PLACE-BASED STEM EDUCATION: PEDAGOGY AND PRACTICE IN SCIENCE AND AGRICULTURAL EDUCATION

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Blacksburg, Virginia (USA)
Place-based STEM education: Pedagogy and Practice

• Inquiry Learning
• 5-E Learning Cycle Model: Problem Solving and Inquiry-by-Design
• Connecting local to global: Examples of Place-based STEM Education Lessons
• Sample lesson Plans
What is inquiry learning?
Inquiry Learning

• Learning begins with prior knowledge and experiences
• Learning begins with concrete experiences and proceeds to abstract thinking (Piaget)
• Learning is situated in culture and environment (Vygotsky)
Learning Begins with Prior Knowledge and Experiences

What is your prior knowledge and life experiences?

Blacksburg, VA Winter
Learning Begins with Prior Knowledge and Experiences

Blacksburg, VA summer time

How many seasons are in Malawi?
Why do we have different seasons?

Seasons caused by tilt of earth.
How do you challenge students prior knowledge?

• Discrepant Events

Puzzling activity
Cognitive Disequilibrium (Piaget)
Learning Theory: Piaget

• Concrete > Abstract

Physics Student Teachers
Virginia Tech
What do you observe? What do you interpret?
Learning Theory: Piaget

- Concrete Operational Thought

Hands-on Instruction!
Lampang Province, Rural Thailand
Learning Theory: Piaget

- Formal Operational Thought

Abstract Thinking
Learning is Situated in Culture and Environment: Vygotsky

Learning From Elders
Zomba, Malawi
Situated Learning (Lave and Wenger)

- Learning in Socio-cultural context

Virginia Tech Student Teachers
Situated Learning

Collaboration  Problem-Solving  Questioning
Designing Solutions  Sharing Results
5-E Learning Cycle Model Lesson

- Model for inquiry learning and problem-solving
Why do you think the water stay in the straw?
5-E Learning Cycle Model

Explain

Force Gravity

Air Pressure = force/area
5-E Learning Cycle Lesson: Explore

What do you think will happen to the water?

Prediction Question
Discrepant Event
5-E Learning Cycle Lesson: Explain

Draw a diagram and label the forces.

Water
5-E Learning Cycle Lesson: Explain

Explain diagram and forces

Newton’s Third Law: Action-Reaction
5-E Learning Cycle Lesson: Elaboration

- Design a Balloon Rocket
- Air pressure released
- Newton’s Third Law: every action there is equal and opposite reaction

![Diagram of a balloon rocket](image-url)
How to Make a Barometer

Materials Needed:
- small glass jar or tin can
- large (12”) round balloon
- rubber band
- scissors
- tape
- small stirring stick
- 5” x 7” index card
5-E Learning Cycle Lesson: Elaboration

- High and Low Pressure Weather Systems
Inquiry-by-Design: Elaboration

- Identify the problem
- Brainstorm ideas that will help solve problem
- Apply science and mathematics concepts
- Analyze resource issues
- Choose the best technologies and methods of data analysis for solving the problem
- Evaluating the solution
Place-based STEM Education in Thailand
Connecting local with global

- Investigating Water Quality

Dr. Rose Klechaya
Lampang Province: Hill Tribe People
Place-based Science Education

- Water Testing local river
Place-based Science Education

- Lessons connect with Thai National Curriculum
Place-based Science Education

- Teacher and student inquiry
- Result shared with local farmers
Place-based Science Education

- Inquiry Learning: Connecting local with global knowledge
Inquiry Teaching and Learning

• Inquiry engages students in:

  * questioning
  * critical thinking
  * analyzing evidence
  * problem-solving and design
Third Space Theory: Connecting local knowledge with modern science

Local Knowledge
First Space

Hybrid Knowledge
Third Space

Modern Science
Second Space

Bhabha, 1994; Wallace, 2004; Glasson et al., 2010
Sample Place-based STEM Lesson Plans: Virginia Tech Student Teachers

- Size Limits of Cells: [link]
- Watersheds: [link]
- Water Pollution: [link]
- Designing Water Filters: [link]
- Salt Water Fish Farms: [link]
- Roller Coaster Design: [link]
Place-based STEM Education

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<th>Science Core Ideas Cross cutting concepts</th>
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Place-based STEM Education: 5-E Model Lesson

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