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Experiences and Lessons Learned from the Formation of a New IEEE EMBS Student Chapter

Leyla Celebi[1], Lara Pickel[1], Mary Sprouse[2], Stephen A. Dyer[1], and Steve Warren[1]
[1]Department of Electrical and Computer Engineering, Kansas State University, Manhattan, KS, USA
[2]Department of Mechanical and Nuclear Engineering, Kansas State University, Manhattan, KS, USA

Abstract—**A student chapter of a professional society offers many benefits to faculty and students, as it presents a means whereby students can become engaged with a global community in their areas of training prior to graduation from their local institution. This paper addresses the experiences and lessons learned from the Fall 2005 formation of a student chapter of the IEEE Engineering in Medicine and Biology Society (EMBS) at Kansas State University (KSU). Since KSU does not currently support a formal biomedical engineering program, the overall goal of this endeavor was to establish an organization that could serve as a focal community for both ongoing and future biomedical efforts. Initial chapter activities targeted fundraising and the establishment of project teams whose goal is to design products to aid persons with disabilities. Successes include very rapid growth in numbers of participants, excitement that the students and local community express with regard to the design projects, and the broad diversity, in terms of both gender and area of study, of those participating. Lessons learned center on constitutional issues and the administration of the student design projects.**

Keywords—**EMBS, student chapter, lessons learned, design projects**

I. Introduction

The biomedical engineering community is experiencing tremendous recent growth, as evidenced by yearly increases in conference participation and memberships in professional societies such as the IEEE Engineering in Medicine and Biology Society (EMBS) [1] and the Biomedical Engineering Society (BMES) [2]. Some of this growth at the collegiate level has been spurred by research investments from, among others, the Whitaker Foundation, the National Science Foundation, and the National Institutes of Health. As of November 2005, sixty-one student chapters of the IEEE EMBS existed nationwide, involving college students of virtually all educational backgrounds [1]. The fundamental purpose of each student chapter is to present a means whereby students can become engaged with the global biomedical community prior to graduating from college. In addition, these chapters often emphasize activities, such as the "Lecture over Lunch" Series [3] and an outreach program designed to promote bioengineering among middle- and high-school students [4], that energize participants and enable them to offer clear societal benefit before they enter the workforce.

This paper addresses experiences and lessons learned from the formation of an IEEE EMBS student chapter at Kansas State University. The motivation for this effort is presented first, followed by a synopsis of startup activities and focus areas. The paper then summarizes the current state of the chapter and addresses both the successes and lessons learned from the first two semesters of activity.

II. Background and Motivation

Kansas State University (KSU), Manhattan, KS, like many of its land-grant peer institutions, offers a pre-medicine curriculum but does not incorporate a medical school (for human medicine) or a biomedical engineering program. However, it does host a College of Veterinary Medicine that is world renowned for its work with both large and small animals. Pockets of activity in biomedical engineering exist at KSU. These include a bioengineering option within Electrical Engineering (EE) that is approved by the Kansas Board of Regents, as well as research activities throughout campus that involve faculty and students from Engineering, Kinesiology, Veterinary Medicine, Gerontology, and other departments and colleges. While students who participate in these activities have support from their local departments, they have lacked access to a community of like-minded individuals with whom they can engage.

A. Motivation for Choosing IEEE EMBS

The decision to establish a relationship between KSU and EMBS was motivated by several factors:

- The IEEE EMBS is a cross-disciplinary organization that offers benefits to individuals engaged in the various areas of biomedical engineering, including cellular studies, instrumentation, and distributed information systems.
- KSU students and advisors believed that linking to an established organization, rather than creating a local *ad hoc* community, would prove more beneficial because of the IEEE publication base and the IEEE online assets. Additional benefits are as follows: opportunities for conference support, resources (such as speakers) that are made available to student chapters, and access to other IEEE societies outside of EMBS.
- Faculty who support the EMBS Annual International Conference understand the benefits that students would derive from attending such events, whether or not they present a paper.
- Because the IEEE EMBS is supported by such a wide array of institutions, the faculty advisors felt that the students would receive a rich experience in terms of speakers, internship opportunities, and content.

B. Why the Time Was Right

Any time is arguably appropriate for the initiation of an EMBS student chapter. While the KSU pre-medicine pro-

gram, the EE bioengineering option, and other research activities have been ongoing, other efforts are underway that can establish mutually beneficial ties with an EMBS student chapter.

First, on the education front, KSU College of Engineering faculty are working to establish a Secondary Major in Biological Engineering that will serve students within the college. Second, many exceptional engineering schools emphasize multi-semester design as part of a core curriculum, where interdepartmental efforts are growing in number. Discussions are underway at KSU regarding how various departments on campus might offer these opportunities to students.

On the research front, KSU has made a major effort in the last three years to define focus areas within which the university can excel. One of these thrust areas, as identified by the KSU College of Engineering, is the biosciences. As part of this overall planning effort, KSU has established a Targeted Excellence (TE) Program [5], for which investigators from various colleges are encouraged to write large, joint proposals that will spawn new projects and raise the research ranking of the university. One of these TE-funded efforts, a Center for Sensors and Sensor Systems, incorporates resources for research and educational activities from 2006 through 2009 to build upon former work in wearable health-assessment systems [6, 7]. These wearable-monitoring activities are supported by the KSU Medical Component Design Laboratory, which is managed by one of the EMBS faculty advisors. This laboratory will support the design projects mentioned later in this paper.

Finally, the job market for graduating engineers has become more competitive in recent years. While many of the graduates from the EE bioengineering program, for example, may move on to medical school or to graduate school, placement with a biomedical corporation is a relative challenge at KSU because of the limited number of biomedical companies established in this region of the Midwest. Since students in the EE bioengineering option tend to be highly capable, traditional engineering companies such as Garmin Corporation, General Dynamics, and National Instruments often hire these graduates into entry-level positions. These are strong companies, but with help from the EMBS student chapter to locate corporate speakers and arrange internships, the representation of biomedical companies that seek KSU graduates will improve.

III. Approach

A. Chapter Startup

After informally discussing the initiation of the chapter, the officers-to-be and the faculty advisors made a presentation to the Office of the Dean of the KSU College of Engineering to petition its support. This message was well received, and the Dean of Engineering approved the request to establish the chapter. Upon receipt of this approval, the officers and faculty advisors contacted individual professors in Electrical and Computer Engineering, Anatomy and Physiology, Mechanical and Nuclear Engineering, Kinesiology, and other departments to gauge their interest in participating in the organization or serving as advisors for the chapter's impending design projects. This response was highly positive and served as a good team-building exercise.

Once these advisory anchors were in place, the club provided the paperwork to the KSU Student Governing Association (SGA) to be recognized as an official organization. This required an initial constitution and set of bylaws, which were composed based upon reference material available on the EMBS web site [1]. The turnaround was immediate, and the KSU Student Chapter of the IEEE EMBS was official.

In August 2005, the appointed officers directed their efforts toward recruitment, working within their respective departments to encourage student and faculty participation. They contacted department heads for permission to visit freshmen- and sophomore-level orientation classes to present information about the new EMBS student chapter. Students in Biology, Kinesiology, and Anatomy and Physiology were approached, with a goal of creating a more diverse membership base. Additionally, the Assistant Dean of Engineering created a mass mailing that encouraged students to participate. At that point, an email listserv and a chapter web site [8] were established to provide information to interested students. This web site provides chapter information, schedules, project updates, and access to the chapter's constitution.

At the first meeting, refreshments were offered to attract other interested individuals; approximately fifty people attended. After a presentation outlining the chapter's purpose and goals, the faculty advisors fielded questions regarding membership requirements, time commitments, and the expectations for the design projects (see the following section). Applications were distributed to those interested in officer positions, and the extremely positive response resulted in all positions being filled at the completion of the following meeting. These meetings continue semimonthly.

The officers hosted the formal initiation dinner and lecture on October 29, 2005. Each participating member received a certificate, whether or not he or she had officially paid dues for IEEE or EMBS (refer to the Discussion section).

B. Design Projects

The KSU Student Chapter of the IEEE EMBS chose to focus early efforts on design projects meant to improve the quality of life for persons with disabilities for two reasons: (1) these efforts allow students and faculty to engage in activities worthy of their time, and (2) KSU has laboratory resources in place (e.g., the Medical Component Design Laboratory within Electrical and Computer Engineering) that can be utilized for these projects. The projects follow the design-project model supported by the National Science Foundation's Research to Aid Persons with Disabilities program [9]. Under this model, an assistive device is designed for a specific person, and upon completion of the project, the person receives a free copy of the prototype. During the 2005–2006 school year, the chapter opted to concentrate on the following three projects: (1) a computer mouse offering tremor compensation, (2) an easy-fold walker, and (3) a remote-controlled door opener. In seeking ideas for these initial projects, chapter members attended Parkinson's Disease and Arthritis Support Group meetings

hosted by the Manhattan Senior Center. After the meetings, it became clear that the special needs of the individuals follow themes of tremor control, balance assistance, gripping, and mobility.

These projects provide excellent opportunities for undergraduate students to engage in research and publish papers prior to graduation. Arrangements have been put into place that allow project participants to receive course credit for their work (via, e.g., a special-topics or honors-research course).

C. Fundraising

Fundraising was identified early on as an important driver for chapter success. Although initial funding allocations were received from the College of Engineering and the KSU Student Governing Association, additional discretionary funds were needed to support the design projects and the chapter's general administrative needs while faculty advisors sought grant-based opportunities. The first major fundraiser, referred to as the "Jayhawk fundraiser," took advantage of the educational diversity represented in the chapter. The University of Kansas (KU) is a traditional intrastate rival for KSU, and good-natured pranks often take advantage of that rivalry. One month prior to a KSU/KU basketball game, the chapter initiated the Jayhawk fundraiser (the Jayhawk is the KU mascot) to simultaneously raise funds and draw attention to the chapter. Chapter members created miniature Jayhawks that could be attached to a professor's door, where a note stated, "You've been HAWKED!" For US$5, the professor could have the Jayhawk removed, but for US$10, he or she could request the hawk to be placed on another professor's door. (Professors could, of course, decide not to participate.) Like migrating birds, the Jayhawks traveled the KSU campus, going as far as the offices of the Provost and the Dean of Student Life.

IV. Results

The chapter consists of approximately twenty dues-paying students and faculty (see Fig. 1). These members demonstrate outstanding gender diversity: 50% of the students are female, which is atypical for most engineering departments. Although the dues-paying members consist primarily of engineering students and faculty, the participation of non-engineering students is encouraged. Those are not required to join IEEE in order to participate in meetings and design projects, but they are asked to provide a minimal payment (US$10) to supplement the chapter's discretionary funds and assist with their individual ownership. The moderated KSU EMBS listserv supports about sixty subscribers.

Fundraising has been successful to date. In addition to seed money provided by the College of Engineering, the Student Governing Association has responded positively to requests for funds intended to support banquet speakers and group travel. The Jayhawk fundraiser and T-shirt sales have also contributed to the discretionary pool. The greatest benefit of these fundraising activities (particularly the Jayhawk fundraiser) was the exposure received by the chapter, both on campus and within the local community. The Manhattan Mercury, a local newspaper, published an article promoting the EMBS chapter and its design projects [10]. The design teams were formed in late Fall 2005; the work is ongoing (see Fig. 2).

Fig. 1 Officers, design project leaders, and faculty advisors for the KSU Student Chapter of the IEEE EMBS.


Fig. 2 Student chapter members probe the pins on a pulse oximeter board in the Medical Component Design Laboratory.

V. Discussion

The experiences of the KSU Student Chapter of the IEEE EMBS have been overwhelmingly positive during its first six months of existence. The following sections summarize early lessons learned by this chapter, both positive and otherwise.

A. General Lessons Learned

The chapter officers and faculty advisors were extremely upbeat about this organization, but the rapid rate at which students joined the group and the variety of departments (both inside and outside of Engineering) that supported the creation of this chapter were unanticipated. Support, not only by the university's administration but also by the campus at large, has been tremendous in terms of both fundraising and encouragement, leaving the officers and advisors feeling that the timing for the start of this organization was right. Furthermore, this support has been mirrored by the local community. The fundraising activities have been enjoyable for those who participated, and the number of funding sources available through the university and its student programs turned out to be greater than expected.

Generally speaking, the startup of this organization has clarified the importance of student leaders as pollinators and

organizers. Students respond to students; there is no substitute for students recruiting other students, especially when it comes to involving underclassmen in chapter activities. Whereas faculty advisors can be tempted to provide quality control for chapter activities and documents, recruitment is an area in which faculty can step back and let the students lead.

Another success was the mechanism chosen to allow non-engineering students to play a role in the organization. In early recruitment efforts, the EMBS officers described the chapter as an inclusive group that welcomes participants from all backgrounds. Some participants do not feel led to join IEEE and EMBS; the minimal participation fee still demonstrates the willingness of these persons to commit to the organization.

Finally, the gender diversity in this chapter is a surprising and encouraging success. Increased female participation relative to that typically observed for other engineering-education settings could stem from any of several factors, including the service nature of the chapter, which is strengthened by the choice of design projects for the disabled as the primary focus of the chapter.

One of the earliest lessons learned stemmed from the immediate need for student leadership to get the chapter started. Officers were assigned prior to a general vote, which was not an issue until one of the officers had to resign her commitment. In the process of replacing that person, it became apparent that the local constitution did not contain clear guidelines regarding when officer positions could be filled and what criteria had to be met to accomplish that goal. While the situation helped to reinforce the role of the faculty advisors as ombudspersons, a clearly laid-out constitution and accompanying set of bylaws would have proved beneficial.

B. Lessons Learned from the Design Projects

The design projects have been positive overall, affirming the choice of the chapter to focus on these efforts. Campus faculty and the community have responded well to requests for ideas and support. The primary lessons learned in this area relate to project activity and rate of progress. While students desire the freedom to work independently on these activities, they also must balance commitments to their education and employment. The urgencies associated with exams and course projects can inhibit the ability of the students to spend time on their EMBS design projects. Although the officers and faculty advisors have not converged upon an optimal solution to this situation, it is clear that some form of course credit and additional faculty oversight would help. Such is especially appropriate for maintaining accountability if project funds are provided by a department or a grant.

VI. Conclusion

A student chapter of the IEEE EMBS offers students a means to become engaged with the global biomedical community prior to graduating from college. This paper described the experiences and lessons learned from the creation of an IEEE EMBS student chapter at Kansas State University. The highlights of this experience include the overwhelming university support, the gender diversity displayed in the chapter membership, the response to chapter fundraising activities, and the use of design projects as a focal tool. Other lessons learned include the need to put forth a clear constitution and the need to establish incentives that encourage consistent progress on design projects.

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