ARTICLE
Developing the Next Generation of Civic-Minded Neuroscience Scholars: Incorporating Service Learning and Advocacy Throughout a Neuroscience Program

Cecilia M. Fox
Neuroscience Program and Department of Biological Sciences, Moravian College, Bethlehem, PA 18018.

The Neuroscience Program of Moravian College aspires to produce well-informed, morally responsible and civically engaged individuals who will become the next generation of community leaders. Through the integration of service learning and advocacy into a Neuroscience curriculum, undergraduates are consistently involved in meaningful community service with instruction and reflection that enriches their learning experience, teaches civic responsibility and strengthens their college and local communities. As a result of our brain awareness outreach programming, formation of a local Society for Neuroscience chapter and advocacy for scientific funding initiatives, we have created a model of student engagement that has connected the academic to the practical in life altering ways for our undergraduates. Our service experiences have become an educational awakening as critical reflective thought creates new meaning and leads to growth and the ability to take informed actions. As expressed in our students' portfolio writings, our service learning endeavors have lead to personal growth, contributed to humane conditions and engaged these citizens in purposeful association with one another.

Key words: service learning, advocacy, civic-responsibility, neuroscience curriculum, reflection

In 2006, the Neuroscience Program at Moravian College, one of the nation's oldest colleges with a tradition of providing a valuable education in the liberal arts and sciences, was established. As with most programs, considering what content to provide in an introductory course of such a dynamic discipline seemed overwhelming given the limitations of an academic semester. Our Neuroscience (BIO 263) course is designed to provide a foundation in key principles in the field of neuroscience ranging from neurophysiology to neuroanatomy to behavior. Once this course is completed in the sophomore year, our majors then decide whether they would like to pursue one of three areas of study within the Neuroscience major: Cellular Neurobiology, Behavior Neuroscience or Cognitive Neuroscience (http://www.moravian.edu/default.aspx?pageid=2220).

As the years progressed, this broad based approach to the introductory Neuroscience course seemed to work well. There were the standard laboratory activities and experiments typical for such a foundational course (neuron electrophysiology, comparative brain dissections, electroencephalography, etc.). However, since our students were learning about the brain and behavior in a liberal arts college setting, I also wanted to introduce the relevance of connecting with other disciplines and educating our college and surrounding communities about the importance of engaging in scientific discussion and discovery.

Many Neuroscience programs across the country are housed under the umbrella of larger departments such as biology and psychology (Faculty for Undergraduate Neuroscience Workshop, 2011). Therefore, it can be challenging to acquire funding as a stand-alone program (Wolfe, 2009). Part of my strategy in securing college support for the Neuroscience Program has been to highlight the interdisciplinary strengths of studying neuroscience and link them to the mission of the college which states, in part, "… this education prepares men and women for advanced study and continuous learning, individual achievement, and *leadership and service for the common good*." The college's vision for the future is a *community of service*, which equips and empowers men and women to serve others with professional skill, grace, and integrity, *including those who live out their lives on the periphery of society* (http://www.moravian.edu/default.aspx?pageid=11).

SERVICE LEARNING

According to the Learn and Serve America National Service Learning Clearinghouse, *service learning* is defined as a teaching and learning strategy that integrates meaningful community service with instruction and contemplation to enrich the undergraduate learning experience, teach civic responsibility and strengthen communities. As a reflection of the mission and vision of Moravian College, our Neuroscience majors learn early on to embrace the potential of service in enriching and revitalizing their college and local communities. In an article by Ernest Boyer entitled, *Creating the New American College*, he encourages institutions of higher learning to educate students for a life as responsible citizens rather than only for a career (Boyer, 1994). By sharing their knowledge about the brain and behavior with a variety of constituencies across the Lehigh Valley of Pennsylvania, our students are developing a model of

academic excellence and providing dignity and prestige to the scholarship of service.

The ideal mechanism that most Neuroscience programs utilize to engage in service learning is Brain Awareness Week (BAW). This event is co-sponsored by the Dana Alliance for Brain Initiatives that funds and presents educational programs on a variety of brain related topics for the general public (www.dana.org). Each March, BAW serves as a global campaign to increase public awareness about the brain and benefits of neuroscience research. When I joined Moravian College in 2003, the idea of a Neuroscience major had not yet been considered. However, as a neuroscientist with a spouse who worked in a local science center, engaging science majors in a few hands-on neuroscience stations to celebrate BAW seemed like a promising endeavor. Our first BAW event was composed of four stations: neuron histology, sensory testing, neuroanatomy and Stroop effect. Back then, approximately 50 children came by during this four-hour event. Twelve years later, our larger programs offer over 30 stations and can attract over 2,500 people (Figure 1). So, how did this small idea of spending an afternoon to teach children about the brain become a service learning initiative that is now woven into the Neuroscience curriculum and become an expectation of undergraduates in our program?

Figure 1. "Checking Out Your Brain Waves" with an electroencephalograph activity.

First, we no longer celebrate Brain Awareness Week. It is now known in the Lehigh Valley as Brain Awareness Season. As a starting point, all students in the Neuroscience course are required (for a grade) to develop a novel hands-on neuroscience station that may be implemented in the upcoming spring's programming. Students are evaluated on the following: strength of the scientific basis of the learning objective(s), originality of design, creativity, appeal, feasibility (cost, ability to transport) and assessment tool to determine whether the desired learning objectives have been achieved. Each student designs a neuroscience related station and then presents it to their peers as well as a sampling of their "target audience"- children from local Boy Scout and Girl Scout troops.

Those projects that earn the stronger grades in each of the categories are then incorporated into upcoming brain awareness outreach events. This serves as a wonderful way to keep our programs updated and refreshed each year. It also sparks some healthy competition among the Neuroscience students for the "best concept." For example, one recent project was entitled, "Robbie the Raisin." This student wanted to teach about the potential impact of tumors on brain function. Each participant became the neurosurgeon as they used two surgical tools (toothpicks) to carefully dissect out a small raisin (tumor) from a small Jello molded brain. As the "tumor" was being extracted, the student described the impairments that could have resulted in the targeted lobe of the brain if the tumor was aggressive. This has become one of our most popular learning stations (Figure 2). Since incorporating this service learning assignment into the curriculum of the Neuroscience course, it is clear that it has invigorated the classroom experience. As with other service learning initiatives in higher education, this project has enhanced performance on traditional measures of learning such as exams, increased student interest in the subject material and strengthen problem-solving skills (especially as the students begin to consider how they can break down complex neuroscience principles for the general public) (Bringle and Hatcher, 1996).

Figure 2. "Robbie the Raisin" station for one of our Brain Awareness Outreach events.

In 2009, my petition to establish a chapter of the Society for Neuroscience (SfN) in the Lehigh Valley was approved. This new partnership became the vehicle for expanding our service learning programming. Neighboring colleges, such as Cedar Crest College, Muhlenberg College, Lafayette College, DeSales University and Lehigh University joined the chapter and a model of organizing Neuroscience undergraduates from across the Lehigh Valley in service learning and scholarship was born. Given the tradition of most of the participating colleges, our Brain Awareness themes typically embrace the liberal arts. We have offered seminar and film series in the Art of Neuroscience, Music and the Brain, Brain Sex and Neuroethics, to name just a few. We have partnered with local schools, science centers, reading programs, libraries and assisted living

communities to offer numerous educational programs about the brain and behavior. As a chapter, we typically offer programs throughout the fall and spring semesters to maintain a vibrant level of student engagement. For more information about our programming, please visit our chapter website at www.lvsfn.com.

Each year, our partnerships grow, but it is not always at the hands of the faculty. Some of our undergraduates suggest new partnerships based on their personal experiences. For example, several of our junior and senior level students have been engaged in memory based research projects involving elderly individuals at a local assisted living community. When they noticed how interested the residents were about their work, they decided to begin a "book club" and meet with the residents on a more regular basis. They began this initiative by discussing Oliver Sacks' book, *The Man Who Mistook his Wife for a Hat*. It was a tremendous experience for all involved as our students took the lead in bridging the generation gap with this community through scientific literature. Other students are tutors through our Campus Community Connection network to assist children from underserved areas in math and science. Some of our best attended outreach programs have taken place in these areas within the Lehigh Valley. Our Neuroscience majors particularly look forward to providing their educational programs to children who may not have such resources available in their local schools (and several of our students attempt to do so in a bilingual fashion).

Throughout their academic career at Moravian, our Neuroscience undergraduates continue beyond the Neuroscience course in supporting our service learning endeavors. However, these experiences are no longer "graded." By junior year, engaging in service learning for the benefit of others has become a natural practice within the Neuroscience major. Our campus BRAIN Club has become the primary organization for our Neuroscience majors to plan, develop and implement our brain awareness programming for the college and surrounding communities. As new partnerships develop, students may become the contact person to assist in the organization of the programs. Many junior and senior level undergraduates have also served as mentors to those students in the Neuroscience course to guide them and brainstorm (*pun intended*) new ideas for their service learning projects. Serving the community in this meaningful way has become part of the culture of our major. As their professor and advisor, it is very rewarding to witness how our Neuroscience undergraduates embrace these service experiences that are educationally focused. It has created an inspiring learning environment and a greater sense of belonging among our majors. Our program retention rate has been above the average college rate each year. Our faculty are committed to this programming and actively participate in many of the outreach programs. Leading by example has been a sustaining part of our success (Figure 3).

Following most programs, our Neuroscience majors are given the opportunity to "debrief" the successes and failures of an event. Essentially, I ask the questions, "what worked?, what didn't work?, how can we make our programs better?". We have had a few stations that most definitely needed to be reconsidered. Some required only slight modifications, such as using baby food for a taste station instead of more processed foods given children's allergies. We also limited the number of candies children could have to "build a neuron." As parents, this is simply common sense. However, for college-aged individuals, this is a lesson that is learned as they see first-hand how a child's excitement level can soar in the presence of Skittles and M&Ms! One station was removed from circulation until a better design could be implemented. Years ago, we offered a station on helmet safety called "Mr. Egghead." The idea was for children to build a helmet for an egg made out of Styrofoam, paper, cotton balls, plastic wrap, etc. The "helmet wearing egg" was then tossed toward a wall to see if the helmet protected the egg. If so, the child was successful in protecting its "brain." If not, then the child needed to problem solve to design a better helmet. The first time we offered this station, our students were confronted with a Cub Scout troop of about 25 boys. There was a measure of apprehension as the boys quickly built their helmets and then pummeled the wall (and a few of our students) with the eggs. The mess after about one hour of the program was remarkable. So, this station, though educationally sound, clearly needed to be modified in practice. A few years later, faculty and students wanted to resurrect this station. It was renamed, "Scrambled Brains." The modification was simple; place the helmet wearing egg in a Ziploc bag and then have one of our students drop it from a specified height. There was no more mess and the important lesson of helmet safety was still effectively shared.

Figure 3. LVSfN undergraduates and faculty just prior to one of our brain awareness events.

Overall, students take ownership of their activities and become clear communicators and proficient program evaluators. They problem solve ways to improve upon learning objectives or specific assessment tools. The students and I developed a rubric that we use to assess a new Brain Awareness station or activity. Some of the major points considered are: scientific basis/strength of

the neuroscience-related learning objective, overall appeal of the station, creativity of the station, feasibility (cost, ease of transport, design) and strength of the assessment tool for the station. The students are supportive of each other and develop a sense of empowerment that leads them to embracing more leadership opportunities inside and outside the classroom. Over the years, I have repeatedly witnessed the five phases of service learning involvement in my students: 1) naïve excitement as sophomores in BIO 263, 2) values clarification – what we are hoping to achieve (sophomore through senior year), 3) insight into the meaning of service (sophomore through senior year), 4) increased participation and advocacy (junior through senior year) and 5) influence of service experiences in career and life choices (junior and senior year) (Delve et al., 1990).

Involvement in service learning throughout the Neuroscience Program has led to several meaningful recognitions both campus and nation wide. At Moravian College, the BRAIN Club has won several Omicron Delta Kappa awards for service. In 2011, barely two years after becoming a chapter, the Lehigh Valley SfN Chapter was honored by receiving the SfN Chapter of the Year award at the annual meeting. In 2012, one of our Moravian undergraduates received the SfN Brain Awareness Travel award. Last year, I was invited to share a presentation for the SfN Chapters Workshop about methods of engaging chapter members in service and scholarly activities. For the outstanding Neuroscience senior who is recognized at our college graduation, in addition to academic performance and scholarship, participation in service learning during their college endeavors is also a consideration in determining the recipient of the Moravian College Neuroscience award.

ADVOCACY

In cooperation with the Society for Neuroscience, scientists are beginning to play a more vital role in working toward increasing research funding and promoting scientific issues with the public and policymakers (www.sfn.org/advocacy/neuroscience-funding). As mentioned earlier, becoming responsible citizens and leaders for the common good are part of the Moravian College philosophy. So, it is appropriate to develop our Neuroscience undergraduates into advocates for such a critical cause. Scientific research adds value to our society through discoveries about health and the world in which we live. In the field of neuroscience research, our work provides a foundation for education and economic expansion that benefit our entire community (Scholl, 2015).

As a member of the SfN Government and Public Affairs Committee, I have brought the tools and resources acquired from this agency to create a grassroots effort focusing on advocacy in the Lehigh Valley. This is a rather new initiative for our Neuroscience Program, but one that dovetails well with our view of service. In the fall term, our Neuroscience undergraduates sponsor an “Advocacy Day” on campus. Students walk around the college with iPads and have laptops available in our Student Union linked to an electronic website provided by the SfN. Students, faculty and staff are encouraged to sign electronic petitions that are then sent to representatives in the state of Pennsylvania (http://www.sfn.org/advocacy/advocacy-network/advocacy-action-center-new) (Figure 4). The central message of these petitions express the benefits of increased scientific research funding for our community. Such scientific discovery has the potential to improve community health, boost the economy and provide innovations in science and medicine.

Figure 4. Signing petitions during Advocacy Day at Moravian College.

Last year, our “Advocacy Day” expanded to take place among all the colleges of the Lehigh Valley SfN Chapter. Faculty and students selected a mutually agreed upon day and each college community reached out to our elected representatives electronically. As part of our Brain Awareness events, we have also invited staff members from the offices of United States Senator Patrick Toomey and Senator Robert Casey to educate our Neuroscience majors in how they may serve as effective advocates for scientific funding. Since the Lehigh Valley is part of the 15th Congressional District, Republican Congressman Charles Dent has visited our Moravian College campus and met with several of our undergraduates. Congressman Dent visited our research labs and left our campus with an understanding that undergraduate institutions feed the pipeline for securing future physicians, researchers and educators (Figure 5). As this advocacy initiative grows, our undergraduates intend to continue these conversations with more representatives from their home districts. In fact, as recently as three years ago, the SfN invited undergraduates to apply for the opportunity to engage in several “in person” meetings for SfN Capitol Hill Day. One of our Neuroscience majors was selected and she helped motivate our students into becoming more intentional about their advocacy efforts.

As for incorporating the topic of advocacy into our Neuroscience curriculum, students engage in conversations within our courses regarding translational research and public/political awareness. Several ideas are currently being developed to implement into the upcoming academic year. As our students and faculty present their research in our Introduction to Neuroscience Methods (NEUR 367) course and at local/regional conferences, an “advocacy advertisement” slide will be

Figure 5. Congressman Dent learning about the potential for scientific discovery within the rat brain.

placed at the end of the presentation to not only express the importance of this subject matter but also create a comfort level in our students for naturally promoting this conversation as their research is considered. It is our intent to ensure our students and their audiences understand that scientific discovery cannot exist without the funding to support it. Furthermore, as our undergraduates and their faculty mentors provide information sessions such as our "Ask the Neurologist/Neuroscientist" events, this same advertisement will be reframed for presentation to the general public.

Undergraduates in the Introduction to Neuroscience Methods course as well as our capstone Neuroscience Senior Seminar (NEUR 373) course, will continue to develop their skills in translating primary literature into documents/ presentations that will target elected representatives or the general public as a means of strengthening their communication skills for sharing the importance of such work. Our students are also going to extend an invitation for our elected representatives to attend our annual Lehigh Valley SfN Undergraduate Research Conference next spring. Finally, I have even been in conversation with colleagues in the Lehigh Valley about the possibility of developing a course focusing on scientific advocacy and social responsibility. This course would be made available for cross-registration so all undergraduates in the Lehigh Valley will have an opportunity to participate in this educational experience.

REFLECTION: THE PORTFOLIO MODEL

The role that reflection assumes in the learning process cannot be overstated. In many models, it creates a bridge between experience and intellectual content or theory (Dewey, 1916, Bringle and Hatcher, 1999). According to Dewey, experience becomes an educational awakening when critical reflective thought creates new meaning and leads to growth and the ability to take informed actions. As a central theme, these service learning endeavors must lead to personal growth, contribute to humane conditions and engage citizens in association with one another (Bringle and Hatcher, 1999). Though there are many forms of reflection, the process of writing and verbal discussion generates new meaning, new understanding of problems and new ways of organizing experiences while exploring the relationships between past learning, current experiences and future action.

As part of our capstone Neuroscience Senior Seminar course, students are expected to reflect upon their experiences within the Neuroscience Program at Moravian College. Using a portfolio model, students address three facets of their growth over the course of their undergraduate years within the Neuroscience major: oral and written communication, research skills, and career goals. They are encouraged to consider the specific classes they have taken (both within and outside the major) and what emerges as significant examples of their learning and growth in these three areas. The portfolio consists of a self-statement, writing assessment, research skills assessment, resume and *service learning/advocacy* reflection.

The self-statement is a thoughtful summary of the student's personal and professional development during their undergraduate career. Students compare their original goals and objectives when they entered college to their post-graduation goals. Values, mission, vision and strategies are considered as the students have developed or changed during their undergraduate years. For the writing assessment, students are expected to provide samples of their writings (with feedback) during their four years in college. They are required to re-read the papers and provide their own feedback. Students then compose a written reaction to their own writings. They highlight what they feel are strengths and what are areas for improvement. They use these examples to illustrate or support their self-analysis. When considering research skills, students reflect on both literature and hands-on laboratory experiences. They compose a reaction to their own work. They are asked to consider evidence for their current abilities as well as their pattern of skill development. The inclusion of a discussion of weaknesses or difficulties in this area is strongly encouraged, especially if they have surpassed them.

A significant part of the portfolio is especially devoted to the student's reflection on their contributions to our brain awareness service learning and advocacy efforts during their participation in the Neuroscience Program. Since our students have come to the realization that science advocacy is not only about funding, but also education and community building, it is appropriate to have them compose an intertwined response on how sharing their time and talents impacted them and their community. As reported in other service learning programs, our Neuroscience majors have consistently shared that service participation improved their critical thinking skills, commitment to activism, self- efficacy, interpersonal skills through collaboration and leadership and even choice of a service career (Astin et al., 2000; Bringle and Hatcher, 1996). The positive responses to service were partially due to the willingness of faculty to discuss these experiences in class as well as provide opportunities for processing the service experience with their peers. There

were repeated remarks that the brain awareness and advocacy events were viewed as learning experiences that allowed them to connect with their community in novel ways. By working in underserved areas, our students have also developed a heightened sense of civic responsibility while embracing an increased awareness of the world in which they live.

In the upcoming academic year, Neuroscience majors will be introduced to the e-Portfolio so they may begin to compose an even more thorough reflective assignment. This tool will provide a means to further consider their academic, service and advocacy experiences as they take place in real time during their progression through the Neuroscience Program. Then, during their senior year, they will have a body of writings, videos, photos, etc. to assist them in reflecting upon their entire undergraduate experience in a more enriching way.

CONCLUDING REMARKS

Developing this next generation of civic-minded neuroscience scholars has the potential to benefit our community in substantial and sustaining ways. Service learning and advocacy represent a potentially powerful form of pedagogy since they provide a mechanism of connecting the academic with the practical (Astin et al., 2000). By focusing on faculty-student collaboration, democratic citizenship and moral responsibility, our service programs are forming meaningful connections with our community and preparing our Neuroscience majors to meet society's needs. In a technology driven world where most people do not take the time to contemplate life's moments, reflective activities allow students to discover the value of dialogue, embrace the importance of perplexity in the learning process and develop the ability to make meaning of their personal experiences.

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Address correspondence to: Dr. Cecilia M. Fox, Neuroscience Program, Department of Biological Sciences, Moravian College, 1200 Main Street, Bethlehem, PA 18018. Email: cfox@moravian.edu