The “Black Butterfly” effect.

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Abstract

The main focus of the camp was to stimulate an interest in advance manufacturing, 3 D printing, and STEM disciplines for young minority children. The CAM (Consortium of Advanced Manufacturing) workshop was mainly run by councilors, who are STEM students from Howard and other Universities. They were taught how to use the NX10 software initially for one week. The next week high school interns were brought in and taught how to use the NX software by the college councilors. This reinforces what the councilors have learned and gives them time to interact with the interns before the actual workshop.
There were fifteen to twenty participants with ages ranging from ten to sixteen. The councilors and the interns conducted the workshop by teaching them the use of NX10 software to create 3D models and the use of 3D printers. A good amount of time was spent on explaining the advantages of STEM disciplines.

Overview of the Project

There were two camps. In both camps, at the beginning each participant took an online survey to express their age, gender, skills, interest in STEM discipline, and motivation for attending. The councilors and the interns carried out the camp by teaching them the use of NX 10 software to create 3D models and the use of 3D printers. A good amount of time was spent on explaining the advantages of STEM disciplines as well. At the end of the camps, the participants were asked to complete a post survey and a project. The end goal of this project was to make a working prototype to be used to solve a common problem in life.

The second camp took place right after the first and it was attended by new participants and a few returning participants. Due to this, the participants were separated into a beginner group and an advanced group.

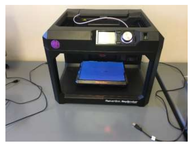
C.A.M Campers Presenting Final Projects, Howard University

Orthographic Views & Clay Modeling

On the first day, the participants learned about orthographic projections. At the end of the first day, participants were given clay to model objects. This allowed the interns and counselors to see the interests and aptitude of the students. As well as allowed the students to sculpt objects that will be 3D printed later on. Then on the next day the participants started learning the software and started 3D printing. This is the format for both camps. In the second camp while the beginners learned about orthographic projection, the advanced group was trained in the use of NX10 software to model. This allowed the beginners to interact with the advanced students and learn new concepts.

What is the Consortium for Advanced Manufacturing?

The CAM program began in 2013 at Howard University. It started off as a one-week program and after assessing time constraints became a two-week program. This program included students from fifth to tenth grades. Its main focus was additive manufacturing and 3D printing. The printers used in the camps were the Makerbot replicator and the Afinia H480 3D Printer. This program aids the growing need of majors in STEM fields, exposes new interest to beginners, and shows how diverse the use of the software and machine in other fields.



Camp 1 & Camp 2

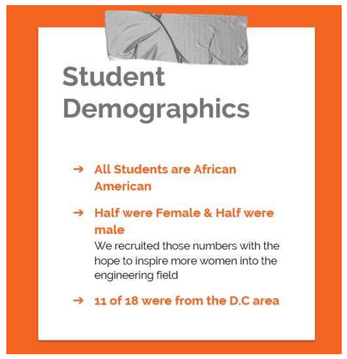
Camp 1: Consisted of new participants. All of them learned to design modeling using NX10 software and printing their design using 3D printers. The participants were being constantly observed during camp activities by the councilors and interns. This camp helped future activities, projects, and group work flow more efficiently.

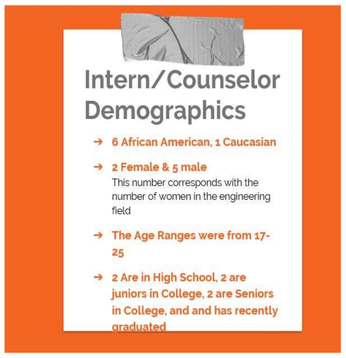
Camp 2: Consisted of new and returning participants. The participants were separated into a beginner and an advanced group. To make the camp exciting for everyone, we didn’t make the advanced campers re-do activities. Instead they were trained to work on new and advanced activities. In this way, the advanced campers had something new to learn.

Center for Advanced Manufacturing Objectives

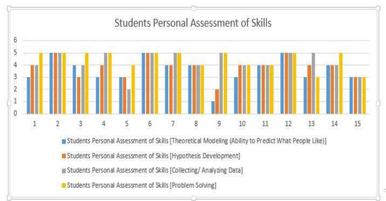
- To design and develop products for the market
- To raise awareness of additive and subtractive manufacturing
- To enhance analytical and research skills
- To aid personal growth, research productivity, entrepreneurship skills, brainstorming skills, and enhance goals
- To enhance problem solving skills, hypothesis development, data collection skills, and theoretical modelling skills.
- To provide opportunities for meaningful interaction with faculty and students from their universities and programs

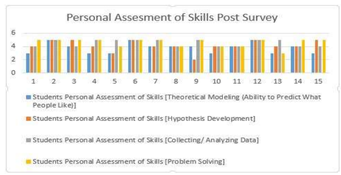
Demographics & Pre-Survey

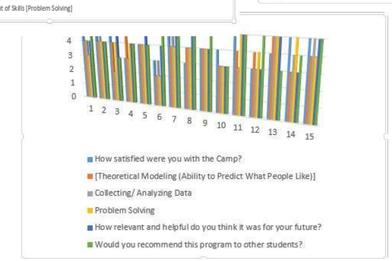




Survey Results







Above are the Pre and post surveys of the C.A.M Camps

The two most influential things to the participants were the personal growth and the contribution of this workshop to their resume. Also the participants had the strongest confidence in their problem-solving abilities (increased from 4.2 to 4.6 on a scale of 5.0) and an increased interest in STEM. They also showed an interest (4.27/5.0) in coming back to the workshop the next year and also in influencing others to come. Overall satisfaction rating was 4.53 out of 5.0.

Continued / Future Research

Questions to Ponder:

1. Will the students want to return and bring other minorities to the program? (Reliability)
2. How do girls/boys think when it comes to S.T.E.M Futures?
3. How many students would like to see programs like this in their cities?
4. How would this affect S.T.E.M retention in college minority freshman?
5. How will having more children familiar with 3D printed parts impact the market for 3D printers?

References

Schaefer, Malinda, et al. “A Collaborative Process for K-12 Engineering Curriculum Development.”*Integrated Teaching and Learning Program College of Engineering and Applied Science*, Session, 2530, pp.1–12.

Hashim, Roslan & Mohd Din, Sr Mokhtar Azizi. (2009). Implementing Outcome Based Education Using Project Based Learning at University Malaya. European Journal of Scientific Research ISSN. 26. 1450-216.

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