Designing Professional Development to fit your Audience (Other)

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Abstract

Professional development for engineering education in the precollege space can vary widely for many reasons. One of the most compelling reasons for differentiation is the learning needs of the audience. A workshop for teachers who have immediate need for activities to incorporate in their classroom looks different from a workshop for counselors who are guiding students through career choices. This paper looks at the design considerations for professional development workshops by using two workshops conducted in 2022 with 56 participants as examples. The first workshop was for a group associated with 9 North Carolina State University College Advising Corps (CAC) members, recent college graduates who may or may not have a STEM degree. These CAC advisors with high school students in rural parts of the state to advise them along career pathways. The second workshop was for 49 teachers in a K-8 STEM school needing to understand integrated STEM instruction and get ideas for nearly immediate implementation in their classrooms. Both groups needed orientation with regards to authentic engineering for K-12 students, as well as an understanding of engineering careers. Both workshops included hands-on engineering activities, discussion of engineering habits of mind, and comparisons between science, math, and engineering. Yet both workshops could not be identical, due to the unique needs of each audience.

The paper includes a description of the content of both workshops, observations of the participants as they engaged in engineering design challenges, and evaluation results of each workshop. Also included is a discussion of the realities of providing professional development as the K-12 outreach and engagement team at The Engineering Place @ NC State University College of Engineering versus the theoretical optimum approach and how to deal with the constraints of working with fund- and time-limited groups of professionals.

Introduction

Our mission at The Engineering Place, a K-12 Engineering Outreach Organization, is to increase engineering access, awareness, and knowledge by engaging educators, K-12 students, parents, and the general public with innovative programming. Our work spans various audiences: formal and informal educators, students in both formal and informal settings, and the general public. Our goal was to answer the following question: What are the best strategies to employ when designing professional development with various audiences?

Effective Professional Development

Understanding what works in teacher professional development is complex and a

challenge for districts and school administrators in understanding specifically which type of TPD or which specific elements of the TPD are effective. This can be daunting for district and school administrators when planning TPD [2], [16]. While there is general consensus regarding the necessary features for effective professional development, proving which individual or combination of components in producing the largest effect can be elusive. Research indicates the most effective type of teacher professional development (TPD) involves a sustained and ongoing experience, which is coherent, job-embedded, and involves active participation by the learner and includes a learning community [2], [3], [4], [5]. However, most teachers continue to participate in episodic workshops [3]. Expenses related to TPD is another reason districts are resorting to shorter duration, incremental TPD, as these types of experiences are less expensive than implementing reform-oriented TPD [17], [18]. During the economic downturn, Ellerson's study [18] found that 71% administrators responded that providing professional development for teachers was down due to budgetary issues. When asked in 2012 what impact sequestration would have on school budgets, 69% of administrators responded that they would cut TPD [18]. These data suggest TPD is the first expense to be cut when schools face tough budgetary times. Since schools are limited in their funding towards teacher PD, organizations such as ours provide episodic workshops and events to support teacher's desire to learn more about engineering and how to integrate engineering content knowledge into their classrooms.

Importance of Engineering Education in K-12

Some of the most common goals of including engineering in the K-12 classroom are:

- Increase the diversity of students who consider engineering as a viable pathway
- Teach critical thinking
- Bring authenticity and relevance to science and math content (Of course, engineering is not the ONLY platform that will provide this.)

Although there has been a concerted effort to emphasize the importance of engineering as it applies to K-12 education [9], once programs are implemented, the original objectives may be lost. The intensity of organizing materials, the use of available resources that emphasize different goals, or simply the effort of finding time to include authentic engineering-related activities can dilute attention to the learning processes that engineering is capable of bringing to the table. This is one of the most important initial messages that is a part of teaching engineering education for the K-12 classroom.

As an example, the use of a kit that allows students to assemble a pre-designed heart rate monitor may not impact critical thinking [14]. An activity that uses the monitor in the course of taking measurements is more of a pure science or mathematics activity than engineering. In fact, any purely procedural activity runs the risk of losing its connection to engineering if it lacks problem

solving or design. This does not mean that the activity is somehow lesser, but it does mean that it doesn't meet learning objectives for engineering.

This type of message is an example of the type of content that may be important if your audience is teachers, but not relevant for counselors. The design of training programs for different audiences require that specific learning outcomes be established for the specific audience in order to be most effective.

Designing for Different Audiences

Session design can sometimes be subsumed in the desire to have a standard message and standard design. This is probably driven by a lack of bandwidth and a desire for efficiency. But, as illustrated by the simple example in the previous paragraph, different audiences have different needs from a session designed to introduce them to engineering.

As we were under the same types of constraints, we arrived at the compromise of developing a general construct and modifying sessions to fit the needs of different audiences. An additional challenge was that we were given widely varying amounts of time to present the sessions. This meant that it was very important to have clear learning objectives.

As an example, the learning objectives for a session for K-8 teachers and a session for high school counselors are compared in Table 1. To make the table readable, we do not write out the full learning objective. We placed verbs from different levels of Bloom's taxonomy [1] to indicate how the learning objectives differ for each audience, because different audiences require different depths of understanding. In addition, each topic is given a level of importance for the particular audience, indicated by low, medium, high, and not applicable.

The importance levels can be used to decide how to trim time from a workshop at need, as well as how to organize material. The Bloom's verbs are used to decide the type of activity, based upon the difficulty level, used to convey the information during the presentation.

Table 1: Learning objectives and audience needs, with learning depth (low to high level) defined by Bloom's Taxonomy verbs

	K-8 Teachers (needs/cognitive level)	College Advising Corps High School Counselors (needs/cognitive level)
Engineering Habits of Mind	High/Explain or identify	High/Recognize
What engineers actually do	High/Identify	High/Explain
Different engineering disciplines	Low/List	Medium/Interpret
Engineering design process	High/Create	Not relevant
Teaching growth mindset	High/Evaluate	Low/Identify
Who makes a "good" engineer? Encouraging ALL students; no meritocracy (attention to diversity, not necessary to be AP students, etc.)	Med to High/Illustrate	High/Assess
How students need to be prepared in high school, alternative pathways	Not relevant (K-5), Medium/Explain (6-8), High/Show (9-12)	High/Classify
Importance of representation in presenting engineering	High/Identify	Medium/Use
Attention to PBL, hands on, open-ended challenges	High/Integrate	Not applicable
Designing challenges (open-ended, fair test, constraints/criteria)	High/Integrate	Not applicable
Connections to curriculum standards	High/Develop	Not applicable

The establishment of learning objectives for the sessions is the first step in planning training sessions. The next step is to consider various pedagogical strategies to present the material. Using an approach to conceptual change, as enumerated in Krause [6], we made a list of common preconceptions and misconceptions about engineering that we have encountered in previous experience in K-12. We then planned to explicitly counter these assumptions as a part of our training sessions.

Some examples of misconceptions about engineering that we specifically address are listed below.

1. Counselors don't need to learn anything about engineering.
2. Students have to be in every AP class, have a 4.0 GPA, etc. [12]. (This actually tends to also correlate with unconscious bias against considering minority students, since they also fight unconscious biases against enrollinging in AP classes, etc.).
3. Students have to be geniuses in math to do engineering.
4. Engineering is not creative.
5. "Doing engineering" in classrooms requires expensive/hard to get materials [15].
6. Engineering is a highly specialized skill set and is too difficult for young children to comprehend [13].
7. There is not time to do engineering.
8. Engineering is disconnected from science, or engineering is a part of science [15].

The first four misconceptions often impede counselors from guiding students, or even cause them to discourage students [11], from pursuing engineering in college. If a student has good language skills, a counselor might guide them toward a humanities discipline, even if the student is very interested in solving problems. This is not to say that scholars of the humanities don't solve problems, but, depending on the types of problems, students who have a broad view of the world make tremendous engineers.

Misconceptions 4-8 often mean that engineering is relegated to only high school students, if at all, despite the advantages it can bring to K-8 classrooms. Many times, these misconceptions can be defeated by giving teachers specific examples and approaches to a more problem-based and a holistic approach to integrated teaching.

Designing for Teachers

Program Objectives and Audience Needs

Customizing teacher professional development sessions ensures relevancy for teacher needs in implementing engineering content knowledge and hands-on open ended engineering challenges into their classroom. The K-8 school principal requested an overview of engineering and how it relates to Science, Engineering, Technology, Art and Mathematics (STEAM) and Project Based Learning (PBL). Recognizing the different needs and circumstances of K-5 teachers compared to 6-8 teachers, we requested the staff split into two groups and developed the program elements based upon these two audiences. In both groups, we blended discussions and group work with hands-on, open-ended engineering challenges to help teachers gain a deeper understanding of engineering, PBL, and Inquiry Based Learning.

Problem-based learning is a powerful way for teachers to acquire and retain knowledge and skills. O'Mahony et al. [10] found challenge-based instruction showed greater interaction and more sharing of knowledge related to and beyond the course content among participants in the challenge-based group. The challenge-based group performed significantly better on posttest items requiring integration and synthesis of concepts. This is because PBL learning engages multiple senses and encourages active participation, which helps learners better process and remember information, enhancing problem-solving skills and creativity, as well as promoting critical thinking and collaboration.

Program Elements

The first three hours in the morning focused on K-5 teachers and the afternoon session addressed 6-8 grade teacher's needs. Each session has the same program elements, but scaled for the grade level audience. For example, Engineering: The Glue in STEAM presentation and Problem Based Learning were the same presentation but discussions were different, based upon the audience's experience and interests. The two engineering design challenges were theme based, focusing on the school garden. At the conclusion of the workshops, teachers were sent an email with a google drive link to the presentations, the engineering challenges, and other resources used in the workshop.

Choosing Activities for Each Session

One benefit of engineering design challenges is the ability to scale them up or down, based upon grade level standards and age level ability. Focusing on a theme can create real-world relevance, content connections, and provide the bases for a problem based learning scenario. In this case, both our engineering design challenges connected to their school garden: A Bug in the "name of school" Garden Classroom and Too Much or Too Little: Engineers Make it Right. Each challenge has a typical set of elements: Scenario and Problem, Constraints, Tools and Materials, and Criteria. Materials for the challenges are mostly inexpensive materials such as straws, cardboard, paper towel rolls, dowels, foam sheets, paper clips, etc. The focus is using everyday materials to create solutions, addressing the misconception that expensive materials must be purchased. In fact, we collect recycling and other items from home that can be used with the challenges. Creating a template to develop different challenges streamlines the consistency of challenges and allows for easy grade level modifications.

A Bug in the Garden Classroom

The first challenge involved students designing a maze for a bug (a hexbug nano) in which the maze meets certain criteria. Creating a differentiated learning outcome with just a few criteria for K-2 and increasing the criteria in each grade level band allows facilitators to design training to fit the audience, as seen in Table 2.

Table 2: Engineering Criteria for A Bug in the Garden Challenge

For grade level K-2, your maze should have:	For grade level 3-5, your maze should have:	For grade level 6-8, your maze should have:
• One entrance and one exit • A tunnel to go through • One left or right turn	• One entrance and one exit • 2 right turns • A tunnel • A loop • A hill • A sound	• One entrance and one exit • 90 degree turn • 360 degree turn • Incline • Decline • Door

Too Much or Too Little? Engineers Make it Right: ESA Garden Challenge

Scaling challenges, as indicated in the previous example, requires more than just adding additional criteria. In the Too Much or Too Little Challenge, the challenge is as follows: You and your classmates are getting ready to plant the new ESA garden. You have learned about what plants need to survive in this climate, and know you will need to water your garden. In order to ensure the plants are watered over the weekend, your team must design and create an engineered irrigation system. Each grade level band completed the challenge based upon their ability and collected data regarding water loss in the system, but when we worked with the 6-8th grade band, we added a more challenging component: a pump system. Everything else remained the same, but the materials changed.

Problem Based Learning and Defining Engineering

We provided a short problem based learning presentation in which we described the why of PBL, Benefits of PBL and what makes an activity PBL. We then shared several examples. In order to add an element of job-embedded relevance to the session, we divided the teachers into grade band groupings to apply the problem-based learning session by identifying state content standards applied to the *A Bug in the Garden* challenge. After discussing the standard connections, the teachers found this helpful to see how problem based learning and engineering challenges could address many required standards. The Defining Engineering presentation provided an overview of engineering basics, what is technology, and key elements of engineering. This presentation includes both mini-lectures along with a hands-on, open ended challenge, embedding once again the engineering habits of mind and the engineering design process.

Design Constraints

Time and workshop materials are two major design constraints when designing professional development workshops. Time both in requested workshop length and time in preparing workshop activities and gathering needed materials. Since we were presenting to ~20 K-5 teachers in the morning and ~20 6-8 grade teachers in the afternoon, we had to select challenges that would work with both groups and fit within a three hour session. Choosing activities which are connected to standards, are easily scalable, and use easily and low cost materials is essential when designing the agenda. Since most schools are interested in short-duration workshops, integrating engineering concepts is essential to make the most of the available time with the

teachers. Integrating and emphasizing the engineering habits of mind, the engineering design process and discussing what engineers actually do are embedded in all the sessions.

Session Wrap Up and Evaluation

The session wrap-up includes discussing how teachers would use and modify the activities in their classroom. Time for teachers to brainstorm and share ideas allows the expertise in the room to help one another with ideas. At the workshop conclusion, we offered to return for a follow-up session as well as sharing opportunities to learn more about engineering as a Summer Engineering Camp Teacher Team Lead. In addition to their salary, teachers gain additional engineering education professional development and access to engineering challenges they can use in their classroom.

At the conclusion of the workshop, the following survey questions were asked to all participating K-8 teachers. 49 teachers responded. Overall, all teachers felt the workshop addressed the workshop goals as seen in Table 3.

Table 3: Teacher Professional Development Workshop Evaluation

Survey Questions	Strongly Agree or Agree	Disagree	Strongly Disagree
Increased my knowledge about engineering	49		
Gave me new ideas about how to integrate STEAM into my classroom	49		
Participating in challenges helped me to better understand how to best facilitate challenges	49		
I feel more prepared to integrate engineering into the classroom	48	1	
Provided me with teaching strategies to consider when facilitating STEM lessons.	48	1	
This was the first time I have heard about Engineering Habits of Mind	40	5	4
The PBL information provided me with new insights and ideas	48	1	

I would be interested in future Teacher Professional Development offerings	49		

When asked, “Did this workshop provide you with resources to help you incorporate engineering specific activities in your classroom this year?” 81.3% of respondents said yes and 18.8% indicated maybe, indicating the need for longer duration teacher professional development. When teachers were asked in the survey to describe their need or what they would want in another session, the following themes emerged: Time to help them develop lesson plans incorporating engineering PBL; more grade level specific activities, especially in the K-2 grades; more content specific instruction, and more cross curricular ideas. All teacher survey comments can be viewed in Appendix B.

What did we learn?

Designing training by modifying challenges to fit two different grade bands is an overall effective way to address the unique needs of each group. However, one 3-hour session only touches the surface and teachers indicated in the survey they desire more. We suggest the following:

1. Require several sessions over the course of the academic year, so teachers can implement the workshop learnings into their curriculum and discuss the challenges and successes, while gaining additional knowledge and activities for the remainder of the year.
2. Provide consistent messaging at conferences and other presentations so past participants can access and integrate the new ideas/materials.
3. We intentionally started the workshop with an engineering challenge to embed the engineering design process with them actively engaged in the process rather than us lecturing about it. We followed it with the PBL session and in future, this might be better at the end of the workshop after they have had more time to process the activities and better assimilate their learning.

Designing for College Advising Corps High School Counselors

Program Objectives and Audience Needs

The College Advising Corps (CAC) places recent college graduates from 32 partner universities as full-time college advisers in underserved high schools across America. CAC focuses on college enrollment and completion among low-income, first-generation college, and underrepresented high school students by delivering personalized, knowledgeable guidance on college admission, financial aid, and enrollment [19]. CAC consists of recent college graduates who may or may not have a STEM degree. These CAC advisors work with high school students in rural parts of the state to advise them along career pathway. The CAC director reached out to our program requesting a 5 hour workshop, including a 30 minute lunch, focusing on information about engineering, engineering careers, and what HS students need to be thinking about if they

are interested in pursuing a career in engineering. The workshop agenda can be found in Appendix C. The CAC Director and the K-12 Outreach team at The Engineering Place @ NC State University College of Engineering co-constructed the workshop goals, ensuring audience needs were met. The program objectives were as follows:

- Learn the difference between an engineer and a scientist.
- Overview of "What is Engineering" and how engineers are the glue in STEM.
- Participate in several engineering design challenges to learn how engineers solve problems.
- Share the different pathways for an engineering career.
- Discuss what students should be doing in high school in preparation for applying to colleges and universities, understanding many students are in under resourced schools.
- Learn more about the contributions from women and people of color who have all made our world a better place.

Program Elements

With these objectives, we could not implement the same workshop sessions with the CAC group as we did with the K-8 teachers. To meet the unique needs of this group, we contacted the Recruitment Director and the directors of both the Women in Engineering Program and the Minorities in Engineering Program to discuss how we could collaborate in providing an effective workshop. While we created several new activities to address pathways into engineering for students and strategies for working with diverse students, we realized we could use and even repurpose some session activities from the Teacher Workshop to fit this new audience.

We started the workshop with the Draw an Engineer activity, a well documented activity regarding students' narrow and stereotypical perceptions of engineers and engineering [8]. We wanted to see if the CAC counselors held similar perceptions. We then identified several teacher professional development workshop activities that might meet the workshop goals. We identified two: Defining Engineering: The Glue in STEAM and The Bug in the Garden.

After the Draw an Engineer activity, we presented the Defining Engineering presentation. We were able to utilize this presentation without any modifications since the developed content was intentionally designed as an introduction to engineering, applicable for anyone working in the schools. The other repurposed activity was the Bug in the Garden engineering challenge. This challenge was modified once again to make it more challenging for adults, adding a testing rubric in which points were giving for all of the following elements that the bug runs through: 90 degree turn – 10 pts; 360 degree spin – 40 pts; Incline – 40 pts/cm; Decline – 20 pts/cm; Door – 10 pts; Exited Playground – 50 pts. This challenge became part of a larger session entitled What Are the Problems Engineering Solve?

What was different in this workshop compared to the K-8 teacher workshop is the higher level of learning in the areas of what makes a good engineer, how students prepare in high school, alternative pathways and the different types of engineering disciplines. To address these needs, we brought in an undergraduate student panel to discuss a variety of topics and were given the following questions to discuss:

- What do you wish you had been told in high school about applying to an engineering program?
- What do you wish you had been told about the engineering profession?
- What are some of the benefits of an engineering degree, as you see it?
- Do you know someone who you think would be an excellent engineering student? Why do you think s/he did not pursue engineering?
- What's the number one skill set a prospective engineering student should be working on in high school?
- What's the number one characteristic common among successful engineering students? (ex. grit, collaboration, etc.)
- Given the fact that we want the engineering profession to more closely resemble society (i.e. proportional representation), what advice would you give these counselors?

Following this session, we also needed to address the various pathways students can enter engineering programs. Pathways to Engineering presentation was given by the Director of Recruiting, a 45 minute information session provided to all interested high school students. This presentation provided valuable information about the College of Engineering and all the programming and services available to university students. Addressing diversity, equity, and inclusion in engineering is a high priority in the College of Engineering, and representatives from the Women in Engineering Programs and the Minority in Engineering Program presented a session addressing the following objectives: Why is DEI important? Why is it important for CAC to think about it? Bias, Stereotypes and microaggressions and Role Play, and discussing the difference between equity and equality. At the conclusion of the workshops, counselors were sent an email with a google drive link to the presentations, the engineering challenges, and other resources used in the workshop.

Design Constraints

The most pressing design constraint centered around the undergraduate student's availability for the panel. While we originally wanted the panel after lunch, the students could only attend in the morning. The workshop flow worked just fine, and was one of the highly rated sessions, indicating this student panel could fit just about anywhere in the day.

Session Evaluation

We collected workshop feedback both with informal feedback and a survey administered at the workshop conclusion. The informal feedback indicated shifts in understanding when counselors

were asked about their surprises about engineering. We received responses from 7 of the 9 counselors and their responses indicated they were unaware of the engineering behind many everyday products, such as M&Ms, shoes, textiles, art installations utilizing LEDs. They also were surprised about an engineer's approach to failure and how engineering is a collaborative approach to solving problems. In the session wrap up, we asked them to write down 3- 5 things they were going to take away and incorporate into their interactions with students. Several themes emerged: Failure is good, encourage not discourage, engineering could be for anyone, problem solving focus, and removing barriers that hinder the college admissions process. The full listing of takeaways can be found in Appendix D. The online survey indicated 88% of the CAC counselors found every session either very useful or useful. The pre and post tests showed increases in every workshop objective, as seen in Table 4.

Table 4: College Advising Corps Workshop Evaluation

Survey Questions:	Before Workshop	After Workshop
How well prepared did you feel advising students in the following:	Very Well Prepared or Prepared	Very Well Prepared or Prepared
The variety of careers in engineering	66%	100%
Encouraging students with average grades to consider engineering as a career option	55%	100%
The various pathways to becoming an engineer	44%	100%
The differences between engineering and science	66%	88%
The Engineering Habits of Mind and how students with these qualities should consider engineering	33%	100%
Helping students to dispel the misconceptions and stereotypes of engineers and engineering	55%	100%

All counselors would recommend this workshop be offered for the high school counselors and advisors in their schools as one respondent stated, “You guys should definitely travel with this workshop. Take it to different high schools to encourage them.”

What did we learn?

While the sample size was small, the overwhelmingly positive feedback from the College Advising Corps of high school counselors indicates this information is of value for high school

counselors as all provided sessions were well received. The Diversity, Equity, and Inclusion session could be extended next time as they were unable to complete all their planned activities.

Conclusions and Recommendations

Existing program elements, such as presentations and engineering design challenges, can be leveraged to work with different audiences to not only meet specific programming goals for each audience, but allow the ability for staff to be more efficient, and therefore, conduct more programming.

Consider the following strategies when designing training to fit your audience:

- Use backward design to create program agendas. Ask your constituents what outcomes they desire from the workshop, and decide on the outcomes that you seek to achieve for the particular audience.
- Model good teaching principles in presenting your workshop. Refer to literature like Loucks-Horsley [7], as well as best practices in engineering education like making content relevant to the previous experience of your audience, using hands-on activities that encourage group interaction, and others.
- Make the “meta” part of your teaching visible. Point out when an activity is building resilience or encouraging creativity. When using problem-based learning, point out the practices you are using.
- Develop engineering challenges with complexity that can be scaled up or down based upon grade level.
- Consider the amount of supplies, the location of the workshop and the classroom space available when selecting the engineering challenges; additionally, consider whether the supplies specified in the challenge are available to your audience, so that they might repeat the challenge in their classes.

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Appendix A: K-8 Teacher Professional Development Agenda

Engineering: The Glue in STEAM
"School Name" Agenda
July 29, 2022

Workshop Summary
This workshop is designed to provide "School Name" K-8 teachers with an overview of engineering and how it relates to STEAM and Project Based Learning. The workshop will blend discussions and group work with hands-on, open-ended activities to help teachers gain a deeper understanding of engineering, PBL, and Inquiry Based Learning and various resources they can use to implement engineering in their classrooms.

Agenda

Time (in minutes)	Topic
5	Welcome & Goals
50	A Bug in the ESA Garden Classroom Challenge
40	Project Based Learning
30	Defining Engineering: The Glue in STEAM
45	Too Much or Too Little? Engineers Make it Right: ESA Garden Challenge
5	Wrap Up
5	Evaluation

Appendix B: Teacher Professional Development Survey Comments

Lesson Plans

- How to incorporate my standards and plan an engineering/STEAM lesson (4 responses)
- I'm always open for more learning about PD, maybe more info on how to take an idea and make it grade appropriate?

More grade level specific

- More hands on activities to do in K (4 responses)
- more specific ideas related to the content I teach
- Specifically integrating into my subject
- How to specifically intergrade (sic) into a k-2 classroom

More content specific

- content specific integration with social studies
- It is hard to incorporate arts specific PD for a training involving everyone, but maybe something including more arts.
- Technology integration in Physical Education
- PBL, anything history related
- I want more content knowledge on my science standards and PD about labs.
- Incorporating math specific standards
- I am interested in any additional workshops in Engeneering (sic) you will be conducting to ensure I have a solid understanding to better help my students.

More cross curricular

- More Music or specials specific related PD
- Teaching PBL in Kindergarten, connecting PBL to literature
- More grade level specific and cross curricular, especially integrating art and music.
- How to incorporate ELA into PBLs besides just writing about a topic or reading a book
- Using the engineering design process in writing (writer's workshop)
- incorporating engineering across other subject areas besides reading, math, and steam

General Comments

- I have just enjoyed learning from you both. Each time I have been in a place where you are teaching students and now a PD I have taken away many ideas and information!
- The challenges were engaging and super helpful in generating ideas
- Build on this session with in-the-near-future opportunities to create PBLs integrating our core subject areas (not letting too much time pass before we get a chance as a team to have dedicated time to plan together). I know the grade level planning day is coming up soon, but I think we need more time than a day.
- Keeping half of the day for time in our rooms allowed me to focus more clearly.I enjoyed the workshop and found it to be very engaging!
- It was done really well. I hope to have similar workshops (Please come back!) at the beginning of each school year.

- I enjoyed the activities and moving around the school more so than sitting and listening.
- I wish there was more chances to meet as a team and plan/debrief after that type of training. Friday afternoon was a tough time.
- I would like to see different PBL or even PD groups come in and maybe spend an afternoon with each group of teachers.
- I loved this presentation, and thought the interactive activities were so fun!
- I'd love for them to come back
- You both are great! I have enjoyed meeting you and gathering ideas from you. Fun, quick, and informational! Great job.

Appendix C: College Advising Corps Agenda

Engineering: Helping Students See Their Potential
Engineering College Advising Corps Agenda
July 8, 2022

Workshop Summary
This workshop is designed to provide the College Advising Counselors with information about engineering, engineering careers, and what HS students need to be thinking about if they are interested in pursuing a career in engineering. The workshop will blend discussions and group work with hands-on activities to help counselors gain a deeper understanding of engineering.

Agenda

Time	Topic
9:00	Welcome, Goals, and Opening Activity
9:30	Engineering 101
10:30	Student Panel
11:15	Pathways to Engineering
12:00	Lunch
12:30	Diversity, Equity, and Inclusion in Engineering
1:30	What kinds of problems do engineers solve?
2:30	Application Discussion
2:50	Wrap Up
3:00	Evaluation

Appendix D: Counselor Takeaways

1. Not to fear failure (as an advisor, individual, student, and an advocate), it can only work to make me a better advisor
2. Leveraging students skills, etc, encouraging students to explore different types of engineering.
3. Knowledge of resources to help support students

1. Asking student what problems they want to solve
2. Asking pronouns of students
3. Encouraging Minorities into engineering

1. Removing barriers at my school that hinder the college admissions process!
2. Advising students equitably about the college of engineering.
3. Failure is good

1. There are summer start and on-campus support for women and students of color, particularly in engineering.
2. Out of classroom activities are very important in admissions.
3. Anybody can do anything.
4. I need to connect students to on-campus resources after admission

1. If you prepare for failure, you won't be surprised when it happens. Be confident and allow it to radiate.
2. Every student deserves all effort, time, & effectiveness that will help them navigate forward their goals & dreams.
3. Don't give up. Failure produces endurance. It's okay to pivot.
4. Focus on teh goal and what's attached to it: resources, contacts, - to help every student.
5. Listen. This allows us to grow & to understand.

1. Encourage not discourage.
    a. Work w/students to support their passons
2. Willingness to Fail
    a. Willing to accept and embrace failure
3. Thinking that problems are solvable.

1. Learn to fail.
2. Lot resources for interested students.
3. Different engineering pathways

1. Engineering is everywhere, you just need to find your place equally with everything else.

1. Use of summer programs
2. Engineer pathway
3. Different type of engineer
4. Wow, I didn't realize : Engineering is not always what you think. Art can = engineering.

1. Engineering could be for anyone/focuses more on problem-solving than I had previously thought.
2. Students don't need AP/Advanced high school STEM courses to be successful in engineering.
3. There are several paths an engineer my be able to take/there are engineers in several years.

1. Engineering is about innovation, collaboration & bring open to a new way of thinking.
2. There are so many different areas of engineering. All require knowledge or background in humanities, math, science.
3. It's ok to fail

1. Integrating undergraduate programs
2. Scholarships
3. Watching spectific (sic) messages/interactions better to students

Counselor Surprises about Engineerings

1. Frog reflection
2. Spider dress
3. tube in activity

1. Art instillation as engineering
2. Technology as any human made thing
3. Solution is not always a design

1. Shoes - mechanical eng., textile, biomechanics
2. M&Ms - Industrial Eng.
3. Psych & Engineering - Industrial Eng.
4. Phones contain conflict minerals where other countries fight to have
5. If you prepare for failure you won't be surprised when it happens
6. You can do anything w/an engineering degree! It's all about solving problems.

1. Design and fashion - Textile engineering
2. Every human made object is “technology”
3. Engineers never work alone
4. Most CEO’s are engineers

1. Critical thinking/creativity (from the activity)
2. Approach to failure (do different from what’s taught in school)

1. Spider Dress - Anouk Wipprecht
2. Cellphones contain conflict minerals

1. Frog Reflection - engineering
2. Technology coure / textile engineering
3. Engineering habits of mind = NASW COE
4. Engineering has a DEI program