

Increasing Female Participation in Engineering: Evaluating *CAMP NAME* Summer Camp

Ms. Jessica R McCormick, Indiana University Purdue University, Indianapolis

Jessica McCormick is the Academic Program Coordinator for the Engineering Dual Degree Program (EDDP), a partnership between Butler University and the Purdue School of Engineering and Technology, IUPUI. In this position she coordinates and runs all aspects of the program; including advising current students, program alumni relationships, and prospective and admitted student contact. She also manages the internship program for all EDDP students. She is the faculty advisor to the EDDP's Engineering Club and the Society of Women Engineers student organization. She also teaches a career planning class for engineers and a first-year engineering course. From 2006-2008, she was the Director for the Preparing Outstanding Women for Engineering Roles–POWER– Summer Camp. Mrs. McCormick received her Masters of Science in Technology and Bachelors of Science in Engineering from the Purdue School of Engineering and Technology, IUPUI.

Ms. Terri L. Talbert-Hatch, Indiana University Purdue University, Indianapolis

Terri Talbert-Hatch, Ed.D. Assistant Dean for Student Services Purdue School of Engineering & Technology, IUPUI

Dr. Talbert-Hatch oversees the Student Services Office with responsibilities for undergraduate student recruitment and engagement, K-12 programming, career services, residential-based learning communities, scholarships, and student government for the School of Engineering and Technology. She works very closely with current students. She is responsible for the Commitment to Engineering Excellence program which is a university funded program that provides scholarships and research funding for underrepresented students in engineering and engineering technology programs. Dr. Talbert-Hatch is also a Co-PI on a recently funded NSF STEM grant that provides scholarships, academic support, and career planning for 2nd year students with unmet financial need who are enrolled in engineering programs.

Prof. Charles Feldhaus, Indiana University Purdue University, Indianapolis

Dr. Charles Feldhaus is an Associate Professor of Organizational Leadership and Supervision in the Department of Technology Leadership and Communication (TLC) with the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI). He is Co-Director of the IUPUI STEM Education Research Institute (SERI) and serves as Chair of Graduate Programs for the TLC department. He received the Bachelor of Science degree in Radio and Television from the University of Southwestern Louisiana and the Masters of Science in Secondary Education from Indiana University. His doctorate is from the University of Louisville in Educational Administration with a cognate in urban education. Dr. Feldhaus spent 20 years as a classroom teacher, principal and district administrator in public education. His research interests include P-12 STEM education, STEM workforce education, post-secondary STEM education discipline based research, engineering technology recruitment and retention, and engineering ethics.

Increasing Female Participation in Engineering:
Evaluating POWER Summer Camp

Introduction

Engineering is a male dominated industry. Females are a small minority, a rarity, in fact. The problem of under-representation of women in engineering continues unabated and in fact is projected to worsen¹⁵. The U.S. Department of Commerce reports that in 2009 only one out of every seven engineers was female. Nearly half of U.S. workforce jobs are held by women, yet they only make up 24% of STEM jobs.⁴ In 2005, women represented only nine percent of the engineering workforce even though they constituted twenty percent of overall undergraduate engineering enrollment.¹⁸

Women are not only underrepresented in engineering jobs; there is also a shortage of women earning engineering undergraduate degrees.⁴ In 2009-2010 the National Center for Education Statistics, NCES, reported the total number of degrees in engineering and engineering technologies conferred by degree-granting institutions was almost 89,000.²⁰ However, less than seventeen percent of these degrees were granted to women—fewer than 15,000.²⁰ Women have made strides in the last few decades with respect to jobs held and degrees earned in engineering, but there is still plenty of growth potential.

In an attempt to increase the number of engineers, many universities offer programs to recruit and retain students in their engineering programs.¹¹ Outreach programs have been implemented in an effort to encourage young women to pursue careers in engineering. They vary greatly and range from after school programs to multi-week summer camps. Summer outreach programs for girls are primary among a variety of strategies being employed by universities to increase the number of women enrolling in engineering programs.¹⁵ These programs are designed to increase

female engineering interest by allowing girls to apply their own knowledge to real-world situations through hands-on activities. The understanding of and attitudes toward the field of engineering are often addressed, along with attempts to break gender barriers and eliminate stereotypes of engineers. Evaluation of the National Science Foundation's Program for Women and Girls found evidence that summer camps were "successful in achieving positive change" for girls in science, technology, engineering, and mathematics (STEM).¹⁵

POWER Camp

In an effort to address the issues surrounding the recruitment, retention and matriculation of females in engineering disciplines, the Purdue School of Engineering & Technology (PSET) at Indiana University Purdue University Indianapolis (IUPUI) developed a summer camp for high school girls to increase engineering awareness among young women. Named POWER—Preparing Outstanding Women for Engineering Roles, it was also intended to be a recruitment tool to increase female enrollment in the PSET. POWER is weeklong residential camp that serves as an introduction to engineering for high school age females. The week includes hands-on activities, opportunities to meet with professional female engineers, and interaction with female college engineering students who serve as camp counselors.

Each year the camp consists of one visit to an engineering company, a professional roundtable, a team-based project following the engineering design process, an overview of different engineering disciplines with hands-on interaction, and a lunch with engineering faculty. In addition camp participants attend a college information workshop, give a presentation to guests on the final day of camp covering things learned during the week, and spend evenings creating a

community among each other through fun and social events. A sample schedule can be found in Appendix A.

The IUPUI POWER Camp has been in operation for seven years and almost 200 girls have participated. However, there have been few comprehensive studies to determine the effectiveness of the POWER Camp. High quality research needs to be conducted to answer a plethora of questions surrounding efficacy, career development, college majors and other issues that help to determine programmatic impact.

Research needs to be done to determine if the POWER Camp is successfully encouraging females to pursue engineering degrees, and thus contributing to the increase of women engineers in the U.S. workforce. Past POWER participants have not been tracked to determine what they did after graduating from high school. Since POWER was in part developed as a recruitment tool for the PSET in addition to increasing engineering awareness, the sponsors would like to verify that the camp is successfully bringing females into their programs.

Literature Review

Over the past thirty years, women and other underrepresented minorities have made some progress in earning baccalaureate degrees in engineering.⁷ According to Tsui, women accounted for only one percent of the undergraduate engineering degrees thirty years ago, and today they earn 20% of the degrees.²⁴ Despite these decades of advancement of women in the areas of STEM, women are still sorely underrepresented both in academia and in industry when compared to their male counterparts.²³

Despite the fact that women are capable and have a historical track record for contributing to STEM related fields, the number of women represented in the STEM fields remains dauntingly low.¹⁷ Not surprisingly, McSherry found mounting evidence that suggests gender bias is alive and well in the engineering profession.¹⁸ This is supported in Baxter's work as she states that one might argue the advancement of women in STEM is as a result of perseverance and resiliency rather than an environmental culture shift.³

It has been discussed that there is a shortage of engineers and skilled workers in the U.S. Research conducted by McSherry found projections showing that unless women and minorities are attracted to STEM, the U.S. will not have the trained personnel necessary to meet its needs and remain competitive in a global economy.¹⁸ The absence of women from STEM education and careers affects more than the women; it is a missed opportunity for those fields because women bring a different perspective that shapes and influences STEM disciplines.¹⁹ Women represent a key sector of the workforce and a viable market to help close the gap in the STEM workforce labor shortage.¹⁷ Engineering is a non-traditional career path for women and a change needs to be made.

There are many incentives and benefits for women to pursue degrees in engineering and enter the workforce. Jobs in the economy are increasingly technology oriented. Technology is good for women in term of more and higher-paying jobs and advancement opportunities.¹⁷ In order to make engineering equitable and beneficial for everyone, it is critical to engage more girls and women to help shape the future of this profession.¹⁷

To address the growing concern about the lack of students entering and completing undergraduate engineering programs, much effort has been made to expose students to engineering content during their K-12 years.¹² Plotkowski, Sheline, Dill, & Noble add that in this impending shortage of technical talent, institutions and industry leaders have invested in a variety of early awareness programs to expand the pipeline of young men and women interested in the STEM field.²¹ Pre-college engineering outreach interventions are vital to the maintenance of the engineering pipeline and to the continued success of the engineering profession as a whole in the U.S.¹ In particular, implementing summer camps that attract high school students for all engineering disciplines has been proven to be a very effective approach to partially addressing the shortage of engineers.²⁵

In addition to combating the decline in the number of U.S. engineers, outreach programs seek not only to increase engineering enrollment but also to diversify the field of engineering.¹ Dave et al. confirm by stating that one way of addressing the lack of engineers is to solve the problem of underrepresentation of women.¹⁰ Outreach programs have been created and developed to specifically target women to address this issue.¹⁰ According to Cano, Berliner-Heyman, Koppel, Gibbons, & Kimmel, summer programs have been implemented that are designed to encourage female students to pursue STEM careers and address their attitudes towards such fields.⁶ They add that single gender programs are invaluable initiatives in providing high-quality educational opportunities to students.⁶

Although key to assessment and evaluation of summer camps, few studies have been conducted to track the long term effects of these outreach programs. Cano et al. states that tracking of participants after completion of programs is most important to the pipeline and diversity issues in

engineering.⁶ Hubelbank et al. cite that there is a need for innovative methods to encourage the assessment of longitudinal outcomes when it comes to outreach programs encouraging females to pursue careers in engineering.¹⁵ The development of innovative approaches to facilitate the collection of longitudinal data would make a significant contribution to program evaluation and toward adding women to the engineering workforce.¹⁵ Research that does include longitudinal assessments show that a large percent of attendees of these outreach programs go on to enroll in a college or university.¹⁴

Some institutions that have implemented outreach programs targeting females show amazing statistics on the increase of female enrollment in their engineering programs. Gilbride, Kennedy, Waalen, & Zywno found in Ontario, Canada, female enrollment in undergraduate engineering programs continues to climb.¹³ Over a five year period at multiple engineering universities, female engineering enrollment has increased by from 12% to 18.5% and Ryerson Polytechnic University has increased faster from 8% to 13.7%.¹³ According to Cotton women engineers are making strides at Colorado colleges since implementing engineering outreach programs.⁸ At Colorado State University, there were 213 undergraduate female engineering students five years ago compared to 424 beginning the fall of 2012, almost double the enrollment. The Colorado School of Mines has also seen a steady growth of females over the last few years. Females comprise 26.5% of the undergraduate engineering population and in the freshman engineering class 28% percent are female.⁸

Based on findings in the literature review, many researchers focus on short-term results of summer outreach programs and fail to identify whether female participants are pursuing

engineering into college and beyond. There is little existing published research evaluating long-term effects of outreach programs designed to increase the number of females in engineering, especially designs similar to the POWER Summer Camp. Evaluating longitudinal data allows a further understanding of the long-term impacts of these programs.

Purpose

The intent of this quantitative study was to determine the effectiveness of the POWER Summer Camp in the encouragement of females to pursue engineering as a career path. Surveys were used to assess the impact on POWER Camp participation and chosen major in college.

Assumptions

It was assumed that all POWER participants were willing attendees of the summer camp and that they had some level of an interest in engineering as a possible career choice. In addition, it was assumed that the respondents were honest in their answers while completing the surveys.

Scope

The scope of this project was specific to past participants of the POWER Camp. It cannot be assumed that the results from this study would be the same if the survey was administered to past participants of summer camps, even those with a similar design.

Methodology

This quasi-experimental research study assessed whether or not the POWER Camp had an impact in increasing the number of females in the engineering pipeline based upon the major chosen in college by past participants of the Camp. The results of this study will allow the

researcher to understand if POWER Camp participants are more likely to study engineering in college. Quasi-experimental research differs from a true experiment because it lacks a control or comparison group. This research qualifies as a quasi-experimental design since the participants are not randomly assigned to any group and were all given the same treatment.

Research Questions

Since the intent of this study was to determine perceptions of past POWER participants the researchers developed the following research questions:

1. Do relationships exist between camp participation and college enrollment?
2. Do relationships exist between camp participation and the chosen college major?

According to Creswell investigators use quantitative research questions to shape and specifically focus the purpose of the study.⁹ The research questions inquire about the relationships among variables and are frequently used in survey studies.⁹

Design

A single-group, posttest-only survey was chosen as the preferred method for data collection since the purpose of the study was to determine the influence of POWER Camp in their major based on past participant perceptions. Surveys provide the ability to quantify the attitudes and opinions of a population.⁹ For this study, a cross-sectional survey was chosen since all participants were studied at the same time. A cross-sectional design was appropriate for studying the impact of the POWER Camp since all past participants could be surveyed quickly during a short timeframe.

A web-based survey was preferred due to the large number of past participants, ease of distribution to participants, and immediate collection of data upon participant submission. This

type of survey allowed a greater number of the population to participate by self-administered online questionnaires.

While the scope of this research included past participants of the POWER Summer Camp from 2006–2012 that have graduated from high school, the survey from this study can be given to future years of the POWER Camp to continue the longitudinal study of the impact of POWER on increasing the number of females in engineering.

Population

The population for this study will be all past participants of the POWER Summer Camp that have graduated from high school. Currently, the population for this study is 140 females. From this population only 134 had emails that were assumed to be delivered or were successfully contacted using social media. It is unknown if all emails were actually received by participants since some of the email addresses used were up to seven years old. It is estimated that up to 33 emails may have not been delivered for this reason. Of the 54 participants who began the survey, a total of 50 surveys were complete enough to be used in this study. Since the POWER Camp has been in existence since 2006 and is for high school students, the age range for the females surveyed was 18–24 years old. All study participants were required to be at least 18 years old.

Instrumentation

The survey questions were developed by the Assessing Women & Men in Engineering (AWE) Project, which is supported by a National Science Foundation GSE diffusion grant, and has been used to assess numerous programs for ten years. AWE provides assessment tools for people

involved in K-16 formal and informal educational outreach activities.² Permission was given by the original authors to use their questions in this study. All AWE products are available through its website and are free with registration.²

AWE has developed multiple surveys that contained questions helpful to answering this study's research questions. AWE's surveys are designed to be used together and many items are based upon factor analysis. The AWE questions used in this study were from the following surveys: Students Persisting in Engineering, Students Leaving Engineering, Pre-College Post Participation, Pre-College SWE AWE Extra Question Sets, and College Choice. The Students Persisting in Engineering & Students Leaving Engineering Surveys measure student reasons for deciding to persist in engineering or transfer out of engineering, respectively, and are specifically designed to be used in conjunction with one another. The Pre-College Post Participation and Pre-College SWE AWE Extra Question Sets determine whether specific activities met objectives and use this information to improve activities and make evaluation decisions. Finally, the College Choice Survey gathers data on why students who were accepted into a college/department of engineering did not enroll and matriculate at that university. The AWE surveys are listed in Table 1 along with the objectives they measure.

Table 1

AWE surveys and correlated outcomes²

Survey Title	Measured Outcomes
Students Persisting in Engineering	<ul style="list-style-type: none"> ➤ Initial commitment to and preparation for studying engineering ➤ Impact of course workload, climate, advising, teaching, etc. on decision to persist ➤ Other factors /events that contributed to decision to persist ➤ Participation in academic and in extra-curricular activities ➤ Confidence in completing an engineering degree ➤ Post-graduation plans
Students Leaving Engineering	<ul style="list-style-type: none"> ➤ Initial commitment to and preparation for studying engineering ➤ Impact of course workload, climate, advising, teaching, etc. on decision to leave ➤ Other factors /events that contributed to decision to leave ➤ Participation in academic and in extra-curricular activities ➤ Retrospective confidence in completing an engineering degree ➤ Confidence in completing a(nother) degree ➤ Post-graduation plans
Pre-College Post Participation & Pre-College SWE AWE Extra Questions Sets	<ul style="list-style-type: none"> ➤ Whether participant intends to study engineering ➤ What participant knows about what engineers do ➤ What factors (if any) about being an engineer appeal to participant ➤ Events or persons that influenced participants' study plans ➤ Participant skill and confidence level in areas that are important for successfully completing an engineering degree ➤ Where participants plan to study engineering ➤ Her/his satisfaction with the quality of the activity in which she/he has participated
College Choice	<ul style="list-style-type: none"> ➤ Gathers data on why students (male and female) who were accepted into your college/department of engineering did not enroll and matriculate at your university

Questions from all of these surveys were used in this study. The development of all AWE surveys are based on literature reviews, needs assessments, and testing with assessment experts, content experts, and users. AWE survey questions have been tested and validated.²

The POWER Outcomes Survey consists of 15 closed-ended questions, 10 rating scale questions, 8 partially open-ended questions, and 8 open-ended response questions. Question 1 gave permission for responses to be included in this study and Question 2 verified participants were at least 18 years old; neither were meant for study evaluation. Constructs were identified in relationship to the research questions and the survey questions. The construct groups are general demographics, college demographics, college attended, major choice, and camp perceptions.

Field testing was conducted to guarantee continued validity and reliability because the questions were selected from multiple AWE surveys. Incorporating questions that have already been evaluated results in the need for less strenuous testing and also provides greater validity to the survey according to Sudman and Bradburn.²² In addition to evaluating validity, field testing was important to ensure the technology worked properly and that it was clear and easy to follow since the survey was administered online. Failure to test the questionnaire represents a serious risk to the success of the project and is an important aspect of any survey design.⁵

In order to ensure content validity, three people were asked to evaluate the POWER Outcomes Survey to gain external opinions as to whether the questions in the survey would produce the desired output. These evaluators were identified based on their knowledge of survey design. The survey was administered using an online survey tool, Survey Monkey, allowing a greater number

of the population to participate in the self-administered questionnaires. The Office of Student Services in the PSET houses personal information for the POWER Camp participants and provided pertinent information needed for this study. Email addresses, phone numbers, and social media outlets were utilized to attract responses from the study population.

Limitations

Limitations of this quantitative study in this section were anticipated or identified during the study, additional limitations may exist. Some of the past POWER participants could have been out of high school for a number of years and may not remember the specific information. In addition, camp participants could be predisposed to pursue engineering as a profession and to attend IUPUI.

Results

Since all participants were asked the demographic questions, all dependent variables categorized in the general demographic construct group were compared to each of the independent variables. Two parametric dependent variables were evaluated in this section high school GPA and SAT/ACT score

Of the 50 survey respondents, 47 reported attending college at some point after graduating from high school. Independent-groups *t* tests were conducted comparing means from high school GPA means and SAT/ACT scores between participants who attended college and those who did not. The results from this test are shown in Table 2.

Table 2

*Attend college and general demographic construct group with descriptive statistics and independent-groups *t* test results*

	Attend College	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
High School GPA	Yes	47	1.49	.748	-3.462	.001
	No	3	3.33	2.517		
SAT/ACT Score	Yes	47	3.04	1.532	-.697	.489
	No	3	3.67	.577		

Of the 47 participants who attended college, 43 identified if they went to IUPUI or another university. Results from the independent-groups *t* tests comparing the demographic data with attending IUPUI are shown in Table 3, which also includes the descriptive statistics.

Table 3

*Attend IUPUI and general demographic construct group with descriptive statistics and independent-groups *t* test results*

	Attend IUPUI	<i>n</i>	<i>M</i>	<i>SD</i>	<i>T</i>	<i>p</i>
High School GPA	Yes	18	1.67	.686	1.551	.129
	No	25	1.32	.748		
SAT/ACT Score	Yes	18	3.17	1.654	.698	.489
	No	25	2.84	1.405		

As seen in Table 2 one demographic dependent variable, high school GPA, proved to be significant for those that did and did not attend college ($t(48) = -3.462, p < .005$). The mean high school GPA range of those that attended college was significantly lower, translating to a higher GPA, ($m = 1.49, sd = .748$) than the mean of those that did not attend college ($m = 3.33, sd = 2.517$). This analysis shows that respondents who attended college had higher high school GPAs than those who did not.

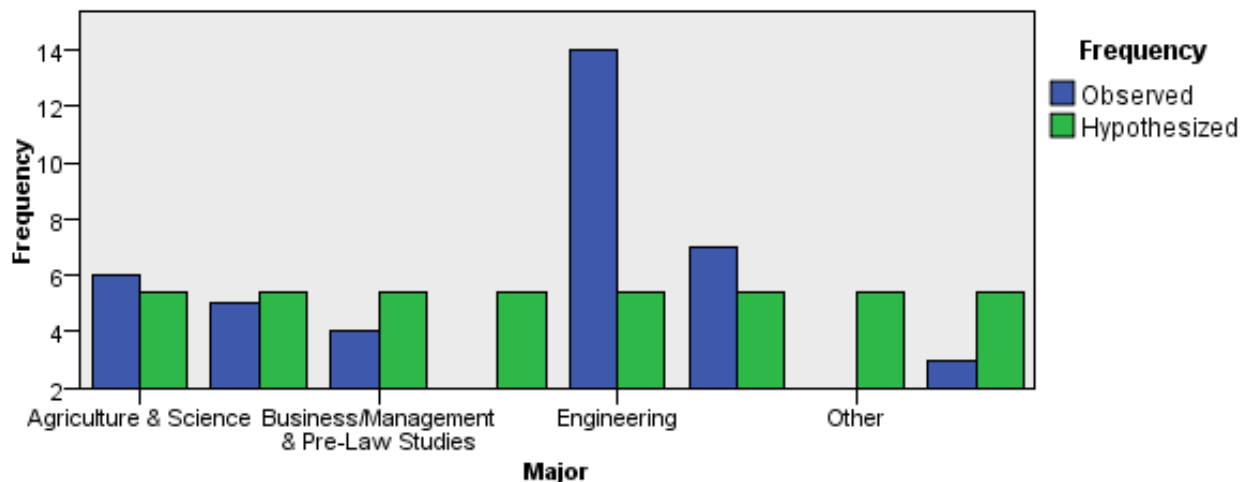
The next section of the survey identified participant's majors. The distribution of majors is listed in Table 4, showing that 30.2% of respondents are pursuing degrees in engineering.

Table 4

Major frequency and percentage

	Frequency	Percent
Engineering	13	30.2%
Engineering Technology	7	16.3%
Liberal Arts/Humanities	4	9.3%
Science	4	9.3%
Business/Management	3	7.0%
Pre Med/Health Professions	3	7.0%
Agriculture	2	4.7%
Education	2	4.7%
Other	2	4.7%
Art/Fine Arts	1	2.3%
Computer/Information Science	1	2.3%
Pre Law Studies	1	2.3%
Total	43	100.0%

A χ^2 goodness-of-fit test was calculated comparing the frequency of occurrence in majors- it was hypothesized that each major category would occur an equal number of times. In order to meet the requirement of having an expected value of at least five for the χ^2 majors with similarities were combined.¹⁶ The categories assigned for this test were Agriculture & Science, Art/Fine Arts & Liberal Arts/Humanities, Business/Management & Pre-Law Studies, Education, Engineering, Engineering Technology & Computer/Information Science, Other, and Pre-Med/Health Professions. This test revealed a significant deviation from the hypothesized value ($\chi^2(7) = 20.070, p < .01$). Engineering appears to be more frequently selected. The χ^2 goodness-of-fit test results are provided in Figure 1.



Total N	43
Test Statistic	20.070
Degrees of Freedom	7
Asymptotic Sig. (2-sided test)	.005

1. There are 0 cells (0%) with expected values less than 5. The minimum expected value is 5.375.

Figure 1. Major chi-square (χ^2) goodness-of-fit test

Summary and Discussion

In order to determine the significance of the results, it is necessary to revisit the research questions previously introduced in this paper. In accordance with the purpose of this study, the two questions developed to shape and guide the research were:

1. Do relationships exist between camp participation and college enrollment?
2. Do relationships exist between camp participation and the chosen college major?

The analysis of survey data revealed some significant results. General demographics section questions of the survey indicated that participants who attended college had a significantly higher high school GPA than participants who did not attend college. When identifying the college attended, more survey participants attended IUPUI than the other universities. Questions addressing major selection, when analyzed, identified that majors among participants were not equally distributed— significantly more were majoring in engineering. In addition, a significant number of respondents began college in engineering. A significant number of participants chose mechanical engineering over the other engineering disciplines.

The POWER Camp is just one example of an outreach program addressing the underrepresentation of females in engineering. Long-term assessment can identify strengths and weaknesses in programs and give administrators insight on how to improve programs to better serve participants. Establishing this baseline longitudinal study on the POWER Summer Camp at IUPUI will also allow programs of similar design to learn from the results and incorporate findings.

Evidence suggests a correlation between participating in the POWER Summer Camp and pursuing engineering as a major in college (Figure 1). Responses indicate that the majority of past POWER participants are choosing engineering as a major when starting college over all other majors, 65.1%. Even accounting for those that didn't persist in the major, a significant number of survey participants are still in engineering, 30.2%. In addition, this study shows that POWER Camp attendees are more likely to attend IUPUI. Participants who attended IUPUI indicated that attending POWER had a significant impact on their decision of what college to

attend. In fact, more survey participants attended IUPUI than the other universities reported—41.9%.

Immediate further research will include continued evaluation of the POWER Outcomes Survey responses already collected. This paper addresses a portion of the questions in the POWER Outcomes Survey. Additional questions focused factors contributing to a past participants decision to attend POWER Camp, decision to pursue engineering as a major, and factors contributing to persisting in an engineering program. In addition, questions addressing perceptions of engineering as profession and capabilities of being successful in engineering before and after attending POWER camp were included. Further evaluation of the survey responses will provide a deeper understanding of the effectiveness of POWER Camp.

The POWER Outcomes Survey should be administered at least every three years. This research was intended as a baseline longitudinal study. It will be beneficial in understanding how the population changes over time and it can continue to address areas for improvement of POWER. Data that does not appear to be significant at this time can also be evaluated further and compared in future research. Open-ended questions were included in the POWER Outcomes Survey, but have not been evaluated. Further evaluation can include responses from these open-ended questions and analyzed for themes. For purposes of this study, demographic information was not gathered; however, adding this data in future research may reveal additional trends and relationships. In addition, comparing results from this study to those from pre- and post-surveys that have been administered to past POWER participants would allow for a large scale, multi-dimensional understanding of the effects of the POWER Camp.

It is also important for researchers to continue studying the results of outreach programs to ensure that the effectiveness of those programs is measured. Both quantitative and qualitative studies should be designed to determine outreach participant perceptions of the outreach experience, influence of the outreach experience on participant disposition to enroll in a college or university, and efficacy to persist and graduate. Specifically, longitudinal studies should be designed to follow cohorts of females ranging in age from 8 to 18 who have completed various outreach experiences in STEM oriented camps. Other research might include outcome comparisons between gender specific camps (males vs. females), comparisons between urban and rural students and their experiences in outreach and comparisons between outreach provided via financial assistance and outreach that costs parents and/or students a significant amount of money.

Bibliography

1. Artis, S., Friedman, R., & LaRue, G. (2010). Strengthening the engineering pipeline one field and one woman at a time: The role of single-discipline, single-sex engineering camps in the U.S. *Proceedings from the 2010 American Society for Engineering Education Annual Conference & Exposition*. Louisville, KY: ASEE.
2. AWE, Assessing Women and Men in Engineering Project. (2012). Retrieved from <https://www.engr.psu.edu/awe/default.aspx>.
3. Baxter, K. B. (2010). Women in science and engineering: Thriving or surviving? (Unpublished doctoral dissertation). University of Southern California, California.
4. Beede, D., Julian, T., Langdon, D., McKittrick, G., Kahn, B., Doms, M. (2011). Women in STEM: A gender gap to innovation. U.S. Department of Commerce Economics and Statistics Administration.
5. Brace, I. (2008). How to plan, structure and write survey material for effective market research. Philadelphia, PA: Replika Press.
6. Cano, R., Berliner-Heyman, S., Koppel, N., Gibbons, S. & Kimmel, H. (2004). Evaluation of summer enrichment programs for women students. *Proceedings from the 2004 American Society for Engineering Education Annual Conference & Exposition*. Salt Lake City, UT: ASEE.

7. Chubin, D. E., May, G. S., Babco, E. L. (2005). Diversifying the Engineering Workforce. *Journal of Engineering Education*, 94(1), 73-86.
8. Cotton, A. (2012, September 13). Women engineers making strides at Colorado colleges. *DenverPost.com*. Retrieved from http://www.denverpost.com/breakingnews/ci_21537881/women-engineers-making-strides-at-colorado-colleges
9. Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks, CA: SAGE Publications.
10. Dave, V., Blasko, D., Holliday-Darr, K., Trich Kremer, J., Edwards, R., Ford, M., Lenhardt, L., & Hido, B. (2010). Re-enJEANeering STEM education: Math options summer camp. *Journal of Technology Studies*, 36(1), 35.
11. Dell, E., Bailey, M. B., O'Hurley, S., Lillis, R. P., Khol, B., Garrick, R. D., & Christman, J. (2011). WE-IMPACT- women in engineering- improving program assessment tools for outreach and retention programs. *Proceedings from the 2011 American Society for Engineering Education Annual Conference & Exposition*. Vancouver, BC: ASEE.
12. Fantz, T. D., Siller, T. J., & DeMiranda, M. A. (2011). Pre-collegiate factors influencing the self-efficacy of engineering students. *Journal of Engineering Education*, 100(3), 604-623.
13. Gilbride, K. A. Kennedy, D. C., Waalen, J. K., & Zywno, M. (1999). A proactive strategy for attracting women into engineering. *Canadian Journal of Counselling*, 33(1), 55-65.
14. Gooden, F., Borrego, M., Edmister, W., Waller, T., & Watford, B. (2010). An assessment of long-term impacts of three on-campus K-12 enrichment programs. *Proceedings from the 2010 American Society for Engineering Education Annual Conference & Exposition*. Louisville, KY: ASEE.
15. Hubelbank, J., Demetry, C., Errington Nicholson, S., Blaisdell, S., Quinn, P., Rosenthal, E., & Sontgerath, S. (2007). Long-term effects of a middle school engineering outreach program for girls: A controlled study. *Proceedings from the 2007 American Society of Engineering Education Annual Conference & Exposition*. Honolulu, HI: ASEE.
16. Jackson, S. L. (2009). Research methods and statistics: A critical thinking approach. Belmont, CA: Wadsworth
17. Kenney, L., Bhatnagar, K., McGee, P. (2011). Different, not deficient: The challenges women face in STEM fields. *The Journal of Technology, Management, and Applied Engineering*, 28(2), 1-9.
18. McSherry, J. (2005). Challenges persist for minorities and women. *Electronic Design*, 53(23), 59-61.
19. Milgram, D. (2011). How to recruit women and girls to the science, technology, engineering, and math (STEM) classroom. *Technology and Engineering Teacher*, 71(3), 4-8.
20. NCES, National Center for Education Statistics. (2011). Digest of Education Statistics table 320 [Data file].
21. Plotkowski, P., Sheline, M. A., Dill, M., Noble, J. (2008). Empowering girls: Measuring the impact of science technology and engineering preview summer camps (STEPS). *Proceedings from the 2008 American Society for Engineering Education Annual Conference & Exposition*. Austin, TX: ASEE.
22. Sudman, S., Bradburn, N. (1982). *Asking questions: A practical guide to questionnaire design*. San Francisco: Jossey-Bass Inc.
23. Swimmer, F., Jarratt-Ziemski, K. (2007). Intersections between science and engineering education, and recruitment of female and native American students. *Proceedings from the 2007 American Society for Engineering Education Annual Conference & Exposition*. Honolulu, HI: ASEE.

24. Tsui, L. (2009). Recruiting females into male dominated programs: Effective strategies and approaches. *Journal of College Admission*. 203, 8-13.
25. Yilmaz, M., Ren, J., Ramirez, D., Custer, S., & Coleman, J. (2010) An improved K-12 outreach camp for engineering disciplines. *Proceedings from the 2010 American Society for Engineering Education Annual Conference & Exposition*. Louisville, KY: ASEE.

Appendix A

Sample POWER Camp Schedule

	Sunday 7/14	Monday 7/15	Tuesday 7/16	Wednesday 7/17	Thursday 7/18	Friday 7/19	Saturday 7/20
8:30 AM							
9:00 AM		Breakfast IP 132 9-9:30am	Breakfast IP 132 9-9:30am	Breakfast IP 132 9-9:30am	Breakfast IP 132 9-9:30am	Breakfast IP 132 9-9:30am	Breakfast CE 450 9-9:30am
9:30 AM		Welcome - CE 405 9:45-10:30am	ECTB and CE Info and Activity 9:45-10:15	College Information Session - CE Theater 9-10:00am	Group Pictures 9:30-10am	Wimp up "The Engineering Challenge" CE 268 9:30-11am	Group Presentations 9:45-10:30am
10:00 AM							
10:30 AM							
11:00 AM		Meyer's Bridges ET 10:00am-12pm	Professional Roundtables CE 148, 306, 308, 310 10:30-12pm	BME Info and Activity SL 220 10:00am-11:30am		Work on Presentations ET 220, 224 11am-12pm	Awards and Closing 10:30-11:30am
11:30 AM				Walk Downtown 11:30am-12pm			
12:00 PM		Lunch - ET 202 and 2nd Floor Lobby 1pm	Lunch - CE - 307 12-1pm	Etiquette Luncheon 12-2pm	Industry Visit 10am-5pm	Lunch - ET 202 and 2nd Floor Lobby 1pm	
12:30 PM							
1:00 PM							
1:30 PM							
2:00 PM							
2:30 PM							
3:00 PM							
3:30 PM							
4:00 PM							
4:30 PM							
5:00 PM							
5:30 PM							
6:00 PM							
6:30 PM							
7:00 PM							
7:30 PM							
8:00 PM							
8:30 PM							
9:00 PM							
9:30 PM							
10:00 PM							
10:30 PM							
11:00 PM							

