ENGINEERING FELLOWS PROGRAM

PLAYBOOK

CREATED BY

WASHINGTON STEM AND WASHINGTON MESA

WASHINGTON MESA Mathematics Engineering Science Achievement

WASHINGTON STEM
REIMAGINING SCIENCE, TECHNOLOGY, ENGINEERING + MATH EDUCATION

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WHO WE ARE:

Washington MESA is a statewide organization housed in the University of Washington, Office of Minority Affairs and Diversity that builds pathways to college and careers for studnts in science, technology, engineering, and mathematics (STEM) fields. Washignton MESA develops programming and initiatives that focus on supporting traditionally underrepresented students in these fields, including African Americans, Native Americans, Hispanics/Latinos, and women.

Washington STEM advances excellence, equity, and innovation in science, technology, engineering and math (STEM) education for all Washington students. Washington STEM works as a backbone organization to serve as a convener and catalyst for STEM education to dramatically increase the number of Washingtonians that are “future ready”—individuals with the creative skills needed to thrive in today’s jobs and in the unknown jobs of tomorrow.

WASHINGTON MESA Mathematics Engineering Science Achievement

WASHINGTON STEM REIMAGINING SCIENCE, TECHNOLOGY, ENGINEERING + MATH EDUCATION

Items in the playbook have be adapted from previous work by Washington MESA and Washington STEM.

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What is the Engineering Fellows Program?

WHY ENGINEERING?

Engineering is essential to solving Washington's most complex challenges, including efficient transportation, environmental sustainability, affordable housing, and economic security. Engineering fuels our local job creation across every industry - technology, aerospace, manufacturing, clean energy, health and life sciences, agriculture and food manufacturing, construction, and retail.

Yet most of our public school students have no formal exposure to engineering. In order to increase access to jobs in engineering fields—in which women and people of color are underrepresented—students need access to knowledge about what engineers do, how engineering is relevant to their everyday life and community, and see engineering as an accessible and desirable career option. Additionally, education standards are changing. In 2013, Washington state adopted the Next Generation Science Standards, which have an unprecedented—and exciting—engineering component intended to drive learning about the engineering design process.

GOALS

To increase engineering education efforts throughout the state, in 2016 Washington STEM and Washington MESA partnered with funding from 100Kin10 to design and implement the Engineering Fellows Program. We are excited to continue implementing and refining the program through local support and partnerships.

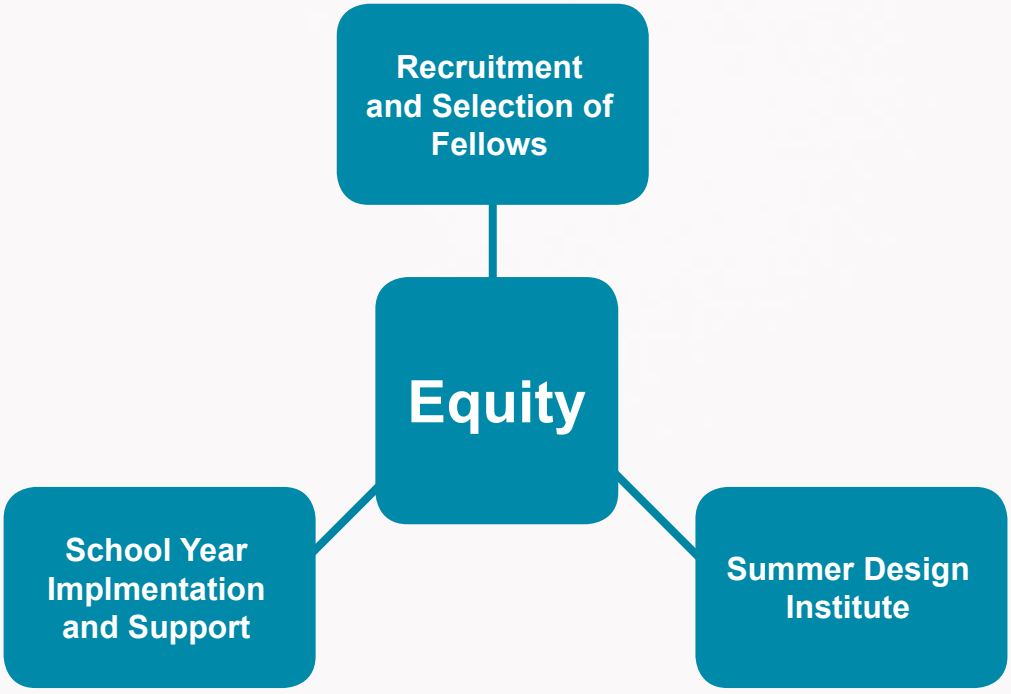
We aim to bring engineering expertise directly into fifth grade classrooms around the state by partnering teachers with professional engineers and college/graduate students studying engineering. Our goals are as follows:

1. Advance 5th graders' interest, awareness, and practice in engineering design.
2. Increase teachers' preparation and confidence in teaching engineering design.
3. Foster college engineering students' experiences as mentors and mentees.

PROGRAM OVERVIEW

Teachers, engineers, and college students apply to take part in the Engineering Fellows program. Beginning with an orientation and an intensive Summer Design Institute, design teams consisting of 5th grade teachers, engineering professionals, and undergraduate and graduate engineering students develop a menu of engaging design challenges. The design challenges are rooted in the principles of engineering, and are aligned with the Next Generation Science Standards. Teachers commit to implementing 2-4 challenges during the school year, with periodic classroom support from the engineering students, professional engineers, and program staff. The entire cohort reconvenes monthly throughout the school year during Saturday half-day sessions to refine the design challenges. Throughout the professional development, participants engage in equity-focused discussions and activities, and teachers return to their classrooms with practices designed to increase access, interest, and awareness of engineering—particularly for youth underrepresented in STEM fields. Fellows also work together to plan family engagement and end-of-year showcase events.

1. Video - The Engineering Fellows Program: A Blueprint for Success
2. Handout - Engineering Fellows Program Overview



PURPOSE OF THE PLAYBOOK

This playbook offers a guide for implementing the Engineering Fellows Program—beyond the design challenges and teaching plans that are developed by teams of teachers, college engineering students, and professional engineers. Achieving equitable outcomes in for students in engineering is challenging work, and doing this work at scale requires buy-in, partnership, and implementation across many stakeholders. We hope that this Playbook serves as a guide for additional organizations, districts, and schools to take up this work in their local system, and gives us a common set of resources to work from. Included are examples and considerations from the pilot year of the program, as well as templates and presentations.

As the program evolves, the Playbook will be updated to reflect our best knowledge and most robust resources.

Program Organization and Planning

Play 1 – Establish Partner Roles

GUIDING QUESTION

How will you establish key partnerships, with clearly defined roles, to make the program successful?

GUIDING PRINCIPLES

- The Engineering Fellows Program requires buy-in and contributions from a range of stakeholders.
- It is important to periodically revisit roles and responsibilities across individuals and organizations.
- All voices in the partnership—lead organizations, teachers, college students, professional engineers, and 5th grade students—are heard and valued.
- Communication with and among partners is essential to foster inclusion in EFP.

GETTING STARTED CHECKLIST

- Identify program partners that could add expertise and resources to the program.
- Set up opportunities to clarify partner and individual roles and responsibilities, and revise as necessary. See this example of program leadership roles and responsibilities at the organization level. See this example of roles and responsibilities at the regional partner level.

Example Roles and Commitments

Engineering Fellows Program

Example Roles and Commitments

Washington STEM	Shared	Regional Partners

• **"Backbone" function**
• Provide EFP Playbook and technical support for program implementation
  ○ Support/lead refinement of program model and Playbook
• Provide technical support for program implementation
• Coordinate program coordinator and lead teacher learning and support
  ○ Convene program coordinators and lead teachers quarterly (or as needed) around program design and implementation (Networked Improvement Community "light")
  ○ Provide resources and opportunities for coordinator/teacher learning (e.g. EiE workshop, support for equity facilitation, etc.)
• Technical assistance on fundraising
• Coordinate program evaluation/documentation
  ○ Including case studies and advocacy material
  ○ Host/coordinate dissemination of Playbook to interested parties
	• Recruit and select college/grad students, professional engineers
	• Track refinement of design challenges
	• Coordinate classroom visits (college/grad students, professional engineers, possibly funders)
	• Utilize and refine EFP Playbook
	• Collect basic program information: students served, outcomes, design challenges.
		• **Program Implementation**
		• Recruit and select teachers, college/grad students, professional engineers, 1-2 lead teachers
		• Participate in quarterly (or as-needed) convenings - share ideas/resources/tools with EFP partners
		• Coordinate all local program logistics (location, time, food, materials, etc.)
		• Coordinate / support family and community engagement events
		• Provide in kind support and/or fundraise for program implementation: FTE time, space, basic materials
		• Support program evaluation/documentation
		  ○ Help broker and coordinate WA STEM site visits for documentation

Download: Example Roles and Commitments

- Develop relationships with local university faculty to help recruit and select college students
- Develop relationships with local industry partners and set up conversations to discuss potential contributions. This may look different with each industry partner, e. g. in-kind contributions, classroom materials, hosting field trips, etc.
- Set up an advisory board of local stakeholders to help champion and shape the program. See this example Advisory position description.

KEY QUESTIONS

- What are the short- and long-term goals of the program?
- How can existing resources be allocated or re-purposed to support program leadership capacity?
- If this program is wildly successfully in three years, what would you hope to see?
- Who will be your allies in making this program a success? How will you get them on your team to contribute to this work?
- How will the program be sustained beyond the first year?

Play 2 – Develop a Program Budget

GUIDING QUESTION

How much does the program cost regionally, and how will you pay for it?

GUIDING PRINCIPLES

- The Engineering Fellows Program is an investment in building teaching capacity in engineering.
- Washington STEM serves as a backbone organization—providing technical support and guidance for program coordinators.
- Regional STEM Networks are a great resource for identifying and working with local partners to raise funds and in-kind support.

GETTING STARTED CHECKLIST

- See this sample budget for estimated program costs.
- If required by your organization, remember to account for indirect costs.
- Consider ways in which existing FTE can be used for program coordination.
- Family engagement is a key tenet of the program, and costs vary widely. Have teachers identify existing school/community events into which engineering can be integrated at low- to no-cost.
- Costs such as classroom materials and teacher stipends are often appealing to business and industry partners. Connect with your regional STEM Network to identify potential sponsors.
- Consider using crowd-sourcing platforms such as DonorsChoose for classroom materials. DonorsChoose can also provide guidance on launching local fundraising campaigns.

Example Roles and Commitments

Engineering Fellows Program 2017-2018

Sample Budget

This sample budget is based on the following assumptions

- Participants receiving stipends: 15 teachers, 5 college/graduate students.
- Adequate program staff time can vary widely based on capacity of lead organization.
-

Expense	Budget	Notes
Program staff	Variable	Range: .1-.5 FTE
Materials and Supplies	$9000	$500 per teacher for classroom supplies, $1500 for PD materials
Consultants or Contractors	$10,000	Stipend for teacher leader, additional consultants
Meetings / Conferences	$5000	Facilities, food, transportation, etc.
Teacher Stipends	$45,000	$3000 per teacher
Engineering Student Stipends	$15,000	$3000 per student
Total	**$108,000**	Does not include program staff time
Optional: Family/Community engagement	$3000	Approximately $200 per teacher
Optional: Faculty sponsors	$5000	Depends on faculty involvement—facilitating PD, supporting college/grad students, etc.
Variable: travel	$10,000	If located outside of Puget Sound, covers travel for regional participants and program staff to state-wide EFP Summit

Download: Sample Budget

KEY QUESTIONS

- How can program costs and activities be integrated into existing activity? For example, can local schools/districts cover some Professional Development costs during the school year as part of regularly mandated Professional Development time?

Recruitment and Selection of Fellows

Play 3 – Recruit Participants

GUIDING QUESTION

How will you recruit and select teachers, college students, and professional engineers for the program?

GUIDING PRINCIPLES

- Equity drives the program vision and goals, and this is explicit in recruitment materials and efforts.
- Teachers are recruited from schools serving primarily students that are under-represented in STEM.
- Every effort is made to recruit a diverse cohort of professionals and college students in terms of ethnicity, gender, age, and field of expertise.

GETTING STARTED CHECKLIST / SPECIFIC IDEAS

PLANNING

Develop a coherent, efficient, and appealing recruitment process that is tailored to the needs of teachers, college/graduate students, and engineering professionals.

- Watch this video to hear from 2016-2017 teachers, engineers, and college students about the benefits of collaborating: The Engineering Fellows: Collaboration is Key.

2016 Recruitment Plan – Gantt Chart

Engineering Fellows Program

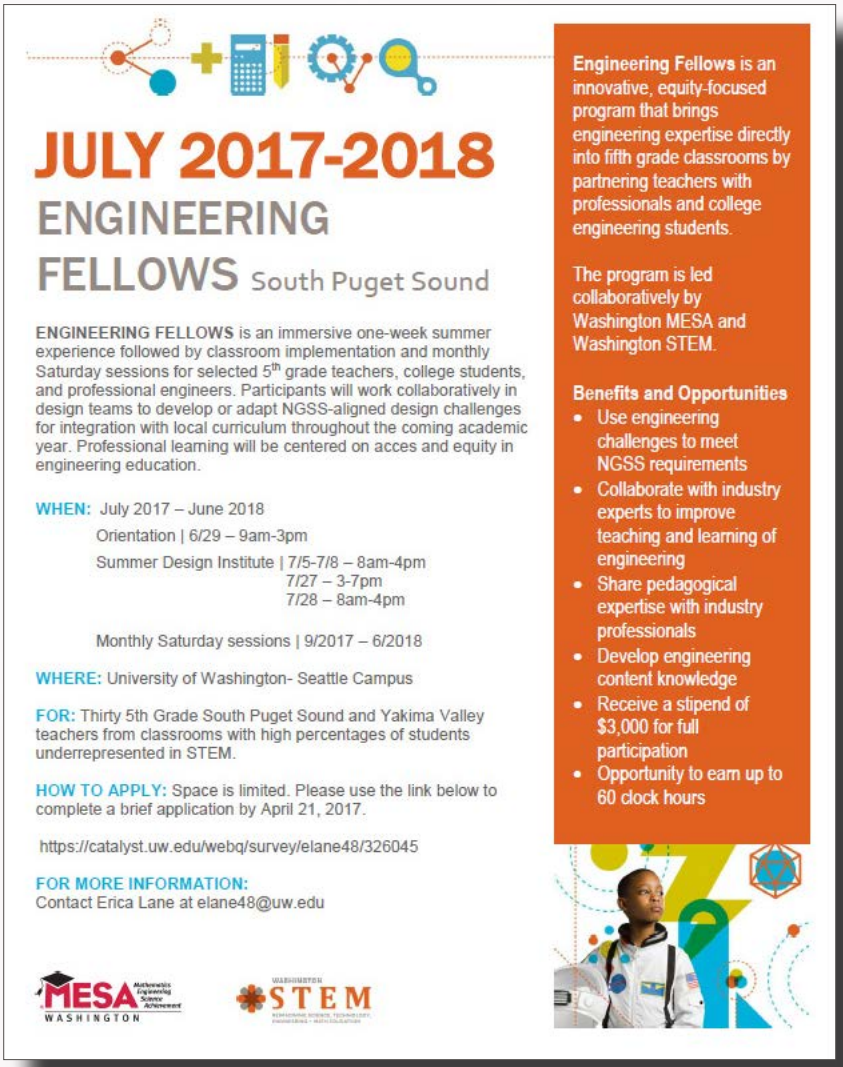
2016 Recruitment Plan – Gantt Chart

Action	February	Feb. 29 - March 4	March 7 - March 11	March 14 - March 18	March 21 - March 25	March 28 - April 1	April 4 - April 8	April 11 - April 15	April 18 - April 22	April 25 - June
1. Develop recruitment materials for each Fellow category	■									
2. Recruit 15 5th grade teachers, 5 professional engineers, 5 college/grad students		■	■	■	■	■				
3. Review applications							■			
4. Select and notify Fellows for program								■		
5. Publicize Fellows selected for program									■	
6. Follow up with all selected participants with pre-Institute requirements										■
7. Follow up with all applicants									■	

Download: 2016 Recruitment Plan – Gantt Chart

- Create a recruitment timeline and selection, starting in February prior to the planned Summer Design Institute. See this sample recruitment Gannt chart.
- Using an online platform such as Canvas or SurveyMonkey, develop separate applications for teachers, college/graduate students, and professional engineers. See sample application questions below:
    - Teacher application questions
    - College student application question
    - Professional engineer application questions
- Develop and distribute recruitment flyers that include clear responsibilities, timeline, and expectations. The following templates are here for your consideration.
- Teacher recruitment flyer
    - College student recruitment flyer
    - Professional engineer recruitment flyer
    - Recruitment flyer template

Teacher recruitment flyer



JULY 2017-2018

ENGINEERING FELLOWS South Puget Sound

ENGINEERING FELLOWS is an immersive one-week summer experience followed by classroom implementation and monthly Saturday sessions for selected 5th grade teachers, college students, and professional engineers. Participants will work collaboratively in design teams to develop or adapt NGSS-aligned design challenges for integration with local curriculum throughout the coming academic year. Professional learning will be centered on acces and equity in engineering education.

WHEN: July 2017 – June 2018
Orientation | 6/29 – 9am-3pm
Summer Design Institute | 7/5-7/8 – 8am-4pm
7/27 – 3-7pm
7/28 – 8am-4pm

Monthly Saturday sessions | 9/2017 – 6/2018

WHERE: University of Washington- Seattle Campus

FOR: Thirty 5th Grade South Puget Sound and Yakima Valley teachers from classrooms with high percentages of students underrepresented in STEM.

HOW TO APPLY: Space is limited. Please use the link below to complete a brief application by April 21, 2017.

https://catalyst.uw.edu/webq/survey/elane48/326045

FOR MORE INFORMATION:
Contact Erica Lane at elane48@uw.edu

Engineering Fellows is an innovative, equity-focused program that brings engineering expertise directly into fifth grade classrooms by partnering teachers with professionals and college engineering students.

The program is led collaboratively by Washington MESA and Washington STEM.

Benefits and Opportunities
- Use engineering challenges to meet NGSS requirements
- Collaborate with industry experts to improve teaching and learning of engineering
- Share pedagogical expertise with industry professionals
- Develop engineering content knowledge
- Receive a stipend of $3,000 for full participation
- Opportunity to earn up to 60 clock hours

Download: Teacher recruitment flyer

ACTION

- See this detailed action plan for key steps in recruiting participants.
- Recruiting engineers often requires a face-to-face meeting. Consider the following modifications for recruiting engineers:
  - Remove the dates from the flyer, but keep a brief description of the program and goals.
  - After interest is determined, set up a face-to-face meeting to discuss what engagement looks like.
  - Discuss classroom visits and emphasize the goal of having 5th grade students meet and get to know real-world engineers.
  - Be flexible and clear with expectations for engagement.

KEY QUESTIONS

- How will you address inevitable teacher attrition (e. g. changes in assignment/school)?
- Which dates are critical for professional engineer involvement, and which dates could be optional?
- What are the different ways engineers could be engaged to work around their schedules?

Play 4 – Select Participants

GUIDING QUESTION

How do we select a qualified and engaged cohort of participants?

GUIDING PRINCIPLES

- Priority is given to teachers from schools serving primarily students that are under-represented in STEM.
- Prior experience in education is not required for professionals and college/graduate students.
- Selected participants are able to attend the full Summer Design Institute, including Orientation.

PLAY

Select participants based on a clear set of criteria and begin to build relationships that will support participation in the EFP program.

GETTING STARTED CHECKLIST / SPECIFIC IDEAS

Teachers

- Check FRL/demographics of student population (OSPI report card)
- Since participation in Engineering Fellows impacts instructional time, include principals on acceptance emails and agreement forms to teachers. See examples below:
  - Teacher acceptance letter
  - Teacher-School Agreement document
- Request summer contact information—some teachers use a different email address when school is not in session.

Teacher acceptance letter

Dear .....,

Congratulations! You have been selected as one of XX 5th grade teachers in Washington State to participate in the 2017-2018 cohort of the Engineering Fellows Program (EFP). This unique program was launched by Washington MESA and Washington STEM in 2016 as part of a national White House initiative called 100Kin10. Our goal is to advance interest, awareness, and learning of engineering for 5th grade students in Washington. We are excited to continue implementing and refining the program this year through local support and partnerships. During the EFP experience, you will be a critical partner in continuing to shape the program to best meet the needs of our students.

We are looking forward to having you join a special team of 15 of your [insert region] peers, 5 college engineering students, professional engineers, and our staff to select and develop authentic engineering design challenges and teaching plans for the next school year. There will also be a cohort in [insert region], and we will spend time this summer and during the school year sharing best practices and design challenge ideas across the two regional cohorts.

The program will begin this summer with the following program components. Please save these dates and times on your calendars.

Summer Dates	Times	Professional Experience	Location
[insert date]	[insert times]	Orientation	[insert location]
[insert date]	[insert times]	Engineering Fellows Program Summer Design Institute	[insert location]
[insert date]	[insert times]	Engineering Fellows Program Reception and Summit **Principals, administrators, and district coaches/specialists invited.*	[insert location]

To confirm your participation, please complete the enclosed form with your principal, scan it, and email it to [insert program coordinator] by [date]. We will be sending you additional details next month.

We look forward to meeting and working with you this summer and the 2017-2018 school year.

Download: Teacher acceptance letter

College students

- Preference is given to junior/senior/graduate students
- Notification of candidates selection in time to help prep/draft design challenges prior to Summer Design Institute (optional)
- Attempt to match students with selected professional engineers in their field of study
- Ensure agreement with expectations and time commitment. See example below:
    - College/graduate student agreement document

Professionals

- Attempt to match field with college/grad students
- Ensure supervisor support

All

- Compile a spreadsheet with all participants' contact information, as well as school, district and/or employer. This becomes very handy for communications and reporting purposes.
    - Participant info spreadsheet template

Participant info spreadsheet template

Participant Info Spreadsheet

	Roles include Teacher, Student, Engineer, Principal, District Admin, instructional Coach, etc. Be sure to use the categories consistently so you can sort accordingly.				Affiliation is the school, college/university, or employer.		
	Role	Name	Contact	Title	Affiliation	District	Notes
Example	Teacher	Frizzle, Valerie	frizz@magicschoolbus.com	n/a	Walkerville Elementary Scho	Outlandish School District	also drives a bus
	Student			n/a	University of Awesome	n/a	studying mechanical eng.
	Engineer			Principal Engineer, Seattle Traffic Project	Problem Solvers	n/a	civil engineer

Download: Participant info spreadsheet template

KEY QUESTIONS

- To what extent will transportation be an issue for classroom visits, particularly during the school year? How will you mitigate these issues?

Summer Design Institute

Play 5 – Pre-Institute Participant Preparation

GUIDING QUESTION

How will you gather information from participants that will inform the Summer Design Institute? How will you plan ahead to ensure a successful Summer Design Institute?

GUIDING PRINCIPLES

- Participant voice should be included while designing the Summer Design Institute.
- To maximize collaboration time, take care of as many participant logistics as possible before Orientation.

GETTING STARTED CHECKLIST

PARTICIPANT PRE-INSTITUTE ACTIVITIES

- For all participants:
    - Request information you may want to include in Orientation/publicity resources, e. g. short bio, photo, media releases. See this example request.

- For teachers:
  - Set up a pre-institute survey (in SurveyMonkey, Google Forms, etc.) for teachers so you can gather information about access to technology, integration with existing teaching and curriculum, and students served. See this list of sample questions.
  - If necessary, ask for a completed W-9 or other information necessary for stipend payments.

Pre – Institute Survey

Engineering Fellows Program

Pre – Institute Survey

Set up questions in online survey platform, send link to teachers

The Engineering Fellows Program team aims to develop a meaningful and impactful Summer Institute for our 30 accepted teachers in South Puget Sound and the Yakima Valley. To that end, we ask that you please take 20 min to complete the following survey so we can best support you in this collaborative work. The questions address access to technology, curriculum, and integration with your existing teaching.

1. Will you have access to a laptop or tablet during the Summer Design Institute?
   (yes/no)
2. Do your students have access to computers/laptops/tablets in the classroom for our developed assessments?
   (yes/no/other)
3. Are you already teaching engineering in your classroom? If yes, please briefly describe.
   (large text box)
4. How much time do your students have for science each week (e.g. 30 min three times a week, 60 min every day, etc.)?
5. Approximately how many students will be in your class(es) in 2017-2018?
6. Do you see any "hot spots" for integrating engineering, or are there any engineering design challenges you are interested in trying out? If you have any documents or resources that would give us more details about your curriculum (scope and sequence, curriculum guide, etc.) please email them to [insert program lead]
7. Please describe your most successful science/engineering unit or series of lessons. What made this unit or series of lessons successful?
   (large text box)
8. As an adult learner, what engineering topics are you most interested in?
   (large text box)
9. What specific engineering topics would you like to know more about in order to better engage your students in engineering?
   (large text box)
10. What engineering topics do you think would interest your students and/or community?
    (large text box)
11. What type of family engagement event (Curriculum Night, Back-to-School night) does your school host in the fall? What is the structure of the event?
    (large text box)
12. Do you have any successful strategies / ideas related to teaching engineering that you would be willing to share with your fellow colleagues in a short session (20 minutes max)?
    (large text box)

Download: Pre – Institute Survey

- For college students:
  - Ask college/grad students to provide a photo of an element of their work, and to prepare a 2 min "elevator pitch" describing the engineering represented in the photo—to be used in kickoff "What is Engineering" activity. See this sample request.
  - If necessary, ask for a completed W-9 or other information necessary for stipend payments.
- For professional engineers:
  - Ask professionals to provide a photo of an element of their work, and to prepare a 2 min "elevator pitch" describing the engineering represented in the photo—to be used in kickoff "What is Engineering" activity. See this sample request.

Elevator pitch and project photo request

Information Request: due [insert date]

For the Summer Design Institute, we would like you to introduce yourself on the first day with an elevator pitch, no more than two minutes long. Criteria for this elevator pitch are:

- Less than 2 minutes
- Assume the audience includes 5th grade **students** (10 or 11 year-olds)
- Describes your engineering field
- Describes one engineering project you have worked on and that you can provide an accompanying photo (more details below)
- If possible, a written version of the elevator pitch is needed by **[insert date]**

During Day 1, we plan to use the **photo** for your project as part of the "What is Engineering?" session. Photos will be presented to teachers (during Orientation) prior to your elevator pitch (on Day 1 of the Institute) to see if the teachers can figure out the field of engineering and the project/research topic. We would like the photo to have the following characteristics:

- Be relevant to your project you will describe in your elevator pitch
- Be interesting and artistic
- No identifying text
- Source information (please do not select a photo that has copyright issues)
- Be of high resolution for use in a PowerPoint

Download: Elevator pitch and project photo request

PRE-INSTITUTE LOGISTICS

- Set up clock hours approval (approximately 60) with local agency.
- Identify local partners (industry, university) that can host lab visits and/or lead relevant engineering activities.
- Check school district calendars for following year as soon as they become available –schedule Saturday sessions around breaks, conferences, etc.

KEY QUESTIONS

- How will you align design challenge interests with NGSS?
- How will you account for different needs across districts, schools?
- What connections does your organization already have with local industry/university partners?

WHAT IS THE ENGINEERING FELLOWS SUMMER DESIGN INSTITUTE?

The Summer Design Institute is the official kickoff of the year-long program. During the SDI, the teachers, college and graduate students, and engineers learn about each others' expertise and develop or revise design challenges for 5th graders. By the end of the week, participants have an increased understanding of engineering education as well as an implementation plan for their chosen design challenges. The week wraps up with a reception to celebrate and showcase the participants' hard work and design challenges, and key stakeholders (principals, coaches, community members, etc.) are invited to participate.

Play 6 – Summer Design Institute Agenda

GUIDING QUESTION

How will you structure a Summer Design Institute that successfully meets program goals?

GUIDING PRINCIPLES

- Equity in engineering drives the agenda—find a balance between high-level discussions and in-the-minute instructional moves.
- During the professional development, model the pedagogical norms and practice that we want teachers to do.
- Balance the agenda between structured learning and extended collaboration time.
- Encourage design teams to develop challenges that encourage students' iterating over extended periods of time.
- Consider the learning needs of each type of participant—teachers, college/grad students, professional engineers.

GETTING STARTED CHECKLIST

- Set agenda, then identify key dates/times for professional engineers' participation.
- Consider the different learning needs of teachers, college students, and professional engineers – ensure they have clear roles during each part of the Institute.
- Include activities to support professional relationship building.
- Provide opportunities for design teams to try out different design challenges. Model the norms and classroom culture that is required for engineering.
- Provide opportunities to practice teaching.
- Provide opportunities for college/grad students and engineers to engage in mentorship activities.
- Find ways to include external stakeholders (principals, district administrators, college faculty, employers) in the Institute.
- Cross-reference SDI activities with program goals/outcomes.
- See a sample Summer Design Institute agenda
- Example resources:
    - Program Goals and Expectations
    - Engineering Photos activity
    - "What is Engineering?" Questionnaire and Key (from Engineering is Elementary)
    - Engineering in NGSS
    - Equity and Access survey: 1st round
    - Daily evaluation survey
    - EFP Reception and Summit agenda

Daily Evaluation Survey

Engineering Fellows SDI Daily Survey

1. What is your role in the Engineering Fellows Program?

- ◯ Teacher
- ◯ College or graduate student
- ◯ Professional Engineer
- ◯ Program staff or guest

2. Please describe a takeaway or "aha" moment you had today during the Engineering Fellows Summer Design Institute.

3. Please describe an obstacle or challenge you ran into today.

4. Please include any other questions or feedback below.

Download: Daily Evaluation Survey

EFP Reception and Summit Agenda

SUMMIT| July 28 | 8am-4pm | Highline College

Breakout Session structure: 70 min

- Introduction and Goals (5 min)
- Story/strategies/examples (20 min)
  - Provide hard copies of resources: handouts for parents, description of activity, etc.
- What worked/what to consider for next time (10 min)
- Work/planning time (30-40 min)

Time	Objective	Activity	Details
8-8:30am		**Breakfast**	
8:30-9am		**Welcome, Goals, Introductions across regions**	
9:10-10:20	**Option 1:** By the end of this workshop, participants will gain ideas about how to share this with their immediate colleagues and entire school. **Option 2:** By the end of this workshop, participants will have a deeper understanding of their professional network and its value in building career opportunities.	**Breakout #1**	**Option 1:** How Do I Share This With My School? **Option 2:** Mentorship Session #2 (for college students and professionals)
10:20-10:30		**Break**	
10:30-11:40	By the end of this workshop, participants will gather information about effective family engagement and develop an initial plan for family engagement in their school.	**Breakout #2**	Designing Family/Community Engagement Events
11:45-12:30		**Lunch**	
12:30 – 1:00	By the end of this session, participants will have two resources to help advocate for	**Advocating for Engineering Education**	Advocating for Engineering Education

DRAFT

Download: EFP Reception and Summit Agenda

KEY QUESTIONS

- What knowledge do participants already have about Engineering in the Next Generation Science Standards?
- What are the tradeoffs between doing multiple challenges vs. sustaining 1-2 challenges over an extended period of time during the school year?
- In what ways are design challenges potentially relevant to students underrepresented in STEM?
- How will you differentiate for the range of participants that need to see a few “fully-cooked” design challenge lesson plans, in contrast with participants that are ready to develop new design challenges from scratch?

Play 7 – Design Challenges

GUIDING QUESTION

How will design challenges be developed and/or revised?

GUIDING PRINCIPLES

- Design challenges should be accessible and relevant to students underrepresented in STEM.
- Participants should have an opportunity to experiment common design challenges and reflect on their experience.
- Design teams should have flexibility and time to research locally relevant scenarios and design challenges.
- Design challenge lesson plans should be shared via on online platform so all participants have access.

GETTING STARTED CHECKLIST

- Watch this video about students’ experiences with the 2016-2017 design challenges: The Engineering Fellows Program: The Student Experience.
- At the beginning of the Summer Design Institute select a simple challenge that design teams can engage with to become familiar with the engineering design process.

- Provide design teams with a set of existing design challenges as examples and resources.
- Provide design teams with common materials that they can use when exploring design challenges. See our 2017 list here.
- A quick internet search for "engineering design process" yields many variations of images and explanations about how engineers execute and think about their work. Our team reviewed several different versions, and developed a graphic that centers communication in the engineering design process.
- Set clear expectations for the level of detail in teachers' implementation plans. Unless teachers are selecting fully developed design challenges, it is unlikely (and unreasonable!) to expect fully detailed design challenges at this point in the program.
- Ask teachers to consider ways in which design challenges can be integrated into subjects besides science. This is particularly important for students are often pulled out during science instruction to receive English language or Special Education services.

2016-2017 DESIGN CHALLENGES

Our 2016-2017 Engineering Fellows developed the following set of design challenges that were implemented and revised over the course of the school year. The full lesson plans will be available in Fall 2017.

Design Challenge Summary

Engineering Fellows Program

2016-2017

Design Challenge Summary

- Design a a) **pencil case** or b) wallet to meet the criteria of a classmate
- Design a model of a **platform** to help students a) see salmon spawning in the river or b) help students document wildlife in trees on school property
- Design a **vertical farming** system that uses minimum water and fits within a 1ftX1ft space
- Design a **vehicle** out of everyday materials that can perform a series of tasks
- Design a **solar-powered model vehicle** that can carry a load a designated distance
- Design a model of a **bridge** that a) allows (and entices) pedestrians to cross a busy street safely or b) bears a load and allows barges to pass underneath.
- Design a **catapult** that a) expedites moving food for farm animals or b) helps a child clean up a room full of Legos
- Design/improve a **filtration system** for a) local storm water b) community drinking water or) reduces microorganisms in pond/puddle water.
- Design a 10cmX10cm **cube satellite** that can carry a payload and power source (adapted from Boeing / Teaching Channel Centennial resources)
  - Variation: **Egg Drop**
- Design a **barge** that can safely carry 26 charcoal briquettes without tipping or pouring any waste into the water.
- Design an **earthquake-safe structure** that is two stories high and can withstand shaking at the base.
- Design a **seed-dispersal system** that mimics multiple existing seed dispersal methods (e.g. sticks to animal fur, can be thrown a distance from parent plant, etc.)

Download: Design Challenge Summary

KEY QUESTIONS

- How will you balance time between exploring existing design challenges and developing new design challenges?
- What are the “hot spots” for integrating engineering into teachers’ existing curricula? Science and Math often connect well with engineering, but there may also be opportunities in language arts and social studies.

Play 8 – Provide Guided Mentorship Opportunities

GUIDING QUESTION

How will you structure mentorship opportunities for college/graduate students and professional engineers?

GUIDING PRINCIPLES

- The Summer Design Institute and select Saturday sessions should be structured such that college students and professional engineers have opportunities to participate in guided mentorship opportunities.

GETTING STARTED CHECKLIST

- Identify times during the Summer Design Institute and Saturday sessions in which participation by the college students and professionals is not necessary for design teams (e.g. when teachers are working on assessment, etc.)
- Select a facilitator to guide college students and professional engineers through 3-5 mentoring sessions. These can be spread throughout the academic school year.
- We recommend adapting resources such as the Career Readiness Workshop Playbook and the Washington State Opportunity Scholarship Skills That Shine to fit your program needs.
- Example workshop ideas:
  - Orientation
  - Networking and practicing an Elevator Pitch
  - Resume writing
  - Interview skills

Mentorship Orientation

Download: Orientation

KEY QUESTIONS

- How much time are you able to allocate to mentorship opportunities during the Summer Design Institute and Saturday sessions?
- What capacity does your facilitation team have for running mentorship sessions? If limited, who in the community can you tap as a facilitator?

School Year Implementation and Support

Play 9 – Saturday Session Scope and Sequence

GUIDING QUESTION

How will you plan Saturday sessions to ensure participants reflect on implementation, improve equitable teaching practices, and refine design challenges?

GUIDING PRINCIPLES

- Each session should follow roughly the same pattern: reflection, new learning, design challenge revisions.
- Data from the Access and Equity survey, classroom visit surveys, student assessments, and participant feedback should inform the content of each Saturday session.

GETTING STARTED CHECKLIST

- Watch this video about how the EFP participants continue to work together throughout the school year: The Engineering Fellows Program: Design, Implement, Refine.
- After the Summer Design Institute, use data from the teachers' Access and Equity surveys to scope out the Saturday sessions. See this sample Saturday session plan.

KEY QUESTIONS

- How will you ensure coherence between each Saturday session?
- What guest speakers can be brought in to Saturday sessions?

Play 10 – Design Challenge Revisions

GUIDING QUESTION

How will you structure the design challenge revisions to capture promising practices and teachers' best thinking?

GUIDING PRINCIPLES

- Design challenge lesson plans are a guide, not a script.
- Design challenge lesson plans are works in progress.
- Teachers, college students, and professional engineers need consistent and frequent opportunities to debrief and reflect on design challenge implementation.

GETTING STARTED CHECKLIST

- Consider using an online platform such as Box, Google Drive, Schoology, Catalyst, etc. to store and share design challenge lesson plans, as well as other group resources.
- Provide guided reflection questions and set the expectation that teachers capture their "implementation notes" after each design challenge. We suggest keeping the reflection questions simple and clear. See a sample list of reflection questions.

Reflection Questions for Implementation Notes

Engineering Fellows

Reflection Questions for Implementation Notes

1. What changes did you make as you implemented this design challenge, and why?
2. What would you do differently next time, and why?
3. Which parts of the design challenge implementation were successful, and why?
4. Please share any observations/suggestions that improved this design challenge experience.
5. What evidence of student learning did, or could, you collect as a result of this design challenge?
6. How did the lesson engage the students in collaborative learning?
7. How did this lesson cognitively engage students?

Download: Reflection Questions for Implementation Notes

- Make these available to the whole cohort in a timely manner.
- Build sustained time into every Saturday session for design teams to debrief how design challenges went, and what could be improved for next time.
- Provide regular time during Saturday sessions for design teams to actually revise design challenge lesson plans, and make sure these are available to the whole cohort.

KEY QUESTIONS

- How will you account for teachers needing or wanting differing levels of detail in the design challenge lesson plans?
- What online platforms are your participants already using that you can leverage?
- How can you authentically include reflections from college students and professional engineers supporting implementation in the design challenge revisions?

Play 11 – Community and Family Engagement

GUIDING QUESTION

How will you support teachers to involve families and community partners in engineering education?

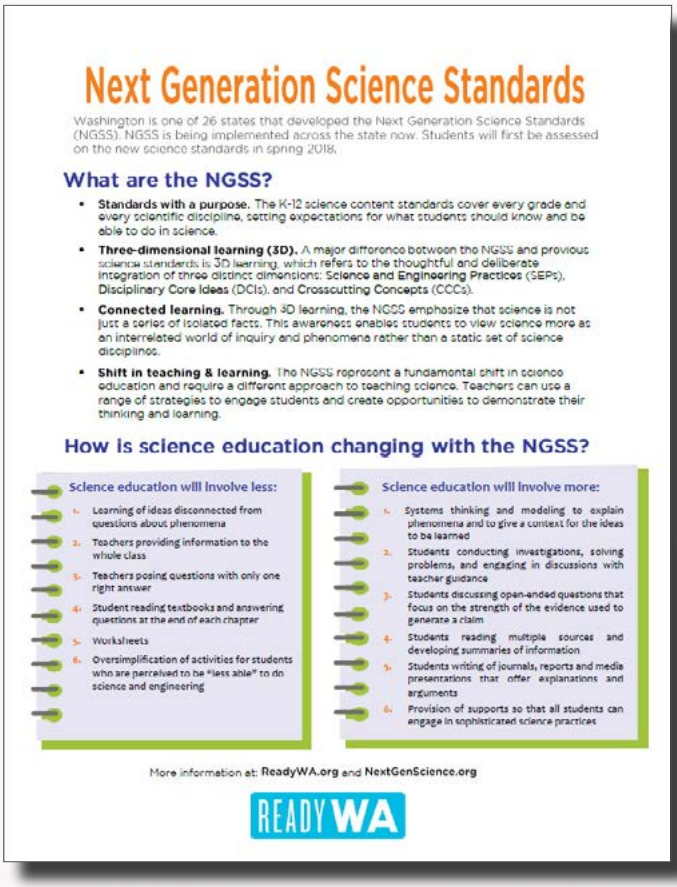
GUIDING PRINCIPLES

- Families can, and should, be involved in learning about their student's engineering experience.
- Interacting with college engineering students and professional engineers can have a lasting impact on families as well as students.
- Family culture, language, and transportation access needs to be considered when designing family engagement opportunities.

GETTING STARTED CHECKLIST

- Think outside of the box about how to engage families, specifically families of students underrepresented in STEM.
  - Provide on-site translation services as well as translated materials. Rev.com offers translation services for many languages at a reasonable cost, with a quick turnaround.
  - Provide food and beverages for the entire family.
  - Consider the venue—is the school easy for people to get to? Is there a local community center that families might prefer or have easier access to?
  - Consider providing transportation, especially in rural communities.
- Here are some ideas for family engagement opportunities
  - Family STEM / Engineering night
  - Family design challenge during conferences
  - Back-to-School Night design challenge
- Working through a design challenge with families presents an opportunity to help them understand the Next Generation Science Standards. Our first year teachers found the following resource to be at the right level of detail for families with limited time during family engagement events.
  - How is science education changing with the NGSS?
- Consider connecting with your regional STEM Network or MESA Center for community support. If you are in a region without a STEM Network or MESA Center, here is a template for connecting with community partners for funding.

Next Generation Science Standards



Next Generation Science Standards

Washington is one of 26 states that developed the Next Generation Science Standards (NGSS). NGSS is being implemented across the state now. Students will first be assessed on the new science standards in spring 2018.

What are the NGSS?

- **Standards with a purpose.** The K-12 science content standards cover every grade and every scientific discipline, setting expectations for what students should know and be able to do in science.
- **Three-dimensional learning (3D).** A major difference between the NGSS and previous science standards is 3D learning, which refers to the thoughtful and deliberate integration of three distinct dimensions: **Science and Engineering Practices** (SEPs), **Disciplinary Core Ideas** (DCIs), and **Crosscutting Concepts** (CCCs).
- **Connected learning.** Through 3D learning, the NGSS emphasize that science is not just a series of isolated facts. This awareness enables students to view science more as an interrelated world of inquiry and phenomena rather than a static set of science disciplines.
- **Shift in teaching & learning.** The NGSS represent a fundamental shift in science education and require a different approach to teaching science. Teachers can use a range of strategies to engage students and create opportunities to demonstrate their thinking and learning.

How is science education changing with the NGSS?

Science education will involve less:

1. Learning of ideas disconnected from questions about phenomena
2. Teachers providing information to the whole class
3. Teachers posing questions with only one right answer
4. Student reading textbooks and answering questions at the end of each chapter
5. Worksheets
6. Oversimplification of activities for students who are perceived to be "less able" to do science and engineering

Science education will involve more:

1. Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
2. Students conducting investigations, solving problems, and engaging in discussions with teacher guidance
3. Students discussing open-ended questions that focus on the strength of the evidence used to generate a claim
4. Students reading multiple sources and developing summaries of information
5. Students writing of journals, reports and media presentations that offer explanations and arguments
6. Provision of supports so that all students can engage in sophisticated science practices

More information at: **ReadyWA.org** and **NextGenScience.org**

READY WA

Download: Next Generation Science Standards

KEY QUESTIONS

- What family engagement opportunities already exist in teachers' schools and/or community centers?
- For program coordinators: does your organization have the capacity to organize a large family/community event for all EFP participants and their students? What are the tradeoffs between a large event and smaller, school- or district-based opportunities?
- How can you ensure that families of students underrepresented in STEM are included and feel welcome in the opportunity?
- How can Engineering Fellows students and engineers participate in the family engagement opportunity?

Evaluation

GUIDING QUESTION

What outcomes can and should be measured in Engineering Fellows? What tools, resources, and processes can be used to measure desired outcomes?

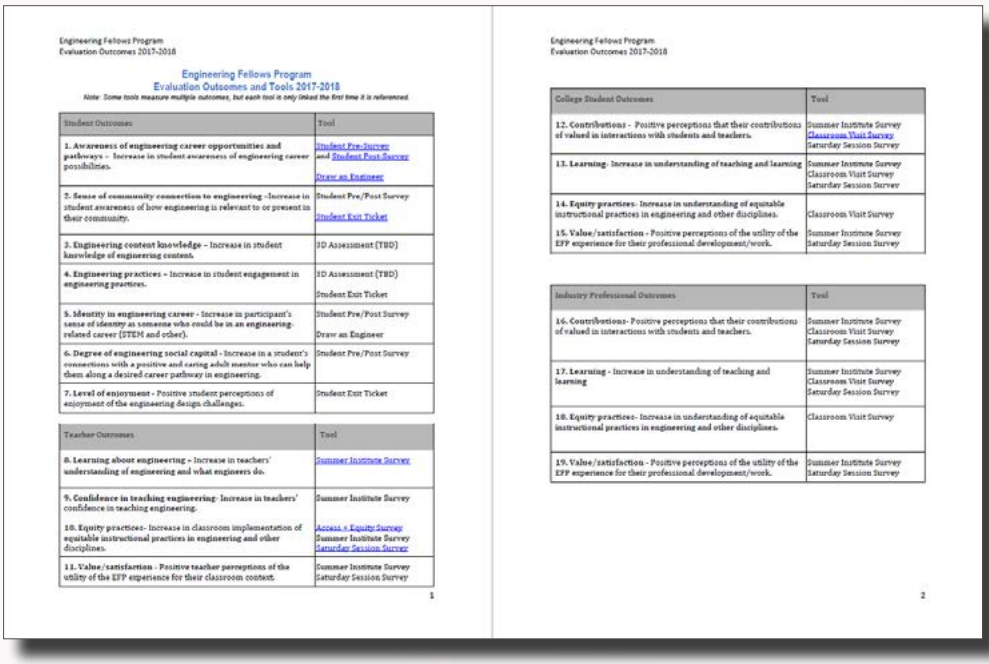
GUIDING PRINCIPLES

- We need to measure outcomes for each of our participants—teachers, college and graduate students, professional engineers, and 5th grade students.
- All participants are partners in the program. Their feedback and reflections are used to inform the program and help us all get better at this work.
- Individual participant data is kept confidential.
- Outcomes and measures reflect our current best thinking, but may change over time as we continue to refine the program.

GETTING STARTED CHECKLIST

- Based on the overall goals of the program, determine the desired outcomes for each type of participant. We refined our outcomes in the second year of the program to focus on access, equity, awareness and participant learning. See our 2017-2018 target outcomes.

Evaluation Outcomes and Tools 2017-2018



Engineering Fellows Program
Evaluation Outcomes 2017-2018

Engineering Fellows Program
Evaluation Outcomes and Tools 2017-2018

Note: Some tools measure multiple outcomes, but each tool is only linked the first time it is referenced.

Student Outcomes	Tool
1. Awareness of engineering career opportunities and pathways – Increase in student awareness of engineering career possibilities.	Student Pre-Survey and Student Post Survey Draw an Engineer
2. Sense of community connection to engineering -Increase in student awareness of how engineering is relevant to or present in their community.	Student Pre/Post Survey Student Exit Ticket
3. Engineering content knowledge – Increase in student knowledge of engineering content.	3D Assessment (TBD)
4. Engineering practices – Increase in student engagement in engineering practices.	3D Assessment (TBD) Student Exit Ticket
5. Identity in engineering career - Increase in participant's sense of identity as someone who could be in an engineering-related career (STEM and other).	Student Pre/Post Survey Draw an Engineer
6. Degree of engineering social capital - Increase in a student's connections with a positive and caring adult mentor who can help them along a desired career pathway in engineering.	Student Pre/Post Survey
7. Level of enjoyment - Positive student perceptions of enjoyment of the engineering design challenges.	Student Exit Ticket

Teacher Outcomes	Tool
8. Learning about engineering – Increase in teachers' understanding of engineering and what engineers do.	Summer Institute Survey
9. Confidence in teaching engineering- Increase in teachers' confidence in teaching engineering. **10. Equity practices**- Increase in classroom implementation of equitable instructional practices in engineering and other disciplines.	Summer Institute Survey Access + Equity Survey Summer Institute Survey Saturday Session Survey
11. Value/satisfaction - Positive teacher perceptions of the utility of the EFP experience for their classroom context.	Summer Institute Survey Saturday Session Survey

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Engineering Fellows Program
Evaluation Outcomes 2017-2018

College Student Outcomes	Tool
12. Contributions - Positive perceptions that their contributions of valued in interactions with students and teachers.	Summer Institute Survey Classroom Visit Survey Saturday Session Survey
13. Learning- Increase in understanding of teaching and learning	Summer Institute Survey Classroom Visit Survey Saturday Session Survey
14. Equity practices- Increase in understanding of equitable instructional practices in engineering and other disciplines.	Classroom Visit Survey
15. Value/satisfaction - Positive perceptions of the utility of the EFP experience for their professional development/work.	Summer Institute Survey Saturday Session Survey

Industry Professional Outcomes	Tool
16. Contributions- Positive perceptions that their contributions of valued in interactions with students and teachers.	Summer Institute Survey Classroom Visit Survey Saturday Session Survey
17. Learning - Increase in understanding of teaching and learning	Summer Institute Survey Classroom Visit Survey Saturday Session Survey
18. Equity practices- Increase in understanding of equitable instructional practices in engineering and other disciplines.	Classroom Visit Survey
19. Value/satisfaction - Positive perceptions of the utility of the EFP experience for their professional development/work.	Summer Institute Survey Saturday Session Survey

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Download: Evaluation Outcomes and Tools 2017-2018

- Once the goals are agreed upon, develop or adapt tools that can be used to measure the outcomes. Our 2017-2018 tools are listed next to each outcome in the 2017-2018 target outcomes document.
- Develop a timeline with clear roles and responsibilities related to each tool. Provide a more specific student learning evaluation timeline for teachers.
- Be transparent about how participant feedback shapes the program. For example, take a few minutes at the beginning of each day of the SDI to share the feedback and course corrections from the previous day.

KEY QUESTIONS

- Who will oversee the distribution of the various survey links to participants?
- How will EFP participants be involved in reviewing and analyzing student learning data?
- How will participant feedback be used to shape the program?