed for HNFE students at Virginia Tech, but the principals of the program are translatable to many agricultural and nutrition departments. Importantly, now two years after the formal USDA-funded program ended, we have been able to continue a scaled-back version of the program using university funds. Details of the USDA Scholars Program can be used as a guide to develop a similar program at another university.

Program Description and Methods

The USDA Scholars program was conceived of and designed as part of an application to the USDA Higher Education Challenge Grant program. The grant proposal was funded with an August 2007 start date. For the summer of 2007, students were funded as part of a Virginia Tech Provost Summer Session grant, and the program was run as a pilot version of the full USDA Scholars program. The grant from the USDA funded the 2008-2010 Scholars program. For the summers of 2011 and 2012, students were funded using institutional money and faculty grant money to support stipends and programmatic events. This project was deemed exempt by Virginia Tech Institutional Review Board (VT-IRB), and did not require further human subjects oversight.

Recruiting and Application Review Process

Students in their sophomore or junior year were invited to apply in the fall semester via announcements in HNFE sophomore and junior level classes and a mass email to HNFE undergraduates. The full application consisted of a current transcript, application form and one letter of recommendation from an HNFE faculty member submitted to a secure website. For the first year of the program, student applicants were required to have

a minimum 3.0 grade point average (out of 4.0) and to have completed both semesters of anatomy and physiology, one semester of organic chemistry and one semester of biochemistry to be eligible to apply for the program. These course requirements were dropped for the subsequent years, but the GPA requirement was retained. For the 2008 program application, the application form consisted of five questions, available from the authors, upon request.

Following the initial year of the program, the application was amended to additionally ask students to identify two HNFE faculty members and to describe why they were interested in each faculty's research and how that faculty's research program complimented the career goals of the student. The application was designed to provide the reviewers and program directors with a complete picture of the type of student who was applying and how they might fit into the overall goals of the program. In general, we were looking for students who thought creatively and were not afraid to fail, but understood how to turn failure into a learning experience. We were also looking for students who understood how research could be used to complement their career goals, whether they ultimately wanted to focus on a research-based career or not. The redesign of questions in 2009 helped us to better match students with faculty mentors, by allowing students to choose research programs they were interested in and conversely having faculty read the applications and determine if they were interested in being matched with the student.

A faculty committee was recruited each year to review applications and using a rubric (available from the authors upon request), determined the finalists (up to 10, depending on program year) and two alternates. Students were matched with faculty and faculty conducted an in-person interview to determine if they would accept the student to their research/laboratory program. Finalists were notified of their faculty match and were given at least two weeks to accept and sign a formal contract. In some instances, students chose not to accept and the alternates were then matched with faculty mentors and notified of their acceptance to the program. Finalists were then given at least two weeks to accept and sign the formal contact. All slots in the program were filled using either the finalists or alternates.

Summer Research Program

Students who were accepted into the program were required to meet with their faculty mentor during the spring semester prior to the summer program and were expected to complete required training (Institutional Review Board, (IRB) Institutional Animal Care Program (IACUC) and/or laboratory safety training).

The USDA Scholars Program

They were also expected to write a one-page proposal for their research, including an annotated bibliography with papers relevant to their research. A 1-credit hour independent study for the spring semester recognized the students' work.

The summer program consisted of an expected 30-hour research work week, a 2 hour per week course and a 1 hour per week journal club meeting. At Virginia Tech, the summer is divided into two sessions (named summer I and summer II). The students were enrolled in 3 credit hours during the both summer semesters and were given a syllabus with required assignments and weekly course topics (available from the authors, upon request). During week 1 of the summer program, students went through "Boot Camp" which consisted of daily 1-2 hour group meetings and lectures going over library databases, using bibliographic software, personality assessment and intro to grant writing and budgets. During the rest of the summer, topics such as Research Ethics and Bench-to-Bedside Research (both panel discussions), resume building, oral presentations/seminars and writing workshops were provided.

In addition to the class, students met weekly for a research/journal club meeting. For this part of the program, the ~10 students were divided into three groups, each led by one to two graduate students and/or postdoctoral fellows. A journal article was selected at least one week in advance of the meeting and students came prepared to discuss the findings and implications. Each student had the opportunity to pick a journal article and to lead the discussion during the summer. This part of the program was developed to provide students with weekly practice reading and discussing journal articles and to ensure that all students were exposed to basic, clinical and community-based research articles.

Scholars were expected to give an oral presentation to the class at the end of the summer. For the USDA Scholars, the entire program culminated with The USDA Scholars Symposium—a multi-institutional symposium between Virginia Tech, University of Pennsylvania and Penn State undergraduate summer research programs. USDA Scholars were responsible for oversight and organization of the symposium program, registration and day-of-event tasks for 2008 and 2010 when the symposium was held at Virginia Tech. University of Pennsylvania students were responsible for organizing the symposium in 2009 when it was held in Philadelphia. For each year that the symposium was held, students gave oral and poster presentations and had social events with the undergraduates and faculty from the other institutions. Funds for the multi-institutional symposium were provided through the USDA Higher Education Challenge grant.

Following the completion of the summer program, students returned in the fall semester to serve as peer mentors in HNFE undergraduate courses and for individual freshmen. The tasks of the peer mentors varied with the courses they were assigned. For example, in some cases, Scholars were asked to give an oral presentation in the course and provide tutoring on PowerPoint presentation preparation. In other cases, Scholars met with an HNFE freshman to serve as an upper-classman mentor, guiding them on coursework and extracurricular activities. In still other peer mentoring situations, Scholars served as journal club leaders for the HNFE undergraduate journal club, a 1-credit course available to all HNFE students.

Tracking and Assessment of Program

Pre- and post-survey questions were collected prior to the start of the program and following the last week of the program, respectively. In a formative assessment, faculty mentors in the program were asked to evaluate their Scholar in the middle of the summer. A summative assessment at the end of the summer allowed faculty to evaluate the overall program and their individual Scholar at the end of the program.

For assessment by the Scholars during the program, Scholars were asked to write a weekly "Friday Reflections" on our secure course website. To do this, the program directors would prompt the discussion with a statement or question and Scholars were asked to comment on the prompt or on a response from another Scholar by the following Monday. Reflection statements from 2009 and 2010 Scholars program were captured in a Word document at the end of the semester. The Friday Reflection blog and the pre-, post- survey data from 2008 were lost due to a change from Blackboard (www.blackboard.com), to Scholar online course management system (Scholar is Virginia Tech's brand for the Sakai open source software), prior to when we downloaded the data. As there was no course for 2007, 2011 and 2012, so that no Friday reflections, or pre-post survey data were captured for these years.

Results and Discussion

Impact and Outcomes for Scholars

A total of 42 students were part of the Scholars program during the summer sessions from 2007-2011. Seven students are part of the 2012 Scholars program. Because of the interdisciplinary nature of the HNFE Department's research, the Scholar's research projects varied widely. Some Scholars were involved in basic research projects involving cellular and molecular biology (Figure 1A). Others had human subjects projects related to nutrition or exercise (Figure 1B), or social/behavioral studies within local communities (Figure

Figure 1: Research and Teamwork in the USDA Scholars Program at Virginia Tech. (A.) A USDA Scholar performing basic research (B.) A USDA Scholar working with a participant in an exercise research program (C.) A USDA Scholar performing community research (D.) USDA Scholars on a teamwork building extracurricular activity.



IC). Group outings, potluck parties, trips to other local events were encouraged (Figure 1D).

Students who participated in the program had a high rate of graduate school and internship acceptance, compared to all HNFE seniors. For those that were USDA Scholars between 2007-2011, one Scholar has obtained a Ph.D., one Scholar a clinical doctorate and two Scholars have obtained their MS in Human Nutrition, Foods and Exercise. A total of 15 students are currently enrolled in graduate school, either MS, PhD, DO (doctor of osteopathic medicine) or MD degree programs. Fifteen additional students are either completing dietetic internships, or working in their chosen field. Thus,

33 out of 42 Scholars (78%) went on to graduate school or professional internships following completion of the USDA Scholars Program. These data are in comparison to 51% of HNFE seniors who report graduate school and internship plans (2012 graduation survey, Renee Selberg-Eaton, personal communication)

Of the 42 Scholars who participated in the summer research program, 74% of them continued working in their research laboratories the following semester (Table 1). Five Scholars have a total of eight peer-reviewed publications as a result of their undergraduate research or continuing work in the same lab with a combined BS/MS or PhD degree, while 12 Scholars have presented their research at local or national scientific meetings.

Departmental Impact of USDA Scholars Program:

The impact of the Scholars undergraduate research program reached far beyond those individual students that directly participated. We found that research participation by all HNFE undergraduates for the fall semester following the summer program increased from only eight in 2007, before the initiation of the internally-funded HNFE Scholars program, to an average of 18, double the numbers prior to the Scholars program (Figure 2). With only 15 research-active faculty in the HNFE department during the measured time period, this most likely represents a near maximum number

of students that might be accepted to participate in undergraduate research for any semester. It is not clear to us why there was a dip in undergraduate research (both honors and regular) in the semester following the summer program. However, we do believe that overall, the USDA/HNFE Scholars program has created a “culture of undergraduate research” within the HNFE Department, as anecdotally, more students are seeking undergraduate research opportunities within the HNFE Department and across the university.

Peer-mentoring was a required (2008-2010) or optional but encouraged (2007, 2011) component of the program and peer mentoring increased the overall impact of the Scholars on HNFE undergraduates. Since

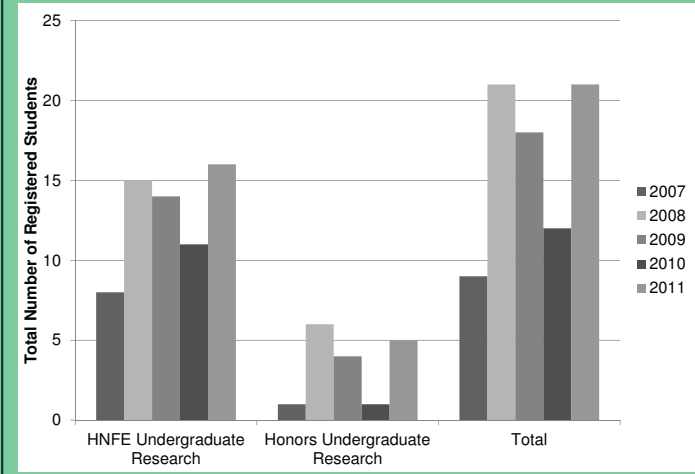
Table 1: Summary of USDA Scholars Program

YEAR	TOTAL NUMBER OF SCHOLARS	TOTAL CONTINUING RESEARCH (FOLLOWING SEMESTER)	SYMPOSIUM LOCATION	PEER REVIEWED PUBLICATIONS/POSTER PRESENTATIONS AT NATIONAL MEETINGS
2007	5	4	Virginia Tech	2 peer reviewed articles; 3 articles in preparation; 1 poster at national meeting
2008	7	6	Virginia Tech	4 peer reviewed articles; 6 posters at national meetings
2009	10	8	University of Pennsylvania	2 presentations at local meetings
2010	10	8	Virginia Tech	2 peer-reviewed publications; 6 presentations at local and national meetings
2011	10	5	Virginia Tech	2 presentations at local and national meetings
2012	7	N.A.*	Virginia Tech	N.A.

*N.A. = not available

The USDA Scholars Program

Figure 2: Total number of students registered for regular and honors-level undergraduate research in the department of Human Nutrition, Foods, and Exercise (HNFE) in the fall semester following the summer undergraduate research program at Virginia Tech (2007-2011). Following the official start of the USDA Scholars program, there was a 1.8-fold increase in regular undergraduate research enrollment and a 6-fold increase in honors undergraduate research enrollment for all remaining years, except 2010.



the start of the USDA Scholars Program on the Virginia Tech campus, 874 registered students in 15 different HNFE classes have received peer mentoring from the 25 undergraduates participating in the 2008-2010 USDA Scholars program, which had a required peer-mentoring component for the academic semester following the summer program. The Scholars also participated in freshman orientation and some individual scholars led undergraduate journal clubs (1 credit courses, open to all levels of HNFE students) for a total of 22 students. This

new class allowed USDA Scholars to share their skills in reading, interpreting and discussing research articles with fellow undergraduates and significantly increased the number of HNFE students involved in inquiry-based learning in a non-laboratory environment. According to other reports, journal clubs enhance critical thinking skills in undergraduates (Minerick, 2011; Roberts, 2009).

Multi-Institutional Impact of the Scholars Program

As part of the summer USDA Scholars program, three multi-institutional symposiums were held in August 2008-2010 at Virginia Tech (2008, 2010, and 2011) and the University of Pennsylvania (2009) (Table 1). Approximately 150 registered participants from Virginia Tech and the University

of Pennsylvania participated over the three years of the conference. Participants also came from other universities, including Penn State, the University of Michigan, Muhlenberg College and Davidson College. Undergraduate research was highlighted during these symposia with undergraduates giving oral presentations and presenting posters during the symposium (Figure 3).

Qualitative and Quantitative Assessment of the Program

The Friday reflections blog allowed faculty directors of the USDA Scholars Program, a forum for posing questions based on the week's activities (usually from the course) and students to provide individual reflections and responses to peer's reflections. All of the remarks are qualitative in nature. During the first week of Friday Reflections for 2009 and 2010 Scholars wrote that they were "blown away from the get-go" by their expectations of the program, which they also described as "pretty enlightening" and "overwhelming at times." Students also commented that they were nervous, but that "the boot camp idea works well and make (sic) the orientation much more enjoyable."

Student's comfort and confidence with independently performing research were assessed in this blog format, as well as in the pre- and post-surveys. In the blog, some comments related to their research include "I came into this program completely intimidated by the

Figure 3: Images from the USDA Scholars Multi-Institutional Symposium. (A.) Student participants for the first USDA Scholars Multi-Institutional Symposium. (B.) A 2008 USDA Scholar presents her poster to an HNFE faculty member (C.) Marquee advertisement at the University of Pennsylvania for the 2nd Annual USDA Scholars Multi-Institutional Symposium (D.) Students from Virginia Tech and the University of Pennsylvania pose in front of the Philadelphia Museum of Arts.



Ph.D. candidates and Master's (sic) students working in the labs because I was under the impression that their experiments always worked out perfect (sic) the first time. Obviously my assumption was wrong. Research is much more of a trial and error process than I expected." Another comment related to research was *"When I first began this program I thought research involved projects that were extensively planned beforehand and the protocol was strict, never changing. After a few weeks in the lab, I've learned that no protocol is for certain and things are always changing!"* Yet another student commented, *"I'm not used to engaging my brain so much. I'm used to memorizing, memorizing and more memorizing—that's what I'm best at. But for this program...I've had to read complex material, analyze, come to conclusions, have an opinion, etc."*

The pre- and post-survey assessment on confidence in research yielded quantifiable data that was statistically significant between pre- and post-survey results for both 2009 and 2010 analyses. Specifically, students were asked "How would you rate your current competency in

research" and given a choice of below average, average or above average, which was scored with a 1, 2, or 3, respectively. As shown in Figure 4A, students scored their confidence in research significantly higher in the post-survey, than in the pre-program survey in both 2009 and 2010. Comments in the post-survey about research included. *"Before this program, I knew nothing about research but now I feel like I know a lot! It was good to have both bench top and community focused students in the program so each of us could learn a little about the other types"* and *"I believe I now have a solid foundation about what research is. Without the other components of the class such as the annotated bibliography, the journal club, the grant proposal, and the final paper I would not have had such a solid grasp. These aspects really helped build my knowledge and competency."* Statistical competency was also analyzed in the survey. This topic was not covered during class and there is no change in perceived competency pre- and post-program survey with most students scoring themselves "average" or "below average" in this measure (Figure 4B).

Figure 4: Student perception of competency in research, statistics, oral presentation skills and scientific writing for 2009 and 2010 USDA Scholars at Virginia Tech. The Pre-survey was given prior to the start of the summer program, by at least one week. The Post-survey was given at least one week following the end of the summer program. (A) Mean + standard deviation Pre- and Post-survey scores for the question "How would rate your current competency in research?" (B) Mean + standard deviation Pre- and Post-survey scores for the question "How would you rate your statistical knowledge?" (C) Mean + standard deviation Pre- and Post-survey scores for the question "How would you rate your proficiency in public speaking?" (D) Mean + standard deviation Pre- and Post-survey scores for the question "How would you rate your writing proficiency?" Data is reported using a scale where 1=below average, 2=average, 3=above average.

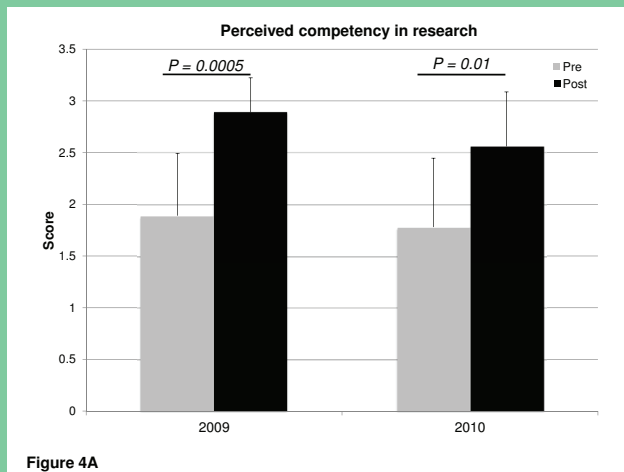


Figure 4A

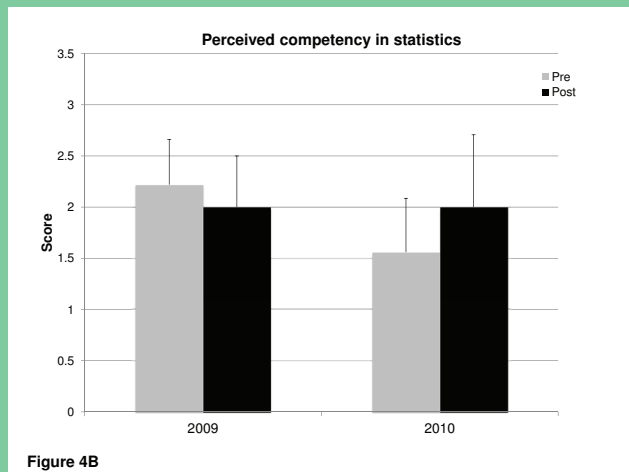


Figure 4B

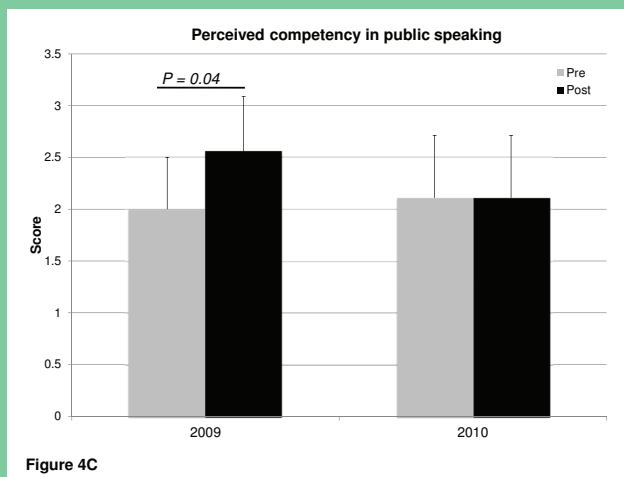


Figure 4C

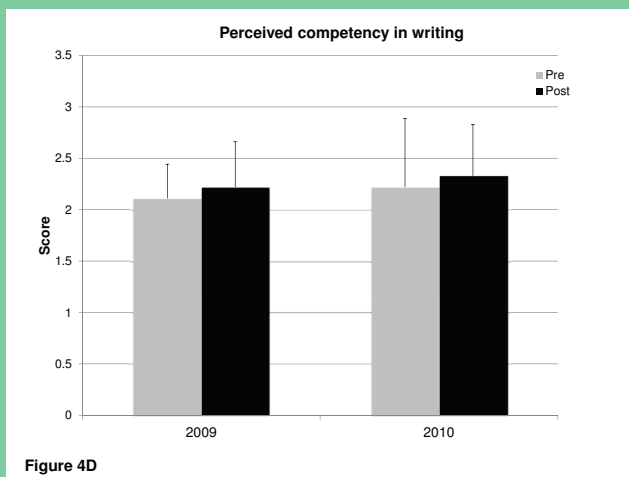


Figure 4D

The USDA Scholars Program

Students were also asked about their public speaking skills, both at the beginning of the semester when they were first asked to give a short overview of their project and at the end of the semester when they were asked to give a full seminar and poster session. Initially, students made comments such as *“next time I will try to be more conscientious of my images and figures to sure (sic) visibility for everyone in the room”* and *“I could have explained my methods a little more clearly and not used such dark slides .”* Another student initially stated that *“I was somewhat disappointed with my presentation and I know I could have prepared better”* during the initial presentations, but for the final presentation stated *“I have prepared more extensively and practiced numerous times.”*

In general, students actually felt more nervous about giving the final presentations than they did giving the initial ones. These feelings were not necessarily reflected in the post-surveys, which asked the question “how would you rate your proficiency in public speaking.” For the 2009 cohort, there was a significant increase in score reflected in the post-survey results. However, in the comments section of the 2009 survey, students stated that *“This program gave me more confidence when I am public speaking, but I still feel shaky at times when I am presenting”* and *“I’m still not completely comfortable speaking in public but this experience has helped to relieve (sic) a lot of anxiety about public speaking,”* which may help to clarify why the increase was so small, and only increased in one of the two years assessed.

Writing skills were also emphasized during the course and the overall summer program with the preparation of annotated bibliographies, poster abstracts, grant proposals and final papers. However, we found no significant increase in score in either year of the program (Figure 4D). The comments within the pre- post-surveys may provide some clue as to this lack of change in writing proficiency. For both years, in the pre-survey, students commented and scored themselves with strong writing skills. However, once they were exposed to scientific or technical writing style, as required for the grant, final paper and abstract, they lost some confidence in their writing skill. For example, one student commented in the pre-survey that *“In regards to my techinal (sic) writing, I feel very confident”, but in the post-survey wrote “Scientific Research Writing is a whole new beast.”*

Faculty survey data were collected for program years 2007-2011. In all years, the most frequent concern stated by faculty in taking a USDA Scholar for the summer program was time (15 out of 24 responses; 63%). Suggestions for improvement to the program included involving the mentors more in the program and classroom training topics (four comments), reducing the

number of classroom hours and/or assignments, so that the students could devote more time to research (three comments), involving the student in the lab in the prior semester (one comment, 2008 only and a change based on this comment was implemented in 2009-2012) and giving more guidance for the grant proposal, specifically the allowed amount of mentor input (two comments in 2008, and this change was implemented in 2009-2010). Comments on the overall program included *“The program was great and extremely well designed to mimic a true research experience, starting with a proposal and going all the way through a presentation and paper”* and *“The coordinators do an excellent job of providing an overview of research (IRB, statistical analysis, research design) and different research within our department. They act as excellent mentors to the students throughout the process too. The program is well-organized and a great asset to faculty and students who participate.”*

Unresolved Issues

There were several issues that remain unresolved. First, faculty time remains the primary concern in the program. Most faculty feel that the time invested in mentoring students may not translate to direct research outcomes (grants and papers) for their program. This sentiment appears to be common among other reports of undergraduate research programs, especially at research-intensive universities. For example, some institutions continue to value research productivity over undergraduate mentoring, especially in regards to promotion and tenure issues (O’Meara and Braskamp, 2005). At some institutions, especially research-intensive institutions, teaching grants are not considered “research” even if considerable scholarly investigation will be conducted during the grant period. At Virginia Tech, the formation of a new Office of Undergraduate Research may help in promoting teaching activities, especially involving undergraduate research-intensive courses, as scholarly activities for faculty. In support of this, it has been suggested that faculty mentoring of undergraduates occurred more readily at institutions where undergraduate research was valued both by colleagues and administration, than at those institutions where it was not valued (Eagan et al., 2011).

A second unresolved issue, which also presents concerns for many summer undergraduate research programs, is the funding source, especially for student stipends. Some of the first federal funding for undergraduate research occurred in 1965, and since then there has been significant growth in money available for these programs (Donovan et al., 2010). However, programs are usually defined in the number of years of available funding and then either need to get another grant, or find

other funding sources. The USDA Scholars Program was originally funded for three years with a USDA Higher Education Challenge Grant. Subsequent years have used internal (department, college and institute) and faculty money, which need to be secured every year without any guarantee of continuity. The formation of an Office of Undergraduate Research at Virginia Tech has resulted in increased coordination of programs, and some travel money for undergraduates. Still, money for research stipends remains the major expense and the concern for program directors.

Summary

We describe the qualitative and quantitative results from assessment of an undergraduate research program “The USDA Scholars Program” at Virginia Tech, funded by a USDA Higher Education Challenge Grant, with matching and internal funds from Virginia Tech entities. Overall, this undergraduate research program represented a significant advance from previous programs that the authors were aware of, either at Virginia Tech, or at other universities. For example, a strong program in Food Science, with many similarities to ours still did not use a the semester prior to the summer research program to “jump start” students, mainly because this program attracts students both from and outside of the hosting institution (Roberts et al., 2010). The use of the semester prior allowed students in the USDA Scholars Program to complete IACUC and IRB training and write a referenced proposal prior to the summer research program. While the downsides of this include additional time and effort by both the student and the faculty member in the spring semester, neither students nor mentors commented on that time as burdensome.

There were no other identified programs that used a weekly student blog to document student concerns and/or reflections and only one other program included that we found included both pre- and post- surveys of the students to document gains (Gum et al., 2007). We believe that both of these components of the USDA Scholars Program contributed to its success both with the department and the university, as changes could be made immediately (for example, if more than one student had similar concerns on the blog) and yearly (based on the pre- and post-surveys of faculty and students).

Overall, between 65-68% students participating in the USDA Scholars Program during different program years self-assessed themselves with a significant increase in research confidence. This increase is similar to those reported in other articles (Sadler and McKinney; 2010, Seymour et al., 2004). In addition, 12% of the Scholars have published research papers in peer-reviewed journals to date and 36% have presented posters as local,

national and international meetings (in addition to the USDA Scholars symposium that was part of the USDA Scholars Program). Most Scholars (74%) continued research in the following academic year and this is similar to other described programs (Cameron et al., 2012; Gum et al., 2007; Kinkel and Henke, 2006; Levis-Fitzgerald et al., 2005; Martinez, 2009; Nnadozie et al., 2001; Roberts et al., 2010). Overall the department saw a significant increase in total numbers of students doing both regular and honors-level undergraduate research in the academic years following the program. Finally, and consistent with other published reports, there were an increased percentage of students going on to graduate school, compared to HNFE graduating seniors in general (Cameron et al., 2012; Kinkel and Henke, 2006; Nnadozie et al., 2001).

Conclusions and Implications

We believe that the USDA Scholars Program represents a model that can be translated to other undergraduate departments that want to start or improve a summer undergraduate research program. Specifically, innovations in using the semester prior to the summer program to “jump-start” student involvement in the research, a student blog with reflections and both pre- and post-surveys to the students are improvements over most published programs. Institutional and faculty support of any undergraduate summer research program is essential to success.

Literature Cited

1998. Reinventing undergraduate education: A blueprint for America’s research universities. U.S., New York: Boyer Commission on Educating Undergraduates in the Research University, Room 310, Administration Bldg., State University of New York, Stony Brook, NY 11794-0701: Web site: <http://www.sunysb.edu/boyerreport>.
- Cameron, C., C. Collie and S. Chang. 2012. Introducing students to cancer prevention careers through programmed summer research experiences. *Jour. of Cancer Education* 27:233-242.
- Donovan, T., R. Porter and J. Stellar. 2010. Experiencing success: Some strategies for planning the program. *New Directions for Teaching and Learning* 2010:89-94.
- Eagan, M., J. Sharkness, S. Hurtado, C. Mosqueda and M. Chang. 2011. Engaging undergraduates in science research: Not just about faculty willingness. *Research in Higher Education* 52:151-177.
- Gum, A., K. Mueller, D. Flink, S. Siraj, C. Batsche, R. Boothroyd and P. Stiles. 2007. Evaluation of a summer research institute in behavioral health for

The USDA Scholars Program

- undergraduate students. *The Jour. of Behavioral Health Services and Research* 34:206-218.
- Karukstis, K.K. 2006. A council on undergraduate research workshop initiative to establish, enhance, and institutionalize undergraduate research. *Jour. of Chemical Education* 83:1744-1745.
- Kinkel, D.H. and S.E. Henke. 2006. Impact of undergraduate research on academic performance, educational planning, and career development. *Jour. of Natural Resources and Life Sciences Education* 35:194-201.
- Levis-Fitzgerald, M., N. Denson and C.A. Kerfeld. 2005. Undergraduate students conducting research in the life sciences: Opportunities for connected learning. Online Submission [Online]. Available: <http://ezproxy.lib.vt.edu:8080/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED491735&site=ehost-live&scope=site>
- Martinez, A. 2009. Learning through research: How a summer undergraduate research experience informs college students' views of research and learning. Ed.D., Columbia University Teachers College.
- Minerick, A.R. 2011. Journal club: A forum to encourage graduate and undergraduate research students to critically review the literature. *Chemical Engineering Education* 45:73-82.
- NCUR. 2005. National conference on undergraduate research board of governors and council on undergraduate research governing board: Joint statement of principles in support of undergraduate research, scholarship and creative activities. [Online]. Available: <http://www.ncur.org/ugresearch.htm>.
- Nnadozie, E., J. Ishiyama and J. Chon. 2001. Undergraduate research internships and graduate school success. *Jour. of College Student Development* 42:145-156.
- O'meara, K. and L. Braskamp. 2005. Aligning faculty reward systems and development to promote faculty and student growth. *NASPA Jour. (National Association of Student Personnel Administrators, Inc.)* 42:223-240.
- Roberts, A.J., J. Robbins, L. Mclandsborough and M. Wiedmann. 2010. A 10-year review of the food science summer scholars program: A model for research training and for recruiting undergraduate students into graduate programs and careers in food science. *Jour. of Food Science Education* 9:98-105.
- Roberts, J. 2009. An undergraduate journal club experience: A lesson in critical thinking. *Jour. of College Science Teaching* 38:28-31.
- Sadler, T.D. and L. Mckinney. 2010. Scientific research for undergraduate students: A review of the literature. *Jour. of College Science Teaching* 39:43-49.
- Seymour, E., A.B. Hunter, S.L. Laursen and T. Dean-toni. 2004. Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education* 88:493-534.

**To submit a manuscript to the
NACTA Journal, go to this website:
nacta.expressacademic.org/login.php**

