

Perspectives on Solution Diversity and Divergent Thinking in K-12 Engineering Design Learning Experiences

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Guiding question 1: *In what ways do researchers, teacher collaborators, or students value a diverse set of solutions to design problems? What does “solution diversity” look like in K-12 engineering experiences?*

Guiding question 2: *How does valuing solution diversity influence assessment, teacher professional development, and the design of instructional strategies and scaffolds?*

Focus Topics / Questions for Small Groups

(1) TRADE-OFFS -

- Why and when would solution diversity NOT be desirable in a K-12 engineering experience?
- What are the pros AND cons of developing and implementing engineering projects that generate/support students’ solution diversity?

(2) ASSESSMENT -

- How do you assess learning when each student team designs a different solution?
- Where in K12 education is solution diversity already flourishing (e.g., fine arts), and how does assessment happen there? What might engineering education learn from this?
- Can we use solution diversity (i.e., the “conceptual distance” among all solutions in a classroom) as a measure of the overall success of a project or class, or of teaching practice?

(3) TEACHER DEVELOPMENT -

- What professional development experiences or strategies help teachers prepare to facilitate solution diversity during engineering projects?
- What do teachers need to know, do, and learn with respect to supporting solution diversity?
- What instructional strategies and scaffolds are needed?

(4) DIMENSIONS -

- How can we characterize what solution diversity looks like during a K-12 engineering experience?
- What are the dimensions of solution diversity?
- What makes two different ways to solve a design problem “diverse,” distinct, or divergent?

A Thought Exercise

Think of a familiar hands-on “making” task that is close-ended or well-structured, such that there is not much meaningful difference among different students’ creations? (e.g., mousetrap car kit, soda bottle rockets, solar-powered toy car)

Try to adapt that task into a more complex, ill-structured (Jonassen, 2006) problem that would allow for diversity of solutions across a class of students. What would need to be changed about the task, the context, the materials provided, the pedagogy of posing the task, etc.?