JETS TEAMS Competitions Builds Future Leaders in STEM Fields

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Abstract

East Carolina University (ECU) received a National Science Foundation grant that was focused on enhancing interest in technology education possibilities for women, minorities, and underserved students in rural areas. From this grant, the Innovative Technology Experiences for Students and Teachers (ITEST) summer camp program was implemented to increase the opportunities for students and teachers to learn about, experience, and use information technologies within the context of science, technology, engineering, and mathematics (STEM) related courses.

To help sustain the efforts made during the ITEST summer camps, the students developed plans for creating an engineering club back at their high schools. Based on this understanding, through the efforts of ITEST, the University began promoting JETS clubs in the high schools that attended the ITEST summer camps and utilized the JETS TEAMS competition to engage these clubs to prepare for and compete both on a local, state, and national level.

This will paper will discuss the need for promotion and preparation needed in STEM disciplines and the use of recruiting high school students to STEM disciplines through engineering clubs and competitions. Finally, the successful STEM recruitment competition will be discussed and analyzed.

Keywords: STEM, K-12 Outreach Partnering

Introduction

East Carolina University (ECU) received a National Science Foundation grant that was focused on enhancing interest in technology education possibilities for women, minorities, and underserved students in rural areas. From this grant, the Innovative Technology Experiences for Students and Teachers (ITEST) summer camp program was implemented to increase the opportunities for students and teachers to learn about, experience, and use information technologies within the context of science, technology, engineering, and mathematics (STEM) related courses. This first ITEST three-week summer camp began in summer of 2007. This summer camp program was in direct response to the growing concerns over the shortages of technology workers in the United States and particularly in the Eastern North Carolina region (Williamson, 2006; Irving, 1999). Supported projects from the grant are intended to provide opportunities for both school-age children and for teachers to build the skills and knowledge needed to advance their study, and to function and contribute in a technologically rich society.

To help sustain the efforts made during the ITEST summer camps, the students developed plans for creating an engineering club back at their high schools. It was recognized that these types of clubs and related activities in high schools can play a significant role in furthering students' long term academic and professional interests. These engineering clubs can create a focused learning environment for students, both in and outside the classroom and also can instill a sense of pride. For example, Fredricks and Eccles (2006) have researched the correlation between the effects of student participation in high school clubs, and drug and

alcohol abuse and found that students that participated in clubs had a higher GPA and educational expectations and had the same or lower use of alcohol and marijuana use. Additionally, Papanastasiou and Bottiger (2004) researched students in junior high school and concluded that a positive relationship existed between mathematics attitudes and achievement and the participation in a mathematics club.

Bardwell, James, Lewis, McSwain, and Priscah (1999) have researched the benefits of summer institutes and science clubs to enhance the science, math, and technology skills of high school students. They found that the clubs and summer institutes foster an environment of personal and professional development through health awareness, scientific literacy, and leadership skills. This and other similar types of research clearly validate the benefits of student and teacher involvement in clubs. These clubs not only further the mission of various departments at the institutions, but also encourage both the students and the faculty to actively engage with their local community. The clubs help like-minded students who share similar goals to interact on a common platform; this in turn helps the students strive for academic excellence. The clubs also play a great role in furthering an institution's agenda of recruitment and retention through outreach and awareness amongst minorities and underrepresented students.

Based on this understanding, through the efforts of ITEST, the University began promoting JETS (Junior Engineering Technical Society) clubs in the high schools that attended the ITEST summer camps and utilized the JETS TEAMS competition to engage these clubs to prepare for and compete both on a local, state, and national level. Initially, JETS clubs were started at all the high schools that attended the summer camp in 2007 and three teams from two of the high schools attended the TEAMS competition at ECU in the spring of 2009.

STEM Fields

Since 2005, several significant reports have been released by well established corporate, scientific and academic forums focusing on the critical need improve on STEM education. Coble and Allen (2005) in their report emphasized five key strategies for improving mathematics and science education. Of particular interest was the strategic need to "promote public awareness of the importance of math and science education to the country's future" (p. 4). The Association of American Universities (AAU) report (Association of American Universities, 2006) emphasized the need to "create and sustain stronger partnerships with school districts, state departments of education, and businesses that focus on training and retraining K-12 teachers to fill the current teacher skills and knowledge gaps in STEM and foreign language education" (p. 19). So why are science and technology so critical to America's prosperity in the 21st century? The National Academy of Science report (National Academy of Sciences, 2008) points out that ever since the Industrial revolution "the growth of economies throughout the world has been driven largely by the pursuit of scientific understanding." (p. 41).

A recent Congressional Research Service report (CRS Report for Congress, 2008) presented to the U.S. Congress underscores the concern at the national level for STEM educational improvements. "There is growing concern that the United States is not preparing a sufficient number of students, teachers, and practitioners in the areas of science, technology, engineering, and mathematics (STEM)." (p. 2) The report goes on to indicate that when compared to other nations "the math and science achievement of U.S. pupils and the rate of STEM degree attainment appear inconsistent with a nation considered the world leader in scientific innovation. In a recent international assessment of 15-year-old students, the U.S. ranked 28th in math literacy and 24th in science literacy. Moreover, the U.S. ranks 20th among

all nations in the proportion of 24-year-olds who earn degrees in natural science or engineering." (p. 2).

According to the National Consortium for Specialized Secondary Schools for Mathematics, Science, and Technology (NCSSSMST, 2009) the initial impetus behind national STEM education initiatives was to develop future engineers and scientists. Early efforts focused on the implementation of specialty or magnet high schools that concentrated in the STEM fields. NCSSSMST (2009) indicates that there are currently over 100 schools specializing in mathematics, science, and technology that serve over 37,000 students nationwide. The consortium will readily admit this is nowhere near the numbers needed and additional STEM-focused programs and activities are needed to not only encourage but also support students toward pursuits in STEM career fields.

In July 2008, a coalition of 16 of the nation's leading business organizations, collectively referred to as Tapping America's Potential (TAP), released a report assessing three years' progress in working towards one 10 year goal; that of doubling the number of students currently earning bachelor's degrees in science, technology, engineering and math (STEM) fields from the 2005 level of approximately 200,000 graduates to a goal in 2015 of 400,000 graduates. The TAP report (Tapping America's Potential, 2008) titled "Gaining Momentum, Losing Ground" indicated that despite growing support for STEM-related educational programs, little real progress has been made toward achieving the in the first three years. By 2008, the number had only increased by only 12 percent in the three -year time frame to 24,000; clearly a number that was not on track to reach the 2015 goal. According to William D. Green, chairman and CEO of Accenture and chairman of Business Roundtable's Education, Innovation & Workforce Initiative (TAP Press Release, July 2008): "America's ability to innovate begins with the talent, knowledge and creative thinking of its workforce, and businesses and government must continue to work together to strengthen science and technology education" (para. 3).

Recruiting High School Students Into STEM Disciplines

By the year 2020, the first graders of today will be graduating high school with many choosing college programs in an ever-widening arena of fields and specialty areas. As educators, we are challenged to fill the workforce coffers with talent that is capable of meeting today's global challenges. Building that pool of talent demands a solid, rigorous and varied study in the fields of science, technology, engineering, and mathematics - better known as STEM. Incorporating and improving on STEM activities into our K-12 educational process is an ongoing effort that becomes more demanding as educators and various corporate recruiting efforts take that next step to compete for the career choice of each promising student.

Across the nation, there is a steep and persistent rise in STEM related job opportunities. Indications nationwide, based on recent U.S. Bureau of Labor Statistics, show that 854,000 professional information technology (IT) jobs will be added between 2006 and 2016; that is an increase of nearly 24 percent. Bureau of Labor studies indicate that 15 of the 20 fastest growing occupations require significant science or mathematics training to successfully compete for a job (BLS.gov, 2007). The bureau also estimates that 1 in 19 new jobs created during that 10-year period will be professional IT positions. However, current statistics show enrollment in undergraduate degree programs in the computer sciences field is more than 50 percent lower than what they were five years prior. Between the academic years 2005-06 and 2006-07, the number of new students declaring computer sciences as a major fell a staggering 43 percent nationwide (eSchool.com, 2009).

To help increase interest in STEM programs, several initiatives at the national-level look to recruit middle and high students into various STEM-related educational activities and programs. One of the biggest proponents in this is the National Aeronautics and Space Administration (NASA). An example is in the NASA Means Business (NMB) annual competition where undergraduates compete to develop promotional plans to encourage middle and high students to study STEM subjects (NMB, 2009).

Another effort in North Carolina is focusing on improving the availability of STEM education in the high schools. Created in 2003 by the Office of the Governor and the Education Cabinet, the North Carolina New Schools Project (NCNSP) is working to redesign 100 high schools across the state of North Carolina to ensure every student is prepared for college, a career, and life in the 21st Century. Of the 100 High Schools, 34 of these schools have taken on a specific STEM focus and 16 of the high schools have a one-to-one student to computer ratio with an emphasis on integrating technology into the curriculum (NCNSP, 2009).

JETS And TEAMS Competition

Junior Engineering Technical Society (JETS), was created over 58 years ago by a Dean Lorin Miller and Professor Harold Skamser at Michigan State University (Skamser, 2000). JETS was one of the first national organizations whose main purpose was to educate and inform high school students about the engineering field. This nonprofit educational organization promotes engineering and technology careers through academic competitions, educational activities and career guidance resources. JETS programs touch over 6,000 high schools in the United States and nearly 40,000 students and 10,000 educators. These numbers are even more impressive when you note that over half of the students are considered as traditional under-represented population and a third are female.

One of the JETS sponsored academic competitions is titled TEAMS. This event has been taking place nationally since 1978. Yoder (2009) states "TEAMS competition will provide 14,000 students in grades 9 through 12 with the opportunity to make real-world connections between math and science to engineering by solving actual engineering scenarios" (para. 2). The 2009 TEAMS competition was entitled Behind the Scenes: Theme Parks (JETS, n.d.). Students were able to learn more about the engineering that is involved with designing, building and running a theme park. The TEAMS competition gave teachers the ability to discuss the math and science applications about theme parks either in the classroom or as an extracurricular activity. JETS provides registered teams with competition scenarios for preparation and also sample questions from previous competitions with tips for answering them. TEAMS creates a fun and exciting avenue for high school students to discover what engineers are work with in a real world setting and also helps the student to connect math and science applications to these challenges.

ECU's First JETS TEAMS Competition

In efforts to not only promote engineering clubs, ECU needed to provide the opportunity for high school students to compete both at a local and national level and thus ECU decided to host its first ever TEAMS competition in the spring of 2009. JETS (n.d.) guidelines state that host sites need four to six months to plan for the event. The planning includes promotion of the event to the high schools, coordination of volunteers for the event, securing the facility to host the event, and finally fundraising.

JETS requires that you host the event within a one-month time period between February and March. ECU faculty determined the date of the event within the one-month time frame and

secured the meeting room space for it. After this was done, faculty utilized resources provided by JETS to market the event. The faculty created a public service announcement and sent invitations to all high schools involved with the ITEST summer camp. The faculty also sent e-mails and faxes to 38 superintendents and principals in the eight surrounding counties. Finally, event faculty recruited additional faculty and staff from both the Technology Systems and Engineering departments within the College of Technology and Computer Science to assist with the event.

Each team was allowed to register for the TEAMS competition through JETS website and the cost for one team was $150 and $100 for additional teams from the same high school. ECU did not add any additional registrations cost. Teams could be comprised of four to eight students ranging from high school freshman to seniors. Teams containing at least one student from the 12th grade were designated Varsity and teams with underclassman only were designated Junior Varsity teams. JETS provides all hosts with a digital interface to keep track of registered teams. JETS sends automatic emails to the coach of the team and the host when a team is registered. E-mails were sent to coaches of the registered teams when they first registered to inform them of the host site contact for the event and to answer any questions they might have. A month prior to the event, a detailed agenda was sent to all the coaches, along with travel and parking information. JETS sent all materials to the host site a week prior, which included the competition materials, answer sheets, TEAMS competition t-shirts, and student participation certificates.

The agenda was set to accommodate the two-part competition which includes various engineering scenarios. The competition was comprised of 80 multiple choice questions for part one. For part two, short answer questions related to some of the questions in part one. An hour and half is allotted for teams to complete each section. The agenda was set to have registration to begin at 8:00 am and the start of the first competition at 9:00 am. The second competition began at 1:00 pm.

To enhance the experience for the students and to provide information about careers in technology and engineering, there were four presentations that covered degrees within the College of Technology and Computer Science. These four presentations lasted only 10 minutes each and were delivered by the Chair or faculty representation from the four departments in the College: Engineering, Technology Systems, Computer Science, and Construction Management. Lunch was provided for the students, their coaches, and faculty and staff volunteers. The money used to cover this expense came from a local industry partner who wanted to support engineering and technology recruitment initiatives.

The faculty and staff volunteers supported the event in various ways. Volunteers were used to register teams and to handout welcome bags. These bags included TEAMS competition t-shirts provided free by JETS and information flyers about all the degrees from the College of Technology and Computer Science. ECU bags were donated by the student stores and provided the students with a way to carry their materials around. Staff volunteers also assisted with proctoring the competition and also grading part one of the competition; this was done during the presentation and lunch time. The results of part one were used to announce local winners; the data was also entered into the JETS website for official purposes to assist in state and national rankings. The second part of the exam was mailed to the JETS headquarters and was graded by JETS officials.

Conclusion

There were six total teams from three high schools and one independent group team that attended the competition; there were two varsity teams and four junior varsity teams. The faculty and staff participation from all four departments within the college added to the environment and gave the high school students a chance to interact with college technology faculty. JETS provided rankings by the state level. At the Varsity level in Division Five in North Carolina, teams ranked second and third, seventh out of eight teams. At the Junior Varsity level for Division Five in North Carolina, teams ranked second and third out of three teams in their division. Finally, in the one Junior Varsity Group Division was ranked first; however, there were no other teams in this Division in North Carolina. This team and the second place team in the Varsity level Division Five scored high enough to have their scores sent on to the national competition.

ECU's first ever JETS TEAMS competition was a considered a great success. However, success can only truly be measured by the opinions of the participants. A coach of one of the teams stated "The TEAMS competition gave me the opportunities to not only act as a coach, but to set the foundation to be available as a mentor to these students" (P. Lunsford, personal communication, June 16, 2009). A student from the competition stated "I had already considered a career in one of these fields, but competing in JETS gave me a better idea of what I might want to do and what it would involve" (J. Lunsford, personal communication, June 16, 2009). This quote reiterates what JETS is trying to do with these competitions -- to provide an exciting way to engage students in applying math and science applications to solve real world engineering challenges (JETS, n.d.). Finally, these types of events assist students interested in college as one of coaches stated "College admission and scholarships are competitive. The TEAMS competition gives these students the opportunity to add to their resume and show their active interest in engineering" (P. Lunsford, personal communication, June 16, 2009).

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