TOGA PARTY - Developing a Tradition

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FIRST is a national competition intended to stimulate high school students to become interested and involved with science and technology. Each year the process begins when teams obtain boxes of components, and a description of the objectives for the competition. Once the materials are received, each team has six weeks to construct a robot which is capable of playing a sport. The components which can be used and the sport which to be played by the robot changes from year to year. In addition to building a robot, teams also compete for the Chairman's award (presented to the team judged to have best exemplified the spirit of FIRST) and an animation award.

TOGA PARTY (**T**eam **O**SU **G**randview Heights **A**merican Electric Power **P**reparing **A**nd **R**eadying **T**oday's **Y**outh) was a unique blend of abilities, personalities, and talent. Our partnership involved four engineers from American Electric Power, twenty-six high school students from Grandview Heights High School, thirteen university students from The Ohio State University, one high school and one university faculty advisor. The high school and university students had diverse backgrounds, interests, and educational objectives. High school students were all currently taking physics, but not all were interested in technology or engineering. The OSU students were from the colleges of engineering, business, and arts and science. The AEP (American Electric Power) engineers were from different divisions, and had diverse backgrounds and work experiences. This combination led to a tightly knit partnership which provided everyone with a positive learning experience. The enthusiasm, excitement and support of the community, AEP engineers, and students makes it easy to claim that TOGA PARTY is developing a tradition.

One of the unique aspects of this partnership was that each partner contributed equally to the project deliverables. Principal product teams were formed for robot design and construction, animation, and the Chairman's award. Additional teams for course construction, image building, resources, leadership, reliability, strategy, steering, and selection were also formed. Each team worked with suggestions and personnel from all three partners. Nobody had preconceived ideas which were unchangeable. Cross-team interaction was common, with design team members

volunteering their services to work on Chairman's award, and vice versa. Both high school and university students were intimately involved with engineers in designing, machining, welding, and wiring components for the robot, designing the Chairman's award, offering suggestions for the animation award, and planning open houses for both parents and community members.

FIRST provided an educational experience extending beyond that of a traditional project. From the outset, it was understood that early development of a sense of team and a rapport among partners was essential. This was orchestrated by Mr. Scott Evans, a junior in electrical engineering. Prior to receiving instructions and parts for this year's competition, Scott organized weekly meetings between the corporate engineers, high school, and university students. During these meetings, team members were randomly divided into groups, with each given a relatively simple problem to solve in a finite time. The solutions were shared with the entire group, and discussed. The groups changed from week to week, as did the level of difficulty of the problems. The three initially segregated groups congealed and unified as everyone became comfortable with their teammates and new friends. This was a subtle but essential learning experience for many of the university students. For some, it was their first encounter with a teaming effort in which building working relationships with complete strangers in a short time frame is essential to completing a task.

The involvement of university students was initially solicited via an electronic posting of the intention of OSU to participate, and a general call for volunteers. Subsequent university student involvement came through word of mouth communication between students. During our first year of involvement, the university students did not receive academic credit for working on the project. It is our intention that this situation will be rectified in subsequent years. The university as a whole has been very supportive of this project, and believes it to be an excellent venture.

For each team member, the entire project was like being a functional part of a small company. Students experienced the pressure of a project for which components of the final product had to be functional, and shipped on a specific date (no late homework is accepted, and no make-up exams are given). This was completely unlike any project they were previously associated with and added a level of difficulty they were not familiar with. Most of their previous experience was with either a white paper design or a product which could be constantly fine-tuned on a much smaller scale.

The university students were placed in a unique position as mentors to the high school students and mentorees for the engineers. As mentors, they decoded technical discussions into terms more readily understood by high school students. This lead to a heightened enthusiasm and a more

concentrated involvement on the part of the high school students. Additionally, university students were able to interact with high school students as peers, which proved to be an educational benefit for each group. High school students respected and admired the abilities of their college peers and saw just how much you could learn in college. It made some re-visit the career choice of engineering. As mentorees, the university students gained valuable experience in several critical aspects of engineering. Their interaction with practicing engineers allowed for higher level technical exchanges similar to those encountered in preliminary engineering design meetings. Ideas for component function and design had to be accurately presented and thoroughly defended before implementation. This was a valuable learning experience emulating actual engineering practice. Additional experience was gained when components failed to work as intended. At this point the common practice of building a prototype to see how it functions was overridden by engineering a solution to specific problems. The problems encountered by our team ranged from structural to electrical and each had to be addressed by applying fundamental engineering principles. Both the university and high school students were able to experience an actual engineering situation in which common sense, intuitive design, and practical concepts had to be supplemented by higher level engineering approaches.

The mentor/mentoree role of university students extended beyond the design and construction of a robot, considered by some to be the focal point of the exercise. Students also had to coordinate finances, plan open houses and public events, work with licensing agencies for rights to use logos, and many other seemingly mundane tasks. Although these tasks were not as high profile as the designing and building efforts, they were critical to a successful first year effort. The approaches taken to fulfill each activity were motivated by comments and suggestions coming from the corporate engineers who had some degree of knowledge regarding each activity. The effort itself was generally coordinated by a university student working with a group of high school students. This relationship carried through the graphic design of team logos, web pages, video tape preparation, and t-shirts. Since only four AEP engineers were involved in the project, the non-building efforts had to be coordinated by students. Although suggestions were offered when it was obvious that something was not going quite right, the Chairman's award and animation entry for the project were orchestrated primarily by students. In doing this, they each learned, and gained a level of confidence and ability which may not have surfaced otherwise.

The principal facility for fabrication of each component of the project (robot, Chairman's award, and animation) was the high school. This facility has very limited shop equipment. As a result, some of the components had to be machined and welded at remote locations. Shop facilities maintained by AEP and OSU were used for most of this work. Additionally, team members were allowed to use resources (machine shops, welding equipment, etc.) owned by relatives, and community members.

This project has built friendships and loyalties which will have lasting effects on all three partners. The national competition is two weeks away, but discussions regarding next year's efforts are already beginning. The time spent by each AEP engineer and both faculty advisors was uncompensated and after normal work hours, but each is looking forward to next year with ideas for improving the preparation of each student. The interaction between high school and university students has been unbelievable. The high school students have learned more from the university students than they could have by interacting only with the corporate engineers. One of the most important lessons they learned was that with hard work and task dedication a seemingly impossible task can be accomplished. Many of the high school students felt that this project taught them the true meaning of commitment. Until this time they felt that they had been committed to organizations and athletic teams, but never to the point of devoting all of their free time, thought, and energies to the success of a project. Additional "tools" the high school seniors have acquired from the university students, and which may prove useful in their post secondary education are; Cliff Notes can be used for reports when you are out of time; "all nighters" are a useful way to make up for procrastination.

The interaction between high school and university students has also influenced the views and possible career paths of some students. Several of the high school students have decided to attend OSU and major in engineering as a result of this project, the friendships they have established, and the desire to be a member of this team again. One student has decided to spend his first year at a junior college, transfer to OSU, and major in engineering.

Many lasting relationships and memorable experiences have resulted from this project. The role of the university student cannot be over-stressed. Without their dedication and involvement, our initial experience with FIRST may have been our last. They gave more than time and effort and gained more than experience. They helped bring an added dimension to the intention of FIRST. As a tool promoting an interest in science for high school students, FIRST has been excellent. For our team, this was seen when one of the high school students, working on a preliminary design with an AEP engineer, turned away from the chalk board, threw up his hands, opened his eyes so wide the room was illuminated, and exclaimed "... there is a use for geometry".

Any university considering involvement with FIRST should find it a very rewarding experience. Although the time commitment is enormous, and staffing is sometimes problematic, the rewards are tremendous.