AC 2011-1408: TECHNICAL OUTREACH COMMUNITY HELP: INITIAL RESULTS

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Technical Outreach Community Help: Initial Results

Abstract

The National Society of Black Engineers Technical Outreach Community Help (NSBE TORCH) Program aims to provide exposure, stimulate enthusiasm and promote the value of science, technology, engineering and math in Black communities by providing introductory training with the ultimate goal of increasing participation in these fields at all levels. The program originated in 2002, and over the 2008-2009 and 2009-2010 leadership years the program was revised and refined to have clear objectives and subcomponents consisting of both informal and formal educational components.   The program is organized at a national level and administered locally in a grassroots fashion. Sample program models and resources are provided to local student leadership for selective implementation with the support of national and regional student leaders. In this paper we examine the program model and the ability to measure impact through the grassroots student run organization of the program.

We present preliminary data from pilot programs and evaluations from volunteers and local level leaders of both the program model and the impact of the program. Data collected from participants includes demographics data, efficacy and learning assessments, and evaluations of the programs' content. This data is collected through survey templates provided to local student leaders, tabulated locally, and returned to the National leadership. Through the pilot studies the data collection and research methods are verified for their effectiveness in this unique program model. This paper will present the program assessment for internal development as well as address research questions about engineering students involved in STEM mentoring activities.

Finally we present recommendations for developing the program further and a plan for a comprehensive study of the impact of the program. In short term for the students benefitting and longer term of the mentors and volunteers involved.   A research plan and toolkit that accommodates for this and allows for sample size increases toward significance are derived from the pilot results.

Program History and Previous Work

Addressing the digital divide that negatively affects minority, inner-city, rural, and other disadvantaged communities was the primary motivation for establishing the Technical Outreach Community Help program in 2002. As the program grew, considerable effort was made to mobilize NSBE's membership to use their technical know-how to assist youth and adults to increase their technical literacy as well as providing academic support. In the early stages of the program there was not much structure, and many individual NSBE chapters took on the challenge of technical community service in their own way. In 2007 additional structure was added to the program and in 2008 the five TORCH content areas were developed. Through the content areas of STEM community training, technical expertise services, informal engineering

and science, A Walk for Education, and traditional community service additional focus was provided along with resources for NSBE chapters to implement in their own way. Internal program evaluations were done to determine the needs of chapters to support NSBE programs and focus was given to introduce TORCH to members who were unaware or unsure. Program assessment and administration models were designed with several types of pilot programs completed ranging from long term STEM education courses to weekend long engineering summer camps. Prior assessments showed that the program was enjoyable and participants gained knowledge from participating, but immediate impacts on goals and academic trajectories were not found. It is expected however that continued follow up with participants may show significant impact on goals. Prior work in other studies suggests that students who have a connection to the field of engineering are more likely to pursue and remain in the discipline than those who do not[2,3,4].

Previous Research Effort

Prior studies done for the TORCH program sought to determine impact on students who received services from the program, primarily through interviews of participants and parents, surveys, and feedback from volunteers. Early work also focused on positioning NSBE's outreach programs in overall minority engineering and outreach literature. It was found that for minorities, near-peer mentors in engineering were not heavily studied or implemented with a theoretical framework[1]. Initial and ongoing questions sought to evaluate if the program impacted participants choice to go to college, to major in engineering or science, impacted their classroom performance, and if mentors of similar background and near age made a difference. Most of these questions are very longitudinal in nature, so immediate answers cannot be provided, but it is the hope that within two to three years those students who participated in TORCH programs will begin to enroll in engineering in college.

There was opportunity to determine more immediate impact of the program on the mentors and volunteers, which is the focus of this work. As most of the volunteers are college students in engineering at the time of becoming a mentor and influence on their goals could be more immediate. Initial expectations were that some mentors would begin to consider STEM education careers, may be more motivated in their own coursework by having a mentee, and promote a greater sense of social responsibility for engineering students.

Current Status and Research Effort

Based on the groundwork laid out in the 2009-2010 leadership year the 2010-2011 objectives with regard to research aspects of the program aimed to establish data collection practices for chapters and help develop tools. Due to the nature of the program data collection is a primary challenge of studying the program's impact. A general framework for the program is established at a National level, and resources are provided to chapters for local implementation.

Objectives for 2010-2011

As a student run organization the program administration changes on an annual basis at all levels (local, regional, national). The primary research objective for the current leadership year is to collect pilot data to begin a wider program rollout and data collection effort in the 2011-2012 leadership year. The effort to transition from planning and framework to implementation and widespread data collection includes both assessment of how to support chapters in both implementation and data collection and pilot data collections to refine data collection protocols.

In the current stage the most important data is the qualitative assessments and descriptions of program models.

Active Program Models
The fall 2010 semester was the first term with a standardized reporting format for chapters to provide information about their efforts to national leadership. To date, eight chapters have submitted hours sheets, program titles, and categories. Most service hours reported are traditional community service projects, for which hours are tracked, but no other evaluation occurs. A Walk For Education is also widely adopted, with Informal Science and Engineering third, STEM community training next and no chapters reporting Technical Expertise Services programs. A Walk for Education has been a popular for several years as many members participated in the event for the first time when it was hosted at the regional level. Through the TORCH program evaluation it became apparent that the program needed adjustment which resulted in chapter based events. This program is also popular for chapter collaboration. Informal Engineering and Science takes many forms for the chapters that participate. Informal Science and Engineering activities are predominantly youth visiting the university campus for a single day program with a hands on project or series of project and demonstrations in the form of a 'reverse' science fair.

Northeastern University hosts a weekly program formatted as a STEM community training program which includes some classes with content overlapping with Informal Science and Engineering and Technical Expertise services. Several other chapters participated in one or two Informal Science and Engineering projects over the course of the semester. Several chapters report TORCH hours as programs that are the result of partnerships with community organizations, such as Citizen Schools, or student chapters of other professional societies such as the Society of Women Engineers or the Socitey of Hispanic Professional Engineers.

Mentor Impact
The impact of participation on the college students participating is an area of key interest and was selected as the first research question to address for strategic and logistical reasons. Answers to this question will benefit the hosting organization and help grow the program and due to the organizational structure accessing the volunteers is more feasible than accessing the student participants or truth data on outcomes.

This topic has been previously addressed primarily with regard to NSF GK-12 programs. These programs support students, primarily graduate students, though occasionally undergraduates as well, to serve in a K-12 classroom[5]. The support provided to the students creates a opportunities for detailed qualitative data collection

Two surveys were used to evaluate the impact on mentors. We aimed to specifically asses the mentors through self-reported impact on their views of engineering education. Key areas of interest are the effect on confidence and perceived skill in communicating technical ideas and impact on an individual's career and educational objectives. Motivation for participating is also of interest. Volunteers presenting for the A Walk For Education programs hosted in the fall evaluated that experience with regard to the impact they were able to make and how the program impacted them. At the end of the semester, volunteers who participated in either formal STEM Community Training or Informal Science & Engineering activities during the fall semester received a related, but more comprehensive survey to assess impact and goals.

A Walk For Education
This component of the program is designed to be a single day outreach program. The objective is to spread information about STEM education opportunities walking door to door distributing information. The information packets contain information about the college application process, local colleges, scholarships, and the local TORCH program. Most locations included other science and engineering or education and career access activities as well at a central location after the information distribution portion of the walk.

Sixty-one volunteers from 8 different walks responded, providing demographic information, AWFE participation information and rating the program on a 5 point Likert scale in three areas: Involvement with Youth, Personal Growth, and Fulfillment of the NSBE mission. Since the program is a society-wide program, alumni members and chapters also participate: 79% of respondents were college students with the remaining alumni, and 90% were NSBE members. Volunteers most strongly agreed with statements that they helped youth learn and provided opportunities to learn (87% agree/strongly agree), provided service to others(87%), enjoyed the opportunity to work with youth(88%), and became a better person the day of the walk(89%). Participants also felt that they were able to develop community connections with this single day outreach program, 69% of respondents agreed or strongly agreed, with 20% neutral to this statement.

These responses, combined with comments indicate that students generally enjoy sharing their experiences with younger students and see benefits of it for the younger students. This event is a 'feel good' day for the volunteers who believe that they are able to make a difference with the project. Tracking and measuring impact on the benefactors directly of this program component is difficult, but the positive feeling it provides to the volunteers will likely impact their decision to participate more broadly in a complete TORCH program. Most open-ended feedback provided through an optional additional feedback related to the additional programming hosted

in conjunction with the walk, further supporting that this model, of a single day outreach program should encourage volunteers to further participate in TORCH efforts.

STEM Community Training and Informal Science and Engineering
Volunteers presenting from several different programs responded to a survey that was distributed after their name was reported by chapter leadership as a participant in the program at a local level. These volunteers were asked demographics, open ended questions about the impact of the program, questions about their level of participation, and to rank statements about the program impact. To avoid influencing open ended responses with the ranking questions the ranking questions were on a second page of the survey that could not be seen until the open ended questions were complete.

, Responses for the fall semester are complete and responses for the spring semester are yet to come. Volunteers were asked to describe any influence on future career and educational objectives, current educational programs, and if they would recommend volunteering in this capacity to their peers. A theme in the responses here cites increased understanding of the importance of the skills obtained to date in their STEM undergraduate career. Most students cited different potential benefits as reasons to encourage peers to volunteer than were personally identified. One volunteer in particular reported no influence on his own career or educational objectives, but stated that volunteering "can give them a sense of direction concerning their career paths." Students volunteering identified the experience as a means of applying technical skills learned in real life and as an opportunity for increased learning as well.

Volunteers were asked to rank on a five point Likert scale their level of agreement with statements about their communication skills, technical skills, community connection, interest in their field, ability to influence students, students' increase of knowledge, students' increase of STEM career awareness, and confidence in technical communication. The strongest response was a better connection with the community around the campus. Volunteers responded neutral to positive on all statements, with the largest degree of neutrality to increased technical understanding and increased interest in chosen field of study. The college students responded with stronger agreement to their ability to impact the participating students.

Mentors noted benefits to themselves, but stronger agreement with the benefit of the program on the students participating and for potential impact on their peers. Mentors note positive benefits to the program and display the expected sense of social responsibility. Though none yet included changed primary plans, many mentors stated that the experience has encouraged them to continue with this type of service throughout their careers. Mentors ranked the influence of the program on their technical skills lowly, but stated that this form of service helped them understand the value of the skills they have acquired thus far. This increased understanding of value may influence motivation and thereby affect mentors' technical skills. This possibility will be incorporated for tracking and measurement in future semesters.

Plan for going forward

Pilot data collection will continue throughout the current academic year. Interviews will be used to further assess the quality of data provided by surveys used and gain additional insight as to how to formulate future data collection. In the coming academic year data collection processes will be piloted to address additional research questions.

With regard to evaluating the mentor impact, this effort will move toward collecting sufficient data for detailed quantitative analysis based on data received to date. The next phase will provide assessments of volunteers on the areas of interest both before and after the experience. These data collections will also focus on combining measures in addition to self-assessment. Self-assessment will move from a only rating the effect of the program to rating key areas derived from the results to date both pre and post program. Volunteers will self-assess technical communication skills and confidence of that rating before and after in order to examine the effect of the program. Volunteers will be tracked over the course of a semester and longer periods of time when applicable. Additionally, select volunteers will be included in more in-depth qualitative analysis that can be coded and evaluated. Over time these students can be compared to the general membership of NSBE as a control for likelihood to enter graduate programs and to pursue educational outreach opportunities throughout their careers. Pilot data was collected via anonymous surveys in order to reduce bias with the limited data set. As the data collection expands, data will be collected in a format that allows for longer term tracking and evaluation of the results.

In order to measure impact on the participating students the next area of interest will be the question, "What is the impact of mentors of similar ethnic, socio-economic or other backgrounds have on K-12 students interested in STEM?" This question relies on efficacy of the students and can be addressed through the given program model. Students will be assessed pre- and post-program and the volunteers will also be asked questions that aim to collect data such that the researcher can assess the desired output in addition to self-assessment. This program will be piloted with assessment tools that local level leadership can use to measure the program and report. After a pilot period, options for implementing longer term tracking and collection of relevant measures, such as grades, will be evaluated and that information will be combined for thorough analysis.

Bibliography

1. Thomas, L.D., M. Smith, S. Brown. (2010) "Technical Outreach Community Help: An Engineering Outreach-Mentoring Program for Minorities". ASEE Annual Conference. Louisville.
2. Pierrakos, O. et. Al. "On the Development of a Professional Identity: Engineering Persisters Vs Engineering . (Switchers." Frontiers in Education: 2009. San Antonio, TX.
3. Ohland. M.W. et. Al. "Persistence, Engagement, and Migration in Engineering Programs" Journal of Engineering Education . July 2008 p. 259-278.
4. Frizell. S.S., and F.M. Nave. "Reexamining the Problem of Engineering Persistence for African American Female Students." Frontiers in Education: 2008 Saratoga Springs, NY.
5. Rao S., D. Shamah, and R. Collay . "Meaningful Involvement of Science Undergraduates in K-12 Outreach." Journal of College Science Teaching, May/June, 2007.