

An Engineering Professional Learning Summit for School Counselors (Evaluation)

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Abstract

This evaluation paper reports on the implementation of an Engineering Summit for high school counselors. Counselors play an important role in guiding students toward postsecondary opportunities in engineering fields. Research indicates that limited knowledge of engineering and narrow perceptions of engineering practice can constrain counselors' advising. Our team designed and hosted the Engineering Summit for 10 high school counselors, a 1.5-day, in-person professional learning workshop. The summit was part of a larger year-long effort examining how professional learning experiences can support counselors' understanding of engineering and their approaches to engineering career counseling. Focus group discussions were conducted to evaluate the summit experience. Findings indicate that counselors valued hands-on and collaborative activities, developed broader conceptions of engineering beyond mathematics and science, and expressed increased confidence in supporting engineering pathways. This paper offers design insights for counselor-focused professional learning in engineering education.

Introduction

The role of school counselors (also known as career counselors or guidance counselors) in student career choices is noteworthy [1]. Students' course selection, postsecondary planning, motivation, and confidence are shaped during high school, and counselors play a direct role in influencing these processes [2], [3]. Strengthening counselors' understanding of engineering pathways may therefore be critical in addressing attrition and gender disparities in engineering. However, counselor preparation programs prioritize general career development, and engineering is treated as one among them. Hence, counselors do not get exposed to what engineering actually means in practice. Prior research indicates that limited time and insufficient foundational knowledge of engineering function as barriers for school counselors when advising students about engineering careers [4], [5]. The literature further suggests that school counselors need a stronger understanding of pathways and career development processes to more effectively support and encourage students to consider engineering [4].

National reports have long emphasized professional development as a key mechanism for improving STEM teaching and learning [6]. Following this, numerous engineering initiatives have been developed [7], [8]. Numerous studies and reports have established the benefits of such programs [9], [10]. However, despite their significant influence on students' career decisions, there is limited documented work on engineering professional development programs intentionally designed for school counselors [11]. As a result, while instructional capacity in engineering may be strengthened through teacher-focused initiatives, the guidance systems that shape students' academic and career decisions may remain underdeveloped. This imbalance suggests a gap in current pre-college engineering education efforts.

To address this gap, our project team designed and hosted an engineering summit for counselors as part of a broader effort to advance understanding of engineering career counseling. The goals of the summit were, first, to advance counselors' knowledge of the engineering profession and engineering career pathways so that they could better guide their students. The second goal was to build school counselors' capacity to enhance all pre-college students' opportunities to consider engineering as a potential career. The current study focused on evaluating the first objective and the design and delivery of the engineering summit. The following paragraphs explain the details of the engineering summit and its evaluation.

Program Context and Procedures

The engineering summit is part of a larger NSF-funded project designed to advance engineering career counseling through a year-long professional learning experience for high school counselors. This paper focuses specifically on the engineering summit, which was designed based on our earlier pilot work [11].

Recruitment

Recruitment followed a multi-pronged approach using project team and advisory board networks, as well as social media, to reach nationwide counselor communities. An interest survey was sent out with three potential dates for the engineering summit. A total of 148 responses were received, and the engineering summit dates were finalized based on the highest ranking. Next, a program application was sent requesting the applicant's school and demographic information, along with a commitment to attend the in-person engineering summit. We received 55 applications, and 10 participants were selected, reflecting a diverse range of school contexts (e.g., urban, suburban, rural, virtual) and career and technical education settings across multiple U.S. states.

Engineering Summit Structure

The Engineering Summit was held at one of the partner institutions in January and consisted of a 1.5-day workshop at the start of the cohort year. As mentioned earlier, one of the summit goals was to advance counselor knowledge of the engineering profession and engineering career pathways. To address this goal, multiple summit sessions introduced counselors to the engineering profession by focusing on the why, what, and who of engineering. Counselors explored the role of engineering in society and how it connects to our daily lives. The summit emphasized team building and hands-on engagement with engineering concepts so counselors could experience activities similar to those their students might encounter in pre-college engineering courses. Counselors collaboratively completed engineering design challenges such as constructing shelters with spaghetti and paper and designing simple robotic arms. The project team also shared information on engineering disciplines and higher education pathways, along with a repository detailing links to videos explaining various engineering disciplines, engineering scholarships, and competitions. Another goal was to build school counselors' capacity to enhance all pre-college students' opportunities to consider engineering as a potential career. To address this goal, counselor participants were asked to read the first

three chapters of the book “Whistling Vivaldi - How stereotypes affect us and what we can do” [12] before attending the summit. During the summit, with the help of the project team members, counselors examined demographic patterns in various engineering disciplines using national reports and databases [13] and discussed common biases and stereotypes about who can become an engineer. One of the sessions focused on discussing approaches to building students’ engineering identity. Dedicated reflection time allowed participants to consider how these experiences, and the associated conversations about stereotypes, informed their self-dispositions and practices related to engineering career counseling.

Participants

High school counselors are responsible for supporting academic, socioemotional, and career development for all students. However, in some high schools, the role has been divided, with school counselors focusing solely on career development as college advisors or career counselors. In our study, all participating counselors hold a graduate degree in school counseling and work in high schools, where their roles include supporting the career development of high school students. Demographic information for participating counselors is provided in Table 1 for reference.

Table 1: Demographic details of counselors

Counselor No.	State	Gender	Race	Years of Experience
1	Arizona (Virtual)	Male	Black or African American	18
2	California	Male	Latino/a/x/e	3.5
3	California	Female	Latino/a/x/e	2
4	Georgia	Woman	Black or African American	1
5	New Jersey	Female	Latino/a/x/e, White	14
6	North Carolina	Female	White	6
7	Ohio	Non-binary	White	5
8	Virginia	Male	White	11
9	Arizona	Female	Black or African American, White	15
10	Pennsylvania	Female	Black or African American	10

Methods

The current study focused on evaluating the first objective of advancing counselor knowledge of the engineering profession and pathways, as well as the design and delivery of the engineering summit. The evaluation was done using qualitative data due to the small number of participants. The first set of data was collected through focus group discussions conducted immediately after the engineering summit. Counselors were organized into small groups of three to five participants to discuss their experiences and reflections on the summit. Each focus group discussion lasted between 30 and 45 minutes.

A second set of data was collected after the summit through written reflections. Counselors were asked to write letters addressed to a future cohort of counselors describing their experiences with the summit and the broader program. All participating counselors completed this activity. The letters ranged from one to two pages in length. Only the content related to the summit experience was included in the analysis.

All collected data were transcribed and anonymized before analysis. The dataset was analyzed using an inductive qualitative approach. Open coding was employed to examine the data and identify meaningful patterns. The first author conducted the initial coding, and the second author reviewed and validated the coding process. The resulting codes were then examined to identify emergent themes.

Results

The analysis led to three themes, which are described in detail in the following paragraphs.

Theme 1: Understanding of Engineering

Counselors described a clear shift in how they understood engineering and their role in supporting engineering pathways. Participants reported moving away from viewing engineering as a field reserved for students with exceptional mathematics and science abilities toward a broader understanding that emphasizes problem solving, communication, creativity, and social awareness. One counselor noted,

“I did place a lot of emphasis on math prior to coming here... I didn’t have any other language to use... going forward, I will certainly highlight some of those other skills... definitely communication and some of those SEL skills...”

Counselors also reported increased confidence in discussing engineering with students and families. They described feeling more prepared to challenge common misconceptions, introduce engineering as a viable option earlier in students’ trajectories, and engage students who might not initially identify with engineering. Participants also articulated greater clarity around engineering fields and pathways, which supported more intentional advising, reduced anxiety, and enabled counselors to provide concrete guidance rather than general encouragement.

Discussions about engineering identity further shaped counselors’ understanding of their professional role. Participants described recognizing engineering as a way of thinking and acting, rather than a narrowly defined credential, which aligned with their existing counseling practices. As one counselor reflected,

“Learning about the engineering identity was eye opening... you’re acting in the manner of an engineer... everyone can be an engineer...”

Taken together, these reflections indicate that the summit supported counselors in reframing engineering as accessible and inclusive, while strengthening their confidence and intentionality in advocating for diverse engineering pathways.

Theme 2: Counselor Perspectives on Summit Design and Delivery

Counselors described the summit as engaging and distinct from other professional development experiences they had previously attended. They emphasized that the interactive structure allowed them to actively collaborate, think creatively, and problem solve together, rather than passively receive information. Opportunities to exchange ideas across school contexts and learn from peers were viewed as particularly valuable. One counselor explained,

“I enjoyed the book conversation... that’s how we learn from each other... hearing what other districts are already doing gets me excited about trying some things in my district.”

Counselors also highlighted the importance of group composition and facilitation. Being part of a diverse cohort in terms of geography, race, culture, and professional experience was described as fostering deeper conversations and a shared sense of purpose. Participants noted that learning alongside like-minded peers and experts from both counseling and engineering backgrounds helped them gain new perspectives and strategies that felt relevant to their own contexts.

In addition, counselors valued the hands-on activities, practical planning tools, and strong leadership throughout the workshop. Counselors explained that hands-on engineering activities helped them see how engineering ideas are applied in practice. They also noted that structured planning tools helped them think about how to adapt these ideas within their own school contexts. As one counselor noted,

“It’s intentionality and real-world application set this program apart from other professional development experiences... It wasn’t just about theory – it was about action... we explored concrete steps to implement change in our schools.”

Overall, counselors valued workshop elements that supported engagement, collaboration, and practical application, highlighting the importance of well-designed and interactive professional learning experiences.

Theme 3: Improvement Suggestions for Future Summits

Counselors offered constructive feedback aimed at strengthening future summits. Participants emphasized the need for more time to support deeper engagement with the content and peer discussion. They noted that the limited time constrained opportunities to fully explore presentations, ask questions, and learn from one another’s experiences across different school contexts.

Counselors also suggested design refinements to better situate participants within the cohort and extend the summit’s impact. These included sharing more information early in the experience about counselors’ school settings and professional backgrounds to better ground conversations. Participants further recommended developing shared outreach resources that document strategies used across schools and support continued learning beyond the summit.

In addition, counselors highlighted the importance of increasing the visibility of the initiative within school systems. They emphasized the need for formal mechanisms to share the summit with school and district leadership to gain recognition and institutional support for engineering related efforts. As one participant explained,

“Please share this initiative formally... with our district leadership... we want to bring more opportunities, but it has to be recognized.”

Taken together, these recommendations reflect counselors' interest in refining the structure of future summits to better support engagement, collaboration, and sustained follow-through.

Discussion and Conclusion

This article explains the implementation and follow-up evaluation of an engineering summit for high school counselors, along with their feedback. The first goal of the summit was to advance counselors' knowledge of engineering and career pathways. Findings from Theme 1 suggest this goal was achieved to some extent. Counselors described moving beyond a mathematics-centered view of engineering and gaining a broader understanding of the field. They reported clearer knowledge of engineering disciplines and pathways and greater confidence in discussing these options with students and families. The second goal of the summit was capacity building so counselors could support a broader range of students in exploring engineering careers. While the current study does not focus on evaluating this objective, some findings indicate progress toward it. Counselors described introducing engineering earlier, addressing stereotypes, and encouraging students who may not initially see themselves in engineering. Although the summit initiated shifts in perspective, sustained change requires continued engagement [14].

A Community of Practice followed the Summit to support ongoing reflection and refinement of counseling strategies. A more comprehensive study is needed to examine how the second objective is achieved in practice and to evaluate the effectiveness of both the engineering summit and the broader project over time. Future work can also explore how counselor focused professional learning can be sustained across school and district settings. It is important to note that the study is limited to a small group of high school counselors participating in a single professional learning summit and reflects counselors' self-reported perspectives.

Analysis of counselor feedback suggests that the understanding of engineering could be enhanced by how it is framed in professional learning, a pattern also observed in prior STEM education research [15], [16]. Prior research on engineering-focused professional learning for teachers similarly argue that immersive, design-oriented experiences broaden conceptions of engineering [17], [18]. Although these studies focus on teachers, the present findings indicate that comparable professional experiences may be effective for counselors when aligned with their advising role. Counselors entered the summit with narrow views of engineering that emphasized mathematics and academic exclusivity. This pattern aligns with prior research documenting gaps in counselors' knowledge of engineering pathways and the persistence of restrictive perceptions about engineering participation [19], [20]. Framing engineering as accessible and relevant, and aligning it with identity-oriented approaches counselors are already familiar with, helps counselors effectively advise students about engineering careers and pathways.

The findings further indicate that professional learning design played a central role in this reframing. Counselors consistently emphasized interactive and experiential elements, suggesting that learning occurred through participation and peer exchange rather than information transmission. This aligns with research on adult learning and professional

development, which highlights experiential learning and social interaction as critical for professional sense making [21], [22]. The results also align with prior work emphasizing that career guidance professionals play an interpretive role in shaping students' understanding of STEM pathways, suggesting that professional learning for counselors should be designed around this function rather than modeled after teacher-centered initiatives [23], [24].

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