

**UF's Scientific Thinking and Educational Partnership:
An Approach for Genetics Outreach**

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Abstract

The purpose of this professional paper is to describe the lessons learned during the first year of the University of Florida's Scientific Thinking and Educational Partnership (STEP) project. STEP was developed to better position the University of Florida to communicate the broader impacts of research in plant, animal and human genetics to the public by integrating faculty members with expertise in communication, life science and social science research. STEP's overall objectives were to improve the quality of decision making and problem solving in the sciences, focusing on developing this capacity in faculty, students, and citizens; and facilitate opportunities for research, teaching, and extension faculty to collaborate on integrated grant projects.

In the first year, the STEP team initiated a strategic planning process that began with a comprehensive needs assessment sent to faculty involved in genetics research. Based on this input, STEP's primary project was the *uf*GENETICS.com Web site, targeting science educators and media professionals. In the development of this site, the STEP team incorporated students with expertise in the areas of teacher education, video production, graphic design, and writing.

STEP has received positive comments from faculty involved with the development of the features on the *uf*GENETICS.com site, as well as from administrators who see STEP as a way to assist faculty in communicating broader impacts of their research to the public. STEP was integral in UF's receiving a \$670,000 grant in 2007, which has provided the program with much needed visibility and built in-roads with faculty from different disciplines. This paper also makes recommendations to faculty interested in developing similar educational outreach programs.

KEY WORDS: outreach, grants, collaboration, genetics, research
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Introduction

Since 2004, the federal research and development budget for nearly all programs has declined. The U.S. Senate and House of Representatives may change that trend with a proposed addition of billions of dollars to the fiscal year 2008 research and development budget (Lempinen, 2007). Much of that funding would target projects dealing with the environment, energy, and biomedical initiatives (Lempinen, 2007).

Researchers may benefit from this potential boon if they can position their grant proposals effectively. One of the obstacles they face is the need to integrate research, education, and teaching into their grant proposals. The National Science Foundation (NSF), the United States Department of Agriculture (USDA), and other granting agencies are including a "broader impact" statement in their requests for proposals. Specific granting agencies now require that grant recipients explain the "broader impacts" of their research, such as integrating education, technology transfer, and societal benefits into their projects (NSF, 2006a).

For many researchers, incorporating a "broader impacts" component into their projects may be difficult (Frodeman & Holbrook, 2007). Grant proposals that succeed in integrating teaching, research, and extension are rare. During the 2005 granting period for USDA/Cooperative State Research, Education, and Extension Service (CSREES)'s Integrated Programs, some program areas had grant proposal success rates as high as 25% (Bewick, 2006). Program leader Thomas Bewick attributed some of this success to the low number of grant submissions and the difficulty in presenting a unified project (Bewick, 2006). USDA/CSREES Integrated Programs Director Deborah Sheely explained that the approved proposals have

outreach components that are truly necessary for the ultimate success of the project and not merely an additional element (Sheely, 2006).

University of Florida (UF) faculty are among those in competition for these federal research dollars. The inclusion of “broader impacts” into grant requests for proposals, or RFPs, has caused some concern from researchers. Many scientists are ill-equipped to relate their research to the public or the media, which disseminates science information to the public (Lundy, Ruth, Telg, & Irani, 2006). UF researchers may have some of these same concerns.

In 2002, a group of UF faculty tried a collaborative approach to grant proposal development. Rather than focusing on scientific researchers alone, this faculty team pooled the expertise of communication, critical thinking, and plant sciences research faculty members (Lundy, Irani, Ricketts, Eubanks, Rudd, Gallo-Meager, & Fulford, 2002). The collaboration was successful and the team received a USDA Challenge Grant to develop a model for enhancing critical thinking skills in students in an undergraduate biotechnology class. The researchers believed that audiences needed to know more about science, specifically genetic science, to be better consumers of scientific information. The grant project focused on using a critical thinking approach and effective communication strategies in science education. In late 2005, the faculty members began discussing how this outreach model could be refined and used by other UF faculty in grant proposals.

The faculty members approached UF administrators to create a team that would further develop this outreach model of teaching genetics using communication and critical thinking approaches. The idea was approved and funded, and, thus, the Scientific Thinking and Educational Partnership (STEP) program was born in July 2006. UF administrators believed that STEP would provide UF researchers with a mechanism to communicate impacts of their research

findings to the public. This paper will detail lessons learned during STEP's first year, plans for the future, and an overall model for outreach that can be used in other academic institutions.

Rationale

Academic institutions in the United States contribute significantly to the amount of scientific research and development conducted nationwide. This contribution is especially important because of the new knowledge added through basic research, of which academia conducts more than half. In 2004, academia dedicated \$42 billion to research and development (R&D) efforts (NSF, 2006a).

In order to accomplish the increasing amount of R&D, academic institutions rely on numerous funding agencies, both public and private. In 2003, the federal government provided more than 60% of the funding for research and development at U.S. academic institutions. Other funds are provided by the institution, state and local governments, industry, and non-profit organizations. In 2005, six federal agencies were responsible for providing an estimated 96% of R&D funds. These agencies are the National Institutes of Health, NSF, Department of Defense, National Aeronautics and Space Association, Department of Energy, and USDA (NSF, 2006b).

Starting in 2001, scientists applying for NSF funding have to provide explanation of how their research will incorporate broader impacts. According to the NSF (2006a), broader impacts include "aspects of teaching and learning, integration of research and education, technology transfer, societal benefits, technological innovation, infrastructure development, and opportunities to include a diversity of participants, particularly from underrepresented groups in science" (p. 17).

Developing outreach programs, specifically for K-12 education, provides a number of benefits to researchers (Dolan, 2004). Through these efforts, scientists can contribute to creating

a more scientifically literate public, improve their teaching skills and apply education theory, while exposing more people to the significance of their research. The long-term success of science outreach efforts are hampered by a lack of rewarding those who choose to dedicate time and energy and a lack of training in outreach strategies (Dolan, Soots, Lemaux, Rhee, & Reiser, 2004).

Although research granting agencies may ask scientists to incorporate outreach strategies in grant proposals, scientists often struggle to meet the broader impacts criterion of the merit review system (Frodeman & Holbrook, 2007). One reason may be that scientists have not been trained in how to communicate or educate the public. As Neal Lane, former director of the National Science foundation, explained:

With the exception of a few people...we don't know how to communicate with the public. We don't understand our audience well enough – we have not taken the time to put ourselves in the shoes of a neighbor, the brother-in-law, the person who handles our investments - to understand why it's difficult for them to hear us speak. We don't know the language, and we haven't practiced it enough (cited in Hartz & Chappell, 1997, p. 38).

When communicating to lay people, scientists need to use simpler language and utilize more metaphors or models to explain complex topics. The information needs of the public are also much different than those of fellow scientists. The scientific community understands that the search for “truth” takes numerous replications and a lengthy timeline. However, through the media, people want to know why the research was conducted, who was involved, the significance of the findings, and any potential implications or consequences (Gunter, Kinderlerer, & Beyleveld, 1999).

Through communication efforts, scientists are able to share information from their research that provides a better understanding of the world, which is valuable in its own right, but this increased exposure of science can also help motivate young people to consider scientific

careers (Treise & Weigold, 2002). Scientists dedicate their time and energy working on research projects and often do not give any priority to communicating that work to the public (Hartz & Chappell, 1997). That priority has shifted due to the requirements of many funding agencies.

Procedures/Methods

The Scientific Thinking and Educational Partnership (STEP) program was developed to better position the University of Florida to communicate the broader impacts of genetic science to the public. The STEP program includes faculty members with expertise in communication, life science and social scientific research. This collaborative approach brings together researchers who have strategies to effectively communicate with lay audiences and the content experts who conduct cutting-edge scientific research.

STEP received funding from the University of Florida Genetics Institute (UFGI), the Institute of Food and Agricultural Sciences (IFAS), and the Division of Continuing Education (DOCE) for two years, which included a full-time program coordinator, part-time student assistants, software, and equipment. The overall goals of the STEP program were to improve the quality of decision making and problem solving in the sciences, focusing on developing this capacity in our faculty, students, and citizens; and facilitate opportunities for UF research, teaching, and extension faculty to work together on integrated grant projects. This would be accomplished through the following strategies: (1) developing and distributing a comprehensive needs assessment to genetics faculty, (2) collaborating with other UF faculty on grant proposals, and (3) promoting the STEP program throughout the university, beginning with the departments that funded the program.

In the first year, the STEP team initiated a formal strategic planning process that began with a comprehensive needs assessment sent to faculty in the UF Genetics Institute. Faculty were

asked as they developed outreach programs, which areas could they use some assistance. From the 45 responses, themes began to emerge among the faculty. Approximately 56% responded that they needed help creating multimedia development, such as integrating video into Web sites. Half of the respondents stated they desired guidance communicating with the media. Almost half, 44%, said they would like assistance with in-service teacher training.

In response to the needs assessment, the STEP directors decided to focus on developing multimedia components for grant projects. The STEP directors and coordinator began meeting with faculty interested in submitting grants that could include science education. A total of ten grant proposals were discussed and developed for a variety of granting agencies including the Howard Hughes Medical Institute (HHMI), the USDA, and NSF. In each proposal, the STEP team had a different role. In one proposal, the team members would hold a workshop on critical thinking for high school science teachers; in another they would develop puzzles that would train genetics students to be better at abstract thinking; in another, videos would be developed and incorporated into a computer game for agronomy students. They each incorporated science education, but the role of the STEP team changed dramatically for each proposed project. To date, the HHMI grant proposal has been accepted with an award of \$676,000.

The benefit of the initial “shotgun approach” to grant projects was that it allowed the STEP team to interact and network with a diverse group of faculty working towards better science education at UF. It also gave the team a time of “pushing the envelope,” exploring different areas, including new media with mobile technology and computer gaming. The downside to trying to create made-to-order outreach components in the various grant projects was that it required a great deal of time from the STEP directors. While the program coordinator could focus solely on developing STEP grant proposals, the directors had full-time duties to contend

with. The directors had to juggle outside responsibilities, with STEP grant meetings and proposal writing.

While the STEP Web site was being developed, the strategic planning process continued with the development of a STEP advisory council. The council consisted of faculty involved in science education throughout UF, including the College of Education, Institute of Food and Agricultural Sciences, and the Division of Continuing Education. The advisory council was presented with the STEP's goals and the strategies drawn up to meet these goals. They also were given the list of grant proposals that had been submitted, and other potential projects for the future. The advisory council expressed concern that the goals of STEP were too broad and the projects were too diverse. The council also stated that some of the goals expressed by STEP were similar to existing programs at UF. While the council members brought up concerns over the mission of the STEP program, they offered few solutions.

The STEP team directors deliberated over the comments from the advisory council. It was determined that the team would focus on a single approach to outreach. The team roles would be clearly delineated to correspond to each member's outside responsibilities. So in effect, STEP projects could fulfill each member's primary responsibilities. The outreach approach became a merging of cutting-edge science, entertainment/education (or "edutainment"), new technology, and learning methods. The showcase project *uf*GENETICS.com was developed to model this outreach approach.

In the first year, the STEP program also initiated a promotional plan. A STEP program Web site was developed (<http://step.ufl.edu>) to give interested faculty and administrators an understanding of the program. The Web site gave information on the mission of STEP, the joint grant proposals that had been submitted, and additional educational resources on critical

thinking, problem solving, and teaching tools for genetics education. Included in the Web site was an online network known as the STEP Science Education Network, which offered a list of faculty involved in science education across the University of Florida. This online resource assists faculty in finding potential collaborators from other colleges or programs to work with on science education projects.

STEP members also promoted the program through paper and poster presentations at the Florida Genetics 2006 Conference, the 2006 Extension Professional Associations of Florida Conference, and the 7th Annual College of Agricultural and Life Sciences (CALs) Teaching Enhancement Symposium.

***uf*GENETICS.com**

*uf*GENETICS.com became the central mechanism for all of the expertise of the team to focus their energy and talents. The project concentrated on a main Web site that would provide science educators and media professionals with a place to receive information on cutting-edge genetics research being conducted at the University of Florida. Media professionals and educators were chosen as the main audiences for the site because those groups currently inform the public and students about science.

The *uf*GENETICS.com Web site, launched in late September 2007, features a series of primers on genetic research conducted at the University of Florida and includes:

- *Videos* running from one to three minutes in length, that focus on an entertaining aspect of science and especially genetics that apply to everyday life. These are geared towards high school and undergraduate-level students.
- *News feature stories* with associated photos that offer more depth on a specific aspect of the science topics.
- *Lesson plans* with objectives, activities, and an evaluation. These lesson plans have been developed for high school-level science instruction.
- *This Is Your Brain on Science* videos, which highlight an entertaining scientist who offers insight into why he or she entered the field of science. This video series focuses on recruiting high school students into the area of science.

It was decided that an outside Web design company would be hired to create the initial Web site to ensure the site would appeal to a diverse audience and not appear too “institutional.” The STEP team wanted the site to look professional and similar in appearance to some of the other online science education sites, such as National Geographic and Discovery Channel (see Figure 1).



Figure 1. *ufGENETICS.com* Web site

The Web site was developed to offer monthly genetic features on a variety of topics including biotechnology, gene therapy, conservation ecology, and genetic markers. The STEP team produced materials concerning each topic that highlighted the expertise of the team, such as news feature stories, videos, lesson plans, and photographs. The materials were meant to pique the interest of media professionals and encourage them to conduct stories with UF researchers about their research. For the educators, online materials offered complete instructional packages (lesson plans, videos, stories) that would engage their students. The videos and lesson plans

were developed with an entertainment-education approach that involved a strong interest approach with an educational message.

Current communication technology was also integrated into the development of the materials. As the *uf*GENETICS.com Web site was being developed, the videos were converted into QuickTime videos and uploaded into the online video database, YouTube. The videos were also repurposed as podcasts and loaded onto iPods to be viewed in STEP presentations and workshops.

The desire of the STEP team was to offer to incorporate the *uf*GENETICS.com site into grants. Researchers could incorporate STEP into their grant proposals and a monthly feature would be developed for the *uf*GENETICS.com site that would then be available worldwide to educators and media professionals. The *uf*GENETICS.com site could also be re-configured for researchers interested in scientific fields other than genetics, such as nutrition.

Results

Although the STEP program encountered growing pains in its initial year, interesting results have emerged. The team has produced an interesting demonstration outreach model known as *uf*GENETICS.com. The next step for the coming year will be testing the site with various audiences, including high school science teachers, agricultural teachers, journalists, undergraduate genetics students, and 4-H agents working with high school teachers.

For initial testing of the materials, the videos were uploaded to the YouTube site (search for key word: “ufgenetics,” all one word). Within two months, the 26 genetics videos were viewed over 1,500 times (as of September 4, 2007). The viewers ranged in age, from 19 to 55, and location, with viewers from Puerto Rico, the United Kingdom, and the United Arab

Emirates. STEP project developers received inquiries from teachers and casual viewers who just happened upon the YouTube videos, before the *uf*GENETICS.com site was launched.

The development of the *uf*GENETICS.com site also provided an unexpected connection to the teaching efforts at the University of Florida. The STEP team incorporated students with expertise in the areas of teacher education, video production, graphic design, and writing. The students worked together to produce cohesive genetics features. This type of production allowed students to have hands-on experience working with clients and deadlines. The students not only supported the STEP program, but also generated a series of professional portfolio pieces. One student production assistant wrote, “Because of this internship, I have gained MANY occupational and life skills. I feel as if I am better prepared for the work force and have the skill set to be successful in any aspect of communication leadership.”

The students were so successful in the production process that the STEP model will be incorporated into a capstone course in Spring 2008 in the UF Agricultural Education and Communication Department. This course will offer students a way to use the skills they have acquired in technical writing, video production, and graphic design. The students will develop genetics features for the *uf*GENETICS.com site. This course would further promote research at the University of Florida while providing the students a more “real-world” experience with clients and deadlines to meet.

Another interesting result has been the feedback from faculty involved with the development of genetics features for the *uf*GENETICS.com site. Many of them were impressed with the entertaining and professional materials developed. The finished materials were also made available to the faculty involved and could be incorporated into their academic program Web sites or courses.

Administrators have also voiced their approval of the project and have been interested in the “one-stop shopping” benefit of working with the STEP program team. One of the benefits they see is the consolidation of faculty and staff with various expertise areas under one roof, with the ability to serve the University of Florida at large.

An additional result of the STEP program has been the Howard Hughes Medical Institute grant award for more than \$676,000. This high-profile grant has provided the STEP program with much needed visibility and built in-roads with faculty from different disciplines.

Recommendations

Following are recommendations for faculty interested in creating effective science education outreach programs:

- Allow enough time to complete the program, with a buffer of at least one month.

Unexpected complications and opportunities arise. It is beneficial to have enough time to work through unexpected issues, such as additional faculty entering the project, changing strategies in mid-project, or outside travel obligations of team members.

- Outsource Web site development or other technical production pieces if the team members are not experts in that area. It saves time on the part of the team members who are stretched beyond their comfort zone of expertise.
- Take time to evaluate if the activities of the team correspond effectively to the mission. Be willing to let interesting activities fall if they do not align well with the mission.
- Take the time to understand the strengths and weaknesses of team members. For example, one team member may be interested in technology, but his real strength is in technical writing. Understanding this will allow the team member to be best use his strength, at least initially, as the project takes shape.

- Create a showcase of the final product. Showing is easier than telling when explaining a concept to administrators, colleagues, team members. Although it took almost six months to complete, showcasing this project has been an invaluable tool in communicating our idea.

Conclusions

By working on grant projects with faculty from across the University of Florida campus, some partnerships have been built with other like-minded programs and departments. UF administrators have also become engaged with the idea of alternative public outreach programs to enhance grant proposals. Another benefit has been the way the administration views the agricultural education and communication faculty involved in the STEP program. Previously, the administration has considered “research faculty” to be those involved in scientific research. The STEP program allowed them to see research conducted in the area of agricultural education and communication as viable and effective.

The STEP program has also encouraged the use of new technology into outreach programs. By incorporating YouTube, Flash videos, and iPods into a public outreach program, the STEP program has begun to “push the envelope” of the possibilities involved with public education.

Many lessons have been learned through the STEP program. The major lesson was that creating a single model that could be refined through testing and reused over time, was a better use of resources than creating a series of different projects. The initial goal of producing individualized outreach programs for science education grants spread the resources of the STEP team thin. By creating new outreach programs for each prospective grant, the STEP directors spent a large amount of time in development with little to show in support of the overall mission.

The *uf*GENETICS.com model gave the STEP team a solid foundation to work from. Through testing with different audiences, the *uf*GENETICS.com will evolve and be improved over time.

Another lesson that was learned through this past year was to use the program resources to hire outside expertise when needed. While the STEP team had expertise in communication, learning strategies, and science, it did not have expertise in Web databases and Flash programming. By contracting with an outside firm, the STEP team members could focus on the content without having to learn Web programming. The result is a Web site that is professional, with effective content. One note that should be added to contracting Web sites with firms outside of the university system is that it was helpful to have STEP team members who were familiar with Web design. This allowed the STEP team to work well with the Web design team.

In the future, the STEP team will focus on testing and refining the *uf*GENETICS.com materials, Web site, and overall model. The materials will be tested with undergraduate students at the University of Florida, high school science teachers in Florida and throughout the nation, and high school students. With each evaluation conducted throughout the next year, the suggestions made will help the STEP team refine the *uf*GENETICS.com project.

Internet search marketing will also be an important part of this upcoming year's work plan. The STEP team will explore ways to use meta tags more successfully, cross-linking with Web sites with a similar mission, using RSS feeds to build a subscribers list, and gaining *uf*GENETICS.com Web site data.

With the *uf*GENETICS.com tested and refined, the next step will be developing more promotional materials and developing target lists of teachers and media professionals to direct market the Web site. Along with this effort will be promotion through professional conferences.

Another step for the STEP team is working with professional development in the area of new media and science education. The team is interested in creating workshops that will introduce faculty to new media, from the standpoint of working with the technology and from a learning methods standpoint, how these new tools can be effectively used in the classroom. The STEP team plans to pursue a USDA Challenge Grant to teach faculty how they can better communicate about science through the use of instructional technology.

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