Do Engineering Summer Camps Increase Engineering Enrollments?

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Abstract

This paper examines the influence that an engineering, science, and math based camp has on the future academic decisions of middle school students (specifically rising eighth and ninth graders). IMAGINATION, formerly known as the Academic Enrichment Camp (AEC), is a day camp provided for the local area by Virginia Tech and the Center for the Enhancement of Engineering Diversity. This outreach to the surrounding communities by the University allows for students to participate in a week long educational experience.

The data collection procedure consists of a subjective questionnaire sent to past camp participants. Targeted cohorts were the 1995-1998 campers. There were two one week sessions each summer, each having approximately twenty to thirty participants. These cohort years were chosen based on the quality of the contact information that was available and the assumed progress of these students, most of whom should be now enrolled in an institute of higher education. Letters were sent to each student in the cohorts along with a short questionnaire concerning their current academic situation. The questions inquired about the student's current academic situation and influences of the camp on the selection of major and/or institution if applicable. Additional questions addressed what students remembered about the camp, i.e., specific activities.

The subjective feedback indicates that exposing middle school students to engineering, science, and math increases the number of students enrolling in such areas. Also presented is information regarding current technologies employed in the camp activities, A discussion of the effect of increasing use of current undergraduate engineering activities is also presented. These changes and perceived benefits are discussed in the paper.

Introduction

Between the years 1995 and 2002, Virginia Tech has seen an overall engineering enrollment increase of approximately 13.2% according to the Office of Institutional Research. Further analysis shows that there has been an increase of 30.4% in African Americans and a 23.5% increase in Hispanics enrolling in engineering during this period of time. The increase in numbers is a preferred trend, but the question remains 'what is causing this increase and how can it be continued?' At Virginia Tech, there are many incentive programs to encourage students from

middle and high school to consider engineering as a career path. IMAGINATION is one of the many programs that Virginia Tech provides to expose students to technical fields of study.

Camp History

Originally known as the Academic Enrichment Camp, this one-week day camp was run twice each summer by the College of Engineering dean's office. In 1995, the Center for the Enhancement of Engineering Diversity (formerly known as the Office of Minority Engineering Programs) assumed responsibility for camp implementation. The camp name was eventually changed to its present name, IMAGINATION.

During the summer of 2002 the camp came under new direction and was revamped. Suggestions made on post camp surveys were considered in the revision of the program. Activities considered outdated were removed and replaced with more innovative events. The following are some examples of activities that were conducted during IMAGINATION 2002:

- Chemistry Magic Show
- Animated Bridge Design
- Fire Extinguisher Training
- Egg Drop Contest
- Electric Cars
- Kodak "Take-Apart" Lab
- Bubble Powered Rockets
- Lego Mindstorms
- Roller Coasters
- Fun With Physics
- Digital Photography
- Sand Casting Lab

Many of these activities are similar to older activities, but have been updated by incorporating newer technology. Virginia Tech has a great deal to offer in the way of faculty, technology, and facilities and the effort was made to take advantage of more of the resources available. Not only did these changes make the camp more exciting for the campers, but they also exposed the participants to the many opportunities at Virginia Tech. The intent was to encourage the participants to choose Virginia Tech when they investigated institutions for post-secondary education.

In the past, campers built toothpick bridges in groups and then would compete by adding weight to their structure to see which bridge could withstand the most weight. During the IMAGINATION 2002 camp, bridge design was the topic of a workshop, but instead of toothpicks, the West Point Animated Bridge Design software was used. A faculty member began the workshop by discussing the principles of materials and structures so that campers had a very basic understanding of how and why certain materials and structural shapes are used in bridge design. Then campers were then allowed to design their bridge using the software. The competition involved comparing cost (cost is generated by the software based on the number of

hollow and solid members and by the material chosen for the members). The lowest cost bridge that sustained the specified weight in the software's animation was awarded a certificate.

Additional changes included incorporating actual laboratory exercises from the engineering curriculum that could be slightly altered for middle school students. This turned out to be very successful; the campers enjoyed these exercises and had a sense of accomplishment knowing that engineering college students perform the exact same exercises during the school year. The two exercises introduced into the IMAGINATION schedule were the Engineering Fundamentals' Kodak Take-Apart Lab exercise and the Industrial and Systems Engineering's Sand Casting Manufacturing Lab exercise.

Camper Demographics

The IMAGINATION 2002 campers came primarily from southwest Virginia; this is also true of the previous years. Thirty-nine percent of the students came from the local community (Blacksburg, Christiansburg, Pilot, Pulaski, and Pembroke); 35% came from Roanoke City schools, and 18% came from Martinsville and Henry County schools. There were also several campers from Northern Virginia and Richmond, who were visiting friends and relatives in the local area.

The demographics of the campers in IMAGINATION 2002 were as follows:

- 51% Male
- 49% Female
- 37% African American
- 59% Caucasian
- 4% Asian

The demographics of the students for IMAGINATION 2002 are also similar to past camps. It is intentional that roughly half the campers are male and the other half female. The camp also strongly recruits students from minority groups to participate in IMAGINATION.

Methods

In order to collect the information concerning the role that IMAGINATION or the earlier Academic Enrichment Camp played in forming campers' futures, a survey was developed (see Appendix A) and distributed. Prior to the current study, a similar 'Where are they now?' study was performed in the spring of 2001. In this earlier study, only 1995 and 1996 cohorts were surveyed, and of the 130 students approximately fifty percent responded. The only data accumulated during this study was where the past campers had enrolled in college and what they were studying. The current study examined not only where the past campers were enrolled, but also if they felt that the camp experience had affected their decisions in choosing a college and major.

Students from the selected cohorts attended the camp between the summer of 1995 and the

summer of 1998, most of which are now college. The survey asked questions regarding their university decision, major field of study choice, and questions about the camp in general.

Results

Of the 160 students surveyed, the first analysis occurred after 23% (37 out of 160) of the surveys were returned. There was concern that many of the addresses were no longer valid, but every survey that was returned with a forwarding address was changed in the archival contact information and the survey resent to the new address.

Approximately 27% of the respondents were still in high school. Approximately 70% are currently enrolled in college. There was only one respondent that had graduated from high school that was not attending college, accounting for the roughly 3% discrepancy.

The main focus of the study was to see how summer camps that are targeted towards middle school students influence their choices in higher education. Students were asked to indicate their current major; the results of the 26 students in college are shown in the following table:

Accounting	1
Art	1
Biology	4
BIT	1
Business Management	1
Computer Science	1
Economics	1
Engineering	6
Exercise Sports Medicine	1
Finance	1
General Science	1
Interior Design	1
MS Accounting	1
Pre-Med	1
Psychology	2
Sociology	1
Undecided	1
Total	26

Fourteen of the students are currently majoring in science or engineering. Twenty-three percent of the respondents in college (6 students) are currently enrolled in engineering; half of those students, or three, are enrolled at Virginia Tech. Engineers make up 43% of the respondents that are enrolled at Virginia Tech (7 total students are enrolled at Virginia Tech). Even though some students have not entered college and some students are not currently studying engineering, there were still a significant number of students that responded favorably when asked if the camp had a positive or negative influence on them when making a decision about pursuing an engineering or technical degree. Seventy-one percent of respondents credited the camp with having a positive

influence. Some of the comments from respondents are as follows:

Positive Comments:

- Yes, because it [engineering] was fun and very enjoyable. I learned things by being hands-on which is how I like to learn.
- Engineering/technical was very interesting from the activities we got to participate in. I would like to challenge myself in getting to know engineering a little better.
- Even though I attended a very interesting program, I found engineering was not for me. This is positive in my eyes because I found that something interesting like engineering is for a dedicated student in that field. I probably would not have been that dedicated b/c it did not interest me. P.S. - VT was my #2 choice! Go Hokies
- Even though I've always been interested in engineering-type careers, this camp was a "fun" experience with engineering and just increased my interest in the field of engineering.

Negative Comments:

- The camp was a great experience, but it didn't make me want to pursue a degree in engineering.
- I was only 11 years old; I didn't know myself well enough to choose a career.
- I was never particularly interested in engineering; I have always loved Biology.

The following comments are from students who claimed a positive influence, but who did not choose to follow a path of study in engineering:

- I became very interested in architecture and interior design from the camp.
- It helped me to understand the options I had. However, I decided I did not want to go into engineering.
- It was helpful exposure to engineering as a discipline. It helped me look in that direction (Architecture). I plan to apply to VT.

Conclusions

The focus of the camp is to introduce middle school students to engineering in a fun and exciting manner. Even if campers chose not to pursue an engineering career, the camp accomplished its goal by exposing the students to engineering at a young age.

Overall, there does appear to be a connection between the campers' experience and their decisions in higher education. Even though campers may decide against a career in engineering, they still have a working knowledge of what engineering is and the opportunities that it offers. This allows campers to return to their schools and communities and share their knowledge of and experiences with engineering. By campers sharing information, the camp's goal of exposing middle school students to engineering is continuously being met.

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APPENDIX A

Imagination/AEC Participant Survey

1. Are you currently enrolled in high school? Yes No

a. If yes, where are you currently enrolled? _____
(Please include city & state)

b. Where do you plan to attend? _____

c. What are you planning on studying? _____

2. Are you currently enrolled in a college or university? Yes No

If yes, where are you currently enrolled? _____

Major_____ Expected Graduation Date (MM/YYYY) _____

3. If you do not attend Virginia Tech, did you apply to Virginia Tech? Yes No
   a. Were you accepted to Virginia Tech? Yes No
   b. Why did you decided not to attend VT?

_____

_____

4. Do you remember participating in the Imagination/AEC summer camp? Yes No

5. Did the Imagination/AEC camp have a positive or negative influence on your decision to pursue an engineering/technical degree? Positive Negative

6. Do you think the camp influenced your decision to pursue an engineering/technical degree?
Yes No

Explain response to Q6: _____

_____

Thank you for completing this survey!