The Invention Bootcamp, a Four-Week Summer Course For High School Underrepresented Students in a University Setting

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Abstract

The Invention Bootcamp is a four-week interdisciplinary program where twenty-five high school students underrepresented in STEM (Science, Technology, Engineering and Math) are invited to discover and experience the worlds of engineering, innovation, and entrepreneurship in a college setting. The course creates, deploys and tests in the field a new educational approach to inspire future inventors. In addition to teaching STEM skills in a hands-on and collaborative manner, the course presents high school students with role models in the form of undergraduate mentors, instructors, researchers, and guest speakers in class and during field trips. The course thus helps empower them, helps them gain confidence in the classroom, but also experience a foretaste of being a college student. By the end of the pilot course in Summer 2016, we asked students if they felt they could be engineers or inventors in the future. A strong majority (91%) agreed they could. Several aspects of the bootcamp are unique, and we would like to share the key learnings. They include: 1) The application process, which was based on non-cognitive variables. No grades were required. Applicants needed to deliver a 2-min video showing their motivation and how they would improve their school cafeteria. Students needed to have a curiosity towards STEM fields and the invention process. A recommendation letter was also needed. 2) The population targeted, which is underrepresented students in STEM such as minorities, women, and low income students. 3) The hiring and training of eight undergraduate mentors and a mentor coordinator. We had one mentor per group of three high school students. The mentor program created a supportive environment to provide students with the emotional, academic and technical support they needed to be successful in this course. By offering close, near-peer support, we enhanced student learning, classroom effectiveness, and retention of students. The majority of mentors was in the classroom with students for the entire program. They all are engineering students with a strong engineering background, and a good attitude under stress and in groups. 5) The hands-on curriculum, that meshed engineering tools (soldering iron, milling machine, hand tools, laser cutter, 3D printer), visit of guest lecturers (local entrepreneurs and innovators), and work on group projects using a human-center design thinking approach.

Introduction

Early exposure to STEM initiatives increases students' interest in STEM content and STEM career fields[1,2]. Additionally, science classes in middle schools and high schools would benefit from focusing on developing critical thinking, problem solving, and open inquiries instead of learning content information[1]. But students can get exposure outside of science classes. Our focus has been on increasing STEM exposure through an extra-curricular STEM program.

There are a variety of extra-curricular STEM programs throughout the United States for high school students. Some are during the school year, others are during the summer with a majority lasting one week long. ChickTech: High School[2] is a series of hands-on workshops that last one year and is for one hundred young women in every city the program is offered. Throughout the camp, students have the opportunity to gain hands-on experience with robotics, programming, and building computers. Additionally, they have the opportunity to build relationships with mentors and create networking opportunities. ChickTech and Invention Bootcamp share some similarities – including emphasis on hands-on projects and building relationships with mentors. Both programs also incorporate small personal projects that the students get to work on. In addition to small personal projects, Invention Bootcamp also incorporates a large project (one per groups of three students) that lasts the duration of the four-weeks program and allows the discovery of the invention process.

Oregon offers a variety of STEM or invention programs and competitions. They range from a one week summer program such as S.E.S.E.Y (Summer Experience in Science and Engineering for Youth)[3], to a list of classes and camps such as in Saturday Academy[4] where programs can be offered at different times, such as evenings, weekends, and summer vacation. Oregon also hosts STEM competitions and challenges such as OGPC (Oregon Game Project Challenge)[5] around computer games.

More broadly, many other programs offer one- or two-weeks summer camps for high schoolers, such as The Samuel Ginn College of Engineering at Auburn University[6] in Alabama, Alexa Cafe[7] across the United States, the WONDER Women Academy and the BATMEN Academy from Mississippi State University[8], the S.P.I.C.E. Camp[9] from University of Maryland-College Park, The Colorado School of Mines' K-12 Outreach program[10], or the Pre-Engineering Program to Stimulate Interest in Engineering (P.E.P.S.I.E.) from the College of Engineering at Tennessee State University[11]. Longer camps exist but are not as common. One example is the Launch Summer[12] program, from MIT, which is a four-week summer program for high school students to enhance their entrepreneurship skills and launch a real startup.

Each of these programs and challenges focus on hands-on activities, building critical thinking and problem solving skills, provide an introduction to entrepreneurship, as well as build their confidence in themselves and their abilities. Some programs are open to everyone, while others are aimed at those who are underrepresented in STEM. The Invention Bootcamp is similar to these programs due to the interdisciplinary nature of the program and with the encouragement and focus on hands-on projects and learning. While some workshops and programs focus solely on individual projects and other workshops focus on larger group projects, Invention Bootcamp incorporates both small individual projects, as well as group projects. The small individual projects allow students to gain familiarity with engineering tools. The group project teaches the students to go through the invention process, in an atmosphere of trust where they use what they have learned and bring their own background, motivation and creativity to the group. Although focusing intensively in engineering tools, it also brings a strong emphasis on the invention process, entrepreneurship and innovation.

High-school participants: Recruitment, application and selection processes

As students are not likely to become engaged through traditional means such as phone calls, mailings or a flyer, our team approached recruitment with a "boots on the ground" method. A one-hour recruitment project was tested and implemented, using focus groups and experimenting sessions. Seven local high schools were selected as schools with a high percentage of underrepresented minorities (URM) and low income students. Eleven ambassadors who are engineering undergraduate students were trained. At each school, a team of two ambassadors would visit a required science class period, presenting the Bootcamp, and typically going through a one-hour design process project where student groups would create a mock-up based on a common theme and would then present it to the class. Students showed great enthusiasm. While raising student interest through this hands-on activities engagement, recruiters were able to dialogue directly with interested students about the project and its expectations. Ambassadors accessed and worked in 39 different classes, reaching out to more than 1000 students. A resulting number of approximately 250 students expressed interest in being part of an informative email list. In addition to working with students directly, we also reached out to teachers from other local high schools, and other programs.

As this Invention Bootcamp is challenging, an admission process, through an equity lens, was established to select a core group of students who were curious and committed to completing the course. In order to be selected, students needed not have perfect exam scores. Grades were not required and selection was based on non-cognitive variables. The main qualities sought were good academic behavior and a curiosity towards STEM fields and the invention process. The admission process consisted of three parts: an application form containing basic student information, a recommendation form to be filled out by a teacher, and a short video that highlights the student's commitment as well as share an invention they might create. Forty-one students applied, and twenty-four were selected. Students from underserved populations were well represented. Of the 24 students who completed the final survey, 7 students (32 percent) identified as female, 14 students (64 percent) identified as male, one student (4 percent) identified as having a non-binary gender, and one student declined to respond. Approximately a third identified themselves as belonging to racial or ethnic groups traditionally underrepresented in science, technology, engineering and mathematics (STEM) fields (Table 1).

Table 1: More than half of survey respondents were from underrepresented groups in STEM

	N	Percent
White	12	52%
Latino/Hispanic*	5	22%
Asian	3	13%
Alaskan Native/Native American*	1	4%
Black/African American*	1	4%
Multiracial*	1	4%

* Underrepresented ethnic or racial groups in the STEM fields

Thirty-nine percent of participating students were entering grade 10, 35 percent were entering grade 11, 22 percent were entering grade 12, and one student (4 percent) had just graduated from high school.

The greatest number of students (48 percent) reported hearing about Invention Bootcamp from a teacher, followed by 26 percent who heard about it from a parent or caregiver, and 17 percent from the Invention Bootcamp website. Only one student (4 percent) was recruited directly from the program's targeted recruitment visits to schools. Thirty-five percent of students also reported that they heard about Invention Bootcamp from other sources. As a result from this pilot year, recruitment effort for the Invention Bootcamp 2017 cohort has focused more intensively on website development and outreach to teachers, and less on class outreach.

Mentoring program

The Invention Bootcamp Mentor Program created a supportive environment to provide students with the emotional, academic and technical support they needed to be successful in this course. As we looked to build an effective support mechanism, a rigorous training and supervision program were critical to ensure the effectiveness of the mentors. Eight undergraduate mentors were hired. Qualifications included having a good knowledge in engineering tools used during the camp (soldering, Arduino programming, milling machine, 3D printing), being calm and show respect under pressure, altruistic, and interested in education and helping others. A mentor coordinator was also hired. All mentors were trained during a two-full-day workshop. The workshop included training on cultural competencies and effective mentoring practices as well as reinforcing the technical engineering and design process foundations. By the end of this training, the mentors formed a tight group where each individual felt comfortable showing weaknesses and asking for help to other mentors. This step was crucial as to lead by example during the bootcamp.

During the course, mentors provided support as needed by the group of students or individuals from the group. Mentors participated in bi-daily meetings (morning mentor preparation, and end of day debrief) during the course session to gather real-time information about students and work to address student concerns or modify the course direction. By offering close, near-peer support, we enhanced student learning, classroom effectiveness, and retention of students.

Findings from a survey halfway through the program indicated that most students felt well-supported by the adults in the program and confident that they knew what they needed to do to succeed in the program.

In the final survey, all students agreed, and most strongly agreed, that their work during Invention Bootcamp was supported from help by mentors (83 percent strongly agreeing) and instructor (78 percent strongly agreeing, Figure 1). Furthermore, teamwork was emphasized throughout the camp not only with mentors, but also with students. Nearly all students agreed or strongly agreed that they were helped by their other group members, and only one student (4 percent) disagreed, and reported that he or she was not helped by peers.

Similarly, nearly all students (96 percent) agreed or strongly agreed they had tried to help their peers, that they had listened to other group members' ideas and that their peers had listened to their ideas. Two students, however, disagreed that they had worked well with the other members of their group (Figure 2).

We administered a brief survey to the eight mentors. All mentors (100 percent) said they would probably or definitely recommend being a mentor for Invention Bootcamp to a friend, and all but one (87 percent) said that they would probably or definitely consider returning to Invention Bootcamp as a mentor again, if offered. Half of mentors (50 percent) indicated that they did or planned to spend time socializing with other mentors or contacting the professionals they met during Invention Bootcamp about opportunities for jobs, internships or collaborations.

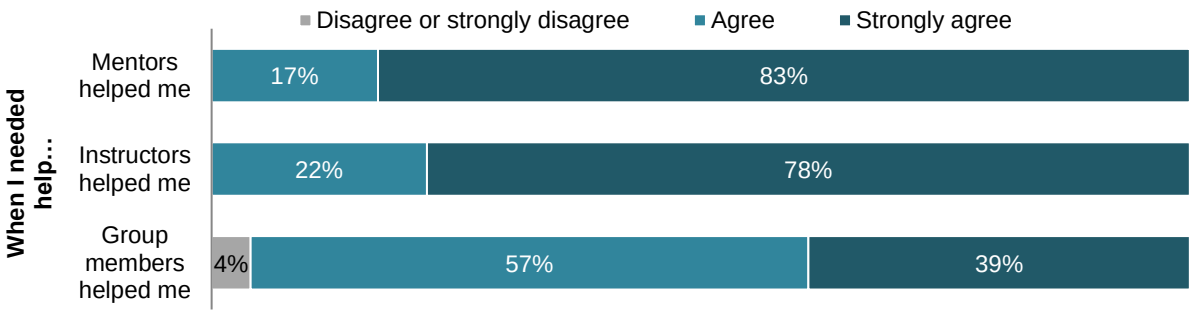

Figure 1: Students perceived available help from mentors, instructors and group members

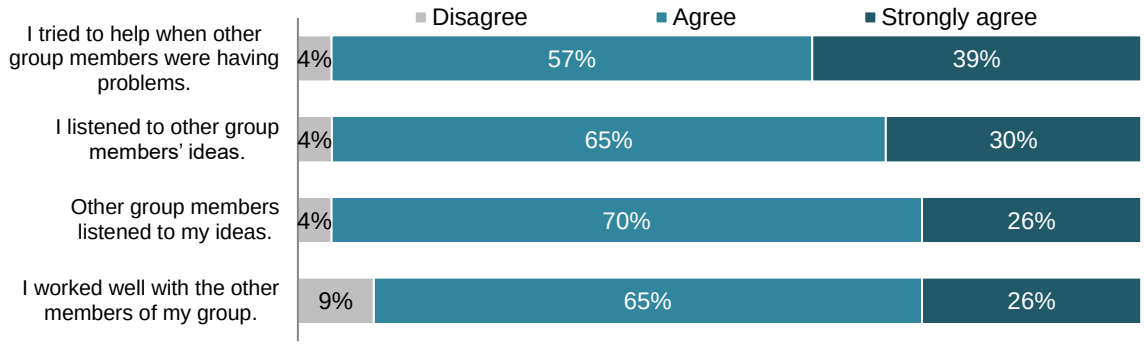

Figure 2: Students perceived support from group members

Curriculum

The agenda of the Invention Bootcamp 2016 is shown in Figure 3. The curriculum strongly emphasizes on design process and basic engineering knowledge and practice. A six-part Arduino workshop program created by Sparkfun and previously tested and used in K-12 educators or students workshops was integrate into the curriculum. In addition to learning and experimenting with microcontrollers, students also learned how to use a soldering iron, a milling machine, and engineering software such as the 2D and 3D modeling software, OnShape. They were able to use this modeling software to create parts using a laser cutter and a 3D printer. At the end of each of these engineering tool modules, students completed an individual project, which they brought home, for a total of four individual projects.

Students were also introduced to the engineering design process. Student groups were therefore able to use a structured approach to create their own devices during the camp. For the pilot course, the theme for group projects was "Rain in Oregon". This theme had to meet a few characteristics: 1) be broad enough for students with different interests and backgrounds to find projects relevant to them, 2) have a strong direction towards technological solutions, 3) be something that all students experience or have an opinion of, 4) not be too overwhelming or difficult to tackle. A curriculum for teaching design process was created and integrated. During the camp, the first week was dedicated to gathering insight into problems pertaining to the theme. Students committed project time to understanding the challenge and defining problems they would like to work on. Students practiced observing, they conducted interviews, and used empathy and shared their insights. By the end of this first week, students were able to present the current problem to solve and describe future opportunities. On the second week, students shifted from defining a problem to identifying a solution. They went through brainstorming sessions, convergence of ideas, rapid prototyping and iterations. On their third and fourth week, students developed their prototypes to achieve the necessary functions. They were able to express their creativity and use engineering tools introduced along the course of the bootcamp.

	Time	Mon	Tue	Wed	Thu	Fri
First Week		20-Jun	21-Jun	22-Jun	23-Jun	24-Jun
	10:00 AM	Welcome	Recap	Recap	Recap	Recap
	10:15 AM	Orientation	Arduino 1	Arduino 2	Arduino 3	Guest Lecturer
	10:30 AM					
	10:45 AM					
	11:00 AM					
	11:15 AM					
	11:30 AM					
	11:45 AM					Lunch
	12:00 PM	Lunch	Lunch	Lunch	Lunch	
	12:15 PM					
	12:30 PM					Arduino 4
	12:45 PM	Introduction	Soldering	Buffer Time	Milling Machine	
	1:00 PM					
	1:15 PM					
	1:30 PM					
	1:45 PM	Break	Break	Break	Break	
	2:00 PM	Ice breaker, mini-project	Project	Project	Project	Guest Lecturer
	2:15 PM					
	2:30 PM					
	2:45 PM					
	3:00 PM	Review	Review	Review	Review	
	3:15 PM					
Second Week		27-Jun	28-Jun	29-Jun	30-Jun	1-Jul
	10:00 AM	Recap	Recap	Recap	Recap	Recap
	10:15 AM	Arduino 5	Natural Hazards	2D Modeling	Arduino 6	Guest Lecturer + Project
	10:30 AM					
	10:45 AM					
	11:00 AM					
	11:15 AM					
	11:30 AM					
	11:45 AM					
	12:00 PM	Lunch	Lunch	Lunch	Lunch	Lunch
	12:15 PM					
	12:30 PM					
	12:45 PM	Project	Natural Hazards	Laser cutter	Buffer Time	
	1:00 PM					
	1:15 PM					
	1:30 PM					
	1:45 PM	Break	Break	Break	Break	Guest Lecturer + Project
	2:00 PM	Project	Project	Project	Project	
	2:15 PM					
	2:30 PM					
	2:45 PM					
	3:00 PM	Review	Review	Review	Review	Review
	3:15 PM					
Third Week		4-Jul	5-Jul	6-Jul	7-Jul	8-Jul
	10:00 AM	Holiday	Site Visits	Recap	Recap	Recap
	10:15 AM			Calibration	3D Modeling	Guest Lecturer + Project
	10:30 AM					
	10:45 AM					
	11:00 AM					
	11:15 AM					
	11:30 AM					
	11:45 AM					
	12:00 PM			Lunch	Lunch	Lunch
	12:15 PM					
	12:30 PM					
	12:45 PM			Curve Fits	3D Printer	
	1:00 PM					
	1:15 PM					
	1:30 PM					
	1:45 PM			Break	Break	Guest Lecturer + Project
	2:00 PM			Project	Project	
	2:15 PM					
	2:30 PM					
	2:45 PM					
	3:00 PM			Review	Review	Review
	3:15 PM					
Fourth Week		11-Jul	12-Jul	13-Jul	14-Jul	15-Jul
	10:00 AM	Welcome	Recap	Recap	Recap	Recap
	10:15 AM	Drop Tower	Project	Project	Project	Conclusion
	10:30 AM					
	10:45 AM					
	11:00 AM					
	11:15 AM					
	11:30 AM					
	11:45 AM					Lunch
	12:00 PM	Lunch	Lunch	Lunch	Lunch	
	12:15 PM					
	12:30 PM					
	12:45 PM	Wind Tunnel	Project	Project	Project	
	1:00 PM					
	1:15 PM					
	1:30 PM					
	1:45 PM	Break	Break	Break	Break	Final Presentation + Award Ceremony
	2:00 PM	Project	Project	Project	Project	
	2:15 PM					
	2:30 PM					
	2:45 PM					
	3:00 PM	Review	Review	Review	Review	
	3:15 PM					

Figure 3: Course Content and Schedule

The final invention projects that students completed included prototypes for:

- A window that opens or closes automatically depending on the weather, using sensors for barometric pressure and temperature.
- A device for generating power by mounting a turbine in a building's gutter or downspout.
- A smart umbrella that uses LEDs and sensors to light up in different colors when it rains.
- A self-automated garden that controls the amount of water and sun based on indicators of the plants' needs.
- A digital display of water flow through pipes and faucets, for water consumption awareness.
- An automatic retracting patio cover.
- An automated deploying rain cover over a tent.
- An app and device displaying rates of water impurities and pH levels for user's water and water in surrounding areas.

In addition to learning and using engineering tools to invent new devices, students were introduced to researchers and guest speakers. It provided students a window into the real world of scientific research, invention and entrepreneurship. Three professors invited students into their research laboratories to perform scientific experiments: testing the effect of absence of gravity on objects or materials in a drop tower; testing aerodynamics of different objects in a wind tunnel; and using different sensors to experiment the effects of earthquakes on different structures.

In addition to these academic experts, six guest lecturers from local industries and innovators were invited to interact with the students. Each guest lecturer attended the bootcamp for two hours: one hour where they would interact with students, ask them questions, focus on their projects. The second part of their stay was a presentation. Each guest lecturer brought their own expertise to the group.

The interactions with academic researchers and speakers from industry demonstrated to the students a broad range of invention activities and provided a well-rounded depiction of how inventions are brought to market and grown to scale. Additionally, students were able to build their connections to the regional invention community, which can serve as future resources for information and employment.

Students were also invited to go to three different locations outside of campus to experience engineering, innovation and entrepreneurship in the local community. Although they gained familiarity with the invention community, students had mixed responses to learning about marketing and entrepreneurship.

We asked students to what extent they agreed with the statement "Invention Bootcamp introduced me to people in the local invention community." Nearly all students (96 percent) either agreed or strongly agreed with the statement. When asked during a focus group about their favorite thing they had learned during Invention Bootcamp, some students specifically mentioned the networking and "entrepreneurship aspects" of the program, and several were especially enthusiastic to learn more about the marketing and business side of invention.

"Meeting the entrepreneurs made it all seem more possible." –Invention Bootcamp student

"I have learned about how to make a business model." –Invention Bootcamp student

"I wake up every morning now ready to do this. And I know the basic steps to get started." –Invention Bootcamp student

For some students, however, meeting entrepreneurs and other professionals in the invention community had the opposite effect. Approximately one-quarter of students in focus groups said that they didn't want to go into business, while still feeling they had learned some useful knowledge about the process. One student said, "It's really hard to get it out and sell it."

Finally, the last day of the course was the apex of the Invention Bootcamp, with a presentation of all projects in front of an open public.

Assessment

We collected data using one student focus group, two student surveys and a mentor survey. During the focus group, which took place during the final week of the program, students reflected on what they had learned, the challenges they faced, and their perceived changes in attitude, knowledge, confidence and aspirations related to invention. All but one student (96 percent) participated in the focus group.

Students took the student survey online as a group using their program-provided Chromebooks, and it was administered in two parts. Part one was administered halfway through the program, to capture a snapshot of students' perceptions of the support available to them from instructional staff, mentors, and peers at Invention Bootcamp. Nineteen of the 24 Invention Bootcamp students responded to part one of the survey, for a 79 percent response rate. Part two of the student survey was administered during the final week of the program. Twenty-three of the 24 Invention Bootcamp students responded to part two of the survey, for a 96 percent response rate.

Finally, we administered a brief online survey to the program's mentors, and all eight mentors (100 percent) completed the survey. The key Findings are listed below.

1) Students were well supported by mentors, instructors, and other students
2) Students gained knowledge, confidence and technical skills related to the invention process.
3) Students gained familiarity with the invention community, but had mixed responses to learning about marketing and entrepreneurship.
4) Students reported high levels of belonging and self-efficacy at Invention Bootcamp.
5) Students gained or retained their 21st Century Skills of critical thinking, communication, collaboration, and creativity, and some were especially challenged by the collaborative aspects of teamwork.
6) Students gained awareness of STEM careers, but need guidance in the next steps of pursuing of a STEM career.

7) Mentors perceived the program as a success, but some faced pedagogical challenges and struggled with belonging.
8) Both students and mentors benefitted from hands-on learning at Invention Bootcamp.

In both focus groups and surveys, students expressed how Invention Bootcamp affected their interest, knowledge, confidence, sense of belonging, and feelings of efficacy as contributors to the invention community. The sample size of the student group was too small to analyze statistically significant differences between student outcomes by gender or ethnicity, but the following sections provide a description of overall student outcomes.

In survey responses, most students reported increased confidence developing prototypes, solving problems, designing and testing products after attending Invention Bootcamp (Figure 4). In focus groups, several students mentioned that to be effective, inventions need to be "feasible, viable and desirable."

Specifically, most students reported that after attending Invention Bootcamp they had a little more or much more confidence in their ability to use tools to build prototypes (96 percent), solve problems as they build (91 percent), test products after they build (91 percent), and design products to solve a real world problem (91 percent) (Figure 4).

Increasing students' self-efficacy in invention was an important goal of Invention Bootcamp, so we asked students in the survey how well they understood what they needed to do to succeed with their final project. For the most part, nearly all students (96 percent) agreed that they understood what was needed to make the project successful, and many students (91 percent) felt they could take risks by trying new ideas during their project (Figure 5).

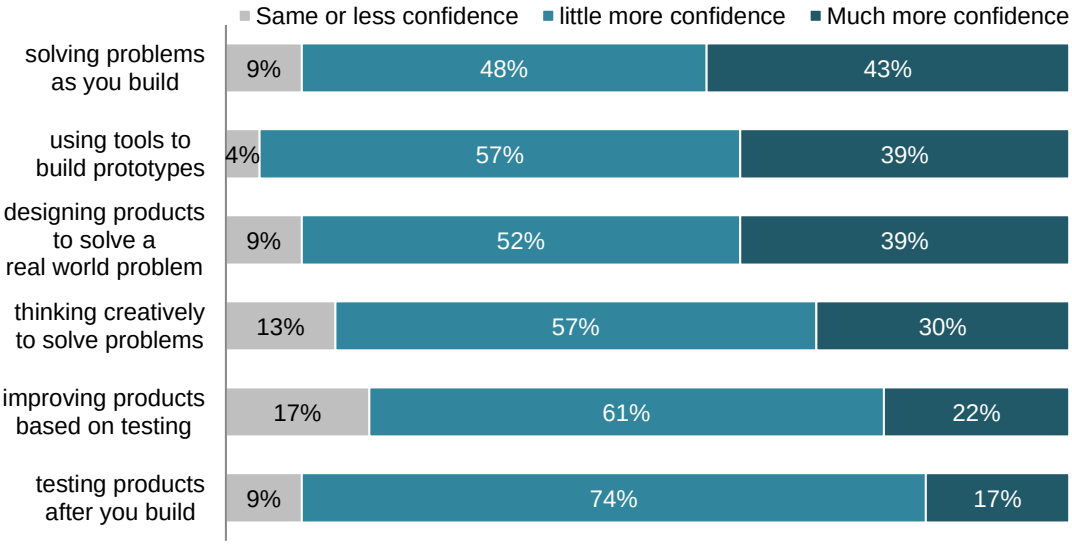

Figure 4: Students perceived changes in knowledge and confidence related to the invention process

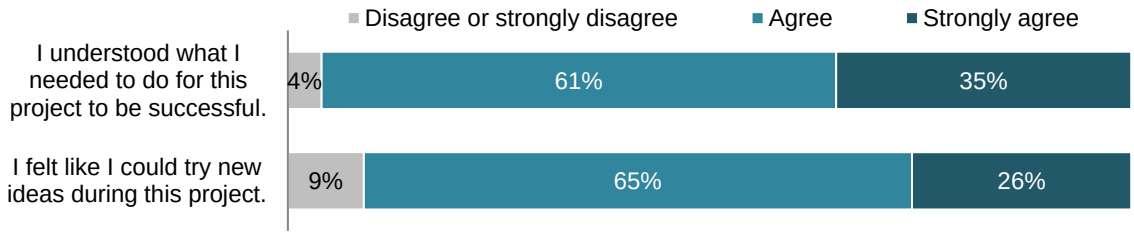

Figure 5: Students understood how to succeed in-group projects, and most felt they could try new ideas

Students reported that they felt like they belonged at Invention Bootcamp. We asked students to what extent they agreed with the statement, "I fit in at this program." Forty-three percent said that they strongly agreed, 52 percent said that they agreed, and 4 percent said that they disagreed.

To gain a sense of how students' sense of belonging changed during Invention Bootcamp, we asked them to think about the first and second half of the program separately. Less than half of students (48 percent) reported that they sometimes or frequently felt like they didn't belong during the first half of Invention Bootcamp. This decreased to 13 percent of students in the second half of Invention Bootcamp (Figure 6). A third of students (35 percent) thought "maybe I don't belong here" less frequently in the second half of Invention Bootcamp than the first half, and only one (4 percent) thought it more frequently. The other students (61%) showed no change.

We asked students to provide an example of a time they weren't sure they belonged during the first half of Invention Bootcamp. Several examples included feeling like the only student who didn't understand a certain skill, such as circuit-building or programming with Arduino. Other examples included having difficulty coming up with or explaining ideas, and having "no idea what I was doing because the information was new."

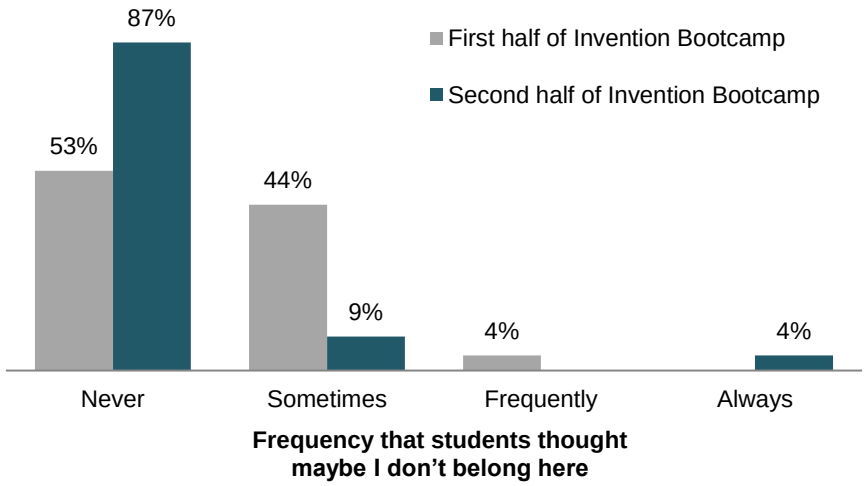

Figure 6: Students had a strong sense of belonging at Invention Bootcamp

Finally, in both surveys and focus groups, we asked students if they felt they could be engineers or inventors in the future. Most students either strongly agreed or agreed that they could pursue these professions (Figure 7). In focus groups, only one student felt that he could not be an inventor, saying "for me it's the creativity. I don't have enough creativity to solve real-world problems, it's just not something I've got in me." Another obstacle expressed during focus groups had less to do with efficacy and more to do with a concern about the profitability of inventing. A student asked, "will I make enough money to support my family?"

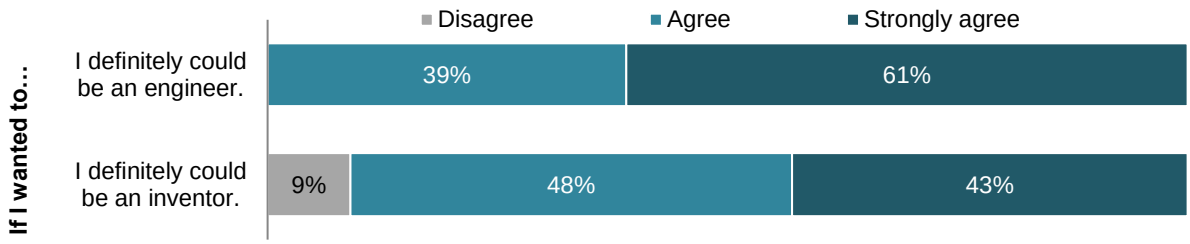

Figure 7: Most students felt they could be engineers or inventors

Conclusion

Overall, the course increased students' positive attitude towards invention and entrepreneurship. It also promoted students' knowledge of and self-confidence in using the invention process. It developed strong student skills in designing and prototyping inventions using advanced technology. It also enhanced students' 21st Century Learning Skills in the areas of critical thinking, collaboration and creativity. Finally, it built students' knowledge of and connections to individuals and businesses from the region's invention community. The Invention Bootcamp course filled a needed gap in connecting young students to accessible authentic experiences that inspire and educate future inventors and entrepreneurs.

Acknowledgements

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References

[1] Dejarnette, N. K. (2016). America's Children: Providing Early Exposure To STEM (Science, Technology, Engineering And Math) Initiatives. Reading Improvement, 53(4), 181-187.

[2] ChickTech. (n.d). Retrieved January 31, 2017, from https://chicktech.org/highschool/

[3] S.E.S.E.Y.: Summer Experience in Science and Engineering for Youth. (n.d.). Retrieved January 31, 2017, from http://cbee.oregonstate.edu/sesey/

[4] Saturday Academy. (n.d). Retrieved January 31, 2017, from https://www.saturdayacademy.org/

[5] OGPC: Oregon Game Project Challenge. (n.d.). Retrieved January 31, 2017, from http://www.ogpc.info/

[6] Engineering Summer Camps. (n.d.). Retrieved April 18, 2017, from https://www.eng.auburn.edu/outreach/k-12/engineering-summer-camp/index.html

[7] Alexa Cafe. (n.d.). Retrieved April 18, 2017, from https://www.idtech.com/alexa-cafe/

[8] Mississippi State University. (n.d.). Retrieved April 18, 2017, from http://www.bagley.msstate.edu/outreach/

[9] High School: S.P.I.C.E. Camp (CMSE & WIE). (n.d.). Retrieved April 18, 2017, from http://wie.umd.edu/k12/spice-camp

[10] Engineering Design High School Summer Camps. (n.d.). Colorado School of Mines. Retrieved April 18, 2017, from http://students.csmspace.com/

[11] Pre-college summer programs. (n.d.). College of Engineering. Tennessee State University. Retrieved April 18, 2017, from http://www.tnstate.edu/engineering/precollege.aspx

[12] Launch Summer. MIT. (n.d.). Retrieved April 27, 2017, from https://mitlaunch.com/program.html