

Intern Perceptions and Learning Experiences: Assessment Insights from a Research Internship Program

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1. Introduction

The SOAR internship program is an excellent example of what the National Academy of Engineering defines as a “high-impact practice” [1]. The purpose of the program is to support underrepresented minorities in science, technology, engineering, and mathematics (STEM) majors and serve as an opportunity to intern with the ARL at Penn State (ARL) to develop the skills needed to succeed in the workforce. Through a cohort and mentorship structure, the program provides interns with hands-on and relevant internship experience. The purpose of the SOAR program assessment was to examine the program during the summer of 2021 and gain a deeper understanding of the intern’s experiences. Specifically, the goals were to:

1. Understand intern perceptions of the program and what sets SOAR apart as a program.
2. Explore intern’s learning experiences in the SOAR program.
3. Provide recommendations for future assessment.

To address these goals, this paper focuses on two major results and describes areas of future inquiry. In Section 4, we focus on intern’s perceptions of the SOAR program which includes (4.1) why student’s chose SOAR and (4.2) how interns described the program to inform future recruitment efforts as assessed through interview and focus group data. In Section 5, we focus on intern’s learning experiences assessed using survey data from (5.1) the MUSIC Model of Motivation and (5.2) the Workplace Thriving scale. Section 6, then details recommendations for future work and inquiry. Overall, this paper provides insight into the assessment conducted on the SOAR program in the summer of 2021 which could inform future practice and evaluation.

2. Context

The Student Opportunities in Applied Research (SOAR) internship program was initially established in 1997 to provide science and engineering students an opportunity to conduct research with faculty and scientists at the ARL [2]. The program is targeted at attracting underrepresented students who may have an interest in pursuing a career as an R&D Engineer at the ARL or attending graduate school at Penn State. Prior to 2022, the program was referred to as the Open Diversity Outreach Opportunities in Research (DOOR) program. Historically, students have been recruited from Historically Black Colleges and Universities (HBCUs), Minority Serving Institutions (MSIs), and Predominantly White Universities (PWIs) who demonstrate an interest in diversity and inclusion. The diversity focused cohort model sets the internship a part and creates a unique context compared to other internship programs.

Additionally, due to the context and timing of the assessment, the data collection was situated both within the SOAR program and within the broader context of the COVID-19 pandemic. The broader context is worth noting due to the effects that the pandemic had on program policy and intern interactions which may have further impacted the results seen in this report. In terms of their work environment, there was variation across the program. Several interns worked

completely in person due to equipment and security needs, however, the majority of the students worked a variation of hybrid modality over the course of the summer. There were three interns who worked remotely from their team for most of the summer and the SOAR staff worked with those interns to attempt to provide space within the LCS office space for the last month to provide them with the opportunity to experience working in the lab. Within their housing the interns were assigned individually to rooms within the same two floors of a dormitory and for the first four weeks of the summer students were required to take their meals “to-go” in the dining commons. Beginning in July the mask mandates and in-person dining restrictions were lifted.

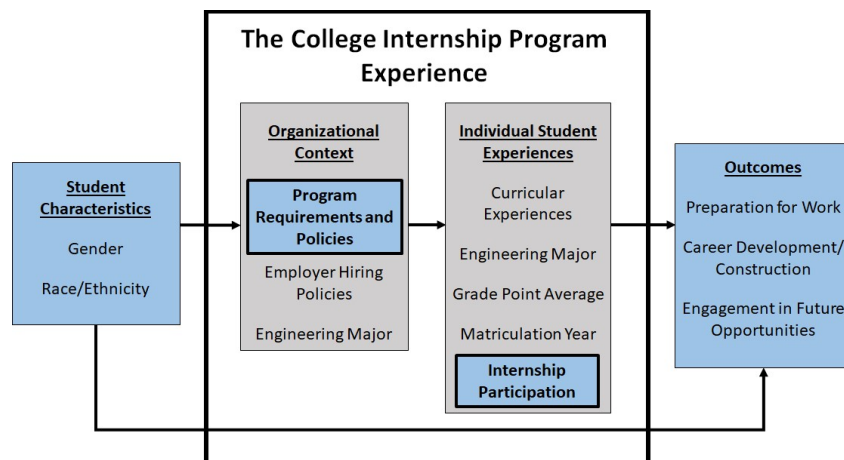
In this assessment report, SOAR’s history as a diversity-focused cohort program and COVID-19 both contributed to the context which shaped the data collection. Consequently, the findings and results are also situated in this context.

3. Methods

Throughout the course of the internship program, assessment was conducted through quantitative and qualitative measures. The data collection methods were guided by ethnographic case study methodology. Informed by ethnographic data collection approaches, the qualitative data collection methods included interviews with participants, both one-on-one and in focus groups, as well as the observation of participants [3]. The goal of the qualitative data collection is to collect information about the participant’s experiences and perceptions while the program is happening. In addition to the qualitative data collection, quantitative data was collected in the form of informational questionnaires and surveys. Educational survey instruments pertaining to internships and high-impact engineering practices were utilized including the MUSIC Model of Motivation [4] and Workplace Thriving [5]. These data collection methods were facilitated alignment with previously used SOAR program evaluation questions and scales. Throughout the findings, identification numbers are used rather than names to protect student’s privacy.

An adapted version of the College Impacts Theory by Terenzini and Reason was used to inform the overall study seen in Figure 1 below [6,7]. Lastly, more detailed data collection and analysis is described within each of the following sections dedicated to the findings.

Figure 1. The College Internship Experience Framework [6,7]



4. Results: Interns Perception of The SOAR Program

4.1. Why Students Chose SOAR

The first concept explored through the assessment examined why students chose the SOAR program and what drew them to the program. This concept was examined through individual interviews, particularly the initial interviews collected in Weeks 1-3 when interns had first arrived. The interns gave a variety of responses to explain why they had chosen the SOAR program. The interview transcripts were analyzed using thematic analysis [8].

4.1.1 Research Opportunities

A major theme that arose when the interns discussed why they chose the SOAR program was the research and work conducted by ARL.

One intern, P15, discussed how in the recruitment phase they felt that their work and knowledge would be valued on the research projects. While this intern had worked in another University-Affiliated Research Center (UARC) previously, they felt that their knowledge was not valued and felt that they did not fit in with the culture of the other lab. This previous experience and the positive foreshadowing they saw in the recruitment process led them to choose the SOAR program over their other offers which included an internship at Google. One intern, P15, stated:

“I actually got accepted to [Big 5 Tech Company], and then this [SOAR]. It was difficult because I was becoming jaded, you know, school was just giving me the same thing over and over. I didn't get really the best experience last summer. Like where do I go? And the conversations I had with the recruiters and mentors from the SOAR program . . . just the way that they engaged with me, they were interested in what I wanted to do. They asked me about my interest where and I was like, they seemed different, you know?” (P15)

Other interns brought up the research opportunity and their potential aspirations to attend graduate school as a motivator behind choosing SOAR. For example, an intern, P7, discussed how the work of one of the research professors led them to apply to the program explaining, *“He's probably the reason why I applied to the [SOAR] program. He's an amazing guy.”* The intern went on to discuss how they found their mentor through interest in their research and then due to their appointment as a research professor the intern was also able to discuss graduate school opportunities with them as well as work closely with graduate students on their work team.

4.1.2 Diversity-Focused Cohort Model

Another theme that arose when students spoke about why they chose the SOAR program was how they had been drawn to its unique nature as a diversity-focused cohort program. Two interns, P4 and P22, specifically mentioned how they had spoken to a former SOAR intern from their university who recommended the program. Both students attended the same HBCU which has recruited many previous SOAR alumni. One of those students, P4, stated that when they went to conduct further research about the program the marketing materials stood out due to the diversity of the photos. The diversity of the program was also discussed by intern P23 as their motivation for applying to the program after their prior summer in program with little diversity. They stated,

“I leaned towards this internship itself because of the broadcasting that is a diversity program. So, I probably wouldn't have even applied if it wasn't diversity [focused] because I already go to school and I'm the only girl in the class or the only black person at the moment and it's like kind of like, I'm pretty over that. I want to work . . . I want to be an engineer and work in an environment that I can feel comfortable.” (P23)

In addition to the diversity-focus of the program, several interns also brought up the cohort structure and benefits as reasons why they chose the SOAR program. Two Penn State students and many of the interns who attended other universities discussed how the room and board being included was unique compared to other industry internship programs and was a factor in their decision. One intern, P8 said during an interview:

“I really appreciate that housing and food was provided for us. And I was looking at the other opportunities that have to the summer I was going to be making less money just based on having to find out what I was going to eat. So, this has really taken a lot of the stress off of that in terms of just like I'm just going to come and work and then, what I make is going to be what I make, and that's it.” (P8)

4.1.3 Analysis of Why Students Chose SOAR

The qualitative dataset that was analyzed to explore why students chose SOAR was taken from the initial interviews and was not directly written into the interview protocol. The majority of these quotes, and subsequent themes, were provided by the interns unprompted. This demonstrates that the students felt strongly in their motivation and reasoning to attend the program into the initial phase of the internship.

Historically, the SOAR program has recruited and served a significant population of students from HBCUs and Minority-Serving Institutions (MSIs). While the 2021 cohort had a lower percentage of HBCU students, the structure of the program and marketing materials depicting previous cohorts appeared to have a strong influence on these students' motivations to choose the program. SOAR alumni and marketing materials appeared to support recruitment efforts; however, the images of previous cohorts also drew the attention of at least one student who noticed the difference in population demographics between the 2019 and 2021 cohorts.

Additionally, it is likely that COVID-19 also influenced recruitment and the motivations that led students to accept (or decline) their internship offer across the themes. In terms of program structure, this was the first summer that not all of the Penn State students took advantage of the room and board offered by ARL. However, two Penn State students specifically cited the room and board as motivators for applying and the quote from P8 was directly from a Penn State student. Additionally, in their individual interviews several of the Penn State students living off campus brought up their meal plan as a benefit of the program and ate in the dining hall with their on-campus peers. While it was originally thought that the data would show larger differences in opinions regarding the room and board, it appeared that even students who did not live on campus valued these components of the program structure.

Ultimately, while each student who chooses to intern with ARL may have varying motivations, in the selection process the SOAR program sets itself apart through its diversity-focused cohort model, competitive benefits, and technical research.

4.2 Results: How Interns Described the Program

During the mid-summer focus groups, the interns were asked to use one word to describe the program to understand how they individually were feeling about the program and their experiences at the halfway point. Within the range of replies, there were several themes in the intern’s descriptions including cohort-centered, knowledge-based, and feeling descriptions both positive and negative. Table 1 below displays the four major themes and corresponding descriptions.

Table 1. *Intern descriptions of SOAR*

Cohort-centered	Knowledge-based	Feeling (+)	Feeling (-)
Community	Informational	Caring	Tedious
Network	Expansive	Warm	Stressful
	Informative	Fun	
	Supportive	Awesome	
	Interesting	Present	
	Essential	Refreshing	
	Independent	Fulfilling	
		Present	

4.2.1 Analysis of Intern’s Descriptions of SOAR

The four categories summarize the major themes and range of responses that interns gave to describe the program in one word. They were asked to provide a short explanation for their choices which helped guide the creation of the four categories and sentiment analysis.

The majority of interns came up with a word with a positive sentiment focused on the cohort model, knowledge-based, or their feelings about the program. The most common response was a word that aligned with a positive emotion or feeling such as caring. These results are in alignment with the results of the MUSIC Model survey instruments where students highly rated their perceptions of the program, particularly in the mentor and SOAR staff caring constructs. Additionally, the category of words most related to knowledge gained is related to the survey constructs of usefulness and interest which were both rated the second and third highest scores after the caring constructs.

In the results, there were two interns who came up with words that would be associated with a negative or neutral sentiment. The intern that responded stressful described that they were overwhelmed with the number of meetings and program deliverables. It is worth noting that this focus group occurred in the same week that the final presentation and poster guidelines were sent

out to the interns, so it is possible that the timing of the focus group influenced the response. The other intern who provided the answer of ‘tedious’ also cited the number of SOAR program meetings and deliverables as the reason for their response.

5 Results: Intern’s Learning Experiences

The intern’s learning experience during the program was assessed through two main quantitative measures. First, validated measures from the MUSIC Model of Motivation [4,9] were used to holistically assess the intern’s experience from the lens of motivation. Secondly, a validated scale of workplace thriving created by Porath and colleagues [5] was used to explore intern’s workplace learning.

5.1 Music Model of Motivation [4, 9]

The MUSIC Model was selected to assess motivation constructs related to learning due to its success as a practitioner assessment tool and prior validation for use with engineering students. This assessment tool, distributed at the end of June, explored the SOAR program and ARL through the lens of a learning environment.

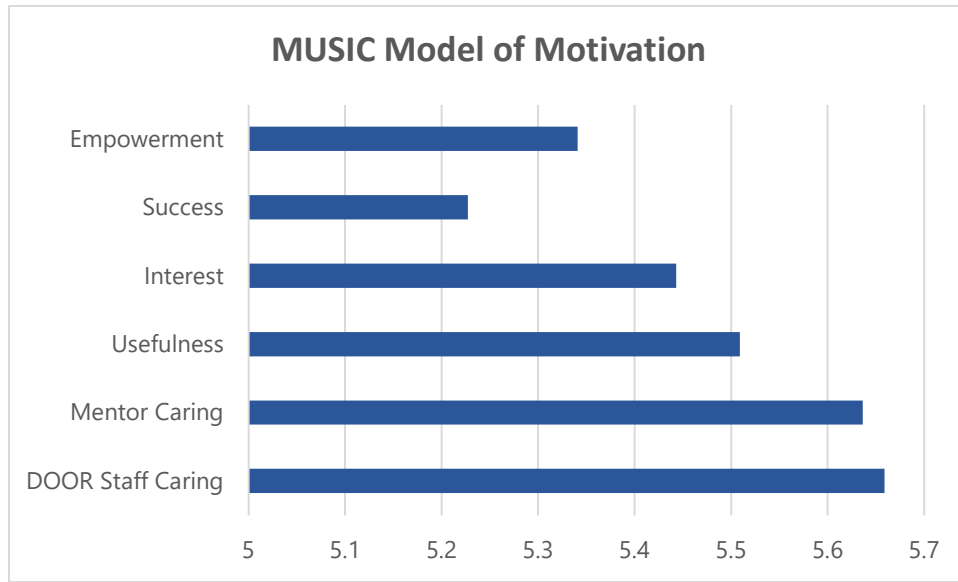
The MUSIC Model assesses the five constructs of empowerment, success, interest, usefulness, and caring. The five key principles of the model captured by the constructs are that the learning facilitator needs to ensure that the learners:

1. Feel empowered by having the ability to make decisions about some aspects of their learning,
2. Understand why what they are learning is useful for their short- or long-term goals,
3. Believe that they can succeed if they put forth the effort required,
4. Are interested in the content and instructional activities, and
5. Believe that others in the learning environment, such as the instructor and other students, care about their learning and about them as a person (Jones, 2018, p. 9).

The scale was created to assess motivation across different populations and has been validated for use with undergraduate STEM students. Additional information related to the MUSIC Model can be found at [MUSIC Model of Motivation – MUSIC Model of Motivation \(themusicmodel.com\)](http://themusicmodel.com).

The survey instrument used for the SOAR interns was adjusted in alignment with the context of the program and ARL workplace. One of the major changes included dividing the construct of caring to assess the SOAR staff and research mentors separately. Other changes were adjustments to the wording of questions to focus on the workplace as opposed to a classroom. In terms of measurement, the model assesses the five motivation constructs as averages and allows us to examine the scores relative to one another. Generally, scores from 4.5-6 are considered indicators of positive learning environments. The scale is most effective when comparing across the same sample because individuals can have different perceptions of scale in the Likert-style answers. The overall results can be seen below in Figure 2 and reflect positive learning environments across all constructs.

Figure 2. *MUSIC Model Results for the SOAR Internship Program*



5.1.1 Analysis of MUSIC Model Results

The results from the MUSIC Model of Student Motivation survey provide useful information about intern's perceptions within the SOAR program. Across the responses, all of the constructs were well ranked by interns which demonstrates positive motivation outcomes related to learning.

The most notable finding from this survey is that the construct of Caring was ranked the highest, with the SOAR Staff Caring being ranked the highest amongst all constructs. This demonstrates that through the recruitment stages, program design, and workshops the interns felt that the SOAR staff cared about their learning and the interns as individuals. This is a strong outcome and supports the program's goal of creating a positive environment. The construct of Caring for mentors was ranked second just below the SOAR Staff Caring. This further demonstrates that the mentors and ARL staff on the intern's teams created a supportive environment.

Usefulness, Interest, and Empowerment were also ranked well and related to the intern's perceptions of their role on their project. It is positive that overall intern's felt their work had a utility value for their short- and long-term goals. Interest and Empowerment were both ranked well, but not as high as Caring, and this is likely due to the scope of a 10-week internship and the nature of research work. Interns are often placed on a project that aligns with their mentor's work and with the security of the lab's work in most cases the project topic is not disclosed until they arrive on-site. These factors likely influence the intern's perception of Empowerment and Interest to some degree.

The lowest ranked construct from the survey was Success, which measures the intern's beliefs that they can succeed if they put forth the effort required. Similarly, to the constraints discussed with Interest and Empowerment, it is likely that their perceptions of success were influenced by the scope of the 10-week internship and the nature of research work.

5.2 Workplace Thriving Survey [5]

For the final concept, the framework of workplace thriving was used as a lens to explore the intern's attitudes towards their internship and the workplace they experienced at ARL. The end of summer survey included a validated scale created by Porath and colleagues [5] to study workplace thriving. The scale has been used with interns and engineers in previous research studies. The concept of workplace thriving focuses on two major ideas according to Spreitzer et al. including: (1) a feeling of vitality and (2) a sense that one is learning or getting better. This scale is included in the appendix.

The results of the quantitative data and descriptive statistics found that the intern's scored highly on the concept of workplace thriving across the board.

Several responses stood out within the results section. When asked to rate their agreement with the statement "At work, I found myself learning often" all of the responses were positive, 56% responded strongly agree and 44% responded agree to the statement. Another question with a similar positive response was the statement "At work, I saw myself continually improving". For this statement, the breakdown of responses was 56% strongly agree and 44% agree with no negative responses noted. When given the statement, "At work, I continued to learn more as time went by" there was an even stronger positive response with 63% strongly agreeing and 37% agreeing. Lastly, another learning scale item that scored strongly for the interns was the statement "At work, I have developed a lot as a person". For this item, 56.25% reported strongly agree, 31.25% agree, and 12.5% slightly agree.

In the survey scale there were several reverse coded questions to ensure that accurate and appropriate responses were being given. For the reverse coded item, the statement "At work, I was not learning" received all strongly disagree and disagree responses from the intern. The results from these reverse coded questions helped validate that the responses on the survey were completed accurately.

5.2.1 Analysis of Workplace Thriving

The results of the workplace thriving survey found that overall, the interns had positive attitudes towards their internship as a learning experience and the workplace environment they experienced at ARL. An interesting finding is that the interns rated the learning items higher than the items related to feeling of vitality. For several questions, all of the interns agreed that they were learning or getting better.

These findings demonstrate that SOAR and ARL created an environment conducive to learning and that the interns viewed the experience as a learning opportunity.

6. Future Assessment Recommendations

After collecting data and conducting analysis on the summer of 2021 SOAR Intern cohort many lessons were learned about the assessment and evaluation process. Recommendations for future assessment are grounded in these lessons. The two overarching recommendations for future assessment focus on areas for future inquiry.

6.1 Mentor Perceptions

SOAR Mentors experience the SOAR program and influence the experience of the interns they work with. For this reason, it is recommended that future assessment include mentor perspectives and perceptions of the program. The program would not be able to run without the mentors and SOAR interns spend a significant amount of time with their teams so it would be useful to understand their perspectives. Insight from mentors could provide the SOAR program with feedback on areas of strength and opportunity. During the summer of 2021, one survey was sent out to mentors which had a very low participation rate. Due to mentor's time constraints it will be important to design an assessment method that allows them to provide feedback in an efficient and effective manner. A mentor specific focus group scheduled during a lunch hour is a possible opportunity or another adjusted survey could be distributed. It is recommended to poll mentors during the Mentor Training session prior to summer to determine their preferred method.

6.2 Influence of Intern Background on Experience

Future work could explore differences by school type and background. For example, targeted questions and protocol building on the findings in this report could help uncover differences in perception by population. These future findings could support future recruitment efforts and inform program structure. Additionally, deeper exploring differences in motivation between Penn State students and students from other universities. Additionally, exploring the motivations behind students from HBCUs or MSIs who may face more of a "culture shock" when transitioning from their school environment to the Penn State environment due to Penn State's status as a Predominantly White Institution (PWI).

7. Conclusions

Ultimately, while each intern who chooses to intern with ARL may have varying motivations, in the selection process the SOAR program sets itself apart through its technical research and diversity-focused cohort model which are supported with competitive benefits. Additionally, the intern's descriptions of the program indicate an overall positive perception of the SOAR. In terms of interns' learning experiences, the positive results from the MUSIC Model survey demonstrated motivation outcomes associated with learning. The findings from the workplace thriving survey demonstrate that SOAR and ARL created an environment conducive to learning and that the interns viewed the experience as a learning opportunity. These results support the goals of the program and also indicate areas for future inquiry including exploring mentor perceptions and influence of intern background on experience.

This assessment and continued research stand to have a positive impact on the SOAR program, the broader defense community, and other internship programs through establishing the program as an effective practice. Furthermore, the results of this assessment have the opportunity to aid continual improvement and support translation of SOAR to other contexts.

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