



## Initiation of Summer Camp Program as Outreach and Recruiting Tool

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# **Efficacy of Summer Camp Program as Outreach and Recruiting Tool**

## **Abstract**

For the past three summers, the Materials Science and Engineering Department at the University of Alabama at Birmingham (UAB) has hosted a summer camp program for area high school students. The weeklong, nonresidential program is open by application to rising high school juniors and seniors. The goals of the program are (1) to increase general awareness of the field of materials engineering among participants and the larger community, (2) to increase the awareness of students and parents of the specific opportunities available to study engineering at UAB, and (3) to recruit students to the materials engineering program at UAB. The paper will discuss the methods used to evaluate the efficacy of the program, as well as best practices and lessons learned since the program's inception. Since the author initiated the program during her first year as a faculty member, the use of rigorous evaluation methods has been important to justifying the time and expense of the program, as well as its value in her tenure portfolio.

## **Background and Motivation**

Outreach and recruitment efforts are an important component of the work done by university faculty. On a broad scale, recent recruiting efforts in higher education have been successful. Undergraduate enrollment in U.S. institutions increased from 14.5 million students in 1994 to 20.7 million students in 2009<sup>1</sup>. Engineering programs have likewise seen strong growth, as full time enrollment in undergraduate engineering increased by 25% between 2008 and 2012<sup>2</sup>. However, a variety of demographic and economic factors affect student enrollment in higher education, and these levels of growth are unlikely to be sustainable in the long term. However, university administrators have come to count on the tuition dollars from increasing numbers of students to offset decreases in other sources of funding, particularly state support at public institutions. Thus, recruiting efforts are likely to receive additional attention in coming years as a way to maintain enrollment trends. In addition, colleges and universities have always had a variety of other enrollment goals which can be met with targeted recruiting, such as increasing numbers of ethnic minority students, high ability students, or women in STEM fields.

Summer camps provide such an opportunity for targeted outreach and recruiting. Within the engineering field, efforts have been made to encourage student interest at all points along the pipeline. A search of the relevant literature turns up descriptions of camps for students in elementary school, middle school, and high school. There are camps that target ethnic minorities, female students, economically disadvantaged students, and high ability students. The camps may be day or residential and range in length from a single day to a week or more.

The motivation for running a summer camp specific to materials engineering at UAB includes several specific factors in addition to those listed above. The University of Alabama at Birmingham is a relatively young institution whose reputation lags behind its growth. It is competing for students against two well-known and long-established engineering programs in the state. In addition, materials science and engineering is not well known as a discipline, and a variety of efforts are underway at the local and national level to increase awareness among students and the general public of the field. The ASM International Foundation, the philanthropic arm of one of the materials professional societies, started the Materials Camp® program over a decade ago as part of this effort to spread awareness of materials engineering to high school teachers and students. Nationally, there are around twenty camps for high school students and an additional forty camps for high school teachers.

### **Camp Logistics**

For the past three summers, the author has organized a Materials Camp for rising high school juniors and seniors on the UAB campus. Initially, the camp was open to 9<sup>th</sup>, 10<sup>th</sup>, and 11<sup>th</sup> graders, but the extremely large number of applications the first year led to limiting the camp to older students who are most directly in the process of making decisions about where to attend college and what to study. The camp is primarily publicized by emailing math and science teachers at local high schools. Students apply via an online application. Participants are selected based on a personal statement about why they want to attend the camp, a teacher recommendation (also submitted online) and GPA. The applications and recommendations are all administered through a free, online survey tool (SurveyMonkey.com).

The weeklong camp runs from around 8:30 a.m. to 4:00 p.m. Monday through Thursday, and ends after lunch on Friday. It is a non-residential program, so students are responsible for their own transportation to and from campus each day. An example schedule of a camp week is shown in Appendix A. During the course of the program, participants experience a variety of tours, speakers, hands-on activities, and field trips. A large component of the week is a group project where teams of students design, build and launch a model rocket made from high-tech engineering composites. During all of these activities, camp participants are able to interact with faculty, graduate and undergraduate students, and representatives of local industry. Images of the campers in action are shown in Figures 1 and 2. Additional information about the first year of the program can be found in the 2012 paper by Genau<sup>3</sup>. A new and successful activity added to the schedule this year was a Quiz Bowl-style team competition on the last day, with questions covering all topics from the week. The campers also particularly like interacting with college students, so a group of UAB materials students are invited to lunch one day during the week, and stay for an informal panel discussion, answering questions from campers about college life, engineering studies, UAB, and a range of other topics.

The camp is offered free of charge to participating students. The program costs between \$1600 and \$1800 to run, in addition to faculty and student time and the use of supplies

from departmental research groups for demos and activities. The primary costs are t-shirts for the participants and volunteers, lunches and snacks for the participants during the week, a barbeque lunch for participants and their families on the last day, and supplies for the rockets and other activities. The ASM Foundation has historically supported one third of the cost of each Materials Camp if funds are requested a year in



Figure 1: Campers compete in a balloon skewering relay race after learning about how the molecular structure of polymers makes the feat possible.



Figure 2: Campers prepare their sand molds for casting in the university foundry.

advance. Additional funding has come from donations from the same local industrial supporters who also serve as guest speakers and field trip sites. The department has covered the remaining costs. This year, the author is working with the School of Engineering director of development to find other sources of financial support for the program.

### Assessment of the Camp

Assessing the effectiveness of any program is an important part of justifying the time and expense associated with it. The objectives of hosting a Materials Camp at UAB have been identified as the following:

- To increase general awareness of the field of materials engineering among participants and the larger community
- To increase the awareness of students and parents of the specific opportunities available to study engineering at UAB
- To recruit students to the materials engineering program at UAB

The demographics of students who applied to and participated in the camp program are listed in Table 1. The student applicants each year come from a remarkably large number of high schools that include public, private, magnet and parochial schools in addition to home schooling organizations. As the table shows, the number of different high schools each year is almost equal to the number of participants. These numbers indicate that the camp is successful at reaching students from a variety of backgrounds, and additionally increasing awareness of materials engineering and UAB among their teachers, families,



and friends. In the future, increased efforts will be made to solicit applications from students in the underserved and primarily African American schools within the city of Birmingham.

Table 1: Demographics of Camp Applicants and Participants

	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b>Applicants</b>	<b>57</b>	<b>24</b>	<b>30</b>
High schools	35	19	24
Females	33%	33%	30%
<b>Acceptances</b>	<b>30</b>	<b>19</b>	<b>24</b>
<b>Participants</b>	<b>23</b>	<b>15</b>	<b>21</b>
High Schools	20	13	20
Females	39%	20%	29%
Minorities	43%	33%	52%

The target number of participants each year is 20 to 22. In the second and third year, the number of applicants was low enough that nearly all students who completed an application were accepted. This was not a problem, since all participants have proven to be bright and enthusiastic. Female students have made up around one third of the applicants each year and slightly less of the participants, although some preference was given to female applicants, as well as rising seniors who would not have another year to apply. Race was not collected for applicants so that data is not available. The attrition rate has averaged around 19%, and includes students who declined to participate due to scheduling conflicts, students who said they were coming but did not appear, and one student who dropped out after the first day. Ethnic minority students have constituted between one third and one half of the participants, with the vast majority of these being African American. This is somewhat above the 26% percent of students enrolled in UAB who are African American, and consistent with the university’s mission of supporting diversity on campus.

No formal assessment of the program was done during the first offering, but a follow-up survey was conducted approximately one year after the camp. The questions and methodology was based loosely on the follow-up survey of campers reported by Gary Winn at West Virginia University<sup>4</sup>. Survey invitations were sent electronically to email addresses provided to campers, the survey was hosted on the same online site used for camp applications, and participation was incentivized with a drawing for an iTunes gift card. Only seven of the 23 participants responded, but those who did were enthusiastic about their participation in the program and indicated a positive effect on their interest in engineering and the University of Alabama at Birmingham.

During the second and third years, a survey was administered to the students at the beginning of the first day of camp and near the end of the last day to assess student interests and opinions. The survey contained the following questions, with a 5 point Likert scale labeled as “not at all” (1), “slightly” (2), “somewhat” (3), “quite a bit” (4) and “very much” (5). Q9 and Q10 were only included on the post-camp survey.

Q1	I am familiar with the field of materials science and engineering.
Q2	I understand the career opportunities in materials engineering.
Q3	I want to study engineering in college.
Q4	I want to study materials engineering in college.
Q5	I want to go to UAB for college.
Q6	I like to take things apart to see how they work.
Q7	I am confident in my ability to build something that works.
Q8	I understand how math and science are important in the real world.
Q9	I am glad I came to Materials Camp this week.
Q10	I would recommend Materials Camp to a friend.

The combined responses from year two and three are summarized in Table 2 and represent the opinions of 34 students who completed both surveys. Data was further broken down to compare the responses of African American students, female vs. male students, and the older vs. younger students. Once the data was combined for the two years, no significant differences were noted for African American students or between the two grade levels. Due to the relatively small sample sizes, differences noted in individual years are unlikely to be statistically significant.

Responses to Q1 and Q2 indicate that the camp is a successful way to improve student's understanding of the field of materials and the career opportunities within the field. Answers to both questions started out very low (both around 2.60) and increased 1.50 and 1.85 points respectively. In particular, the female students started out with slightly lower understanding for both questions, but reported significantly higher increases (changes of +1.88 and +2.43 for Q1 and Q2 respectively).

When asked about their desire to study engineering in college, student responses were basically unchanged. In part, this is because most students who attend the camp are already highly motivated to study engineering, with 50% reporting the highest level of commitment (5) both before and after the camp. Twenty one percent of the students expressed an increased commitment to study engineering after the camp, and four students (12%) expressed a decreased commitment. It has been noted by previous authors that decreases in commitment to study engineering may also be considered in a positive light, if the camp experience made students realize they would rather do something else<sup>5</sup>. The increased interest in engineering was reported almost exclusively by female students, and brought the female students reported interest in studying engineering to a level almost equal to the male students (Q3 female students 3.75 to 4.25 compared to male students 4.27 to 4.31).

On average, students expressed a modest increase in interest both in studying materials engineering (+0.54) and studying at UAB (+0.50) as a result of the camp. In addition, strongly positive responses to Q9 and Q10 indicated that the participants enjoyed the camp and found it a worthwhile experience. Thus, the camp has provided these students with a positive experience of both materials engineering and UAB.

As expected, male participants reported higher agreement with Q6 (I like to take things apart to see how they work.) and Q7 (I am confident in my ability to build something that works.). Pre and post camp results were nearly the same, although for logistical reasons, the post camp survey had to be administered immediately before the students attempted to launch their rockets. Since all student rockets have launched successfully, it is

Table 2. Summary of survey results

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
All Students	Pre	2.62	2.59	4.15	2.74	2.91	4.41	3.97	4.62		
	Post	4.12	4.44	4.29	3.28	3.41	4.29	4.15	4.59	4.68	4.68
	<i>Change</i>	<i>1.50</i>	<i>1.85</i>	<i>0.15</i>	<i>0.54</i>	<i>0.50</i>	<i>-0.12</i>	<i>0.18</i>	<i>-0.03</i>		
African Am Students	Pre	2.54	2.62	3.92	2.31	3.08	4.46	3.85	4.62		
	Post	4.17	4.50	3.92	3.17	3.33	4.42	4.17	4.50	4.33	4.42
	<i>Change</i>	<i>1.63</i>	<i>1.88</i>	<i>-0.01</i>	<i>0.86</i>	<i>0.26</i>	<i>-0.04</i>	<i>0.32</i>	<i>-0.12</i>		
Female Students	Pre	2.50	2.38	3.75	2.38	3.13	3.88	3.63	4.63		
	Post	4.38	4.50	4.25	3.06	3.25	3.50	3.88	4.63	4.63	4.75
	<i>Change</i>	<i>1.88</i>	<i>2.13</i>	<i>0.50</i>	<i>0.69</i>	<i>0.13</i>	<i>-0.38</i>	<i>0.25</i>	<i>0.00</i>		
Male Students	Pre	2.65	2.65	4.27	2.85	2.85	4.58	4.08	4.62		
	Post	4.04	4.42	4.31	3.35	3.46	4.54	4.23	4.58	4.69	4.65
	<i>Change</i>	<i>1.38</i>	<i>1.77</i>	<i>0.04</i>	<i>0.50</i>	<i>0.62</i>	<i>-0.04</i>	<i>0.15</i>	<i>-0.04</i>		
Rising 11th graders	Pre	2.78	2.67	4.39	2.78	3.06	4.33	4.06	4.72		
	Post	4.28	4.44	4.22	3.47	3.61	4.28	4.17	4.67	4.72	4.67
	<i>Change</i>	<i>1.50</i>	<i>1.78</i>	<i>-0.17</i>	<i>0.69</i>	<i>0.56</i>	<i>-0.06</i>	<i>0.11</i>	<i>-0.06</i>		
Rising 12th graders	Pre	2.44	2.50	3.88	2.69	2.75	4.50	3.88	4.50		
	Post	3.94	4.44	4.38	3.06	3.19	4.31	4.13	4.50	4.63	4.69
	<i>Change</i>	<i>1.50</i>	<i>1.94</i>	<i>0.50</i>	<i>0.38</i>	<i>0.44</i>	<i>-0.19</i>	<i>0.25</i>	<i>0.00</i>		

expected that students would answer Q7 more positively if the survey could be given later in the day. Students reported a level of understanding of the importance of math and science in the real world which was initially high and did not change.

After two years of data collection, ways to improve the usefulness of the pre and post camp surveys are being considered. For example, Q8 will likely be removed. Q6 may also be removed, as the camp does not currently provide students with an opportunity to take anything apart. In addition, it may be more informative to use more directed questions, such as Chen et al used in their assessment of the EPIC program at Cal Poly<sup>5</sup>. For example, instead of a Likert scale, they asked camp participants, “How committed are you to studying engineering. Please choose the statement that best fits you.”

- I plan to study engineering in college.
- I’m considering engineering but am also considering other majors for college.
- I’m not sure what I want to study.
- I don’t plan to major in engineering.
- I don’t plan to go to college.



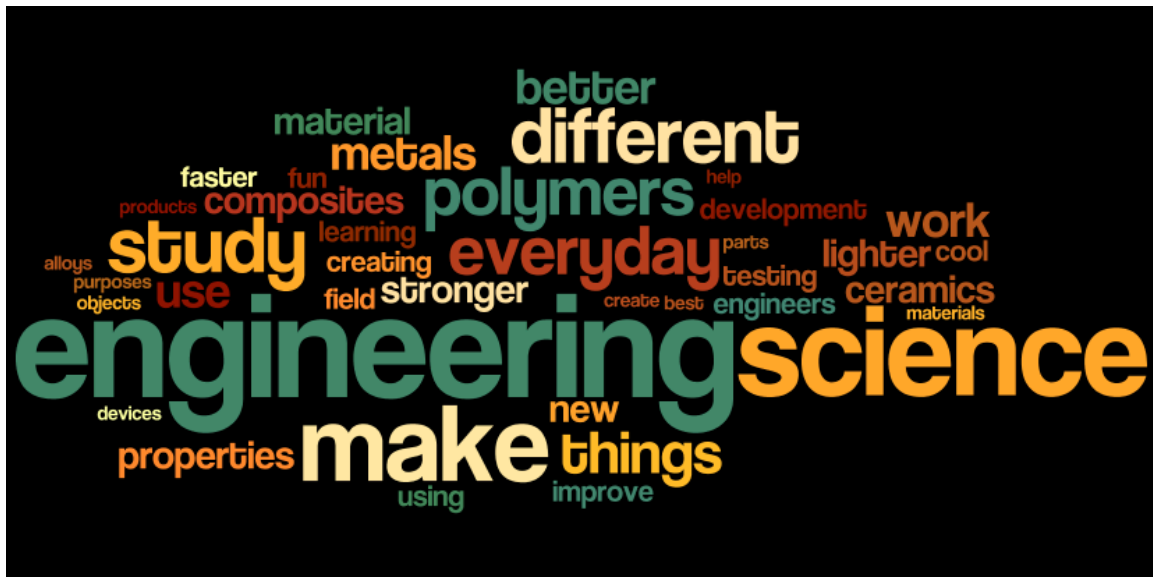


Figure 4: Post-camp Word Cloud

### **Efficacy of Camp toward Outreach and Recruiting Goals**

The surveys indicate that the Materials Camp program is successful in meeting the first two goals of increasing awareness of the field of materials engineering and the opportunities to study engineering at UAB among participants. It is more difficult to assess the impact of the camp on the awareness of the larger community, however there are several encouraging factors. First, virtually all of the participants left excited and enthusiastic about the program. It is expected that they will share their excitement and new knowledge with family, friends and teachers in their many communities and schools. Second, the large family turnout for the rocket launch on the last day provides a direct chance for parents, siblings and other family members to have a positive experience with the UAB campus and engineering program. Third, each year the rocket launch has attracted local media attention, with coverage by several local new stations and the newspaper. Figure 5 shows the students watching a rocket launch while being photographed for the newspaper. The university's internal media service has also covered the camp. This is an important chance to increase community visibility of the engineering program at UAB.

The third goal of the camp is to recruit students to the engineering program at UAB and specifically to the materials engineering program. Of the twenty-two participants from the first year of camp who are out of high school, eleven are attending UAB. Four are in the engineering program, and one has specified pre-materials. One additional student is finishing two years at a community college with the intention of transferring to the materials department at UAB next year. Of the six students from the second year of camp who have finished high school, four are attending UAB. Three of those are in the engineering program, and one has specified pre-materials. In general, the number of freshmen who arrive at UAB with a declared interest in materials engineering has

increased from historically near zero to eight during the last school year. Materials Camp is one of a number of outreach efforts by the department which are likely responsible for this change.



Figure 5: Students launching the model rockets that they designed and built during camp.

### **Impact of Organizing Camp Program as Assistant Professor**

For assistant professors on the tenure track, balancing research, teaching and service commitments is an ongoing challenge. Organizing and running a program like Materials Camp falls in the service category, which is generally considered the least important area for tenure and promotion decisions. Any camp program requires a significant amount of time and effort from the organizing faculty member(s), and will inevitably decrease the amount of time available for proposal and paper writing, research activity, and course preparation.

Feedback from several UAB faculty members in administrative positions with P&T committee experience was collected informally, regarding their impressions of the Materials Camp program, and its potential impact on the author's career advancement. In general, the program is seen as a very important outreach and education activity. The initial offering of the camp was not the idea of the author, but met a long-standing need within the department. Specifically, the materials engineering department's Industrial Advisory Committee had been requesting that such a camp be organized for many years, but no previous faculty member had been willing to take it on. The camp has thus been seen in a very positive light by the department's industrial supporters. In addition, the camp activity is likely to be considered positively on an NSF CAREER proposal by showing existing work in the "broader impacts" area, which CAREER funding could leverage into a wider scope.

All of the administrators surveyed did note the importance of not allowing the program to take up too much time. Service activities such as this are often seen as "checking a box"

on the tenure and promotion forms; one the box has been checked, additional effort in the area is a detriment. Thus, the camp becomes a time management issue. One administrator stressed the importance of asking for help with various aspects of the project, and saying “no” to additional service commitments. The value of outreach programs like Materials Camp to a T&P committee can be greatly increased by bringing in significant extramural funding for the effort. Development of pedagogical approaches, new teaching methods, and a consistent record of publications in educational journals are also valued.

It is important to note that UAB is classified as a “very high research activity” (formerly Research I) university, so there is a high priority on externally funded research activity and scholarly publication. An informal rule of thumb was mentioned that educational work should not make up more than 25% of a research portfolio. However, even in this environment, the author was never told that the Materials Camp program was not worthwhile, or should be dropped. As one administrator commented, “The beauty of academia is the freedom to choose what we do.” Significant outreach activities can be a valuable part of an early career faculty member’s effort, even at large research universities, when undertaken in a thoughtful and balanced way.

## **Conclusions**

Over the three summer offerings, Materials Camp at has been successful at introducing a diverse group of highly engaged and motivated student participants to the field of materials science and engineering, and providing them with a positive experience at the University of Alabama at Birmingham. Around half of those participants who have since graduated from high school have enrolled at UAB, with around half of those enrolled joining the School of Engineering. In addition, the camp has provided positive publicity for the engineering program at the university, opportunities for current UAB students to take leadership roles in organizing and running the camp, and opportunities to strengthen ties between the department and local industry. The outreach program will constitute an important part of the author’s promotion and tenure package, and is valued by her administration.

## **References**

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## Appendix A: Materials Camp Example Schedule

<b>Monday, July 8</b>							
8:00-8:30	Registration/Donuts						
8:30-9:30	Welcome/What is MSE?						
9:30-11:00	Engineering Communication Exercise (Tinker Toys)						
11:00-11:45	Guest speaker from local industry						
12:00-12:30	Lunch: Pizza						
12:30-1:30	Intro to Composites and Rockets						
1:30-4:00	Rocket planning in groups						
<b>Tuesday, July 9</b>							
8:30-10:30	Make composites parts for rockets						
10:30-11:30	Lab Activities: Fun with Polymers or Charpy Testing						
11:30-12:00	Scanning Electron Microscope						
12:00-12:30	Lunch: Subway sandwiches						
1:00-3:00	Field trip to local steel mill						
3:00-4:00	Activities Switch: Polymers or Charpy Testing						
<b>Wednesday, July 10</b>							
8:30-10:45	Assemble rockets						
10:45-11:00	Snack						
11:00-12:00	Guest speaker from local industry						
12:00-12:30	Lunch: Chicken Strips						
12:30-2:00	Solidification Demos (3 rotations with grad students)						
2:00-3:00	Polymers and Recycling (lecture and activities)						
3:00-4:00	VisCube: 3D immersive reality lab						
<b>Thursday, July 11</b>							
8:30-9:30	Decorate rockets						
9:30-9:50	Ballon skewer relay						
10:00-11:30	Campus tour						
11:30-12:30	Lunch / Panel with current MSE						
12:30-1:30	Foundry in a Box presentation and demos						
1:45-2:45	Foundry lab tour, iron casting activity						
2:45-3:55	Composites production lab tour						
<b>Friday, July 12</b>							
8:30-9:30	Polymers, cont.						
9:30-10:30	Quiz Bowl!						
10:45-11:30	Athletic field: prep rockets, test launches						
11:30-12:00	"Grand Finale" launch for family and friends						
12:00-1:00	BBQ Lunch and Recognition						