

NNCS Leadership Symposium: Adding a Leadership Component to Science Education

Abstract

The NSF Navy Civilian Service (NNCS) program is now in its second year of operation and has embarked on a course to add a significant leadership training component for participating students. This paper will describe the nature and history of NNCS, the rationale for the leadership component, and a description of the symposium itself. Also included will be a programmatic overview from the perspective of its origins in ONR's workforce development programs.

NNCS has the following main three goals:

- To identify and fully develop a diverse group of science, technology, engineering and mathematics (STEM) professionals with advanced degrees to ensure the economic future of the nation;
- To foster stronger ties between the university research community and the Navy in order to apply the latest research in a more timely fashion;
- To provide new pathways for talented STEM professionals to enter careers at Navy research and development centers.

The focus of the NNCS Leadership Symposium is having an initial gathering of students from several different universities across the nation. They will come together to form learning communities across boundaries. Each student will engage with teams of learners, mentors and advisors from differing backgrounds and interests. These teams will provide an environment for learning support, for deep inquiry and encouragement for stretching oneself to take on a leadership role in their respective communities.

The paper will conclude with a discussion of the results of an evaluation of the program which was used to gather both student and teacher/mentor input at the symposium, a listing of lessons learned, and plans for the future development and extension of the program.

Introduction

Navy's civilian science and technology (S&T) workforce number some 22,000 strong. Of those some 4,000 charge 50% or more of their time to actual S&T projects and are considered to be the core practitioners of S&T for the Navy. Almost half of those 4,000 hold Ph.D.s¹ with about half working at the Naval Research Laboratory (NRL) and the other half working at our various research and development centers (called warfare centers inside the Navy) around the country. The Naval Research – Science & Technology for America's Readiness (N-STAR)² initiative started some four years ago with the primary goal of revitalizing the workforce just described. Reality for the Navy, as with many other similar organizations, is an aging workforce with a large percentage of them being eligible for retirement over the next five to ten years. A vast amount of corporate knowledge is represented by this workforce and over the next ten years there exist a unique opportunity to capture that knowledge. N-STAR through programs like NNCS³ is attempting to do just that. In order to generate 4,000 new employees over the next ten years we will need to produce four to five hundred per year. We don't expect NNCS to do that by itself but it should grow to be a significant contributor.

History of NNCS

It started with the idea that N-STAR wanted to do something more than the standard scholarship/fellowship program where students receive support, work in whatever research area they chose, then once they graduate go to work wherever they want. These types of programs (referred to as "open loop") have value but are difficult to demonstrate specific benefits to the funding organization and become even more difficult to justify during period of shrinking resources. With these facts in mind a search was conducted of Federal agencies to see what other models existed. The scholarship for service model was discovered where students receive support in specific research areas of interest to the funding agency and in turn for that support commit to work for that agency after they graduate. This is referred to as the "closed loop" model and a working example of one was in operation just down the street from the Office of Naval Research (ONR) (N-STAR's parent organization) at the National Science Foundation (NSF).

In the Division of Undergraduate Education (DUE) of the Education and Human Resources (EHR) Directorate at NSF a "closed loop" program had been in operation since 2001 called the Federal Cyber Service: Scholarship for Service (SFS)⁴ program.

The goal of this program is to produce US citizens with degrees in Information Assurance, computer security, and related fields to join the Federal workforce and help protect the critical cyber infrastructure of this country. As a result close working relationships were developed between key personnel at both ONR and NSF. These relationships enabled the transfer of lessons learned along with the model for implementing SFS like programs to ONR and help facilitate the creation and growth of NNCS.

Operating under a Memorandum of Understanding (MoU) between the two agencies, FY04 saw the execution of the first year of NNCS operations. One million dollars of funding (half from each agency) provided the resources to fund the first set of five two year awards. Five schools, the University of California-Berkeley, the Pennsylvania State University, the New Jersey Institute of Technology, the University of Florida, and the University of Colorado at Boulder comprised the first set of participating institutions. In total the awards provided thirteen student slots, eight students were selected, one of them has since graduated and is now working at a Navy lab. The second round of NNCS in FY05 produced seven more awards. Purdue University, the University of Houston, the University of Texas at Austin, Drexel University, the University of California-Riverside, MIT, and Northwestern University formed this group with another twelve student slots and eight more enrolled students to date. All of the research projects involved with the first group were in or related closely to the field of nanotechnology. All of the Principle Investigators (PIs) for this group were currently funded NSF award winners. Likewise, the second group of PIs were also currently funded NSF award winners from the following set of NSF programs: Nanoscale Interdisciplinary Research Team (NIRT)⁵, Nanoscale Science and Engineering Center (NSEC)⁵, Engineering Research Centers (ERC)⁶, Science and Technology Centers (STC)⁷, Integrative Graduate Education and Research Traineeship Program (IGERT)⁸, and their Information Technology Research (ITR)⁹ program. Plans are in place to widen the group of eligible PIs even more in the current and future years.

Rational for Leadership Component

As ideas for NNCS were being developed the focus became how can we add value in a novel way to our program? It is often observed that technical graduate education rarely includes any exposure to the concept of leadership. As the careers of scientists and engineers progress they increasingly find themselves in leadership position. Such positions are frequently critical to the

health and wellbeing of an organization and having people with no prior leadership training in these positions can result in less than optimal outcomes for both the scientist/engineer and the organization in general. Providing young scientists/engineers with training in this critical area clearly is needed. Other models such as the McKnight Doctoral Fellows program¹⁰ provide examples where an annual gathering of all the enrolled and recently graduated students have them the opportunity to network, support each other, establish mentor relationships, explore the research activities of their peers, and provide program officers with important feedback on the effectiveness of the program. Such a gathering or symposium also presents an ideal setting to introduce the concepts of leadership to the group. Once these realizations became apparent a committee was formed to design what was to become an annual event. This activity represents a key aspect of the holistic approach NNCS takes with its students and value added for them regardless of where the future takes them.

The Symposium Launch

The design of the Symposium was carefully considered, realizing it was important for the students to meet and dialogue with Navy Scientists, explore what a typical Warfare Center looks and feels like, meet other students who are considering the same futures and learn what leadership has to do with all the rest. The Design Committee felt students must be able to leave the Symposium with an understanding that each piece of their three day experience was a significant contributor to a strong foundation for their leadership process. This Symposium experience would establish the platform for a year-long study and engagement with others to better understand what leadership actually looks like, feels like and how to personally shape an intentional leadership journey forward.

Prior to coming to West Bethesda, Maryland, students received a substantial package of information preparing them for the experience. A piece of this package included a brochure describing the year-long program, its intent and expectations for the learning communities that would provide support and assistance along the way. Other preparation included undergoing a battery of personal assessment tools that would help the student become more aware of their leadership potential, their learning styles, key competencies, emotional competence and personality characteristics. Interpretation of the assessment results was a key piece of the training during the three days of the launch, so that students could use this very personal data to construct their

learning agendas and goals for becoming their idealized leader for the future.

When the students arrived at Carderock Center in West Bethesda, they were welcomed by many scientists who work at the Center as well as officials from the National Science Foundation and the Office of Naval Research. Their welcome was further enhanced by meeting one another and their assigned Navy mentors. In several cases, the student's University Program Officer was also part of the welcome ceremony on the first day. After initial welcomes and introductions, the students were treated to a six-stop tour of Carderock labs, learning from scientists and engineers about many innovations in magnetostrictive materials, advanced power sources and batteries, shipboard environmental quality, lightweight naval alloys and friction stir welding, as well as resistance and powering of small, fast ships. Students were awed with the extensive research facilities and the obvious knowledge and dedication of the scientists and engineers who hosted the students for brief informational sessions in their labs.

Students were vocal about their impressions of Carderock. "I am a bit overwhelmed," said Lisa Hilliard, a graduate student working toward her Ph.D. in Chemistry from the University of Florida. "It is amazing to think that someone is willing to pay you to think about the things you've always wondered about as a kid. It's very exciting," she said.

After the tour and lunch, the students were welcomed, along with their mentors and advisors, to join in an afternoon session of defining the critical components of effective leadership. They were able to join in small groups to discuss their own experiences of working with inspiring, admirable leaders and the impact those leaders have had on them. By the end of the first day, the group had developed a full set of characteristics they felt reflected the ideal leader of the future and were able to consider which of these characteristics matched the image they would embrace for their future.

The following two days, students spent time individually, in small groups and as a large group, learning about their assessment results, synthesizing the data and developing a short and long-range plan of action. Through interpretations of the assessment results, the students gained increased self-awareness, learned how others viewed their leadership strengths, and how they might position themselves for greater growth in influencing others and managing relationships as a leader. Each student spent thoughtful

time analyzing his/her data to draw conclusions regarding their present situation. With that knowledge in mind, they spent time articulating a vision for their future that would be a stretch for them in their practice for becoming a leader. The resulting action plan then became the roadmap that would take them from their present situation to that future ideal. It described their uniquely chosen path for becoming the inspiring leader who is able to make a significant contribution in the world.

Each student presented his/her “leadership action plan” to the larger group, seeking input and support for their goals. Students were quick to support as well as challenge each other. They further identified the key stakeholders in their learning and leading environments, defining how they would use these people to further develop themselves. Students were given tools for enrolling their stakeholders—inviting them to provide ongoing feedback, seeking their support and asking for continued guidance. Key among these people were the Navy mentors, faculty Advisors and others invested in the students’ future.

Mentors as a Key Relationship

Each student has a key partnership relationship with a Navy Mentor as well as their Faculty Advisor, forming a triangular support base to see that their research and their leadership intentions are realized. These key stakeholders play a critical role in guiding and coaching the student as they test their leadership skills and knowledge in a *live* work setting within the Navy.

Students, eager to develop a close relationship with a helper who has experience, sought out their mentors to learn what they could—how would they be challenged and how could they contribute in an arena that tests their prowess in the research field they so enjoy? They further sought to build an understanding of the mentors’ style, energy and commitment to the partnership. This meant developing a further plan for how to use their mentor wisely, seeking support and help as needed. They were given tools for understanding the critical nature of the mentor relationship as well as guides for how they would work closely together to further the students’ capability with both the technical and the leadership sides of the arrangement.

Mentors are also being provided with tools and supports for their use in working with the student. They are learning how they can contribute to the students’ success, while teaching and guiding him/her to new levels. This support structure is continually being

monitored and enhanced as the student progresses with his/her plan of action, intervening as the partnerships suggest new opportunities for growing and learning together.

Since one of the primary goals of the NNCS Program is to foster stronger ties between the university research community and the Navy for timely application of latest research, these mentoring relationships facilitate that process also.

Learning Communities

Beyond the partnership with faculty advisors and Navy mentors, the students are also positioned with each other through a learning community of support. This community comes together via teleconference call each quarter for the upcoming year to share with each other their progress, as well as addressing issues that may have surfaced. These teleconference calls are facilitated by the instructor who designed the leadership program and continues to guide and direct the learning process. From time to time, the Navy mentors and faculty advisors are invited to participate within the community to learn from the larger pool of students.

Some students are fortunate to have fellow graduates in the program who come from their same University settings. These students have built-in colleagues who provide one another support and feedback on their plans. Three students from the University of Texas in Houston spoke of their commitment to each other, “we spend time with each other to keep one another motivated and on track, helping each other to see the opportunities that await us once our research is completed.”

This community of learning leaders offers each student opportunities to see differing points of view, differing styles of leading and differing ways of making things happen within their own settings. They can test their growing expertise within a safe, non-threatening community and learn to exercise their own ‘voice’ within a community of learners. Furthermore, they share their successes and learn from each others’ mistakes. They brainstorm together to consider new ways of approaching problems that come from the collective best thinking and experience.

This community support is critical at the early stages of learning about leadership. It provides a container for experimentation, encouragement and problem-solving—all critical features of a learning laboratory for becoming strong and effective leaders for the future.

At the end of the year of community learning, experimenting with their new-found leadership skills, the students return at the end of the year for another three day experience to share the results of their learning experience of leadership, to re-define their goals for leadership and modify their leadership plans based on their learning. This culminating 3-day event will focus on the leadership journey as an ongoing process of learning, experimenting and re-shaping an agenda that is targeted, constantly growing and changing. It will focus on helping the student see themselves as an agent of change, an influencer in their environments and an effective model in the science and technology community.

Outcomes Expected for the Program

The program is early in its unfolding process. Seventeen students have completed the Symposium launch with only two actually placed to date in Navy facilities for their two-year commitment. The remaining students expect to be placed in their Navy assignments within the next year. During this time, they are actively working to apply some of their leadership skills within their university settings and undertake an action learning project that pushes the boundaries of their leadership skills.

The NNCS Program outcomes are aimed first, at providing students the opportunity to learn deeply about themselves while developing a plan for learning more about leadership, testing themselves in a challenging environment and preparing for a journey to achieve their ideal. Other more specific outcomes include:

- Building a broad and deep understanding of team effectiveness in the context of global implications;
- Deepening their understanding of the impact of the global environment on technology strategy;
- Making real-time applications of their research in navy R & D Centers across the US;
- Developing skills for collaborative learning, sharing and growing as a community; and
- Contributing to the research enterprise of the US Navy in meaningful ways.

There is an expectation that by providing the leadership development component, future leaders of the Navy Science and Technology community will likely come from the ranks of these talented students who have been selected for this program.

Evaluation of the Program

The initial response to the program has been very positive. While students and their support communities are still very much engaged in this first year of experimentation, the Symposium launch was seen as very successful in the eyes of the students. One student said, “the best part of the Symposium was being able to usefully interpret some of the assessment data and proactively plan for how I will use this to enhance myself and ultimately influence my interaction with others.” Others spoke of the positive aspects of “meeting other students, learning from those who are already placed in Navy assignments” and “being able to meet face-to-face with other scientists on the base and getting to know all of the leaders/heads of the programs.” Beyond seeing the atmosphere for the Symposium as very enjoyable, friendly and dedicated, the students are anxious to put some of their new skills and knowledge to the test by actually working in a Navy Center with other scientists who can teach and guide them as they move forward on their leadership journeys.

Ongoing monitoring and evaluation will be part of the NNCS Program, with opportunities for feedback from mentors and faculty advisors as well as other stakeholders supporting the students. It will be important to use both quantitative and qualitative measures to ensure that the program is effectively accomplishing what is intended.

A second community of students will be coming together in the fall of 2006, overlapping with the final 3-day session of the 2005 group. It will be interesting to witness their interactions together and share new insights into making the program even more practical, focused and helpful for all who are part of this important shaping of future S&T leaders.

Conclusions

Running a scholarship for service type program presents challenges at every turn. Recruitment, retention, graduated rates, job placement, and quality control just to name a few, are some of the most important aspects to be considered. For a program to provide more than just the standard fair these issues must be handled in a systematic way to ensure that the basic goal of the program are being met. Accomplishing this minimum operational goal give the program the chance to then explore ways to add value to the program which will benefit both the students and the gaining

organizations. A leadership component is exactly what is needed and time will determine the true extent of the effectiveness of this training. Continuous monitoring of our graduates though out their careers will be the ultimate determiner of success or failure for this activity.

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