2021 ASEE ANNUAL CONFERENCE
Virtual Meeting | July 26–29, 2021 | Pacific Daylight Time
Paper ID #33612

Student to Scholar: A Professional Skills Focused Library Collaboration

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Student to Scholar:
A Professional Skills Focused Library and Student Affairs Collaboration

ABSTRACT

The Student2Scholar initiative began as a collaboration between library and engineering faculty in the Spring of 2017. The primary focus of Student2Scholar (S2S) was to develop focused programming to reinforce professional skill development among engineering students. During the Summer of 2020 the S2S initiative partnered with New York University's Tandon School of Engineering Summer Undergraduate Research (SUR) Program to develop an 8 week long workshop series focusing on opportunities in areas such as scientific communication, visualization, ethics and research, information literacy, and mentorship. A pre and post student survey was administered to evaluate the effectiveness of the workshops and offer an opportunity for direct student feedback. In addition to these student surveys students, SUR students were provided an opportunity to engage in one on one interviews with S2S leadership. This paper presents the preliminary results from the data collected in the summer of 2020 as an illustrative example to guide future studies by institutions with similar program development and implementation.

INTRODUCTION

This paper provides a written account of a work in progress co-curricular program called Student2Scholar (S2S). A recent report conducted by MIT (2018), stated that engineers will need to address complex societal challenges of the 21st century by building a new generation of machines, materials, and systems [1]. As a result, these challenges will require us to examine how we not only educate engineers for the future, but also to integrate techniques from the larger field of education so that we can apply research-informed approaches to engineering education. When we talk about a research-informed approach in the context of this work, we are discussing the method of engaging in interactional ethnography as a logic of inquiry, and as a method for informing curricular based decisions [2]. Many engineering and science curricula focus primarily on students developing the technical skills required for their careers post-graduation. This focus on technical skills often comes at the cost of the professional skills (e.g. public speaking, time management, conflict resolution, emotional intelligence, critical thinking etc.) students will need to excel after they depart from the university [3,4]. At the ASEE conference in 2018, we presented a model for enhancing professional skills for engineering students [5]. This paper presents an account of how we have further developed this program and piloted it in an educational context.

THEORETICAL FRAMEWORK

Co-Curricular Programs

In addition to the learning opportunities within the classroom space, co-curricular programs provide opportunities for learning outside of the formalized space, but also serve as a point to complement the formal curriculum [6, 7]. Co-curricular programs can include activities, research intensive experiences, internships, externships, and learning experience [7]. Some of these co-curricular experiences can be designed around student services programs or be in alignment with discipline specific programming. In the context of this paper, we are engaging in a discussion around our work of co-curricular education in the field of engineering given there is a gap of knowledge in professional skills [5]. In his report for *The Chronicle of Higher Education*, Selingo, explored just how differently Gen Z approaches college when compared with the Millennial Generation. A common theme Selingo comes back to is that the "bells and whistles" that attracted millennials are not as appealing to this current generation of students [4]. Recent studies [3, 8-9] have examined engineering students' co-curricular experiences in pre-college and higher education contexts. Findings from research studies have made visible that co-curricular experiences for engineering students provided opportunity for students to develop leadership skills as well as ethical understandings. But, what has been missing from the dialogue in engineering co-curricular programs is a more direct approach to teaching specific skill development. Our program of study seeks to take a different angle of a co-curricular approach in conducting an assessment of a curriculum unit that was designed to provide an opportunity for students to build an understanding of what research is and to receive formal instruction in research skills and other related areas.

Survey Development

Survey collection usually involves the collection of three types of information: descriptive, behavioral, and attitudinal. Descriptive surveys try to elicit respondent information and facts such as age, major, ethnicity, and more. As Rea and Parker mention, these detailed characteristics provide a lens at understanding the population being studied [10]. In contrast, behavioral survey questions seek to gain insight into the respondents pattern use [10]. Lastly, attitudinal questions focus on attitudes and opinions of context or condition. In the context of this study, we developed a series of survey questions that were targeted between descriptive and attitudinal questions [10].

CONTEXT OF STUDY

In Fall 2018 and Spring 2019, the Student to Scholar Program was piloted with workshops across professional development concepts. A survey administered at completion of the initial program confirmed that workshops were supportive and helpful in student participants' development of professional skills [5]. Review of survey data made visible a lower participation rate in Spring 2019. Further inquiry to understand student participation contributed to the decision of engaging in a small case study during the 2019-2020 academic year. Engineering students, some of whom had participated in previous S2S workshops, were interviewed about their experiences as students broadly and areas for student support. The interview conversations further reinforced

the need to develop workshops around the following topics and themes: 1) Teaching students to learn how to organize and prepare self for transition to higher education ; 2) Professional development - (Public Speaking, Mentoring, Preparing for Engineering Licensure Exams, Interviewing - Technical and Traditional, and etc); 3) Research Development (What is research?, Ethics in research, Writing for Publication, etc).

For summer 2020, the S2S program partnered with New York University's Tandon School of Engineering Undergraduate Summer Research Program to pilot a module of 8 workshops for the 80 plus students who were engaging in research projects across different STEM disciplines. Based on the goals of the Undergraduate Summer Research Program and the previously conducted interviews with students the workshop topics included discussions around the following: What is research?; Developing a literature review; Writing a research statement; Ethics in research; Developing a research proposal; Constructing a Research Poster; Writing for Publication; Applying for Graduate School; and, Finding Funding for Graduate School. The workshops and their objectives are provided in Table 1.1. Due to the ongoing COVID 19 pandemic all workshops were developed for remote learning. Almost all workshops were conducted synchronously through Zoom unless otherwise noted in the table. In addition to the live workshops, worksheets were created for the students to reinforce learning on topics discussed within the sessions.

Table 1.1

Summary of Workshops for Undergraduate Summer Research Program

Workshop Title	Workshop Objectives
What is Research	• Define what it means to conduct research • Explore the relationship between research and the scientific method • Develop techniques for preplanning a research project
Developing a Literature Review	• To understand the relationship between research, the scientific method, and library resources. • To recognize and understand how to use the resources available to you as an NYU researcher. • To see the value of conducting a literature review, and learn effective tools for searching and locating research. • To explore techniques and tools to improve organization and writing of a literature review.
What is a Research Statement	• To explore what a research statement is • To understand why someone would craft a research statement • To start developing a personal research statement
Ethics in Research*	• To understand basic theories in the field of ethics and how to apply them to your own work • To examine the ways ethics and ethical behavior affects a researcher • To explore the history of ethic research with human/animal subjects • To understand where you can find information about ethical behavior within your research discipline
What is a Research Proposal	• To define what a research proposal is • To understand why research proposals are important • To learn to develop your own research proposal
Constructing a Research Poster	• To understand the means of scientific communication • To recognize the importance of accurate and transparent communication • To review best practices in data visualizations • To introduce resources for designing your poster
Applying to and Finding Funding for Graduate School	• To understand the graduate admission process and what schools are looking for • To learn how to best positions yourself for successful applications
Writing for Publications*	• To explore the genre of scientific writing • To consider how to identify what kind of publication you want to write • To introduce concepts regarding publication and authors rights • To understand practices for engaging in scientific writing

* indicate the workshop was conducted asynchronously

METHODS

In this work in progress study, we developed a series of surveys (pre and post) to assess what students conceptualized prior to the start of this research program, and their comfortability with these concepts post the Undergraduate Research Program. Students enrolled in the Summer Undergraduate Research program were required to attend each of our workshops and encouraged to complete the surveys during their participation in the program. The surveys consisted of questions on a 5 point Likert scale and open ended questions to provide a more in depth explanatory picture of their experiences.

ANALYSIS

In this section, we will examine the survey data by area of emphasis. These emphases were developed in relation to the clusters of professional skills. It is through the pre and post mean we seek to assess what were the students perceived understanding of their level of expertise upon entering the Summer Undergraduate Research Program, and, how did they rate their level of expertise after engaging in S2S Workshops and the Summer Undergraduate Research Program? Each of the tables below provide a visual representation of the pre and post mean as a result of the survey data.

The last table examines students' assessment of their knowledge around applying for graduate schools. Within this session, we explored concepts around knowledge of graduate school admission models, obtaining a research advisor, finding graduate programs relevant to your interests, preparing for the application and interview process, finding funding opportunities, and developing an application for funding. This particular session showed a larger distribution between pre-mean and post-mean in contrast to the other sessions.

Table 1.2

Student Assessment Around Scientific Inquiry

	Mean Pre	**Mean Post**	**Difference**
Knowledge of systematic inquiry	2.8	3.77	0.97
Engaging in/with the scientific method	3.5	4	0.5
Knowledge of research norms for conduct	3.05	4.08	1.03
Knowledge of data collection and publishing process/rights	2.65	3.82	1.17
Distinguishing between acceptable and unacceptable research behavior	3.47	4.23	0.76
Engaging in research involving human subjects	2.23	2.89	0.66

The first Table 1.2, examines professional skills around engaging in science inquiry. In the first column, you will see a list of concepts we asked the students to assess in relation to the scientific inquiry. The concepts entailed knowledge of systematic inquiry, engaging in/with the scientific method, knowledge of research norms for conduct, knowledge of data collection and publishing process/rights, distinguishing between acceptable and unacceptable research behavior, and engaging in research involving human subjects. The second and third columns display the mean value of the students' self assessment prior to the start of the program (n=86) and mean post participation in the program (n=66). In the last column the net gains in each category are shown. The respondents of both pre and post surveys were participants in the summer undergraduate research program, and though the anonymity of the survey does not allow us to directly compare a specific student's pre and post answers the average values are being compared from the same group of students. It can be seen that there was growth in all categories, with the largest growth in *Knowledge of data collection and publishing process/rights* in contrast to the beginning of the summer program. Evidence of the data collection process, publishing process and rights was covered in what is ethics in the research workshop. Students participating in this workshop stated in support of the findings in this survey, that "*I liked the ethics one because I never really considered the ethical questions of research before. Ethics in research. This was never covered in any of my classes, so I enjoyed this and plan to take an ethics course*." This statement provided by the student further supports our work in relation to the ABET student outcome 4 that engineering students should have "an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments…" [11].

Table 1.3, analyzes professional skills in relation to scholarly communication. Within this session, we explored concepts around Finding academic resources; Determining the validity of a source; Formulation Persuasive evidence that a need exists for a proposed study; Communicating methods for conducting a research study; formulating questions for research based on information gaps; or on the reexamination of existing data; Communication your research objectives through a written statement; visualizing your data, summarize information or research concisely; actively try to publicize research to generate discussion. This series of workshops had similar results in that there were clear gains between the pre and post means.

Table 1.3

Student Assessment Of Skills Around Scholarly Communication

	Mean Pre	**Mean Post**	**Difference**
Finding academic resources	3.78	4.2	0.42
Determining the validity of a source	3.7	4.15	0.45
Formulation Persuasive evidence that a need exists for a proposed study	3	3.94	0.94
Communicating methods for conducting a research study	3.17	4.02	0.85
Formulating questions for research based on information gaps, or on the reexamination of existing data	3.05	3.94	0.89
Communication your research objectives through a written statement	3.3	4.05	0.75
Visualizing your data	3.35	4.09	0.74
Summarize information or research concisely	3.31	4.05	0.74
Attractively try to publicize research to generate discussion	2.59	3.7	1.11

Table 1.4

Student Evaluation of Applying for Graduate School

Questions Assessing Graduate School Knowledge	**Mean Pre**	**Mean Post**	**Difference**
Knowledge of graduate school admission models	2.09	3.42	1.33
Obtaining a research advisor	2.52	3.48	0.96
Finding graduate programs relevant to your interests	2.22	3.64	1.42
Preparing for the application and interview process	2.51	3.48	0.97
Finding funding opportunities	1.85	3.39	1.54
Developing an application for funding	1.85	3.32	1.47

Table 1.4 examines students' assessment of their knowledge around applying for graduate schools. Within this session, we explored concepts around knowledge of graduate school

admission models, obtaining a research advisor, finding graduate programs relevant to your interests, preparing for the application and interview process, finding funding opportunities, and developing an application for funding. This particular session showed a larger difference between pre-mean and post-mean in contrast to the other units and topics covered. As evidenced in the survey, students felt this workshop series "*taught how to effectively find programs and reach out to potential mentors."* Furthermore one student responded that this unit was *"beneficial to find the papers and locate the universities performing the research that I want to perform."* A possible reason for the larger differences between pre and post surveys related to these topics is the age of students participating in the program. The Summer Undergraduate Research program is available to rising sophomores, juniors, and seniors. As such, many of the rising sophomores and juniors may have not started considering if they want to apply to graduate school yet.

CONCLUSION and FURTHER DISCUSSIONS

As Baker and Green argue there are limits to certainty to what can be seen in a particular event [12]. While this study provided insight on students' perspectives and growth in knowledge of what research is, there needs to be an additional longitudinal study to assess growth. From the presented research we can see that involvement in the Summer Undergraduate Research Program, and S2S workshop demonstrated a perceived increase in students' confidence in a number of areas related to research, communication, and graduate schools. In some cases these increases were rather significant, more than a point on a 5 point scale. Unfortunately, at this point in the work we can not conclude if these significant gains were a result of their faculty advised research over the summer, the S2S presented workshops, unconsidered outside factors, or a mix of each. Future studies should consider the development of pre and post tests to evaluate growth in knowledge development beyond student self assessment, and for a broader landscape, an examination of student participation in these co-curricular programs and the transfer of skills into senior projects or other curricular milestones. Additionally, utilizing a control and test group could better isolate the specific impact of the S2S workshops. These types of studies would build a clearer picture of how the S2S workshops impact a students professional skill development.

The authors of this paper will be working with the Summer Undergraduate Research Program again in the summer of 2021. Our intentions for the upcoming summer are to expand the workshop offerings, we intend to include workshops on leadership and presentation skills in summer 2021, and develop pre and post assessments for a more rigorous study on students development of professional skills. We are also working to pilot an additional program with the 2021 Summer Undergraduate Research participants to explore how building electronic research portfolios may reinforce professional development. Lastly, our work with undergraduates indicates that many graduate students may be entering Masters and PhD programs lacking in a

variety of research and professional skills. We are currently working with members of the engineering faculty to transition some of our workshops towards graduate students, with the hope of designing a multiyear study on the impact of professional skill development on graduate student success.

REFERENCES

[1] "Reimagining and rethinking engineering education: New MIT report takes a worldwide look at the future of how engineers are trained." March 27, 2018. [Online]. Available: http://news.mit.edu/2018/reimagining-and-rethinking-engineering-education-0327. [Accessed December 12, 2019].

[2] Green, J. L., Dixon, C. & Zaharlick, A. (2003). Ethnography as a logic of inquiry. In James Flood, Jensen, Lapp & Squire (Eds.) Handbook of Research on Teaching the English Language Arts.

[3] Mohan, A. & Merle, D. & Jackson, C. & Lannin, J. & Nair, S.S.. (2010). Professional Skills in the Engineering Curriculum. Education, IEEE Transactions on. 53. 562 - 571. 10.1109/TE.2009.2033041.

[4] Sellingo, J. (2018). The New Generation of Students: How Colleges Can Recruit, Teach, and Serve Gen Z. A report of The Chronicle of Higher Education, 2018.

[5] Frenkel, M., & Bringardner, J., & Borges Rajguru, S. (2019, June), *Work in Progress: Student to Scholar: A Learning Community Model for Professional Skills Development* Paper presented at 2019 ASEE Annual Conference & Exposition , Tampa, Florida. 10.18260/1-2--33650

[6] "Co-Curricular," in a Glossary of the Internet. The Glossary of Education Reform: For Journalists, Parents, and Community Members, [online website], 2013. Available: https://www.edglossary.org/co-curricular/ [Accessed: April 13, 2021]

[7] Rutter, M. P. & Mintz, S. "The Curricular and the Co-Curricular," Inside Higher Ed. October 20, 2016. [Online]. Available: https://www.insidehighered.com/blogs/higher-ed-gamma/curricular-and-co-curricular. [Accessed April 12, 2021].

[8] Knight, D. B. & Novoselich, B. J., "Curricular and Co‐curricular Influences on Undergraduate Engineering Student Leadership", Journal of Engineering Education, vol. 106, no. 1, January, 2017). Available: https://onlinelibrary.wiley.com/doi/epdf/10.1002/jee.20153. [Accessed April 13, 2021].

[9] Burt, B. A., & Carpenter, D. D., & Finelli, C. J., & Harding, T. S., & Sutkus, J. A., &

Holsapple, M., & Bielby, R. M., & Ra, E. (2011, June), Outcomes of Engaging Engineering Undergraduates in Co-Curricular Experiences Paper presented at 2011 ASEE Annual Conference & Exposition, Vancouver, BC. 10.18260/1-2--18498

[10] Rea, L. M. & Parker, R. A. (2005). Designing and Conducting: Survey Research - A Comprehensive Guide.Jossey-Bass

[11] Criteria for Accrediting Engineering Programs, 2020-2021 (2021). Retrieved from: https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2020-2021/

[12] Baker, W. D. & Green, J. L., 'Limits to Certainty in Interpreting Video Data: Interactional Ethnography and Disciplinary Knowledge, Pedagogies,' An International Journal, vol. 2, no. 3, July, 2007. Available: https://www.researchgate.net/publication/232948652_Limits_to_Certainty_in_Interpreting_Video_Data_Interactional_Ethnography_and_Disciplinary_Knowledge. [Accessed December 12, 2019].

APPENDIX

Survey Questions

Matrix - Likert

Please rate your level of comfort/expertise in the following areas. [Questions shown in table 1.2, 1.3, and 1.4]

Open Ended

Q1 Major
Q3 Area of Research
Q4 How was the Summer Undergraduate Research Program advertised to you?
Q5 Were you made aware of the Summer Undergraduate Research Program prior to your admission into NYU's Tandon School of Engineering?
Q8 Have you had the same mentor each time you participated? Are you working on the same project as in previous summers?
Q9 How would you describe your application experience?
Q10 Is there anything you would change in navigating the application process?
Q11 Do you have any prior experience engaging in research? If so, please elaborate in what capacity.
Q12 How did you become aware of the Summer Undergraduate Research Program?
Q13 What motivated your interest in joining the Summer Undergraduate Research Program?
Q14 What do you hope to gain from your research experience?
Q15 What do you hope to gain from your participation in this program?
Q17 What are your professional goals upon completion of your undergraduate degree
Q18 What support do you feel you need to help you facilitate reaching your professional goals
Q20 Please provide us with your email so we can contact you about future participation.