A Venue for Attracting Talented High School Students into The Engineering Program: DC BEST (Denton County Boosting Engineering, Science, and Technology)

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Abstract

The description and success of a recently held local competition (organized and managed by the College of Engineering at the University of North Texas) that featured radio controlled robots constructed by local high school and middle school student teams will be described in detail. Students from local North Texas high schools and middle schools were given the opportunity to test their homemade robots that simulated bio-robots (installed inside a cell wall) used for collecting genes from ruptured DNA. This paper describes the scope of the event from the initial concept for the year's game theme, to the distribution of supplies, to the field day for testing and ending with the final game day competition. Information in regards to program initiation, funding, hardware construction, final event awards and judging, and the total success of the program will be presented in detail. A final discussion will include the anticipated educational assets in organizing a technical program described in this article, all centered on developing student interests targeted towards the engineering curricula.

Introduction

You could feel the intensity in the face of the student driver in trying to control his robot. Amidst the background noise of popular music, cheers, yells, boos, the driver could barely hear the words of his partner who was yelling “move it to the right! no! move it to the left! go up! no! go that way! no! go this way!” Those three minutes of round robotics competition must have seem like an eternity to the student drivers competing in the DC BEST robotics competition. In the background, you could hear the cheerleaders from ERA High School yelling “let's go Twinkies! let's go Twinkies!” in reference to two students from their high school who were dressed in yellow costumes in the shape of
the popular Twinkies snack. When the announcer kept announcing before every match “let’s get ready RUMBLEEEEEEEE!!, the crowd just about went wild with excitement. In an area away from the game field, more activity was going on. Teams of students were constantly using their drills and tools to try to make their robot perform better on the next match or as they said, “before they went up on deck.” Team coaches were also very serious with some of them analyzing and/or keenly observing robots from other schools to try to determine if these other robots where within the given guidelines or they needed to be disqualified. The atmosphere was fun, yet serious. Each team member there was there to win the main prize for their school. This was the scene that occurred on October 30, 2004 in the University of North Texas Coliseum as part of the DC BEST Robotics Competition, an event that attracted more than 350 participants, a crowd of about 600 people and the local media.

**What is DC BEST?**

Denton County Boosting Engineering, Science, and Technology (DC BEST) is a hub from the main BEST organization whose website is www.bestinc.org. DC BEST is a non-profit organization whose goal is to encourage high school, middle school, and homeschool students to pursue careers in engineering, science, and technology. It does this by holding an annual robotics competition where teams from local schools compete for placement in the district, state, and national championships. DC BEST gets schools involved by providing them free of charge the supplies, the game field, the environment for competition and any technical help that they may need. For 2004, DC BEST provided to the schools three events: Kick Off Day, Mall Day and Game Day. The Kick Off Day event was held on September 18, 2004 at the UNT College of Engineering Research Facility, Denton, Texas; the Mall Day event was held on October 24, 2004 at the Golden Triangle Mall, Denton, Texas; and the Game Day event was held on October 30, 2004 at the University of North Texas Coliseum, Denton, Texas. DC BEST also provided to the schools and participants liability insurance for all these events through the BEST organization. DC BEST was able to do this through sponsorship from industry and academia. For the year 2004, the University of North Texas College of Engineering was the main sponsor, and the robotics event was funded by companies such as Boeing, Peterbilt and the Labinal Corporation.

**Awards**

DC BEST gives awards for participating in the robotics competition. The Competition Award is given to the robot that scores the most points in a robotics tournament that is held on Game Day. The BEST Award is a team oriented award that also encourages creativity and it is given to the team that “best embodies the engineering concept”. To
win this award, a team has to submit a notebook, give a presentation, set a table display, enter the robotics tournament and demonstrate sportsmanship and/or spirit at Game Day. The first place and second place winners of the BEST Award and the winner of the Competition Award advance to the state level competition. For the year 2004, in the DC BEST robotics competition, Marcus High School received the Competition Award, Pilot Point High School received the first place BEST Award and Lewisville High School received the second place BEST Award.

**Game Theme**

The robotics competition starts each spring with BEST personnel deciding on the theme for the year’s competition. The theme is usually centered on a special robot named “Squeaky” who is officially the BEST robot mascot (and whose appearance changes every year) and it is supposed to represent the “son” of the BEST founder Mr. Ted Mahler, an engineer from Texas Instruments. The theme selected by BEST determines the game field and the rules of the game for the upcoming robotics competition.

For 2004, the theme of the game revolved around Squeaky becoming extremely ill resulting in his temperature rising so high that his DNA broke down into the basic DNA components called deoxyribonucleotides (a sequence of those make a gene for a physical ability or characteristic). It was said that poor Squeaky had developed BEST FEVER. So to rescue his health, biorobots were injected inside his blood vessels to sort out these DNA deoxyribonucleotides and PCR primers (DNA repairing components) from a pool of dislocated deoxyribonucleotides. Along with picking up these items, the biorobots also picked up a “hidden gene,” which was a special gene that could give Squeaky an everlasting life. Thus, based on this theme, the game was set. A donut shaped game field (made out of plywood with an inside diameter of about 12 feet and outside diameter of 16 feet which sloped about 35 degrees toward the inside) represented the blood vessel, plastic balls represented the deoxyribonucleotides, tennis balls represented the PCR primers, and an special assembly of eight plastic balls glued together represented the hidden genes. The biorobots were the robots that the students were supposed to construct. These robots were restricted to a location and would reach for the plastic balls, the tennis balls, and the hidden genes and try to put them in special locations in the playing field. Depending where they placed these items, the scoring was set.

**Prototype Day**

After the theme has been set, in the middle of the summer the BEST organization holds the Prototype Day event. This is the implementation phase of the theme. This is the time where all the hub directors observe the actual game field and some actual robots (made by the professional engineers) using the game field. This is the time where the rules are
explained and every key hub management person has a chance to ask clarification questions prior to having all the documents finalized. A few weeks later, the game field documents are given to the HUB directors so that each hub can construct the game field in the summer before school begins and can buy the needed supplies prior to the Kick Off Day.

**Kick Off Day**

After the game field has been constructed, the Kick Off Day starts about three weeks after Fall school semester starts. Kick Off Day is the day when the schools will come to pick up the supplies to construct the robot, observe the game field, and receive an explanation of the rules of the game. For 2004, Kick Off Day event for DC BEST was September 18, 2004. For this particular event, about 170 people showed up. Here, the game theme was introduced to the schools and the rules of the games were explained. The schools realized that they had a time frame of six weeks to construct a working robot. The schools picked up their supplies and some coaches took measurements of the actual game field.

On Kick Off Day, DC BEST provided free of charge to the schools the supplies needed. These supplies were of two types: returnables and consumables. The consumable lists consisted mostly of items that were found in a Home Depot store (e.g., pvc pipes, screws, pvc cement, elbows, hinges, electrical tape, metal sheets, etc.). The returnable list consisted of mostly electrical and mechanical oriented components (e.g., servos, switches, a remote controlled radio, motors, fuses, chargers, etc.). Schools had to return to the hub the items from the returnable list. They could keep whatever was left of the consumables.

**Mall Day**

Five weeks later (after the Kick Off Day), on October 24, 2004, DC BEST held Mall Day at the Golden Triangle Mall in Denton, Texas. Mall Day was a practice day where the students tested their robots and assessed their competition. This was a day where the teams were given the opportunity to polish their robots prior to the final day of the competition. Each school had approximately an hour reserved for practice on the actual game field. For DC BEST, 15 schools brought in their robots for testing in the actual game field. Tables were set up so that the teams could adjust the robot with drills and other tools. Many schools realized that they had a lot of work to do before Game Day came and they left early. Others stayed there until closing time. Mall shoppers stood on the sidelines watching with fascination the students trying to make their robots work.
Game Day

A week later (after Mall Day), DC BEST held Game Day on October 30, 2004. The robotics competition took place on this day. The setup was in a tournament fashion with rounds that lasted three minutes and each round involved four teams competing against each other. The winner of the robotics competition in this tournament advanced to the state competition which was held at Southern Methodist University on November 12, and 13, of 2004. For the year 2004, this winner was Marcus High School.

The DC BEST Schedule for Game Day is given below:

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 a</td>
<td>UNT Coliseum open for all participants</td>
</tr>
<tr>
<td>7:00 a – 8:00 a</td>
<td>Exhibit area open for setup, UNT Coliseum Concourse</td>
</tr>
<tr>
<td>7:00 a – 8:00 a</td>
<td>Team photos (as scheduled)</td>
</tr>
<tr>
<td>7:00 a – 8:00 a</td>
<td>Pit Check in, UNT Coliseum</td>
</tr>
<tr>
<td>7:30 a – 8:00 a</td>
<td>Coaches Meeting, Letterman’s Lounge (limit 2 reps per team)</td>
</tr>
<tr>
<td>8:00 a – 8:15 a</td>
<td>Drivers Meeting, Letterman’s Lounge (limit 2 reps per team)</td>
</tr>
<tr>
<td>8:00 a – 8:15 a</td>
<td>Teams assemble in stands</td>
</tr>
<tr>
<td>8:15 a</td>
<td>Commencement for Year 2004 !</td>
</tr>
<tr>
<td>8:30 a – 12:00 a</td>
<td>DC BEST Tournament begins</td>
</tr>
<tr>
<td>12:00 a – 12:45 p</td>
<td>LUNCH on your own (approximate time)</td>
</tr>
<tr>
<td>12:45 p – 1:00 p</td>
<td>Halftime Report</td>
</tr>
<tr>
<td>1:00 p – 4:00 p</td>
<td>DC BEST matches in simultaneous games, continued</td>
</tr>
<tr>
<td>4:00 p</td>
<td>DC BEST Championships</td>
</tr>
<tr>
<td>4:15 p</td>
<td>Awards Ceremony</td>
</tr>
<tr>
<td>5:00 p</td>
<td>2004 DC BEST Championship concludes. All teams remove their banners</td>
</tr>
<tr>
<td></td>
<td>ALL TEAMS RETURN PARTS ISSUED!</td>
</tr>
</tbody>
</table>

Fig. 1. 2004 DC BEST Game Day Schedule
Game Day for DC BEST was held in the UNT Coliseum and it was filled with excitement. There were cheerleaders, mascots, and students dressed in outrageous outfits to cheer on their teams. These students were trying their best to score in the sportsmanship and spirit category of the BEST Award. A D.J. provided the background music and an announcer kept the crowd entertained. The table displays that the students set up in another area in the Coliseum were extremely colorful and artistic. Many of them were set in the fashion of a tent and were decorated inside and outside with all sorts of gadgets. There were reporters filming the event and taking notes. The students were really enjoying the competition and taking it as seriously as they do with any other sport team competition. The robotics event was for them a “battle of the brains”… and the students were not going to let another rival school beat them at this game. The coaches, usually instructors, were also very serious. The referees had the jobs of not only keeping track of the scoring but also of settling conflicts. But despite all that excitement usually associated with major sport events, the major outcome of this competition was just plain fun in the name of engineering, science, and technology.

Conclusion

Most modern young people usually get excited about sport oriented events and rarely about academic oriented events. DC BEST brought in an excitement to the lives of many young people that was based strictly on engineering, science, and technology. DC BEST taught many young people not to be afraid of components that look intimidating and to create a working robot using these components. DC BEST also emphasized the concept of teamwork through its awards, competition structure, and overall atmosphere.

It is difficult to determine the success rate of motivating these young students to study engineering, science and/or technology. This is the first year that DC BEST was run by the UNT College of Engineering and that data is not available yet. We hope to see as a measure of success more DC BEST students attending the UNT College of Engineering. Once, the trend is established, then it will be easier to determine the success rate of DC BEST in terms of influencing more students to pursue careers in engineering, science, and/or technology.

An immediate measure of success for this event was the type of media coverage that it generated for DC BEST and for the UNT College of Engineering. This event received press coverage and TV coverage in a local TV station. One parent of a DC BEST student even wrote positive comments to the editor of the newspaper and urged schools to support more these types of events.
References


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Ms. Leticia H. Anaya, DC BEST Director, is a Lecturer at the University of North Texas, College of Engineering. She currently teaches courses in the Mechanical Engineering Technology curriculum and organizes events for the University of North Texas College of Engineering.

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MITTY PLUMMER
Dr. Mitty Plummer is an Associate Professor at the University of North Texas. There, he serves as Coordinator of the Nuclear Engineering Technology Program which the Department of Engineering Technology remotely delivers to the Comanche Peak Steam Electric Station. Dr. Plummer’s research interests include energy storage and recovery from cryogenic substances and distance learning technology.