



# Usable STEM Knowledge: Fostering motivation and interest in STEM learning

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## Research Questions

- (1) What science investigation and engineering design features are present in a solutioning curriculum program?
- (2) When implementing a curricular program with science investigation and engineering design features, what evidence of interest and motivation are present?

## Solutioning Instructional Model

Engage	Students ask questions associated with an introductory activity (often local environmental issues).
Explore	Students collect data to use as evidence
Explain	Students use evidence from the Explore phase to construct arguments to address their scientific questions.
Engineer	Students design a solution and a plan that meets specific design criteria and constraints. Students test their solutions through feedback and data collection to determine if their solution is optimal for addressing the problem.
Educate	Students synthesize key ideas from their designs to inform and educate local stakeholders about possible implementation.

	Unit 1							Unit 2				Unit 3							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Providing Choice or Autonomy		I				I		I						I	E	E	I	E	E
Promoting Personal Relevance	E	E		E	E							I	E	I	I	I	E	I	
Presenting Appropriately Challenging Material			I		I				I	I	I		I	I	I	E	I	I	
Situating the Investigations Socially and Culturally		I		I									E	E	E	E	E	E	

## Results

- Ten lessons strongly emphasized at least one of the design features, and 16 lessons included at least one design feature.
- After experiencing the program, more than 60% of all students scored high (4 or 5) on all four science and engineering meaningfulness and interest survey items (N=134).
- During interviews, teachers and students expressed evidence of autonomy, personal relevance, and appropriate challenge - design features associated with interest and motivation.

Design Feature	Quotes
Providing Choice or Autonomy	"Maybe we could put the green sticks on top instead of the sides and then cut a hole in the top to let the insects in" - Student 1
Promoting Personal Relevance	"I think they're more excited with this because it was something they could actually do, and they could kind of visualize doing it in our schoolyard... They're like, 'This is real. This is tangible,' so I felt like they were quite excited." - Teacher A
Presenting Appropriately Challenging Material	"I don't think a Boxelder Bug can fit through that hole." - Student 2 "Oh, let's cut a bigger hole in the middle." - Student 3

