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Ms. Carrie-Ann Miller LCSW, State University of New York, Stony Brook

Carrie-Ann Miller, LCSW, is Director of the Women in Science and Engineering, State University of New York at Stony Brook, Stony Brook, NY 11794-2200. Email: Carrie-Ann.Miller@stonybrook.edu. Phone: 631-632-9648. She has a B.A. (1978), SUNY at Stony Brook, in interdisciplinary social science with minor in women studies, and a M.S.W. (1982), SUNY at Stony Brook, School of Social Welfare, in integrated practice. From 2004- present, she is Director of the Women and Science and Engineering Program, College of Engineering and Applied Sciences, SUNY at Stony Brook. From 2001-2005, she was Faculty Director of the Community Service Learning, Living Learning Major, SUNY at Stony Brook. From 1997-Present, she is Adjunct Professor, School of Social Welfare, SUNY at Stony Brook. From 1997-2004, she was Executive Director of Suffolk Psychiatric Service, Clinical Instructor SUNY at Stony Brook. She was Co-PI for several years with Paul Siegel, on TechPREP and STEM Tech. TechPREP is a program that provides 90 hours of education in the areas of computer science, mathematics, and physics, and engineering to middle school girls from under-served school districts. It also provides college mentors for each student. STEM Tech is a collaborative program that engages community and industry partners and WISE student mentors in developing STEM Tech Clubs. The clubs will service girls from underserved school districts. Each club will use service-learning to exam and come up with a design for an environmental issue. The designs will be built using the engineering design model and presented at a capstone event. She served on the Connect To Tech Advisory Board as a member on this network of school personnel, industry leaders, and community members, whose goal is to further the education of students on Long Island in STEM areas. She has been a Long Island Regional Service Learning Network, Advisory Board member. Members provide curriculum and technical assistance to school districts that are interested in developing a service learning pedagogy. Her focus has been on science and engineering programs. She has been a member of the Brookhaven National Laboratory’s Women in Science group for the past four years. She partnered on the Forward to Professorship grant. This will provide workshops to WISE students and post graduates on how to negotiate the post graduate years. The program will also provide mentoring for young women. She developed and implemented the Macro Social Work class for the master’s degree program at Stony Brook University. Collaborators include David Ferguson (Stony Brook University, Department of Technology and Society), TechPREP; Judy Murrah, Motorola Foundation and Connect To Tech; Paul Seigel (SUNY at Stony Brook), TechPREP proposals 2008, 2009, and 2010; Simmerjeet Gill (Brookhaven National Laboratory BWIS); and Bonita London-Thompson (SUNY at Stony Brook-Psychology Program), "Advancing Women in Science: Building Engagement through Academic Transitions.”
Effective Community Partnership’s for Women in STEM

The College Women in Science and Engineering Program (WISE) was established in 1994 with funding from the National Science Foundation and is a nationally recognized program. WISE is a comprehensive program at a premiere public research institution that engages women in the science, technology, engineering, and mathematics (STEM) fields. The mission of WISE is to provide a community with the institutional structures and resources to attract and retain academically talented and motivated women of diverse backgrounds. The programs short term goal is to increase the numbers of women entering college with the intention of studying and graduating with degrees in STEM. Its long term goal is to ultimately increase the diversity in the STEM workforce.

The College WISE program incorporates service-learning as the pedagogy for many of its programs. This paper will focus on two programs that were developed by the College WISE program staff and the College of Engineering and Applied Sciences in conjunction with several community organizations and corporate partners. The programs are called TechPREP and STEM Tech. Tech PREP engages female students starting in the sixth grade and continues for three years. The graduates of the TechPREP’s program are then invited to participate in a new program called STEM Tech. Subsequent to finishing STEM Tech they are invited to join the High School WISE program. Our ultimate goal is to provide a support structure that will follow them through middle and high school and ultimately through college.

The College WISE program is a multifaceted program that utilizes several methods to engage its students in success. Some of the methods are: frequent faculty contact, specially created courses, extensive mentoring system, hands on research beginning in the first year of college and engaging in strategic partnerships. WISE is able to do all of this, because of the many partnerships it has developed over the years. The objective of WISE is to give young women exposure to STEM fields and to have a lasting impact on their commitment to STEM Education and STEM Careers. The College WISE students play a significant role as the coordinators and mentors for both TechPREP and STEM Tech.

The College WISE program began as a four year college honors program. Soon after its inception WISE added a high school program that invites students from local school districts to participate in hands-on programs in Science, Technology, Engineering and Mathematics (STEM) at the university. The current High School
WISE program starts in the 10th grade and continues through 12th grade. Over the years, we have realized the importance of reaching further down the pipeline to engage girls in STEM activities in hopes that they will not lose interest in STEM studies prior to reaching high school or college.

It is the strength and success of the College WISE program that provides the foundation for each of the other programs. The graphs below show evidence of the strength of the College WISE program.

Over the past ten years the number of applications to College WISE has steadily increased. The quality of the student’s academics as also improved. The students SAT and grade point averages continue to rise. The College WISE Retention Rate and Graduation Rates compared to the University as a whole are also significantly higher. (Institutional Research 2011)

WISE-GPA Cohort 3-18 Compared to University
(Institutional Research Figure 1)
WISE students have significantly higher SAT scores, grade point averages, retention rates and graduation rates compared to the university as a whole. WISE vs. University SAT Scores Cohort 2-18 (Institutional Research Figure 2)

WISE First Yr. Retention Rate v. University 2003 - 2008 (Institutional Research 3)
WISE has a consistently Graduation Rate than the University. (Institutional Research 4)

All first year College WISE students are placed in mentor groups based on their majors. The small mentor groups are lead by WISE students who are either in their 3rd or 4th year of college. This set of mentors are called Jr. Mentors. The mentors are trained and supervised weekly by a graduate student, who reports to the Director of WISE. The groups meet 6 hours a week in the fall and 4 hours a week in the spring. Throughout the academic year the students study together, attend programs/ lectures that are specifically designed to provide knowledge, expose the students to different aspects of science and engineering and engage in stress reducing social activities. This program benefits the first year students significantly. Any issues that may arise are immediately addressed. The mentors also benefit from this experience because they are interacting with graduate female role models, and faculty on a regular basis. In addition, mentoring helps them to solidify their knowledge and give them an avenue to share their passion for their STEM. Most students in WISE identify the mentor group in their first year as a significant factor lending to their success in college. Many of the College WISE students are given an opportunity to be a mentor, either though our Jr. Mentor program or for one of our middle/high school programs. All of the students are trained in how to utilize service learning pedagogy to enhance learning outcomes. The focus of our service learning component is on integration of classroom learning with issues that are relevant to the students in each program. Two examples will be given below as part of the discussion of the TechPREP and STEM Tech Programs.
TechPREP was started in 2008 with a grant from the Motorola Foundation. It is a program that engages 6-8th grade girls in STEM education that takes place at our campus. Students from two “high needs” district were invited to attend. The grant included transportation, instruction, a mentor and field trips. STEM Tech was started this year, with funding from the Motorola Solutions Foundation. STEM Tech was created to keep the student in TechPREP involved in STEM education. STEM Tech engages 7-9th grade girls in STEM Clubs by providing an after school program in their communities. The pedagogy of both programs is deeply rooted in service-learning. All of the projects the students do are generated from the interest and focus on the environment and the community in which they live. The programs are supported by multiple community organizations, networks and corporate sponsors.

WISE has many partnerships that support its programs. Each provides an important function that lends to their success. To get a full understanding of the magnitude of the WISE partners I have listed and given a short description on of how they support the WISE, TechPREP and STEM Tech students.

The University- the College WISE Program works with the Provost Office, the College of Engineering and Applied Sciences, the College of Arts and Sciences as well as other departments at the university. The co-founder of TechPREP and STEM Tech is in the Department of Technology and Society.

Advisory Boards- Includes the Friends of WISE Advisory Board (Corporate Sponsors and Advisor for WISE and High School WISE), TechPREP/ STEM Tech Advisory Board (Faculty and Industry Partners). These two advisory boards provide a forum for all of our partners to come together to provide expertise and enhance the programs both financially and pragmatically. The director of WISE manages and or co-manages the boards along with the co-director of TechPREP and STEM Tech.

The Long Island Regional Service Learning Network (LIRSLN) - is a 20 year old organization funded by the New York State Education Department that encourages K-12 as well as college professors/teachers and administrators to utilize service learning methods to enhance learning outcomes. Several colleges and universities on Long Island also work with LIRSLN to provide service learning curriculum. The network provides teacher training and a forum for educators to meet and share best practices. The Director of WISE has been an active member of the LIRSLN Advisory Board for 15 years.
ConnectTo Tech (CTT) – is a consortium of industry professionals whose mission is to assist the local school districts (K-16) teachers and administrators with STEM education by providing mentoring, opportunities for real life role models and shadowing opportunities for students. In addition, they do presentations on STEM Careers at the schools, and facilitate teachers in planning and implementing STEM Career Fairs. They provide technical assistance to our TechPREP and STEM Tech clubs.

Local School Districts and Community Organizations – the College WISE Program, TechPREP and STEM Tech have several partners that are community organizations. The Girls Scouts, Girls Learn Inc. of Long Island, a community center, libraries, is just some of our partners. Our community partners, such as the Girl Scouts and local school districts, provide program assistance, students, training, space and expertise. All participants in TechPREP and STEM Tech are trained in service-learning by the LIRSLN members. All of our Community Partners provide staff, training, space, equipment and expertise in education and service learning.

Corporate Partners- our corporate companies such as Motorola Solutions, Northrop Grumman, Computer Associate and some local companies provide financial, technical and practical experiences for students in the form of scholarships, program funds, tours, internships and professional development.

The WISE Sisters in Science, Technology, Engineering and Research (SISTER) Mentors are students currently in the WISE College program. They college students are trained by the WISE Director and graduate students in leadership, communication and mentor skills. They meet bi-weekly for supervision. The college students are enthusiastic role models for younger girls who might have an interest in STEM already, or an undiscovered interest waiting to be nurtured.

Having an historical perspective and understanding the political and financial climate of the past several years is imperative in gaining insight into the evolution of the two service-learning programs. Much of the funding sources for local school districts and community centers have decreased significantly. All parties have been fiscally concerned. There are fewer resources available for buses, field trip, supplies and after school activities.

Fewer students, particularly minority and women are entering college with the intention of studying math, science, technology or engineering. This coupled with the increase need for trained professionals in STEM fields has created an
environment in which people are increasingly eager to collaborate and share resources. The need for minorities and women in STEM fields has become increasingly more evident. The TechPREP and STEM Tech programs both have targeted under-served minority students to participate in the programs.

The lower numbers of women going into STEM fields; particularly engineering and computer science is well documented. According to the NSF most recent Division of Science Resources Statistics, Directorate for Social, Behavioral, and Economic Sciences publication entitled ‘Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011’ “Women’s participation is lowest in engineering and computer science. In the 20 years since 1989, however the proportion of women in engineering has increase, mostly at the master’s a doctoral levels. Women’s participation in computer sciences has increased at the doctoral level but declined at the bachelor's level.” “Men earn a higher proportion of degrees in many science and engineering fields of study. Women earn less than half of science and engineering degrees awarded to their respective racial ethnic groups”.

However, according to CNN Money.com and Pay Scale.com the growth of IT Software Architects will be a 34 percentile in the next ten years. Environmental Engineering jobs will grow 31% over that same time period. Moreover, the ratio of annual job openings due to growth and net replacement needs is about twice that for all occupations. The number of newly trained professionals is low relative to the rapidly growing numbers of available job openings. These figures suggest that IT Jobs will grow slightly more than 7 percent per year over the decade, far more quickly than the 1.4 percent average across all jobs. According to the Hackett Group off-shoring has leveled off. Now the need is to re-build for a new more highly-skilled type of IT role in the U.S. (The National Association of Colleges & Employers

There are many reasons why fewer women going into STEM fields including lack of exposure to what STEM professionals actually do. There are many misconceptions of what the fields have to offer in way of salaries and creativity. And finally there is a serious lack of female role models. The College WISE, TechPREP and STEM Tech program try to address many of these issues. Our mentors are young females who are educated in what STEM professions have to offer.

The College WISE program and all of its off-shoots, have as their goal to keep young women engaged in STEM activities and education throughout middle and high school, college and beyond by bringing their curriculum to life utilizing a
service learning pedagogy. Service learning can be implemented in any discipline and at any grade level. STEM education and particularly engineering provides a flexible springboard for service learning as it is all about bringing real life solutions to problems using skills learned in school. Our STEM Tech Club utilizes the Engineering Design Model when doing their projects. The LIRSLN provides training for all of the professionals involved in TechPREP and STEM Tech. In doing, so they provide the philosophical framework to students, mentors, staff and professionals and a clear understanding of how to incorporate service learning into the programs. Each project is unique as it is generated by the student’s passion and interest in a particular area.

Members of Connect to Tech (CTT) consortium volunteer to mentor the College WISE students and the younger students. All of the mentors involved are trained by the WISE staff in leadership, communication skills and in how to be a mentor. They are supervised weekly by the WISE staff as well. Collaboration is encouraged throughout the process on all levels!

TechPREP, our 6-8\textsuperscript{th} grade program, brings girls from two local underserved districts to campus for 90 hours of STEM education. The program takes place at the university campus over a period of three years. The students participate in 90 hours of hands and classroom instruction and mentoring each year. They begin with computer science. The second year program is in Mathematics and Physics. The final year is an engineering module. The students come to campus on seven consecutive Saturdays in the spring, followed by a two week camp in the summer for three years. All three years use service learning as a method for inspiring the students. The entire curriculum is experiential in nature. The students are encouraged to think about how to apply what they learning in the classroom to real life issues.

WISE college students, working with TechPREP and STEM Tech are called SISTER’s in Science, Technology, Engineering and Science (SISTER) mentors. They work with a small group of TechPREP students over the three year period. During the course of the program the students meet professional role models and participate in hands on learning. Every session is instructed by a faculty member and a SISTER mentors. Pre-Service Teachers work with the groups as well. All learning is experiential and has a high impact on the students.

In between the group meetings, the students communicate with their mentors utilizing technology such as FACEBOOK (we have TechPREP and STEM Tech page) and our word press blog. They both provide continuous opportunities for
dialogue and support. The students visit laboratories including Brookhaven National Laboratory and the Center for Wireless Technology. They tour local corporations such as Motorola Solutions and Computer Associates. They meet world renowned female faculty on the staff of the host institution. They are exposed to cutting edge research that is taking place in their community. Through our industry partnerships and the WISE SISTER Mentors the girls in our program learn about the variety of STEM opportunities for women.

The TechPREP program ends with a showcase of the student’s projects and celebration of their accomplishment with their families, school administrators, industry friends and teachers. Early and consistent access to mentors and programs gets them and keeps them on a pathway to STEM education and careers. Our retention rate for Cohort 1 was 90% for all three years and Cohort 2 was 90% for the first two years. They program is beginning its fourth year. All TechPREP students were given a pre and post questionnaire. The results indicate the feel they are more interest, have more knowledge and desire to study engineering after the program ended.

Cohort #1- Completed Three Years of TechPREP

Upon graduating from TechPREP the students are invited to join a new program that started this year called STEM Tech. The Motorola Solutions foundation now supports both programs. We further enlisted the support of all of our partners to
develop a program that would continue building the pathway for our TechPREP graduates. STEM Tech clubs were established in the communities in which the students reside. The program is different from TechPREP as TechPREP takes place at the university. The skills acquired in TechPREP and in the classroom are utilized to develop a service-learning project in STEM Tech. The program teaches the students about the Engineering Design model and has professionals from Connect to Tech provide technical assistance with their chosen project.

The students begin the process by learning about the many different types of communities they are involved in, from both the micro to the macro level. Once they understand the concept of the community they identify issues that concern them in their environment. They learn about the issues by doing research, utilizing the skills and knowledge they acquire in their classroom. They work as a team to learn to come to a consensus as to what issue they would like to address, and how they plan to address it. At the end of the year the students participate in a capstone event where they can share with others their process. According to Cathryn Berger Kay, M.A., there are five Stages of Service Learning. “They include: Inventory and Investigation, Preparation and Planning, Action, Reflection and Demonstration”. All our STEM Tech Clubs follow this model.

The SISTER mentors and professionals facilitating the groups tie the issue of concern to the students various level of curriculum. They share their enthusiasm and knowledge of STEM education and opportunities. The school administrators work with the groups, as well as teachers to help with this part of the process. The students then are encouraged to meet with various professionals and make a list of possible ways to address it. Subsequently, they use the engineering design model to plan, develop and build a project that addresses the issue. If it is not possible to actually build the project they are encouraged to build a model of it and or a poster.

For example, one of the groups of students was concerned about violence and loss of fellow students in their community. They wanted to build a fountain and a garden to have a place for people to go and reflect upon their love ones. They felt that the memorials that were springing up all over the town were dangerous and distracting to drivers. The students decided to design a fountain to honor their friends. They are planning to meet with an architect to help with the design. They also talked to the Town Board and have their support for the project. The town is in the process of a renewal project and asked if they could incorporate the fountain in their design. The fountain will be incorporated into towns design. The students utilized their math skills and learned about design, architecture and civic engagement. They have been encouraged to reflect at the end of each meeting and
in a journal they made the second week of the program. They will be invited along with the other STEM Tech Clubs to share their project with others at our capstone event in May.

Many of the projects involve learning about civic engagement and empower the students by building competence and confidence, while bringing their schools curriculum to life. Another one of the STEM Tech Clubs is going to develop a website that will raise awareness of resources and safety for animals.

One of the other clubs decided they were upset about the street lighting and the fact that the students walk home a distance in the dark if they take the late bus. They felt that their neighborhood was not safe. The group developed a petition and created an advocacy campaign to try to get the school district to either use different lighting, and or change the bus route. They discussed changing the lights to ones that are one sensor so that they will go one when a person walks by. The mechanics of this was looked into.

The added bonus is that the younger students are exposed to STEM female role models, not much older than themselves and to STEM professionals. The SISTER mentors have the opportunity to bring their classroom knowledge to life while reinforcing their learning and love for their chosen professions. In addition, they have the opportunity to network with local industry professionals. The professionals benefit from meeting young talented college students that can add to the diversity of their workforces. The program is a win-win for all involved.

Both the TechPREP and STEM Tech Programs engage youth, college students, industry volunteers and faculty in civic engagement and reflection. During each part of the process students are asked to reflect upon their experiences. Reflection cards are used to provide feedback for the students and the program administrators. Asking specific questions such as: What did you do this week? How did you do it? How do you feel about what you did? What could you have done differently? What resources do you need? What is the next step? Reflection teaches the students to value the process, not just the end result. Each student is asked to make a reflection note book. They are encouraged to be creative by writing poetry, essays, music or drawing etc.

In addition, each group is given a small stipend to fund one or two field trips and purchase supplies. The participants learn business skills by using their math knowledge to manage their budget. Finally, all of STEM Tech clubs and TechPREP students are invited to our campus for a "Fun with
Engineering” program which includes meeting their peers that are in our various programs, laboratory tours, hands-on engineering projects, a professional panel and a WISE SISTER Mentor panel.

Both the TechPREP and STEM Tech programs conclude with a capstone/celebration of the student and their partners achievements! Parents, administrator, community leaders, industry volunteers, teachers and mentors are invited to our showcase of the work the students have accomplished.

WISE is strategic about generating it alliances and partners. All of the partners/organizations have a deep and lasting commitment to STEM education, outreach, programming and service-learning. Together they make a strong, diverse foundation for the students who become involved and continue to be involved in until they graduate from College. As a result of the integration of our collaborators we have been able to extend our reach down the “pipeline” starting as young as the 6th grade and continuing up through college and beyond. The synergy of the partnerships are emphasized and celebrated throughout the process. Service learning provides a means to motivate the students and to teach them that through education, applying their knowledge learned in school they can make a difference in their world!

1. SBU Institutional Research 2011
2. SBU Institutional Research 2011
3. SBU Institutional Research 2011
4. SBU Institutional Research 2011
7. Questionnaire of Cohort 1. Participants of three modules of TechPREP pre-and post