

Work in Progress: Student to Scholar: A Learning Community Model for Professional Skills Development

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ABSTRACT

This Work-In-Progress paper documents the first steps in the creation of a co-curricular program, Student to Scholar (S2S), designed to assist students in their development of professional skills. A literature review, as well as an examination of local curriculum provides the evidence for the need of such a program. A fully realized S2S program will have a tiered structure involving faculty, graduate students, and undergraduate students. Graduate students entering the S2S program take a for-credit course exposing them to a number of professional skills, and helping them to understand how to teach those skills to undergraduates. Once trained the graduate students become the leaders of cohorts, or learning communities, of undergraduate students. The graduate students will meet with their cohorts several times a semester to engage with them in professional skill workshops.

The S2S program aims to prepare both graduate and undergraduate students with the professional skills they will need after graduation regardless of if they are going into industry or academia. A multitude of skills are covered in the program that address the knowledge, skills, and abilities necessary for the T-shaped engineer, including but not limited to: information literacy, leadership, teamwork, diversity, time and project management, reflection scientific/written/oral communication, writing, career services, entrepreneurial mindset, and public speaking. To reinforce students development of these skills the tiered structure of the program transitions students from learners to teachers. This transition occurs at every level, with graduate students senior undergraduates, seniors teaching juniors, and so on down to the first year.

Currently, this study aims to help develop the needed institutional support to implement the full S2S program. As that work takes place a pilot program has begun to test student reception to a variety of professional skills workshops. The results of this testing are presented here. Through a partnership between the library and the Vertically Integrated Projects (VIP) program, 5 workshops took place during the fall 2018 and 3 during spring 2019 semesters. Faculty and staff with expertise in various professional skills have been brought in to lead students through these workshops. The students were surveyed during the spring semester to evaluate each workshop.

INTRODUCTION

This work in progress focuses on the “Student to Scholar” (S2S) program at New York University’s (NYU) Tandon School of Engineering. The S2S program is intended to create opportunities for both undergraduate and graduate engineering students to develop and reinforce the professional skills that are often underrepresented in their curricula. In this paper we outline the motivation for such a program looking at both external studies, as well as work done internally by the engineering library. Following the motivation a broad overview of the S2S program is given, and the work that is already underway is detailed.

MOTIVATION

The library has always been interested in providing undergraduate and graduate student instruction, particularly in regards to information literacy [1]. Information literacy is a skill that is often lost to the engineering curriculum, but as stated by England:

Many engineers lack skills in accessing and retrieving information. Yet the ability to monitor, access, retrieve, evaluate, use, and communicate information will be critical in a global information society characterized by rapid technological change. Engineers who possess a more thorough knowledge of information retrieval strategies and information resources will be more effective in educating themselves, will develop more creative solutions to problems, will practice more efficiently, and will be more competitive in the global economy [2].

Information literacy is just one of many professional skills that students need to succeed in both their academic and professional careers. Colwell outlines 14 such skills including oral and written communication, time management, ethical decision-making, and leadership [3]. The Bern Dibner library at NYU Tandon hosts between 20 and 30 workshops a semester on topics including data services, research skills, and information literacy. Over the spring and fall 2018 semesters the library surveyed students attending these workshops. 626 students responded to this survey. When asked what workshops they would be interested in attending approximately 250 students indicated “[professional] skills (communication, presentation, organization)” and 220 selected “research skills (literature reviews, citation management)”. Students were allowed to choose more than one option so it is likely there is overlap between these choices. Unfortunately, though students indicate an interest in acquiring these skills, they are not often well reflected in the curriculum.

An examination of two different engineering disciplines’ core curricula against the A-K ABET requirements demonstrates how not all accreditation criteria are treated equally. For example, in these curricula criteria A and K “an ability to apply knowledge of mathematics, science and engineering” and “an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice” respectively received a combined 72 credit hours in one

discipline and a combined 101 in the other. On the other hand criteria such as D and F “an ability to function on multidisciplinary teams” and “an understanding of professional responsibility” receive an average of 5.5 credit hours each for the two disciplines. A number of other criteria received less than 10 credit hours. This means that these departments are reliant on student-chosen electives to teach these skills, and as a result these skills are often learned outside the context of engineering.

Several large-scale studies have examined what professional skills are the most important for engineering graduates. The National Academy of Engineers (NAE) built on the ABET learning outcomes and called for higher education to focus on developing non-technical attributes of engineers including ingenuity, creativity, communication, management, leadership, ethics, and resilience [4,5]. An additional call came from the American Society of Mechanical Engineers for higher education to embed the NAEs professional skills into rich project-based experience [6]. More recently, the National Science Foundation and the American Society for Engineers have engaged stakeholders through the Transforming Undergraduate Engineering Education (TUEE) initiative including recruiters, top engineering company executives, professional societies, faculty, and students to identify the most critical knowledge, skills, and abilities (KSAs) needed for successful transition from school to the engineering profession [7]. The 36 KSAs that were identified helped to collect previous studies into a single framework. Holloway and Radcliffe compare the NAE, ABET, and TUEE frameworks in global context for graduate education [8]. These frameworks were considered in the development of the Student to Scholar Program.

STUDENT TO SCHOLAR PROGRAM OVERVIEW

The S2S program is intended to be top down mentoring/instruction program as seen in Figure 1. At the top of the program is a small level of faculty and administrators responsible for organizing the program and the first level of mentoring. This top level of mentoring is conducted through a credit bearing course for first semester Ph.D. students. The purpose of this course is to provide new Ph.D. students with explicit instruction in the many research and professional skills they will need to succeed in their graduate studies, and to prepare them to act as mentors in the S2S program. The course is meant to take all incoming engineering Ph.D. students regardless of discipline. There are two advantages to this, first it helps increase the class size since there may only be a small number of new Ph.D. students in a given year, and second it helps generate interesting conversations with students that have different undergraduate trainings. Over the course of the semester the class will focus on three major areas: research skill, communication skills, and professional skills. A breakdown of example topics related to each of these areas can be seen in Table 1. The main assignment for this course is to write a review paper on a topic

they are interested in pursuing during their future graduate research. Students will submit a paper to the course's main instructor, and will also present what they have learned to the class either through a talk or poster. Students that do well in this course will have the option to become mentors in the next level of the S2S program.

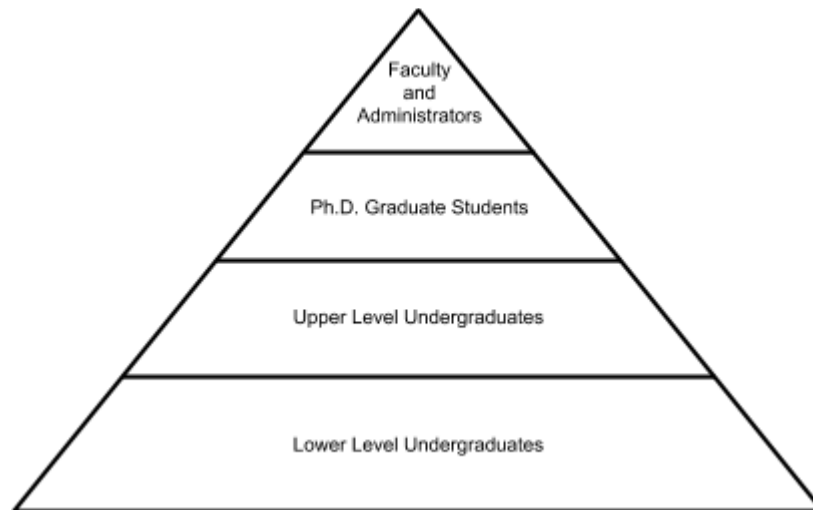


Figure 1. The top down mentoring structure of S2S.

The second and third level of mentoring in the S2S program are for undergraduates. At the second level Ph.D. students that have completed the S2S course mentor upper level (third and fourth year) undergraduates. At the third level of mentoring undergraduates in their third and fourth year mentor first and second year students. Students that have completed the first two years of S2S and hold strong academic standing can qualify as mentors. At both of these level mentors meet with smaller cohorts of students (20-30 students) for between two and four hours a month. The content of these meetings varies to fit the needs of the students. An example of some of the materials discussed based on year can be seen in Table 2. There are two reasons we aim to use the students mentoring students model. First, the model allows for greater scalability. Relying only on faculty as mentors would be next to impossible for larger schools. Second, placing students in the mentor role allows them to reinforce many of the skills they are learning in the S2S program.

Table 1. Breakdown of example topics in S2S graduate course.

Research Skills	<ul style="list-style-type: none"> ● Information Literacy ● Experimental Design ● Data Management
Communication Skills	<ul style="list-style-type: none"> ● Written and Oral Communication ● Scientific Publishing ● Peer Review
Professional Skills	<ul style="list-style-type: none"> ● Ethical decision-making ● Time management ● Critical thinking

Table 2. Content focus for different undergraduate engineering years.

Year/Term	Fall	Spring
First year	<ol style="list-style-type: none"> 1. Time and project management 2. Teamwork and diversity 	<ol style="list-style-type: none"> 1. Conflict resolution 2. Reflection and emotional IQ
Second year	<ol style="list-style-type: none"> 1. Written communication 2. Research fundamentals 	<ol style="list-style-type: none"> 1. Oral communication 2. Ethical decision-making
Third year	<ol style="list-style-type: none"> 1. Human-centered design 2. Societal and global context 	<ol style="list-style-type: none"> 1. Creativity and innovation 2. Entrepreneurial mindset
Fourth year	<ol style="list-style-type: none"> 1. Leadership 2. Career and interview skills 	<ol style="list-style-type: none"> 1. Continuing self-education 2. Professionalism

STUDENT TO SCHOLAR CURRENT MANIFESTATION

The previous section overviews the ambitious end goal of the S2S program. To reach this goal will require years of work building training programs, garnering additional administrative support, and securing funding. While all of that is taking place we have begun developing and testing content with the students. During the fall semester of 2018 the first S2S workshops were held. The workshops were jointly supported by the undergraduate student council, the Vertically Integrated Projects (VIP) program, and the Bern Dibner library. Five workshops were held in the fall including: information literacy, developing a research question, career services, entrepreneurial mindset, and effective presentations. Each session was hosted by a different guest speaker with an expertise in the area, and a number of different methods were used for presenting the material including the flipped classroom, lecture, and active learning.

VIP courses are taken one-credit hour per semester and offer students the opportunity to work on faculty research and innovation projects for curricular credit. VIP teams are made up of 5-40 students of all undergraduate academic ranks, and organized into a professional management structure. Students enroll in the one to three credit for at least three semesters and up to six. The long term engagement on the project allows students to grow into leader and mentor roles and ideally create a sustainable cycle of students, as third and fourth year students train new first and second year students. This experiential learning opportunity enables students to build a portfolio of projects that will help them secure jobs and develop their professional skills learned in the S2S Program. Faculty and graduate students benefit from student work and a broader impact of their research and education efforts, while students gain additional project experience, leadership opportunities, and professional skills. The structure of the VIP Program complements the goals of the S2S pilot.

The results from the fall semester were encouraging with an average of 37 students attending a workshop (high 60 low 23). When compared with library hosted workshops the S2S workshop generate nearly double the attendance. No assessment was put into place in the fall semester, but feedback from the students was positive. For example, after the session on developing a research questions several graduate students requested that the session be held again and the length be doubled because they found the workshop so helpful. As another example, at the effective presentation skills workshop students were given an opportunity to present a poster they were working on and receive feedback. A team of undergraduate students that were presenting at an upcoming VIP conference reorganized their poster and presentation based on the feedback they got at the workshop and won the award for best presentation at the conference.

In the spring semester of 2019 another three workshops were held. These workshops focused around career resources, information literacy, human-centered design. Additionally, starting in the spring semester greater efforts were placed on assessing each workshops. A survey has been developed for students to complete after each workshop. The questions of the survey can be found in Appendix A. Despite strong registration numbers, an average of 42.3 per workshop, the overall attendance at S2S events decreased substantially in the spring, an average of 11 per workshop. This drop in attendance was also seen in library workshops throughout the semester and it is unclear what the cause was. Students were emailed a follow up survey after the workshop was completed. Seven students (21%) responded to the survey in the spring semester. The limited response were overwhelmingly positive. When asked if they thought the workshop would help them with their future career goals students gave an average answer of 4.3 out of 5 and when asked if they would recommend the workshops to a friend the gave an average of 4.9 out of 5. Additionally, some quotes from the students included, “it was [an] exceptionally great workshop. I am looking forward to more advance workshops like the one we had,” and “the

information was extremely important and is not something that is taught often. It furthered my knowledge of job hunting and gave a good insight into the hiring process.”

CONCLUSIONS

The S2S programs aims to create opportunities where students can learn and develop the many professional skills that facilitate success in academic and professional careers. The current work being done is helping to create a foundation that the S2S program can be built on. Over the next several years we aim to continue to develop and assess content for the program, as well as implement a sustainable top down mentorship model. Currently, work is underway with several departments to add a S2S course to the graduate school curriculum. We are also considering how we might be able to integrate professional development credits into the program. We hope that in the next few years we can take the S2S program from a few workshops each semester to a self sustaining program that enhances the experience of hundreds of students.

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APPENDIX

Survey Questions

Open ended

1. Why did you attend the S2S workshop
2. How did you find the workshop useful? Be as specific as possible.
3. Was the material presented what you expected it to be Please elaborate.
4. What was the most valuable about this workshop?
5. What was least valuable about this workshop
6. What other workshops would you recommend?

5 point likert scale

1. I found the pace of the workshop to be appropriate
2. I found the day of the week and time of the workshop optimal
3. The workshop activities gave me sufficient background
4. I will be able to use what I learned in this workshop
5. The workshop was a good way for me to learn the material
6. I found HOW the material was presented to be helpful
7. The workshop will help me with my future career goals
8. I will recommend this workshop to my peers.