

University Participation in FIRST WPI's Experience

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Abstract

WPI has entered the FIRST Competition every year since its inception and continues to strongly support the contest precisely because the philosophy is critically important to high school students in our technological society. A number of organizational models have been used in attempts to effectively involve the university community as well as corporate sponsors and high school students and faculty. Every entry resulted in a competitive robot, excellent high school team, and successful performance. The highest place finish was a second place and one honor, the Creative Design Award, was achieved. Integration of the FIRST effort into the university community, especially faculty and student involvement, has proved difficult. Many of the difficulties have been overcome so that the WPI experience may provide useful experience for other universities.

Introduction

WPI entered the first competition with a robot designed and built by research engineers from the manufacturing engineering laboratory along with students from a nearby high school. One faculty member was involved and provided overall guidance. The laboratory was a self-supporting research activity and was, therefore, more like an industrial setting than an academic one. Only two engineers and a technician were involved and only a few high school students - just enough to provide a pool of drivers - were involved. This same model was essentially utilized in the second year as well.

In the third year, WPI sought to fully utilize its project based educational program by having senior engineering students design and fabricate the robot. High school participation was expanded to include the Massachusetts Academy of Science and Mathematics, an on-campus two-year high school. A single faculty member provided leadership and high school faculty began to become involved. The robot design was divided into three portions, with an undergraduate project team responsible for each portion.

In the fourth and fifth years, only the Mass Academy students and faculty participated as the high school team. The overall project was under the direction of a faculty member and used a very compact design and fabrication team composed of a research engineer, graduate student, and an undergraduate student.

The sixth year saw much greater involvement of the high school students and faculty. They accepted all responsibility including development of strategy, team organization, travel, driver

training, etc., except design and construction but, they nevertheless, contributed in those areas as well. The engineering team was under the leadership of a faculty member with additional faculty help, and utilized a number of graduate and undergraduate students with prior FIRST experience. Academic credit was not awarded and research engineers were not involved. Fabrication was conducted in the existing campus shops by machinists and technicians along with students and alumni.

The University Environment

There are a number of reasons why universities ought to participate in FIRST and a number of impediments which have yet to be overcome. On the positive side is the fact that the robot design and fabrication is a real engineering problem and ought to provide a good design project basis. In addition, the university gains visibility, develops high school links, and builds a sense of community. The opportunities for alumni involvement, corporate support, faculty development, and student placement would seem sufficient reasons for participation by themselves. On the negative side are the facts that faculty are not especially interested, there is a timing and duration mismatch with the academic calendar, that it is difficult to structure student efforts for academic credit, that it is expensive, and that shops and other facilities are needed at just the time they are in otherwise high demand.

The timing and duration issue is very difficult to address on a college campus. Normal academic pursuits rightfully have highest priority and an activity like FIRST is, necessarily, less important in this sense. The burst-mode nature of the effort required is difficult to accommodate in the context of traditional academic activities. It can certainly be argued that students ought to have such experiences, and often do in the case of final examinations, but the reality is that neither students nor faculty can make the requisite time commitment. Being early in the second semester of most college calendars means that laboratories and shops are in demand for work needed by undergraduate and graduate students focusing on a June graduation. The commitment required by a FIRST robot is very difficult to make.

The issue of academic credit deserves serious consideration. At WPI, there is a degree requirement, the Major Qualifying Project (MQP) which would, at first glance, be suited to robot design and fabrication. This project requires that students demonstrate their ability to integrate the fundamental engineering, mathematics, and sciences into the solution of a “real-world” design activity. These projects are almost always spread over the entire senior year. While some are completed in three-quarters of a year, and very occasionally, in half of a year, it is very rare, if not impossible, to complete an MQP in a quarter of a year. WPI students have experimented with the notion of pursuing the design and fabrication in a quarter year and then completing the requisite analyses and reports in a second quarter, after the actual FIRST competitive events. However, such a sequence puts the science and mathematics after the fact and is not the best pedagogy. It may be that the FIRST design activity can form the basis for a capstone design course. However, we have no experience in such an approach as yet.

Faculty commitment is critically important to any university activity of the FIRST type. There are, of course, many other “contest” type opportunities for college students and all are similar challenges in that the fundamental components of faculty expectations - teaching, research, and

service - are not easily achieved. In general terms, such activities require at least one faculty champion and then strong support from the academic administration. Graduate students can provide excellent leadership for the effort under this structure. While student participation can be easily achieved if the activity can be offered for credit, as in a capstone design experience, it seems as if a club-type activity is a good alternative and involves many students from various backgrounds and with varying levels of ability. WPI has found that as the number of FIRST alumni grows, such association forms naturally and forms the basis for student efforts in the competition.

An important fact for universities to bear in mind is that FIRST includes thousands of high school students predisposed to science and engineering. In order to reward the enthusiasm of these students and further pique their interest, WPI offers a full-tuition, four year scholarship to one FIRST student each year. The selection strategy provides for the teams, themselves, to select the winning team and for that team to select the recipient.

Conclusions

WPI has participated in every FIRST competition and has explored a number of organizational models for to the university environment. The most serious difficulties involve the timing and duration of the FIRST competition, the academic credit/student participation issue, and the faculty involvement issue. WPI has addressed these and other issues by maximizing the community involvement, providing a means for every interested student to participate, and by providing incentives for faculty and graduate students to become involved.