Classroom Instructors’ Perceptions of Site Leadership and Interest Outcomes within a Summer Engineering Program (Evaluation)

Ms. Trina L. Fletcher, Purdue University, West Lafayette (College of Engineering)

Trina Fletcher is currently a doctoral candidate within the School of Engineering Education at Purdue University. Her research focus includes informal STEM education, professional development, African Americans in STEM and single-sex versus coeducation learning environments. Prior to Purdue and NSBE, she spent time in industry holding technical and operations-based roles and has experience with outreach projects focused on STEM education and mentoring.

Dr. Monique S Ross, Florida International University

Monique Ross holds a doctoral degree in Engineering Education from Purdue University. She has a Bachelor’s degree in Computer Engineering from Elizabethtown College, a Master’s degree in Computer Science and Software Engineering from Auburn University, eleven years of experience in industry as a software engineer, and three years as a full-time faculty in the departments of computer science and engineering. Her interests focus on broadening participation in engineering through the exploration of: 1) race, gender, and identity in the engineering workplace; 2) discipline-based education research (with a focus on computer science and computer engineering courses) in order to inform pedagogical practices that garner interest and retain women and minorities in computer-related engineering fields.

Mr. Christopher Alexander Carr, National Society of Black Engineers

Christopher Carr is the Director, Collegiate & Professional Programs at the National Society of Black Engineers (NSBE). He is the World Headquarters representative for the 232 NSBE collegiate chapters and 63 professional chapters around the world at conferences, workshops, panels, and webinars. Christopher mainly works in the area of STEM education and policy, with a particular passion for access to opportunity, diversity in STEM, and education retention. Christopher is a frequent collaborator with the White House Office of Science & Technology Policy on issues of cultural intelligence, mentorship, and youth leadership in STEM. Christopher holds a Bachelor of Arts in International Relation from William Jewell College, and a Master of Public Policy from Pepperdine University. He is currently working on his Doctorate of Education degree (interdisciplinary leadership focus) at Creighton University.

Ms. Brittany Boyd, National Society of Black Engineers
ABSTRACT
To help address the issue of underrepresentation of African Americans obtaining engineering degrees and matriculating into engineering industry, the National Society of Black Engineers (NSBE) launched the Summer Engineering Experience for Kids (SEEK) program in 2007. As of 2015, the program had 17 sites across 16 major U.S. cities. The free 3-week summer camp provides access to engineering education activities through competition based, hands-on curriculum. At each of the locations, four individuals were hired to serve as site leaders to oversee all operations and logistics at the program: 1) Site Director 2) Assistant Site Director 3) Operations Specialist and 4) Data Specialist. Classroom instructors, who are referred to as mentors, were hired at a 6:1 ratio with a total of 3 per class. The site leaders and classroom mentors were primarily comprised of undergraduate and graduate engineering, STEM non-engineering and education majors.

During the summer of 2015, instructor surveys and student pre and post assessments were distributed, collected and analyzed by the external evaluator. The instructor survey data was analyzed and findings were shared within one of the three reports provided to NSBE by the external evaluator including the overall, all-sites report, site-specific reports and an internal report. However, several of the 34 questions within the instructor post-program survey, a mix of open-ended and likert scale, were not analyzed by the external evaluator. A quantitative analysis will be conducted using raw data from questions related to classroom instructors’ feedback on site leadership performance including areas of management, supervision, their ability to give feedback, professionalism, work ethic and problem solving skills. These results will then be compared to the classroom instructors interest outcomes on the SEEK program. The implications of this research include better understanding the role of leadership during short-term, out-of-school (OST) engineering programs such as training and professional development and other potential best practices.

INTRODUCTION
Out-of-school time (OST) programs including after-school, before-school, and summer-based activities assist with narrowing the achievement gap and increasing interest in STEM for students of color. OST programs serve low-income and minority children at a greater rate than the general population and provides an opportunity for undergraduate and graduate students and people of color to serve as mentors [1]. OST-based programs provide services to 15% of the national school-aged population which is 24% African American, 21% Hispanic, and 16% of Native Americans; a total of 61% for URMs [2,3,4]. According to the Learning in Informal and Formal Environments Center (LIFE), children only spend 81.5% of their waking hours outside of the formal education environment [5,6]. From an outcomes standpoint, OST programs have been found to improve students’ attitudes toward STEM classes, increase interest in STEM careers,
and boost academic achievement. As encouraging as this is, many OST programs struggle to provide science programming because of lack of resources and knowledge, and limited access to professional development [7].

One program that has been able to provide access to STEM education to students of color for 10 years is the Summer Engineering Experience for Kids program (SEEK) hosted by the National Society of Black Engineers (NSBE). As of 2015, NSBE SEEK was in place within 16 major cities across the United States. The program provides a STEM focused curriculum to approximately 3,000 students per summer and employees, on average 400 to 500 collegiate and professional instructors also known as mentors. The mentors are primarily NSBE members who are engineering or STEM students and technical professionals. For 2015, each SEEK site was led by a Site Director, Assistant Site Director, Operations Coordinator and Data Specialist. This leadership team is responsible for the overall management of mentors, student participants, parents, and sponsors. Additionally, they manage the operational and logistical aspects and needs including collecting daily attendance and managing pre and post assessment data. A majority of the site leaders had previous experience with the SEEK program either as a site leader or classroom mentor [8].

Each SEEK site was staffed by SEEK mentors in the aim to provide a unique experience in which students have an opportunity to discover the wonders of STEM. All were required to participate in a 1 week long mentor training that took place the week prior to the program beginning for the students. This training included a review and demonstration of the curriculum, classroom management, team building activities and the parent orientation, which was mandatory for parents, and guardians of all students. At the end of the 4-week experience for mentors, they completed a post-program survey that consisted of a wide variety of questions including multiple choice, likert scale and open-ended options. Several of those 34-questions were not analyzed by the external evaluator. In particular, there were questions related to classroom instructors’ feedback on site leadership performance including areas of management, supervision, professionalism and problem solving skills that were not analyzed but mentioned on a high-level within the internal report. For example, the evaluator stated that two particular sites leadership team members received overwhelming poor feedback from classroom mentors and that NSBE SEEK should further investigate the potential causes [9].

LITERATURE REVIEW
The unique structure of the NSBE SEEK program requires that it is youth led. For the purposes of this review, youth are defined as 18 - 25. Within this youth led model, it is necessary for there to be components of service, cultural competency, and self-efficacy. Youth participation can have a considerable effect on community change. Since the community of the NSBE SEEK program is one of youth leaders, you essentially have youth leading other youth. It is important to note that the NSBE SEEK model considers “youth participation [to be] about the real influence of young people in institutions and decisions, not about their passive presence as
human subjects or service recipients.”[10]. Once engaged as full participants, you begin to see youth not as necessary recipients of care, but as empowered, and involved citizens who have purpose, knowledge, drive and potential. Working on the opposite side of the spectrum of the “adolescent pathology industry”[11], NSBE SEEK works from the empowerment model to enable the Site Leadership to lead their teams throughout the NSBE SEEK program.

The model is built on four antecedents, “individual level factors (sex, personality, control desire), leader-subordinate relationship factors (trust, leader-member ex-change), organization level factors (organization system control) and culture factors (power distance, uncertainty avoidance).” [12] Of these antecedents, the NSBE SEEK program must consider its impact on individual factors when seeking leadership through a people of color lens, being purposeful with gender breakdowns and allotments, and doing personality assessments to make sure that that the right teams are assembled for each camp. For organization level factors, NSBE SEEK must provide sound reporting structures, payment schedules, and mission driven programming that provides consistency for leaders, removing the concerns around organizational interests. What is left is the development of the leader-subordinate relationship factors and taking into account the culture factors. One of the main areas is to build trust and rapport, as trust is critical in youth led initiatives and in the empowerment model. Having the SEEK Mentors trust the site leadership will mean that the leaders have done an effective job of showcasing their skill-set and have empowered the others to work toward the program goals in a way that they feel capable. Lastly, by providing consistent lines of communication with NSBE SEEK programmatic leadership, there is an opportunity to lessen the power distance and remove uncertainty avoidance from the equation. This will enable the NSBE SEEK program to create those empowered, involved leaders who have purpose, knowledge, drive, and potential.

An additional model of leadership is also necessary in the NSBE SEEK program, in that it takes the leader-as-a-servant of others as a baseline. NSBE SEEK Site Leadership is not just a dictatorial structure issuing edicts down to mentors, who then enforce that among the 3rd-5th grade participants. It is a servant leader model, where the site leadership are there to make the job of the SEEK Mentors easy and enjoyable. One that helps them see in themselves the capabilities to lead classrooms and further employ the empowerment model down to help the younger students believe and see themselves as engineers. This allows for a new approach to be utilized taken when taking a look at the issues of power and authority and helping people, “to learn, however haltingly, to relate to one another in less coercive and more creatively supporting ways”[13].

As the perceptions of site leadership are measured to determine the effectiveness of the NSBE SEEK program, it will be beneficial to apply the principles of these two leadership models to the review process and in considering what changes, if any, can be made to make the process effective for all those who are touched by participation.
METHODOLOGY
In order to further research the feedback provided by classroom instructors on Site Leaders at SEEK sites in 2015, two research questions were developed to help guide the analysis: (1) What are the perceptions of classroom mentors on their site leaders and (2) How do the perceptions of classroom mentors on their site leaders compare to the their interest in returning to SEEK and likelihood of recommending the program to others?

The mentor post program survey was emailed to the full classroom mentor population which was a total of 624 individuals that worked during the 2015 SEEK program. Of the 624, 550 (88%) completed the 34-question survey. Although there were 17 sites that took place, only sites that have been in existence for at least 3 straight summers as of September 2015 were included in the study. San Diego met the site requirements but is a predominately Hispanic populated site compared to all others included that are majority African American. Therefore, it was not included. Table 1 below highlights the full list of 10 sites, how many mentors they hosted and the sites overall percentage of mentors in comparison to other sites included within the study.

<table>
<thead>
<tr>
<th>#</th>
<th>City</th>
<th># of mentors</th>
<th>Overall % of mentors</th>
<th># of Years as of September 2015</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Atlanta</td>
<td>40</td>
<td>9.85%</td>
<td>3</td>
<td>2014, 2015, 2016</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>406</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: 2015 SEEK programs by city, number of mentors and students for 2015 and the various years the program took place.

The data analysis consists of taking the responses provided in post program survey questions #30 and #32 and comparing them with responses from questions #15 and #16. Question #30 asked the mentors to Rate your site director in the following competency areas. The competency areas included are listed below in Table 2.
<table>
<thead>
<tr>
<th>Competency Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Leadership, management and supervision</td>
</tr>
<tr>
<td>2  Ability to Give &amp; Receive in an effective way constructive criticism, praise and discipline</td>
</tr>
<tr>
<td>3  Professionalism</td>
</tr>
<tr>
<td>4  Flexible and adaptable</td>
</tr>
<tr>
<td>5  Strong work ethic</td>
</tr>
<tr>
<td>6  Communicates effectively with others</td>
</tr>
<tr>
<td>7  Creates &amp; Maintains positive relationships with mentors &amp; students</td>
</tr>
<tr>
<td>8  Shows good judgement &amp; Problem Solving</td>
</tr>
<tr>
<td>9  Creates a positive work environment</td>
</tr>
<tr>
<td>10 Assertiveness</td>
</tr>
<tr>
<td>11 Public speaking and presentation skills</td>
</tr>
<tr>
<td>12 Organization</td>
</tr>
<tr>
<td>13 Event planning/project management</td>
</tr>
</tbody>
</table>

Table 2: The items above represent the competency-based, sub-questions listed on the SEEK Mentor post-program survey for questions number 30 and 32 focused on the performance of the site director and assistant site director.

For likert style questions representing number 30, each mentor had the option of selecting Exceptional, Very Good, Satisfactory, Marginal, Poor or Did not observe for each competency area. This same question was asked for number 32 but it was for the assistant site director: Please rate your assistant site director in the following competency areas. The next phase of the data analysis consisted of comparing the responses from questions number 30 and 32 to numbers 15 and 16. Question 15 asked How likely are you to participate in SEEK again next year? (Select ONE). Question 16 then asked How likely are you to recommend a friend to work for SEEK? For both questions, the options were Very likely, Somewhat likely, Unlikely or Not sure. The next section will highlight the results from the data analysis.

RESULTS
Respondents’ answers were compiled per site, overall and analyzed per category for all 4 questions. Mentor ratings for questions 30 and 32 were compared to ratings for questions 15 and 16 for each SEEK location and across sites. Figure 1 and Figure 2 below highlight the results for each area as rated by classroom mentors for the SEEK Site Directors and Assistant Site Director.
Figure 1: Results from the SEEK Mentor post program survey for question #30 focused on the site director.

Figure 2: Results from the SEEK Mentor post program survey for question #32 focused on the assistant site director.
**Mentor Perceptions in Atlanta**

Over half of respondents rated their site leaders high, such that an average of 79% of the site director’s and 70% of the assistant site director’s ratings were exceptional, or very good in all categories. Similarly, mentors likelihood to return next year and recommend a friend were both over 70%, as shown in Figure 3.

![Figure 3: Mentor perceptions of future likelihood in Atlanta, GA](image)

**Mentor Perceptions in Chicago**

Over 89% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. Similarly, a majority of respondents are likely to recommend a friend (88 percent), while only 48% are likely to participate again next year (63 percent).
Figure 4: Mentor perceptions of future likelihood in Chicago, IL

**Mentor Perceptions in Denver**
Denver received the lowest average ratings across sites. Less than 30% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. However, over 30% of respondents are likely to return (40%) and 51% are likely to recommend a friend.

Figure 5: Mentor perceptions of future likelihood in Denver, CO

**Mentor Perceptions in Detroit**
Almost 50% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. Similarly, a majority of respondents are likely to recommend a friend (88 percent), and participate again next year (63 percent).
Mentor Perceptions in Houston
Almost 80% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. While a majority of respondents are likely to recommend a friend (77%), only 30% are likely to participate again next year (63%).

Mentor Perceptions in Jackson
Jackson received the highest average ratings across sites. Almost 90% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. Similarly, over 90% of respondents are likely to return and 100% would recommend a friend.
**Figure 8:** Mentor perceptions of future likelihood in Jackson, MS

**Mentor Perceptions in New Orleans**
Over 60% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. Similarly, a majority of respondents are likely to recommend a friend (74 percent), and participate again next year (68 percent).

![Chart](image)

**Mentor Perceptions in Oakland**
Over 70% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. Similarly, over 70% would recommend a friend, and 50% are likely to participate again next year.

![Chart](image)
Mentor Perceptions in Philadelphia
Over 80% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. However, less than 80% are likely to recommend a friend (76 percent), or participate again next year (54%).

Mentor Perceptions in Washington, D.C.
Over 70% of the site leaders ratings were high (i.e., exceptional, very good) across all 13 categories. Similarly, a majority of respondents are likely to recommend a friend (88 percent), and participate again next year (63 percent).
Figure 12: Mentor perceptions of future likelihood in Washington, DC.

Mentor perceptions across sites
A majority of respondents scored their leaders positively (i.e., selecting exceptional, very good). Overall, site directors received higher average ratings than assistant site directors from mentors. More than half of the respondents indicated they would likely return to the program (58.62%) and an even larger number are likely to invite a friend (76.35%), as shown in Figure 13 below.

![Figure 13: Mentor perceptions of future likelihood across sites](image)

Discussion and Conclusion
Overall, a majority of respondents scored their leaders positively (i.e., selecting exceptional, very good) with site directors receiving higher average ratings than assistant site directors from mentors. All 12 sites, with the exception of Detroit, had a lower percentage of mentors that
selected Very Likely for the likelihood to participate next year than their likelihood to recommend a friend. This means that mentors are much more likely to recommend a friend to SEEK rather than joining the program again themselves. An additional finding is that Jackson, Mississippi, one of two single-sex (girls only) sites, had 100% of mentors who selected Very Likely to recommend the program to a friend and over 95% said they would join again. Jackson and Detroit were the only two sites that had over 90% of mentors select Very Likely to return to SEEK again and to recommend a friend. Overall, the program had positive feedback, however, the results indicate an opportunity to further investigate feedback from mentors in order to make improvements to the program.

LIMITATIONS
Based on the findings, there were two primary limitations. The first focuses on the area of using available qualitative data that could have contributed to answering the research questions. For each mentor, there were open-ended questions asked on the survey that could have information supporting their answers within questions number 30 and 32. Unfortunately, that was not within the scope of this paper due to time constraints. Additionally, there were both likert scale questions and open-ended questions around SEEK Mentors feedback on their fellow mentors. Even through feedback here may have not tied directly into gaining feedback on perceptions of Site Leaders, there could have been some information to help with answering aspects of the research questions as well. Research question number two, in particular, focused on their interest in returning or recommending the program to others.

The SEEK Mentor post program survey was designed for programmatic purposes not necessarily for research purposes. Therefore, the design of the SEEK Mentor survey wasn’t developed with a research lens in mind. Particularly, there wasn’t a keen focus on leadership development and how that impact plays a critical part in the effectiveness of individuals hired to work with students. This is very similar to professional development that is designed for K-12 teachers.

FUTURE WORK
One particular project recommended for future work consists of comparing classroom mentors feedback on site leaders and their level of interest in the program to the students’ perceptions of classroom mentors and interest outcomes. For SEEK, each student completes and pre and post program assessment that includes both academic and interest outcomes. Various statistical tests including an ANOVA analysis of mean differences as well as a regression analysis of the student and mentor data should be conducted. Additionally, as introduced within the limitations section, an analysis of classroom mentors opened-ended questions should be analyzed for qualitative research purposes. This is especially important for those mentors who had negative experiences and may have reflected that information within the survey.
BIBLIOGRAPHY


[8] IMPAQ (overall report), 2015

[9] IMPAQ (internal report), 2015


