Engaging Students in STEM Topics through Problem-Based Learning

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Project ExCEL – Ignite, George Mason University

George Mason University's Project ExCEL (2014) (S206A140022) and Project E-Ignite (2019) (S206A190025) are U.S. Department of Education's Jacob K. Javits Gifted and Talented Students Education Program funded projects.

ExCEL & E-Ignite

Jacob K. Javits federally funded projects

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If we prepare doctors with PBL, we can prepare students with PBL.

Characteristics of Problem-Based Learning

Ill-structured problem

Analysis of multiple perspectives and decision making

Habits of mind of a practitioner

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Instructional Differences

Ill-structured Problem	Cognitive Apprenticeship	Student as Stakeholder
Initiates the instruction	Models open-mindedness and curiosity	Authority
Needs more information	Creates an environment for student self-directed learning	Responsibility
Has more than one resolution	Coaches students with metacognitive questions to prompt to reflection	Accountability

Source: Horak, A. K. & Shaklee, B. (2017). Elements of problem based learning. [Unpublished infographic]. Project ExCEL. George Mason University.

Engagement	Inquiry & Investigation	Definition	Resolution	Debrief
• Students are immersed in the problem.	• Students begin to uncover information about the problem.	• Students frame the problem.	• Students present solutions.	• Students reflect.

Source: Horak, A. K. & Shaklee, B. (2017). Elements of problem based learning. [Unpublished infographic]. Project ExCEL. George Mason University.

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How PBL Teaches Creative and Critical Thinking

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Multidisciplinarity and Transdisciplinarity

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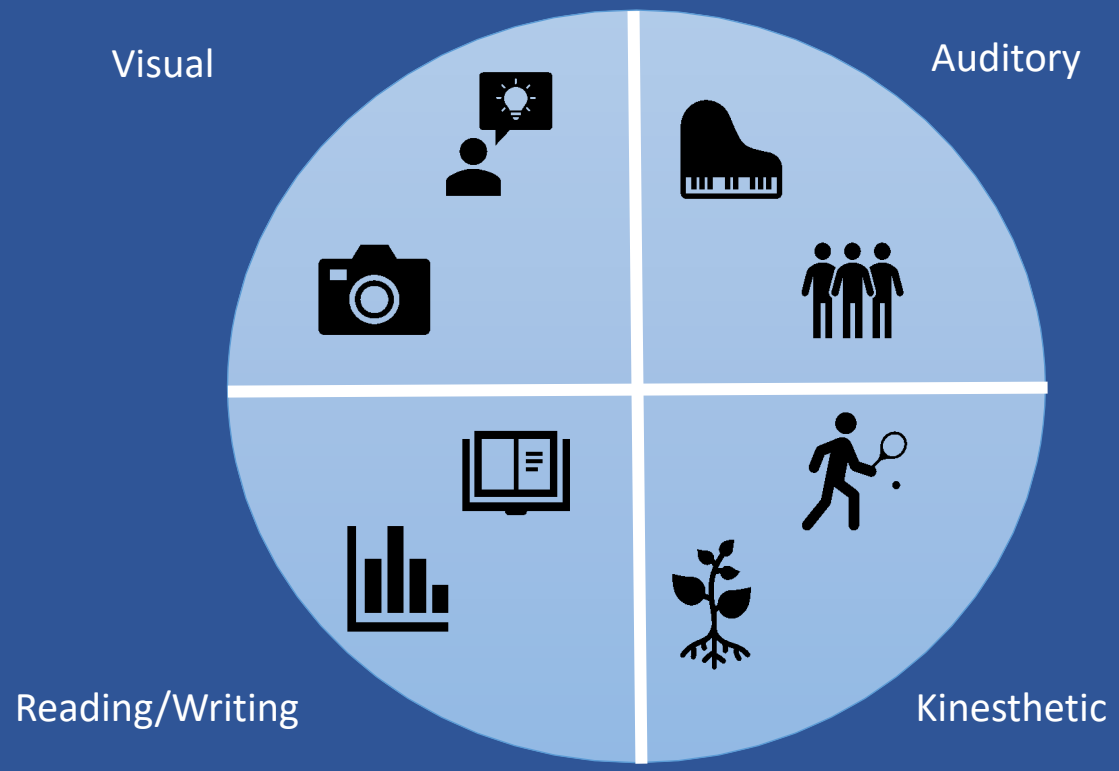
Connections for English Language Arts



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Units with a STEM Focus

Completed Units

Screens in Schools: A Problem Investigating the Value of Educational Technology in the Classroom

Bees in the City: A Problem Investigating the Use of Urban Beekeeping to Support Honeybee Health

Units Under Construction

The Problem with Plastics: A Problem Investigating Single-Use Plastic and Its Impact on the Oceanic Ecosystem

Artificial Intelligence

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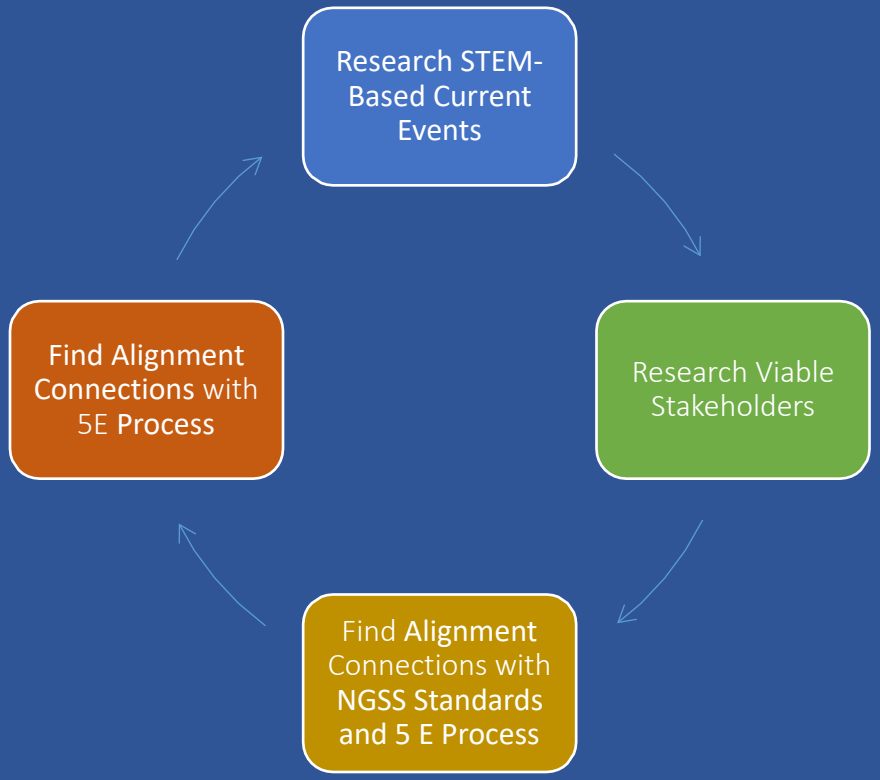
Finding Connections to STEM Content



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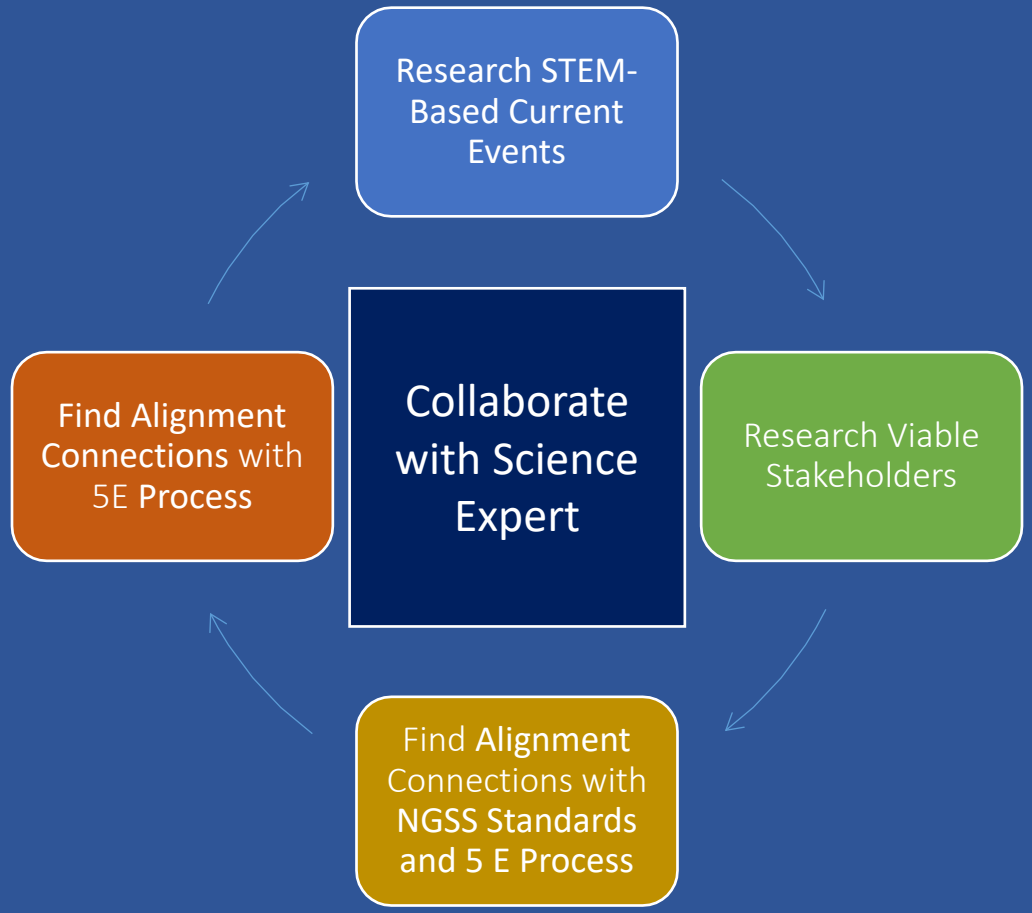
Role of the Science Expert



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5 E Alignment

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Bees in the City: A Problem Investigating the Use of Urban Beekeeping to Support Honeybee Health

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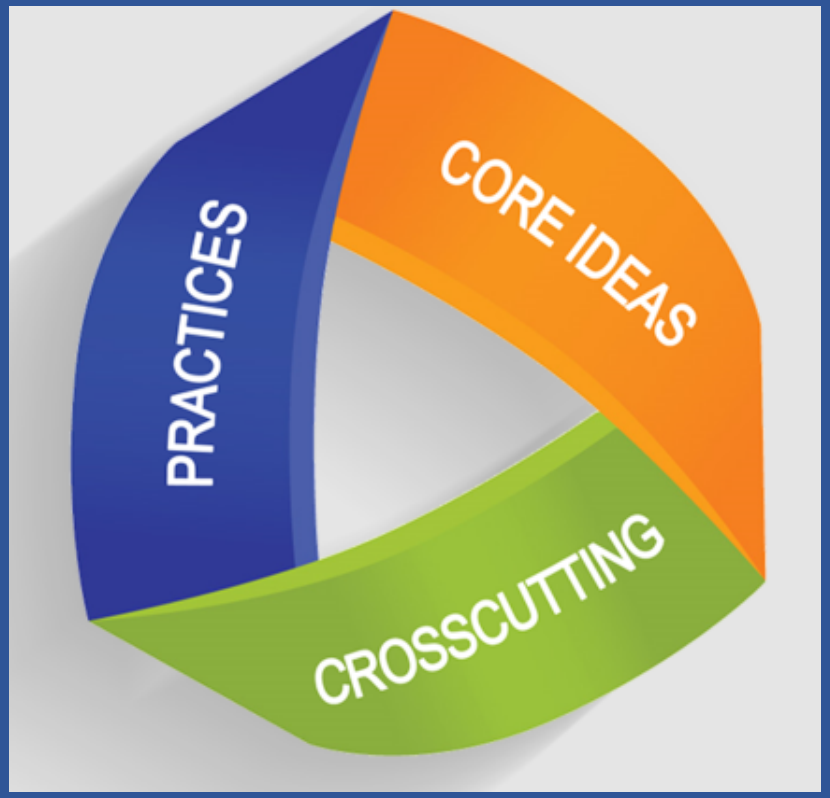
Next Generation Science Standards (NGSS)



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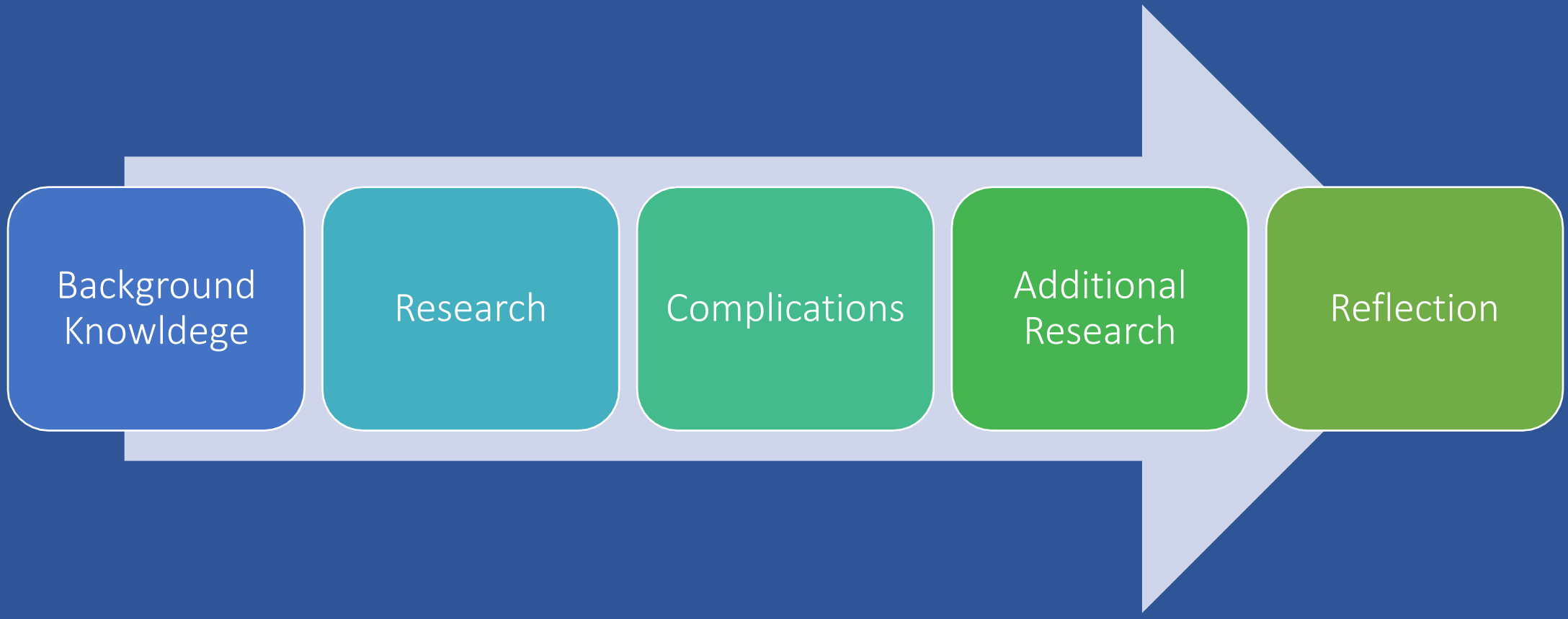
Hypothesis Building



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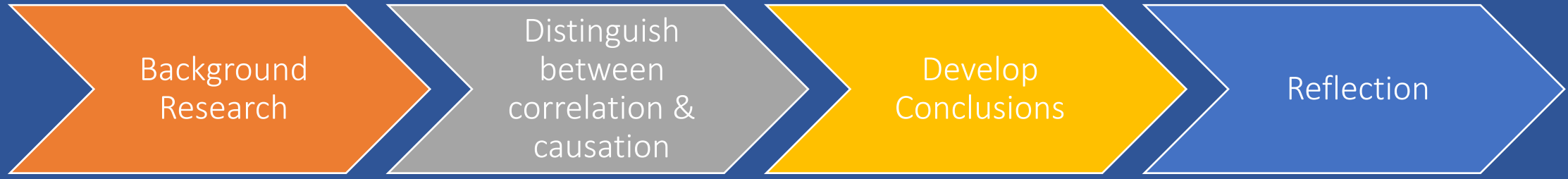
Analyzing and Interpreting Data



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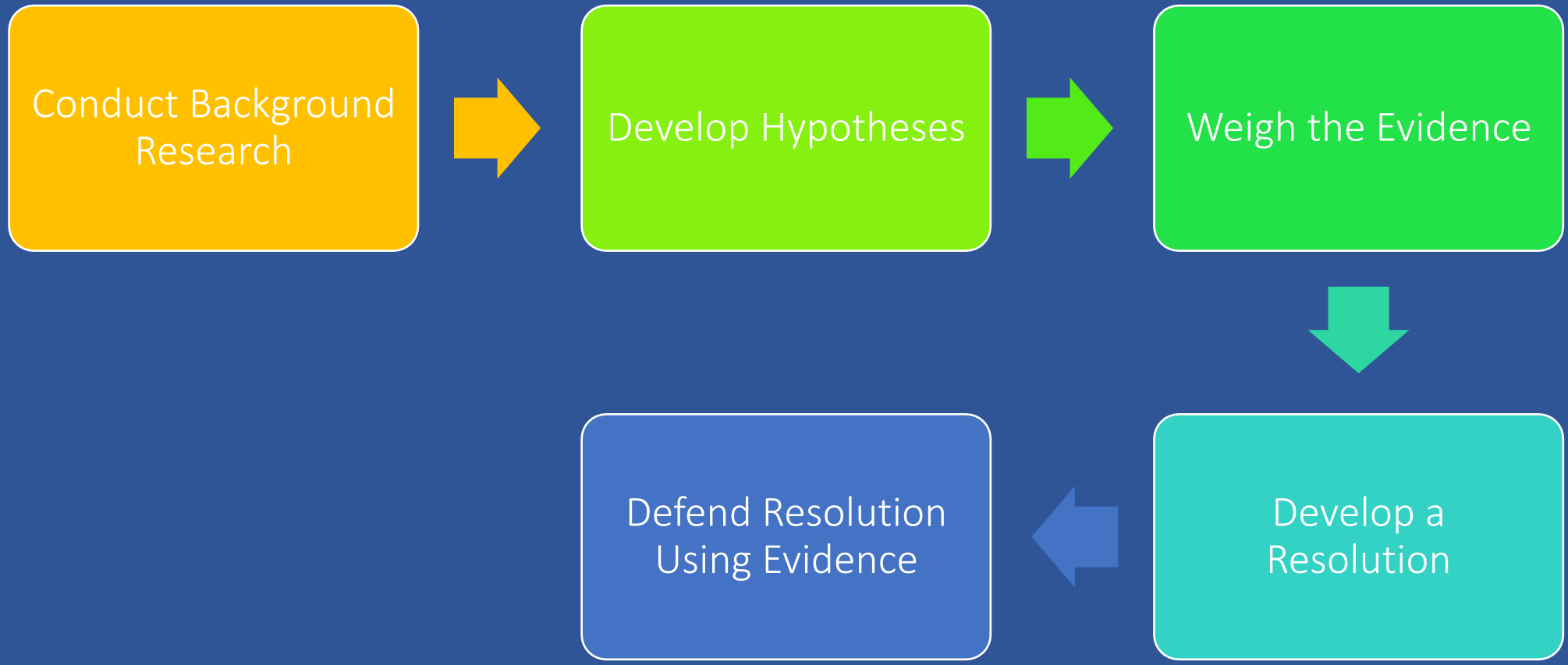
Engaging in Argument from Evidence



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Constructing Explanations and Designing Solutions

Multiple Sources of Evidence

Reliable Citations

Reflection

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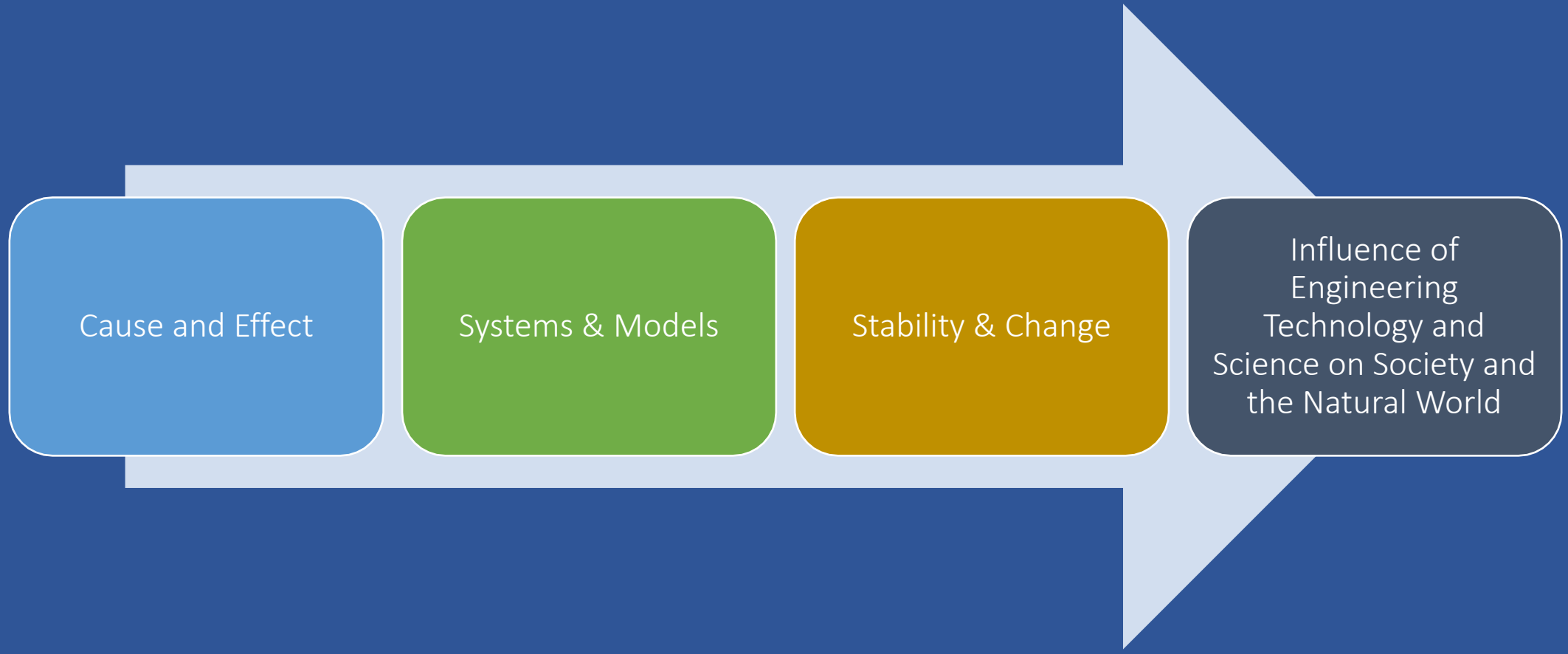
Cross-Cutting Concepts



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Questions? Contact:

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Curriculum Questions

To pilot or obtain copies of our PBL curriculum, please scan below:

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