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Tenet: Engaged and Challenged

How Can We Understand Students' STEM Experiences Using Empathy Interviews?

Fundamental to implementing the Next Generation Science Standards (NGSS) is having a guaranteed and viable engineering curriculum. Therefore, the Wenatchee School District adopted the Museum of Science Boston's Engineering is Elementary (EiE) kits. We sought to understand the students' experience through the use of empathy interviews.*"Collecting empathy data is a key way to practice the improvement principle: make the work human-centered.*" (Smith et.al, 2019)

Individual 10 minute interviews were conducted with 18 students in grades Kindergarten through Fifth. We asked:

1. Can you help me understand more about the engineering kit you did this year?
2. What's the best part about doing engineering in your science class?
3. Tell me a great experience that happened while you were engineering.
4. How does doing engineering make you feel?
5. How is doing engineering & science different from your other subjects or the rest of your day?

Three categories arose from the interviews: Relevance, Teamwork, and Hands-on Learning.

Relevance

"A rich science education has the potential to capture a student's sense of wonder about the world and to spark their desire to continue learning about science throughout their lives. Research suggests that personal interest, experience, and enthusiasm--critical to children's' learning of science at school or in other settings--may also be linked to later educational and career choices." (NRC Framework, 2011)

Many students reported relating to the EiE character's "problems" and wanted to solve them in order to help. This real-world application component was stated by many students: "It's important because oil spills could hurt our environment. It felt really good to clean the oil spill so no animals were being hurt." "It made me want to help." "We used tools like spoons or rubber bands and what tool is better to clean up the oil spill and how they would, the real people who actually clean up the spills, actually use tools like that, only bigger."

Teamwork

When students work in teams around solving engineering problems, they mimic the true practices of real scientists and engineers. "Science is fundamentally a social enterprise and scientific knowledge advances through collaboration and in the context of a social system with well-developed norms… The work of engineers,

like the work of scientists, involves both individual and cooperative effort; and it requires specialized knowledge. " (NRC Framework 2011)

Every student interviewed remarked that working on a team was one of the best parts of engineering. "We got to share ideas with the team. You don't have to do this by yourself. You wouldn't be alone and would share ideas." "It helps because you don't have to do all the work alone. If you mess something up or somebody else messed something up then you can find more information." "Talking with my partner, we talked about if we should put things here instead of another thing there. Having a partner was helpful." "There was a time when my partner did something wrong but then we figured out how to fix it. We got to experiment more and fix it." "Felt nice getting everyone on the hands on project to try and figure out the best idea out there. Working in a team we put together ideas and thinking about what would happen everyone had great ideas, and it was nice that everyone put together ideas."

Hands-on Learning

Every student reported that the hands-on component of engineering was the most fun and is what separates engineering from other subjects. Students said: "In engineering, you get to work with your hands, not just reading and writing" "I like it as a change. I really like science. There's a lot more to it than math. Math is just problems and solutions. Science combines all of that. Trying to find a solution." "In math you write down the answers. In engineering you experience it." "It's more interaction and hands on and I personally think that's better. You can think more about the subject when its hands on. If we were just doing it out of a textbook and you were just reading, you wouldn't get as much information, you couldn't think about in a way that it's actually happening." "It was hands-on-- You get to feel stuff, and do it, using a strategy to actually clean it up. Not exactly the real thing but it was black oil, and we used different strategies"

Empathy interviews allowed us to honor students' experience and voices, and collect data on whether we were meeting some of the goals of NGSS. The three big categories that arose from student interviews-- Relevance, Teamwork and Hands-on learning-- are part of a recipe for engagement and equity. "Equity in science education requires that all students are provided with equitable opportunities to learn science and become engaged in science and engineering practices; with access to quality space, equipment, and teachers to support and motivate learning and engagement; and adequate time spent on science. In addition, the issue of connecting to students' interests and experiences is particularly important for broadening participation in science." (NRC Framework, 2011)

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References

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