A Pilot Symposium to Highlight
Undergraduate Research in Engineering[*]

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Abstract

This paper documents a pilot symposium to recognize undergraduate research in engineering. Held in October 2004, the symposium included presentations and posters by more than forty undergraduates in the College of Engineering at Virginia Tech. One goal of the symposium was to give undergraduate researchers a means to communicate their work. A second goal was to inspire other undergraduates in the college to seek research experiences.

One feature of this symposium was that undergraduates in the college's honorary societies played a large leadership role. For instance, students from three honorary societies (Tau Beta Pi, Pi Tau Sigma, and Chi Epsilon) did the following: served as symposium organizers; reviewed more than forty abstracts and designated presentation or poster status for each; served as session chairs for the six presentation sessions and four poster divisions; and served as judges for the best presentation and poster in different categories. Allowing undergraduates to fill such leadership roles in the symposium gave these undergraduates a sense of ownership of the event and served to increase the number of participants at the event. A second feature of the symposium was that the symposium became an opportunity to teach communication skills to the presenters—especially since the event had a real audience, purpose, and occasion. Soon after the announcement of the acceptances, workshops were held to teach best practices for the design of presentation slides (http://writing.eng.vt.edu/slides.html) and best practices for the design of posters (http://writing.eng.vt.edu/posters.html). In addition, the week before the symposium, the participants gathered for another workshop in which they critiqued each other's slides and posters. This paper presents lessons learned from this pilot symposium and discusses how we intend to incorporate these lessons into next year's symposium.

Introduction

The Boyer Commission Report has urged universities to "make research-based learning the standard" for the education of undergraduates [1]. Also calling for more

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research by undergraduates in science, technology, engineering and mathematics are the National Science Foundation [2], the American Association for the Advancement of Science [3], and the National Research Council [4]. Participation in research not only deepens the student's understanding in science, mathematics, engineering, and technology, but promotes communication and teamwork to solve complex problems [5]. As stated by the Reinvention Center at Stony Brook [6], "When undergraduates working alongside faculty participate in the generation of knowledge or artistic creation, they join the university's rich intellectual community and they derive unique, life-long benefits." For these reasons, engaging more engineering undergraduates in research is a goal of many engineering colleges. However, given the pressures to reduce the number of credit hours in engineering curricula, engineering departments are hard-pressed to find other courses to foster an appreciation for engineering research.

Such is the case in the College of Engineering at Virginia Tech, which consists of a dozen departments with 5,500 undergraduate students, 2,000 graduate students, and 300 faculty members [7]. Although the College of Engineering at Virginia Tech is large, incorporating research into the education of the students remains a top priority as evidenced by its commitment to become a top 30 research institution. With this goal in mind, a program to provide undergraduate students the opportunity to perform research is being developed within the College of Engineering. The development of this undergraduate research program has also fostered a desire to allow participating students to present their research as well as to expose other undergraduates to the opportunities to perform research. The need to highlight undergraduate engineering research has provided the motivation to create a pilot symposium this past year.

This paper presents the lessons learned from our pilot symposium. Presented first are our preparations for the pilot symposium. Given next is a discussion of the symposium event itself. Finally, this paper presents the lessons learned from this pilot event, which other colleges of engineering might consider when preparing for a similar symposium.

Preparation for the Pilot Symposium

The decision to host an undergraduate research symposium in the College of Engineering at Virginia Tech occurred in June 2004. In addition to the desire to promote undergraduate research, two reasons sparked this decision: (1) the desire by the Dean of Engineering at Virginia Tech to have such a symposium, and (2) preparation for an NSF-funded project [8] to foster undergraduate research through a modified technical communication course. Because this symposium was a pilot symposium and because the College of Engineering at Virginia Tech is so large, advertising for the symposium was focused on the three largest departments: Mechanical Engineering, Electrical and Computer Engineering, and Civil and Environmental Engineering. Next year, the intention is to expand advertisement of the symposium to all engineering departments in the College.

Shown in Table 1 is a listing of the milestones marking the preparation of the symposium. As seen in the table, the first milestone was the selection of a symposium chair. For this pilot symposium, we chose a rising senior in mechanical engineering who

had research experience. Next came the creation of a web page for the symposium that provided the symposium schedule and instructions for submitting the abstract (http://writing.eng.vt.edu/symposium.html). An impetus for this web page came from observations of an undergraduate research symposium, in which the participants complained because they had little idea about the schedule of events. For example, participants did not learn whether they were to present a poster or make a formal presentation until only one week before the symposium. Our symposium web page with its schedule was popular among the participants. In August, this web page received 275 visits, and in September, this page received 406 visits.

Following that was a call for abstracts, which were due on September 6, 2004. The call for abstracts, which contained a link to the symposium web page, went to all undergraduates in the College of Engineering. In addition, faculty in the three targeted departments were contacted. Our experience was that contacting the faculty was important, because the faculty overseeing research appreciated the importance of students communicating that research in a symposium.

Table 1. Milestones for the preparation of the pilot symposium (all dates in 2004).

Milestone Date	Description
July 15	Selection of a symposium chair
July 17	Creation of symposium web page: http://writing.eng.vt.edu/symposium.html
July 17	Announcement of call for abstracts
September 6	Abstracts due to symposium chair
September 17	Announcement of accepted talks and posters
September 24	Submission of revised abstracts
September 26	Posting of revised abstracts on the web
September 27	Help sessions for the preparation of slides and posters
October 11	Workshop for presenters to obtain feedback on slides and posters and training for symposium judges and session chairs
October 14	Symposium

Forty-two abstracts were received by the deadline on September 6. When the abstracts were received, the conference chair sorted them into three main divisions: mechanical engineering, electrical and computer engineering, and civil and environmental engineering. Each honor society involved in the symposium was responsible for judging one division of the abstracts. Pi Tau Sigma, the honorary society of mechanical engineering, judged the abstracts for the mechanical engineering division, and Chi Epsilon, the honorary society for civil engineering, judged the abstracts for civil and environmental engineering. Tau Beta Pi, whose membership spans engineers of all disciplines, judged the abstracts for electrical and computer engineering. These honor societies were responsible for reading anonymous versions of the abstracts that were initially submitted to the chair, evaluating the abstracts based on their technical merit and the quality of their writing, and then recommending which abstracts should be presented as formal presentations, which should be presented as posters, and which should not be

accepted. This year, all of the abstracts were accepted; however, on a few abstracts, significant revisions were requested. After the abstract evaluation was completed, the participants were notified of their status (presentation or poster) and provided a symposium schedule. In addition, participants were requested to revise their abstracts and submit a final version in a standard format for inclusion on a web-based program.

After the receipt of the final versions of the abstracts, the abstracts were posted in pdf format on the following web page:

http://www.writing.eng.vt.edu/symposium_program.html

This page became popular among the participants. In September, this page received 239 visits, and in October, this web page received 241 visits. After the posting of the final abstracts, one of the immediate objectives of the symposium organizers became assisting the participants with the preparation of their oral or poster presentations. The impetus for this training came from observing other undergraduate research symposiums and noticing that many undergraduates had little idea about how to present their research. In essence, our pilot symposium was regarded as an opportunity to teach communication skills to the presenters—especially since the event had a real audience, purpose, and occasion. Soon after the posting of the final abstract versions, workshops were held to teach best practices for the design of presentation slides (http://writing.eng.vt.edu/slides.html) and best practices for the design of posters (http://writing.eng.vt.edu/posters.html). In addition, the week before the symposium, the participants gathered for another workshop in which they critiqued each other's slides and posters. At the second workshop, the symposium chair also met with students from the three participating honor societies to discuss the expectations and procedures for being either a judge or session chair.

Throughout the period preceding the symposium, increasing the visibility of the event was a priority. One method used to advertise the symposium was the symposium web page, which is shown in Figure 1. The address for this web site was included in several advertising emails sent to undergraduates and faculty in the College of Engineering. As indicated, this symposium web page had a link to the page presenting the abstracts, thus allowing potential visitors the opportunity to learn more about the research projects that were to be presented.

In addition to the web site, paper programs were created once the presenters for the symposium were selected. The programs were given to faculty in several departments before the symposium as well as were provided to visitors on the day of the symposium. The final version of the program that was distributed is shown in Figure 2, and served as both a source of advertisement for the symposium as well as information to those who attended the oral and poster presentations.

2004 Virginia Tech Symposium for Undergraduate Research in Engineering

Overview

On October 14, 2004, the College of Engineering at Virginia Tech hosted a pilot symposium for undergraduate research. This symposium arose from a National Science Foundation grant to promote and foster undergraduate research [Alley, Lo, and Watford, 2004]. Participating in this symposium were undergraduate researchers either who are from Virginia Tech or who worked in laboratories at Virginia Tech. The research was performed in 2004. **For this pilot symposium, 40 abstracts were submitted.**

Kaoru Ikuma, an undergraduate researcher from Biochemistry and Biology, in the Environmental Biotechnology Laboratory of Professor Nancy Love.

Description of Symposium

This pilot symposium, which occurred on Thursday, October 14, consisted of six sessions of formal presentations and one large session for

Award Winners

Category	Name of Winner
Electrical and Computer Presentation	Michael Chorzempa
Electrical and Computer Poster	James Chung
Mechanical Presentation	Joseph Ranalli
Mechanical Poster	Tiffany Murray
Civil and Environmental Presentation	Joseph Wallenfelsz
Civil and Environmental Poster	Thomas Dickerson
Biological Presentation	Tom Blaszak

Figure 1. Web page for the pilot symposium. The web page served as an information page both for those undergraduates desiring to participate in the symposium and for faculty who had undergraduate researchers eligible to participate. After the symposium, the page served as an announcement of who the presentation and poster winners were for the different divisions.

The Pilot Symposium Event

The 2004 symposium was held on October 14, 2004, in Owens Banquet Hall on the campus of Virginia Tech. The event began promptly at 8:00 AM and continued until 3:45 PM, with the conclusion of the awards ceremony. A complete schedule of all the events at the symposium is shown in Table 3. The 2004 symposium was held in a large room that was divided into two smaller rooms in order to conduct concurrent presentation sessions. The concurrent sessions were arranged so that presenters in different divisions presented at the same time, allowing visitors a choice of research area and also facilitated judging. Shown in Figure 3 is one section of this larger room, which was set up for an oral presentation session. Over the lunch break, one of these rooms was rearranged to allow for poster displays for the afternoon poster session.

2004 Virginia Tech Symposium for
Undergraduate Research in Engineering

The 2004 pilot symposium for undergraduate research in the College of Engineering at Virginia Tech will occur on **Thursday, October 14,** in Owens Hall on the campus of Virginia Tech. The event is sponsored by the National Science Foundation, the Environmental Protection Agency, the Center for Excellence in Undergraduate Teaching (CEUT), and the following three departments: Civil and Environmental Engineering, Electrical and Computer Engineering, and Mechanical Engineering. Everyone is invited to attend.

For more information on the presentations, please visit our webpage at: **http://www.writing. eng.vt.edu/symposium_program.html.**

Presentations (Owens Hall)

Session 1: Mechanical Engineering (8:00-9:15 a.m.)
Ranalli, Joseph, Sponsor: Department of Mechanical and Nuclear Engineering, Penn State University
Keim, Kaitlin, Sponsor: NASA-Langley
Borka, Sara Pechtel, Sponsor: Mechanical Engineering Department, Virginia Tech

Session 2: Electrical and Computer Engineering (8:00-9:15 a.m.)
Anderson, Amy, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech
Markham, Penn, Sponsor: College of Engineering, Virginia Tech
Krishnamurthy, Siddhartha, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Session 3: Mechanical Engineering (9:30-10:45 a.m.)
Simmers, Eddie, Sponsor: Mechanical Engineering Department, Virginia Tech
Akinli, Cengiz, Sponsor: Virginia Space Grant Consortium
Schwartz, Kyle, Sponsor: Vibrations and Acoustics Laboratory, Virginia Tech

Session 4: Electrical and Computer Engineering (9:30-10:45 a.m.)
Somers, Marc, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech
Goodwin, James, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech
Chorzempa, Michael, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Session 5: Civil and Environmental Engineering (11:00-12:15 a.m.)
Weaver, Christopher, Sponsor: Civil and Environmental Engineering Department, Virginia Tech
Betz, Robin, Sponsor: Civil and Environmental Engineering Department, Virginia Tech
Wallenfelsz, Joseph, Sponsor: Civil and Environmental Engineering Department, Virginia Tech

Session 6: Biological Engineering (11:00-12:15 a.m.)
Ng, Tracy, Sponsor: Mechanical Engineering Department, Virginia Tech
Davis, Frances, Sponsor: Biomedical Engineering, Virginia Commonwealth University
Blaszak, Tom, Sponsor: Departments of Veterinary Medicine, Electrical and Computer Engineering, and Chemistry, Virginia Tech

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Figure 2. Program created for the symposium. This program was used both as an itinerary for visitors as well as advertisement of the symposium.

Posters (Owens Hall)

Biological Engineering (1:30-3:30 p.m.)

Ash, Joseph, Sponsor: Toshiba Stroke Research Center, State University of New York at Buffalo

Campbell, Ian, Sponsor: Department of Radiation Oncology, Wake Forest University Baptist Medical Center

Campbell, Ian, Sponsor: Mechanical Engineering, Virginia Tech

Dames, Enoch, Sponsor: National Institutes of Health

Laney, Doug, Sponsor: Los Alamos National Laboratory

Civil and Environmental Engineering (1:30-3:30 p.m.)

Dickerson, Thomas, Sponsor: Center for Geospatial Technology, Virginia Tech

Prince, Emily, Sponsor: Civil and Environmental Engineering, Virginia Tech

Ikuma, Kaoru, Sponsor: Civil and Environmental Engineering, Virginia Tech

Electrical and Computer Engineering (1:30-3:30 p.m.)

Anderson, Chris, Sponsor: Bradley Department of Electrical and Computer Engineering, Virginia Tech

Antonov, Lyudmil, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Bachetti, Edwin, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Belcher, Justin, Sponsor: Computer Science Department, Virginia Tech

Chung, James, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Henderson, Kevin, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Nkei, Bertrand, Sponsor: Oak Ridge National Laboratory, Department of Energy

Roney, Matthew, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Riabtsev, Alexei, Sponsor: Department of Electrical and Computer Engineering, Virginia Tech

Mechanical Engineering (1:30-3:30)

Beal, Colin, Sponsor: Physics Department, Virginia Tech

Chen, Rui, Sponsor: Virginia Space Grant Consortium

Muecke, Karl, Sponsor: Mechanical Engineering, Virginia Tech

Murray, Tiffany, Sponsors: Mechanical Engineering & Aerospace and Ocean Engineering, Virginia Tech

Saint Raymond, Marc, Sponsor: Mechanical Engineering Department, Virginia Tech

Simmers, Eddie, Sponsor: Mechanical Engineering Department, Virginia Tech

Awards Ceremony (Owens Hall, 3:30-3:45 p.m.)

Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

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Figure 2 (Continued).

Table 3. Schedule of events at the 2004 pilot symposium.

Time	Event
8:00–9:15 AM	Presentation Session 1: Mechanical Engineering
8:00–9:15 AM	Presentation Session 2: Electrical and Computer Engineering
9:30–10:45 AM	Presentation Session 3: Mechanical Engineering
9:30–10:45 AM	Presentation Session 4: Electrical and Computer Engineering
11:00 AM – 12:15 PM	Presentation Session 5: Civil and Environmental Engineering
11:00 AM – 12:15 PM	Presentation Session 6: Biological Engineering
12:15–1:15 PM	Symposium Presenter's Luncheon
1:30–3:30 PM	Poster Presentation Session
3:30–3:45 PM	Awards Ceremony

Figure 3. One of the two rooms in which the pilot symposium occurred.

Assessment of the Symposium

Following the symposium, we performed an assessment of the event through a survey of the participants, a recording of comments by attending faculty, and a discussion of strengths and weaknesses by the symposium chair and the symposium faculty advisor. We found that overall the symposium was successful as a pilot event, though several areas existed in which improvements could be made for subsequent events. These areas

included the event location, the room setup, the scheduling of the presentations and poster sessions, and the number of symposium chairs needed.

First, we selected a location that was physically separated from the buildings in which most engineering instruction occurs. Although this remote location was handsome and impressive, its positioning made it difficult for students and faculty to attend. For that reason, attendance at the event was not nearly as high as we had hoped (about 10 visitors for each formal presentation and about 100 visitors for the poster session). Granted, because this year's symposium was a pilot symposium, it did not have a historical precedent, which likely would have contributed to higher attendance. Nonetheless, in future symposiums, the intent will be to have the presentations occur in one of the main engineering buildings, which will increase the number of visitors as well as the visibility of the symposium.

An additional problem for the symposium arose from the set up of the room in which the poster presentations were held. Based on a setup in which the posters were grouped by division, presenters positioned near the entrance of the room received many more visitors than those in the back. The lack of visitors to posters in the back of the room was caused in part by the setup of the room containing those posters, shown in Figure 4. Both the symposium organizers as well as those who had presented posters in an exit survey noted this specific problem regarding the organization of the poster presentations.
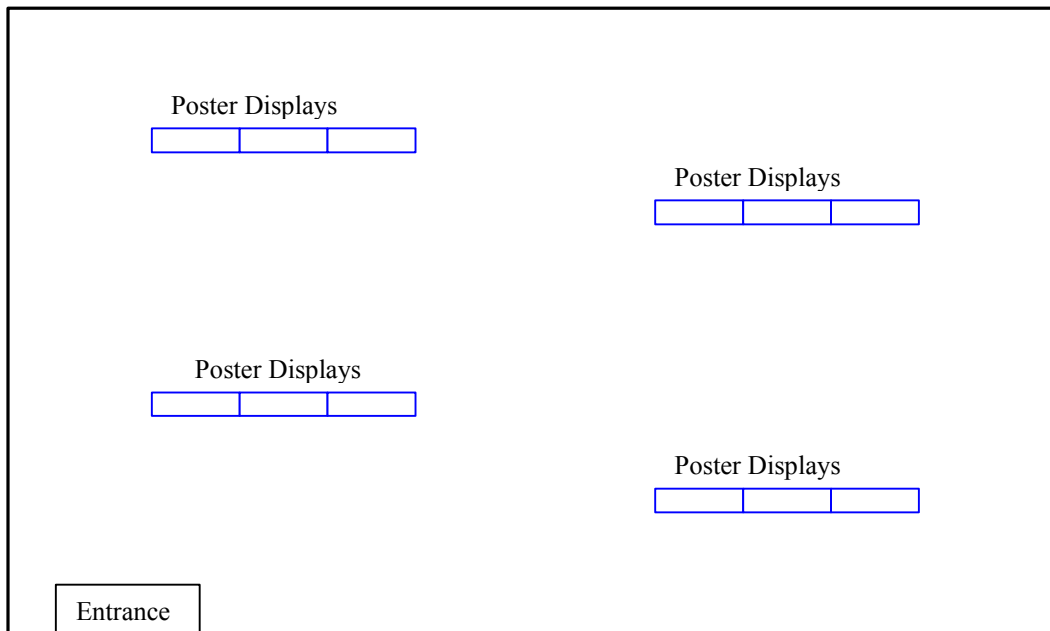
Figure 4. Schematic of the poster presentation layout at the symposium relative to the room in which the presentation occurred.

Another problem arose with the scheduling of the poster sessions and formal presentations. At our pilot symposium, the poster presentation was too long (2 hours)—this issue was noted both in the surveys and faculty comments to the symposium organizers. Another issue with the scheduling occurred with the starting time for the formal presentations (8:00 AM). The reason for this early start time was to accommodate

the large number of presenters for that day. However, several presenters and audience members noted that they were displeased with this early starting time, and we believe that significantly more students would have been present for those presentations if they began somewhat later in the day. Third, more care has to be given to the start and stop times of classes that are held on that day. Although the presentation sessions followed the class schedule times, the poster session spanned two class periods, which was a burden for several presenters.

Finally, having just one symposium chair was not enough for all the tasks that needed to be done. Even with all the volunteers from the three honorary societies, too much of a burden fell upon our symposium chair. In the future, we believe that three symposium chairs are needed, especially if our symposium expands to solicit submissions from all departments in the College. One chair is needed for the scheduling and running of the actual event, another chair is needed for the organization and management of the volunteers from the honorary societies, and a third chair is needed for solicitation, review, and web posting of the abstracts. This third chair should have enough html experience that he or she can create and maintain the symposium web pages.

Figure 5. Attendance at the poster session.

Conclusion

In its pilot year, the Virginia Tech Research Symposium for Undergraduate Research in Engineering was successful, as assessed by more than 90 percent of its participants in a survey. The successful features of our symposium are sumarized in Table 2. Perhaps the main feature was to allow undergraduates the opportunities to serve as conference chairs, session chairs, and judges. Allowing undergraduates to participate in such functions increases their experience and prepares them for service in professional research conferences. A second feature was to schedule the event far enough in advance so that the participants have the chance to prepare strong presentations and posters. A

third was to use the web to communicate information to participants and potential visitors.

To improve the symposium in subsequent years, several lessons from the 2004 symposium will be applied. A summary of these opportunities for improvement are provided in Table 2. It is hoped that the knowledge gained from this pilot symposium will be useful for others who are considering the creation of an undergraduate research symposium as well as for those who currently organize an event of this type.

Table 2. A summary of features and lessons learned from our pilot research symposium.

Features of Pilot Symposium

1. Allow undergraduates to serve as conference chairs, session chairs, and judges
2. Schedule the event far enough in advance that presenters have time to prepare strong presentations and posters
3. Use the web to communicate key information to participants and visitors
4. Use the symposium as a way to teach effective communication skills
5. Provides a means for poster presenters to print out posters

Lessons Learned from Pilot Symposium

1. Locate the event close to engineering buildings
2. Set up the poster sessions so that all posters receive equal access from visitors
3. Think hard about the scheduling of presentation and poster sessions—from both the perspective of participants and visitors
4. Have enough symposium chairs to handle the many tasks involved

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ALICIA WILLIAMS is scheduled to graduate with a B.S. in mechanical engineering from Virginia Tech in May 2005. In the fall of 2004, she served as chair for the first Undergraduate Research Symposium for the College of Engineering at Virginia Tech, which included 18 formal presentations and 23 posters. Alicia plans to attend graduate school in mechanical engineering.