The STEM Gender Gap: An Evaluation of the Efficacy of Women in Engineering Camps

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Abstract

In the present day, it is not uncommon for there to be a class full of engineering students with very few women among them. To combat this lack of gender diversity, colleges and universities have employed outreach programs and developed summer engagement opportunities that allow women to explore engineering before they graduate high school. The present research, an extension of work previously presented at the 2018 American Society of Engineering Education conference, was conducted at the University of Dayton to evaluate the effects of a single-sex camp and a co-ed residential engineering camp on female participants' interest in and self-efficacy related to engineering. Surveys were used to collect quantitative and qualitative data, and observation provided additional context. Data was collected at a total of four engineering camps during the summers of 2017 and 2018. Analysis of the survey responses indicated that these engineering camps have a significant impact on female participants' self-efficacy in engineering, indicating the importance of coordinating camp activities that engage participants' creativity while building their confidence in engineering. Furthermore, the way engineering camp activities are presented may affect participants' perceptions of their own abilities in engineering. These findings add to the existing body of research exploring engineering self-efficacy and the participation of women in engineering, in addition to the effects of K-12 engineering outreach and camp programming.

Introduction

In 1945, nearly 50,000 students were enrolled in engineering courses at colleges and universities across the United States. However, only about 3.5 % of these students were women (Bix, 2013). Although the total number of women in engineering has increased since 1945, the field of engineering continues to lack female representation despite the fact that, in 2008, women represented over half of the students enrolled at public universities (Borzelleca, 2012). In 2017 in southwestern Ohio, women made up only about a quarter of the incoming classes of engineers at Miami University, the University of Cincinnati and the University of Dayton (Driscoll & Filby, 2017). This disparity is also seen in the workforce, with women only representing 15.4% of employees in architecture and engineering occupations as of 2014 (U.S. Bureau of Labor Statistics, 2015). This persistent gender gap begs the following question: why do women not choose to pursue engineering?

According to Jacobs (2005), there are several factors to consider when trying to understand why women do not pursue engineering: career choice is not an objective measure of ability; students are more likely to pursue math and science courses when they are confident they will do well in these courses; the value a student places on particular school subjects is important for their career trajectory; and finally, the perception of strong social support for achievement is vital when a student is making a career choice, especially for female students.

Through the use of implicit and self-report measures, it was found girls experience a weaker identification with math than boys and endorse the stereotype that math is for boys (Cvencek, Meltzoff, & Greenwald, 2011). Evidence has also been found supporting the idea that stereotype endorsement (i.e., a math-gender stereotype), has an effect on "women's disengagement from math and science" (Steffens & Jelenec, 2011, p. 332). Smeding (2012) also found that these stereotypes have a negative effect on math performance for female students. The pervasiveness of these stereotypes in our society have resulted in many women feeling as though they do not have the ability to succeed in science and math. According to Frontier and Rickabaugh (2014), "the presence or absence of strong self-efficacy often determines whether learners will engage in challenging tasks in which the outcome of the work is not certain" (p. 132) Stereotype threat, (i.e., the pressure or threat a person experiences when a negative stereotype about one's identity group could potentially be confirmed by one's individual performance) may also have an effect on females in these male-dominated, STEM environments (Adams, 2013). Stereotype threats "can have a negative impact on the performance of targeted individuals" (Schmader, Johns, & Barquissau, 2004, p. 846). Women may not be pursuing STEM fields because they lack self-efficacy in science and math, and they may also be aware of the negative stereotypes about women's ability in math and science, which can also negatively impact their performance in these subjects.

Research also suggests there is a close link between a child's interest in science and family influence (Buschor, Berweger, Frei, & Kappler, 2014; Meyer, Cimpian, & Leslie, 2015). Therefore, if family members do not believe women should go into STEM, a female child may also believe she does not belong in STEM. This child may also not receive encouragement or support from her family to pursue a STEM field. According to McIlwee and Robinson (1992), opportunities and other resources should be made available to mitigate the effects of these stereotypes.

Additionally, research has recently been conducted to understand the intersectional experiences of diverse populations in engineering (e.g. girls and women of color). One example of such a study explored the experiences of women of color in STEM higher education and how different spaces, both physical and figurative, impacted their social experiences and perceptions of themselves in their field (Ong, Smith, & Ko, 2018). These researchers found that safe social spaces where these women could feel a sense of support and belonging in STEM had positive impacts on their perceptions of their belonging. These experiences of girls and women of color will continue to be important as they enter and engage in STEM fields are increasingly important to understand.

In addition to increasing participant interest and self-efficacy, it is important to demonstrate other essential elements, such as the interpersonal aspects of a career, to increase female interest in that career or field (Forssen, Lauriski, Harriger, & Moskal, 2011). A "re-branding" of engineering has been encouraged to reflect the field "as inherently creative and concerned with human welfare, as well as an emotionally satisfying calling," which has been shown through research to attract female and minority students to engineering (National Academy of Engineering, 2013, p. viii; Wulf, 2002). Payton, White, and Mullins (2017) found that through a study of students enrolled in STEM and dance curricula, the students indicated that the arts and STEM serve as complements. Through incorporating creativity with engineering, participants' curiosity and critical thinking skills are engaged all while the students experience scientific inquiry through hands-on problem-based learning (Han, Rosli, Capraro, & Capraro, 2016). Additionally, problem-based learning has been found to improve motivation towards learning and self-directed learning, allowing participants to create meaning for themselves in what they do (Kretchmar, 2013; McLoone, Lawlor & Meehan, 2016). According to Shull & Weiner (2002) activities should also replace "fear-based, undue caution with a sense of appropriate, application-based caution," which is done by placing an emphasis on the process to achieve any outcome, instead of an emphasis on only a successful outcome (p. 442). It is not always beneficial to have activities where participants follow step-by-step directions. Participants must be able to experience problems they could encounter as engineers, and they must be able to problem-solve and create their own meaningful experiences.

To encourage women to consider engineering as a career field, many colleges and universities, including the Ohio State University, University of Akron, Arizona State University, and Purdue University, have developed various outreach and summer engagement opportunities to provide young women with the opportunity to explore engineering before graduating from high school (The Ohio State Univeristy, n.d.; University of Akron, n.d.; Arizona State University, n.d.; Purdue University, n.d.; University of Cincinnati, n.d.; University of Kentucky, n.d.; Georgia Institute of Technology, n.d.; Rochester Institute of Technology, n.d.). Engineering camps are often marketed toward specific minorities, such as women, or they are marketed to anyone interested in engineering. During an engineering camp, participants often engage in many activities related to various fields of engineering. These activities are meant to provide some context for what engineering is, what engineers do, and what it takes to become an engineer. For example, some camps provide participants with modules and activities for the various disciplines of engineering, some offer participants a direct experience with industry and industry professionals, and some focus on specific skills such as coding or robotics. Engineering camps can provide women with the tools to build their self-efficacy and allow them to discover that they can succeed in engineering (Bachman, Bischoff, Gallagher, Labroo, & Schaumloffel, 2008; Rittmayer & Beier, 2009; McCormick, Talbert-Hatch, & Feldhaus, 2014).

The University of Dayton has hosted a Women in Engineering Camp since 1973 (Updyke, 2018). The camp specifically features guests from local industry and professional engineering societies, and a "Day with Industry" where participants are able to interact with working engineers and see what engineers do day-today (Aldrich & Hall, 1980). Additionally, the camp also features technical presentations from the different fields of engineering and engineering research to give a full picture of the different paths in engineering (Aldrich & Hall, 1980).

Although these engineering camps have been in existence since at least the 1970s, only recently have efforts been taken to examine their effectiveness in increasing the camp participant's interest and self-efficacy in engineering (Bottomley, Lavelle, D'Amico, & LaPorte, 2015). Phelan, Harding and Harper-Leatherman (2017) found that a STEM camp for female students from an underserved population was successful at increasing participant interest in STEM. Therefore, there is still a need to examine engineering camps to understand the effects they have on their participants: are these camps turning participants away from engineering or are they building confidence and fostering desire to continue with engineering? This question is especially important when considering the low numbers of women in engineering. The purpose of this study was to evaluate the effects of single-sex female and co-ed engineering camps at the University of Dayton on female participants' interest and self-efficacy in engineering.

Method

To assess the efficacy of both co-ed and single-sex female engineering summer camps at increasing the participants' interest and self-efficacy in engineering, data was collected from surveys at engineering camps hosted by the University of Dayton. Each camp was about six days long and allowed participants to explore some core fields of engineering such as mechanical, chemical, civil, computer, and electrical engineering. It should be noted that the camp activities may have varied slightly between camps and between the summers of 2017 and 2018. Additionally, the single-sex camp participated in a day with industry, where groups traveled to industry partners to tour the companies or plants and learn more about engineering from engineering professionals. The co-ed camp program, on the other hand, featured a robotics module, where participants designed, built and programmed robots to perform tasks in a competition.

Data was collected from paper and pencil pre-camp and post-camp surveys. The pre-camp survey was disseminated to participants during the orientation session prior to any camp activity. The post-camp survey was disseminated at the closing session after the end of all camp activities. Participants were asked to create an identification code to link their pre- and post-camp surveys. Surveys that were not able to be linked were excluded from the data analysis. A total of 234 responses were collected and analyzed across two summers of engineering camps. Observation was also used to provide context for the survey responses, however observation was only completed during the first summer. Due to scheduling conflicts, observation was not completed during the second summer. The participants in attendance were high school students from across the United States. This study was given approval by an institutional review board, and participants assented to participate with parental consent.

A total of 112 responses from 2017 and 122 responses from 2018 were analyzed. The survey questions for 2017 and 2018 are detailed in Schilling and Pinnell (2018), and have been included in Appendix A. For each summer, responses were analyzed in three groups: responses from the female participants from the single-sex engineering camp (Group 1), responses from male participants from the co-ed engineering camp (Group 2), and responses the female participants from the co-ed engineering camp (Group 3). The table below (Table 1) shows the number of responses per group for each summer of research.

The surveys allowed participants to report their willingness to problem solve, their persistence when faced with a challenge, their self-assertiveness, their self-efficacy in math, science, and engineering, and their interest in and intention to pursue engineering (Bandura, 2006). Additionally, some questions were modified from the Assessing Women in Engineering (AWE) Project 2008 surveys to make them more relevant to high school age participants. For example, terms such as "engineering curriculum" were changed to "math and science courses" because it would be better understood by the participant population. Other questions were also tailored to the participant population under the assumption that not all participants were of an age where they would be deciding what major to pursue in college. Therefore, one question gauges interest in engineering as a college major while another gauges intention to pursue engineering. Questions were also influenced by research conducted on how engineering is viewed (National Academy of Engineering, 2008).

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Pre- and post-camp survey responses were separated by group. Responses were analyzed using paired t-tests to determine any significant differences between the pre-camp and post-camp responses. By determining significance and shifts in the average responses, the effects of the camp on the participant's interest in and self-efficacy in engineering were able to be identified.

Results

Table 2 shows the average response for the survey questions from the summer of 2017 per Schilling and Pinnell (2018), while Table 3 shows the averages from the summer of 2018.

For Group 1, questions 7 and 10, which asked participants to identify a statement related to how they view engineering and asked about their self-efficacy related to

Group	2017	2018
Group 1	54	53
Group 2	41	57
Group 3	17	12

Table 1. Number of responses per group for each summer

Question (Scale)	Q1 (1-5)	Q2 (1-5)	Q3 (1-4)	Q4 (1-5)	Q5 (1-5)	Q7 (1-4)	Q8 (1-5)	Q9 (1-5)	Q10 (1-5)	n
Group 1 Pre-camp	4.57	4.33	2.48	4.19	4.61	3.63	4.46	4.24	3.91	54
Group 1 Post-camp	4.56	4.39	2.43	4.32	4.55	3.89	4.43	4.39	4.13	
Difference	-0.01	0.06	-0.05	0.13	-0.06	0.26**	-0.03	0.15	0.22*	
Group 2 Pre-camp	4.5	4.39	2.56	4.49	4.71	3.66	4.59	4.49	4.29	41
Group 2 Post-camp	4.56	4.54	2.61	4.68	4.80	3.80	4.68	4.61	4.59	
Difference	0.06	0.15**	0.05	0.19**	0.09*	0.14	0.09	0.12	0.3**	
Group 3 Pre-camp	4.53	4.47	2.29	4.06	4.65	3.65	4.65	4.59	4.35	17
Group 3 Post-camp	4.65	4.47	2.35	4.18	4.59	3.71	4.59	4.53	4.12	
Difference	0.12	0.00	0.06	0.12	-0.06	0.06	-0.06	-0.06	-0.23	

*Indicates the difference between the pre-camp and post-camp response showed statistical significance, p≤0.05.

**Indicates the difference between the pre-camp and post-camp response showed statistical significance, p≤0.01.

Table 2. Average response to set-response survey questions, 2017

Question (Scale)	Q1 (1-5)	Q2 (1-5)	Q3 (1-4)	Q4 (1-5)	Q5 (1-5)	Q7 (1-4)	Q8 (1-5)	Q9 (1-5)	Q10 (1-5)	n
Group 1 Pre	4.81	4.47	2.62	4.38	4.74	3.60	4.68	4.68	4.23	53
Group 1 Post	4.87	4.51	2.68	4.42	4.72	3.58	4.66	4.68	4.53	
Difference	0.06	0.04	0.06	0.04	-0.02	-0.02	-0.02	0.00	0.30**	
Group 2 Pre	4.65	4.44	2.47	4.47	4.77	3.66	4.65	4.51	4.30	57
Group 2 Post	4.63	4.44	2.54	4.56	4.79	3.63	4.65	4.56	4.51	
Difference	-0.02	0.00	0.07	0.09	0.02	-0.03	0.00	0.05	0.21*	
Group 3 Pre	4.42	4.58	2.33	4.00	4.58	3.55	4.50	4.33	4.00	12
Group 3 Post	4.50	4.58	2.67	4.42	4.67	3.92	4.50	4.67	4.33	
Difference	0.08	0.00	0.33	0.42*	0.08	0.37	0.00	0.33*	0.33	

*Indicates the difference between pre-camp and post-camp response showed statistical significance, p≤0.05.

** Indicates the difference between pre-camp and post-camp response showed statistical significance, p≤0.01.

Table 3. Average response to set-response survey questions, 2018

Subject	Science		Math		Social Studies		English		Art		Health/Physical Education		Other	
Year	‘17	‘18	‘17	‘18	‘17	‘18	‘17	‘18	‘17	‘18	‘17	‘18	‘17	‘18
Group 1	65%	77%	76%	83%	19%	26%	17%	28%	37%	28%	6%	17%	13%	25%
Group 2	83%	91%	71%	98%	22%	30%	7%	13%	5%	13%	7%	17%	12%	23%
Group 3	53%	50%	65%	92%	12%	17%	29%	17%	47%	17%	0%	25%	12%	8%

Table 4. Distribution of Responses to Question 6 regarding Favorite Subjects

engineering, respectively, showed statistical significance (*p*=0.01 and *p*=0.04, respectively) and an increased average from pre- to post-camp. For Group 2, questions 2, 4, 5, and 10, which asked participants questions about their persistence and self-efficacy related to math, science and engineering, showed statistical significance (*p*=0.01, *p*=0.01, *p*=0.04, and *p*=0.002, respectively). The average responses for these questions increased from pre-camp to post-camp. For Group 3, no questions showed statistical significance.

For Group 3, questions 4 and 9, which asks participants about their confidence in their math and science skills and their likelihood of continuing to pursue engineering, respectively, showed significance (*p*=0.05 and *p*=0.04, respectively). The average response to question 10, which asked about their self-efficacy related to engineering, increased for all groups but only showed significance for Groups 1 and 2 (*p*=0.004 and *p*=0.02, respectively).

Table 4 shows the distribution of responses to Question 6, which asks participants to identify their favorite subjects in school. “Other” includes subjects not listed like foreign language, engineering or technology classes, and band or orchestra.

Discussion

In the 2017 results, Question 10 was shown to have a significant difference in the response between the pre- and post-camp survey for Groups 1 and 2 (p=0.04 and p=0.002, respectively). Recalling that this question was meant to evaluate the participants’ self-efficacy related to becoming an engineer, this significant increase indicates that the single-sex female camp and co-ed camp had a positive effect on the participants in Groups 1 and 2, respectively. It was observed at the single-sex engineering camp there were many activities that allowed participants to explore engineering in an environment that allowed for fear-based caution to be overcome and increase their confidence in their abilities (Schilling and Pinnell, 2018). These activities may have led to an increase in their self-efficacy and a change in how they viewed engineering, demonstrated by the significant increase in the average response of questions 7 and 10 (Table 2).

For Group 3 in 2017, the difference between the pre- and post-camp average response for question 10 showed a decrease, suggesting that these participants had experiences at camp that decreased their self-efficacy related to engineering (Table 2). During this camp, it was observed that there were not many opportunities for female participants to fully participate in activities. This was often due to being given the task to take notes for the group, or in one case, not being given a complete explanation of the module because the majority of the male participants in the room already had experience with the activity. Many activities seemed to be well suited to male participants who demonstrated greater confidence in math, science and engineering (Table 2, Questions 4, 5 and 10) (Schilling and Pinnell, 2018).

The anecdotal evidence provided for the results of Question 10 for Groups 1 and 3 ultimately suggest that facilitators can have an influence on how participants view and interact with engineering. When facilitators allow participants to explore engineering in a positive environment and encourage them to work through challenges, participants can build confidence in engineering. However, if participants are not familiar with the activity being facilitated, they may not be as confident to start. If the activity is not explained, it may cause this lack of confidence to persist and may cause participants to disengage from the activity all together. It is important for facilitators to understand that the environment they create during an activity can have profound impacts on their participants, even if they are unintentional.

In addition to self-efficacy, participants also responded to a question that asked them to indicate their favorite school subjects (Question 4). The results to this question can be seen in Table 4. The results for 2017 indicated that participants enjoyed math and science, which was expected as these participants often self-select to attend these camps. However, Groups 1 and 3 overwhelmingly indicated that art was one of their favorite subjects. This response was unexpected but was encouraging as it directly relates to the work the National Academy of Engineering (2008) is aiming to accomplish with the “rebranding” of engineering as a creative pursuit to attract more women to engineering.

Upon receiving these results and feedback from 2017, the camp directors changed the program of both the single-sex camp and the co-ed camp to incorporate more creative activities for the 2018 camps. Participants were able to access the university’s makerspace workshop, explore creativity in coding in computer engineering, and experience nanotechnology and photolithography. The robotics activity at the co-ed camp was shortened to only three days of the camp, which may have benefitted all participants and created a less competitive environment; in that short amount of time, few participants were able to become “experts,” which may have removed some pressure to perform well and be the most successful. Ultimately, these changes in the camp program are thought to have influenced the positive increase in the average response seen in all groups for Question 10 (Table 3). In fact, this increase was significant for Groups 1 and 2 (*p*=0.004 and *p*=0.02, respectively), suggesting the importance of this change on participant self-efficacy related to engineering.

The results to Question 4 remained much the same in 2018 as in 2017 (Table 4). The female participants of Groups 1 and 3 indicated that art was a favorite subject more often than the male participants in Group 2. However, Groups 1 and 2 indicated that subjects related to music like band or orchestra are also favorites. In addition to just more artistic and creative activities, these results suggest that incorporating activities related to music could also attract more participants to engineering as it engages their interests while demonstrating that engineering is something they could do. For example, explaining the dynamics of a speaker or how vibration works to create music could be of interest to participants and could also explain key engineering topics.

It is also important to note the increased averages for all survey questions in Tables 2 and 3 for female participants in Groups 1 and 3 between 2017 and 2018. In 2017, male participants in Group 2 had higher average responses than Groups 1 and 3, generally indicating they were more persistent, assertive and confident in math, science and engineering. However, in 2018, the average responses of Groups 1 and 3 was equal to or greater than the average response of Group 2. Though outside the scope of this study, it is interesting to consider the influence of the prominent sociopolitical movements related to women’s rights and women’s visibility in STEM. It could be imperative for future studies to consider the effects of society beyond the camp and how these outside factors may affect female participants' self-efficacy in science, math and engineering. It should be noted that some participants at any camp may have realized that engineering is not something they want to pursue, regardless of their camp experience. This is recognized as a valid and valuable outcome of the camps, but is not something that was included in data collection.

Limitations of this study include the number of female participants attending the co-ed engineering camp, limited diversity within populations, the difference in camp programs, the space in which the surveys were given, and the timing of activities. Though the lack of female participants attending the co-ed camp is representative of the field of engineering, the small sample size did not allow for adequate analytical power; while the data collected from Group 3 was true for Group 3, it is not necessarily representative of the larger population.

The diversity within all participant populations was also not taken into consideration in the collection of demographic data. Because information on race, ethnicity, and other identities was not collected, an intersectional analysis was not completed. This analysis would be incredibly beneficial to include in future studies to explore the intersections of various social identities as women make the decision to pursue or not pursue engineering. As Bruning, Bystydzienski, and Eisenhart (2015) suggested, intersecting dimensions of race, class, gender, and even locality complicate the possibilities of making the choice to pursue engineering. It is important to understand how these intersections affect engineering camp participants, especially those participants that belong to underrepresented populations in the field. An intersectional analysis also may have provided insight into how camp activities were perceived and how they could be further improved. According to Young, Young, and Paufler (2017), traditional STEM environments often do not support diverse populations—in the case of their study, girls of color. They ultimately suggested that culturally relevant and community focused activities support girls of color and encourage them to pursue engineering or other STEM fields (Young, Young, & Paufler, 2017). Collecting more demographic data and including an intersectional analysis in future studies would be beneficial to understanding the complexity of the social and cultural experiences women in engineering face.

Many of these participants also self-selected to attend these camps and were able to pay the associated camp fees to attend. This indicates that these participants in this study already had some interest in engineering, and at least some degree of family support. In future studies, this survey should be given at a co-ed engineering camp with a more equal ratio of female-to-male participants, perhaps at a camp where self-selection bias would not be as great of a factor (e.g. a camp where participants do not have to pay to attend). Another improvement would be for future research to be conducted at a single-sex camp and co-ed camp that had identical activities, which would allow for some consistency and would allow for better analysis of responses. Ideally, the participants would also be able to sit at desks or tables in a quiet environment while they completed surveys to minimize distractions. Lastly, the timing of certain activities and conflicting schedules made it difficult to observe all of the activities that were occurring. Because of conflicting schedules, no activities were able to be observed at either camp during the summer of 2018. It would be worth having a team of researchers observe the camps and record activities to provide complete context for the structure of the camps.

Conclusion

The results of this research suggest a few things. First, a single-sex engineering camp model can have more positive effects on the self-efficacy of the young women who attend and participate. Incorporating creative activities that allow to participants to connect engineering to concepts beyond just math and science can also have positive impacts on participants' self-efficacy related to engineering, and will ultimately attract women and other minorities to pursue engineering. Finally, facilitators at engineering camps can affect how participants view and interact with engineering, which can ultimately affect participants' self-efficacy related to engineering, either negatively or positively. A better understanding of how all engineering camps affect the self-efficacy of the participants is necessary to understand how to effectively engage them in engineering, and to discover how to better engineering camps as a whole for positive experiences.

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Malle Schilling graduated from the University of Dayton in 2018. During her time as an undergraduate engineering student, Malle pursued a thesis project through the University Honors Program. Her project focused on the effects of engineering camps on female participants' engineering self-efficacy and interest in engineering. Malle has also worked with other K-12 STEM education programs, assisted with the development of promotion and tenure policies, and has researched using engineering camps as a university recruiting tool. She will be pursuing a Ph.D. in Engineering Education at Virginia Tech. Her research interests include diversity and inclusion in engineering, K-12 STEM education, and engineering identity.

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Dr. Margaret Pinnell is the Associate Dean for Faculty and Staff Development, and the Bernhard Schmidt Chair in Engineering Leadership. She has been actively involved in K-12 STEM outreach and education since 2008. Dr. Pinnell worked at the Composites Branch of the Materials Laboratory at Wright Patterson Air Force Base, the Structural Test Laboratory at the University of Dayton Research Institute prior to joining the faculty at the University of Dayton Research Institute. She has taught in the Department of Mechanical and Aerospace Engineering at UD since 1999. Margie worked with the ETHOS program at UD for approximately ten years and also served as an assistant dean for recruitment and outreach in the school of engineering for about two years. Her research interests include service-learning, K-12 STEM education and mechanical testing of materials, especially biological materials. She regularly teaches materials and an associated lab and biomaterials.

APPENDIX A

Survey Questions

1. How much do you enjoy solving problems?
a. I very much enjoy solving problems.
b. I somewhat enjoy solving problems.
c. I neither enjoy nor dislike solving problems.
d. I somewhat dislike solving problems.
e. I very much dislike solving problems.

2. When confronted with a challenge:
a. I continue to work hard to move past it.
b. I continue to work but feel somewhat set back.
c. I continue to work but feel very set back.
d. I feel very set back and don't work as much.
e. I give up entirely.

3. How often do you raise your hand to answer questions during class?
a. I raise my hand for every question.
b. I raise my hand for most questions.
c. I raise my hand for few questions.
d. I raise my hand for no questions.

4. How confident are you in your math and science skills?
a. I am very confident in my math and science skills.
b. I am somewhat confident in my math and science skills.
c. I am neither confident nor unconfident in my math and science skills.
d. I am somewhat unconfident in my math and science skills.
e. I am very unconfident in my math and science skills.

5. How confident are you in your ability to complete math and science classes?
a. I am very confident in my ability to complete math and science classes.
b. I am somewhat confident in my ability to complete math and science classes.
c. I am neither confident nor unconfident in my ability to complete math and science classes.
d. I am somewhat unconfident in my ability to complete math and science classes.
e. I am very unconfident in my ability to complete math and science classes.

6. What is your favorite subject in school? (circle all that apply)
a.
b. Science
c. Math
d. Social Studies
e. English
f. Art
g. Health and Physical Education
h. Other:______________________

7. Pick the statement below that best describes what engineering means to you.
a. Engineering improves our lives by creating new solutions that connect science to life.
b. Engineering means being brilliant and doing well in math and science.
c. Engineering leads to good jobs and making money.
d. None of these describe what engineering means to me.

8. How interested are you in engineering as a college major?
a. I am very interested in engineering.
b. I am somewhat interested in engineering.
c. I am neither interested nor uninterested in engineering.
d. I am somewhat uninterested.
e. I am very uninterested in engineering.

9. How likely are you to continue with engineering in future education?
a. I am very likely to continue pursuing engineering.
b. I am somewhat likely to continue pursuing engineering
c. I am neither likely nor unlikely to continue pursuing engineering.
d. I am somewhat unlikely to continue pursuing engineering.
e. I am very unlikely to continue pursuing engineering.

10. How confident are you that you have what it takes to be an engineer?
a. I am very confident that I have what it takes to be an engineer.
b. I am somewhat confident that I have what it takes to be an engineer.
c. I am neither confident nor unconfident that I have what it takes to be an engineer.
d. I am somewhat unconfident that I have what it takes to be an engineer.
e. I am very unconfident that I have what it takes to be an engineer.

Question 11 varied between the pre-camp and post-camp survey iteration. On the pre-camp survey, participants were asked what they hoped to get out of their camp experience. On the post-camp survey, participants were asked what activity they found the most interesting and exciting.