A stylized, light brown illustration of a plant with several leaves and a cluster of small, round fruits or berries, positioned on the left side of the slide.

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

George E. Glasson, Ph.D.
Virginia Tech
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



Blacksburg, VA Winter

What is your prior knowledge and life experiences?

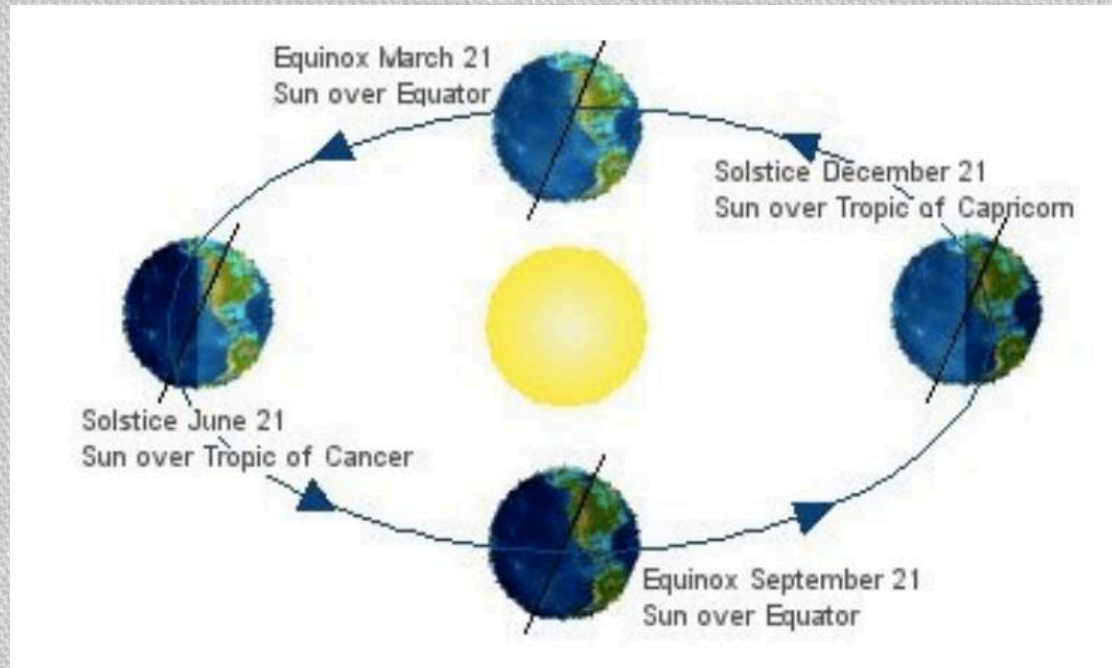
Learning Begins with Prior Knowledge and Experiences



Blacksburg, VA summer time

How many seasons are in Malawi?

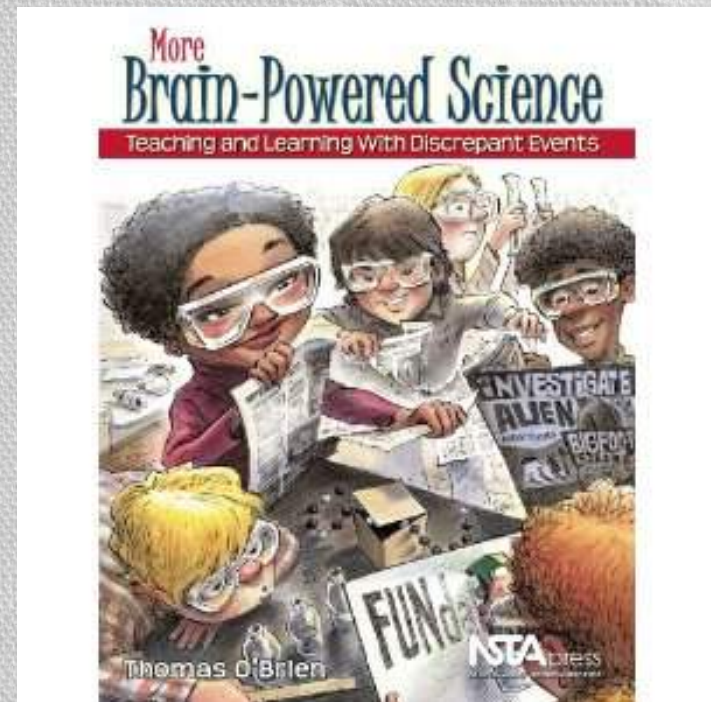
Why do we have different seasons?



Seasons caused by tilt of earth.

How do you challenge students prior knowledge?

- Discrepant Events



Puzzling activity

Cognitive Disequilibrium (Piaget)

Learning Theory: Piaget

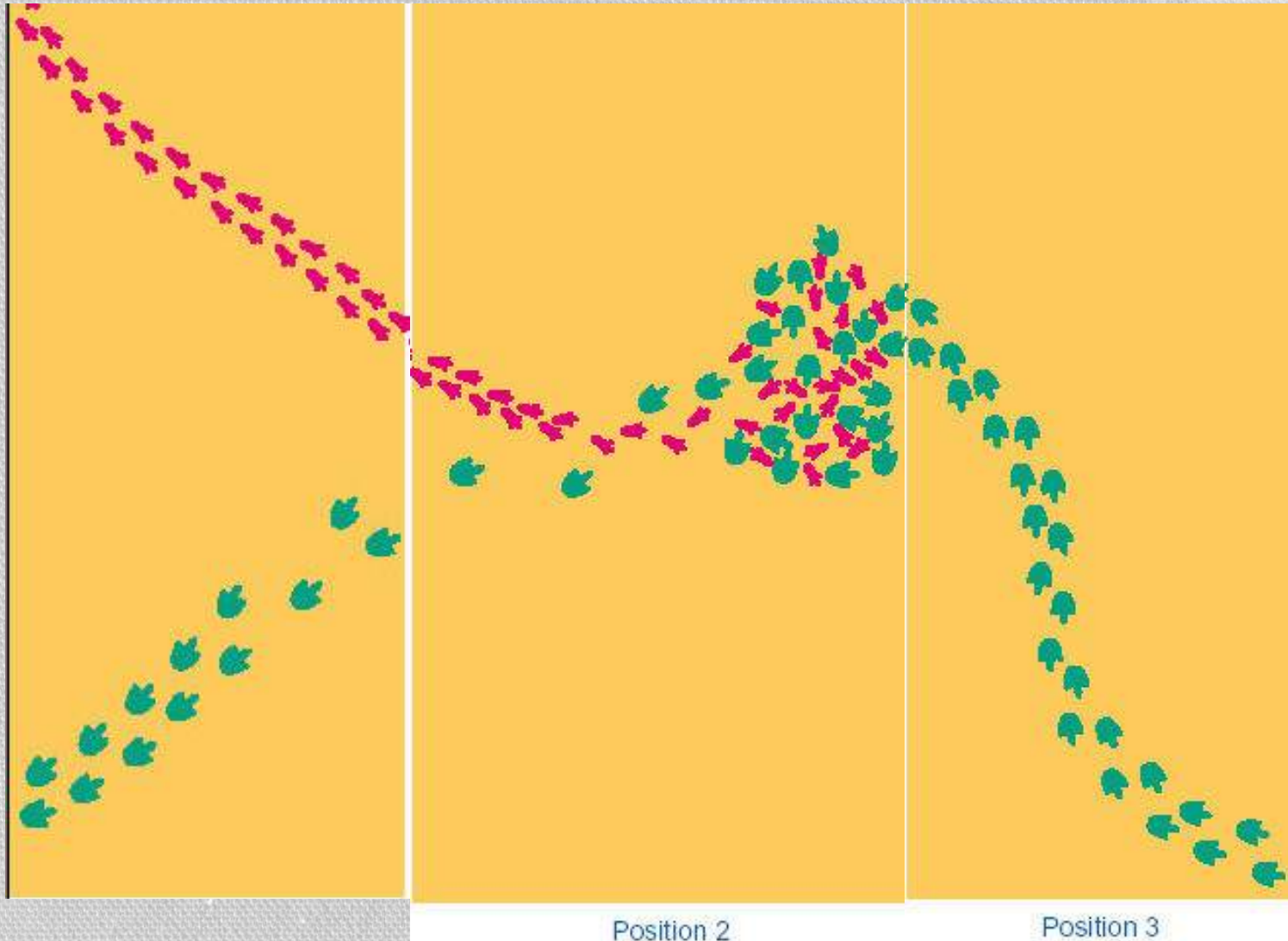
- Concrete > Abstract



Physics Student Teachers
Virginia Tech



What do you observe? What do you interpret?



Learning Theory: Piaget

- Concrete Operational Thought

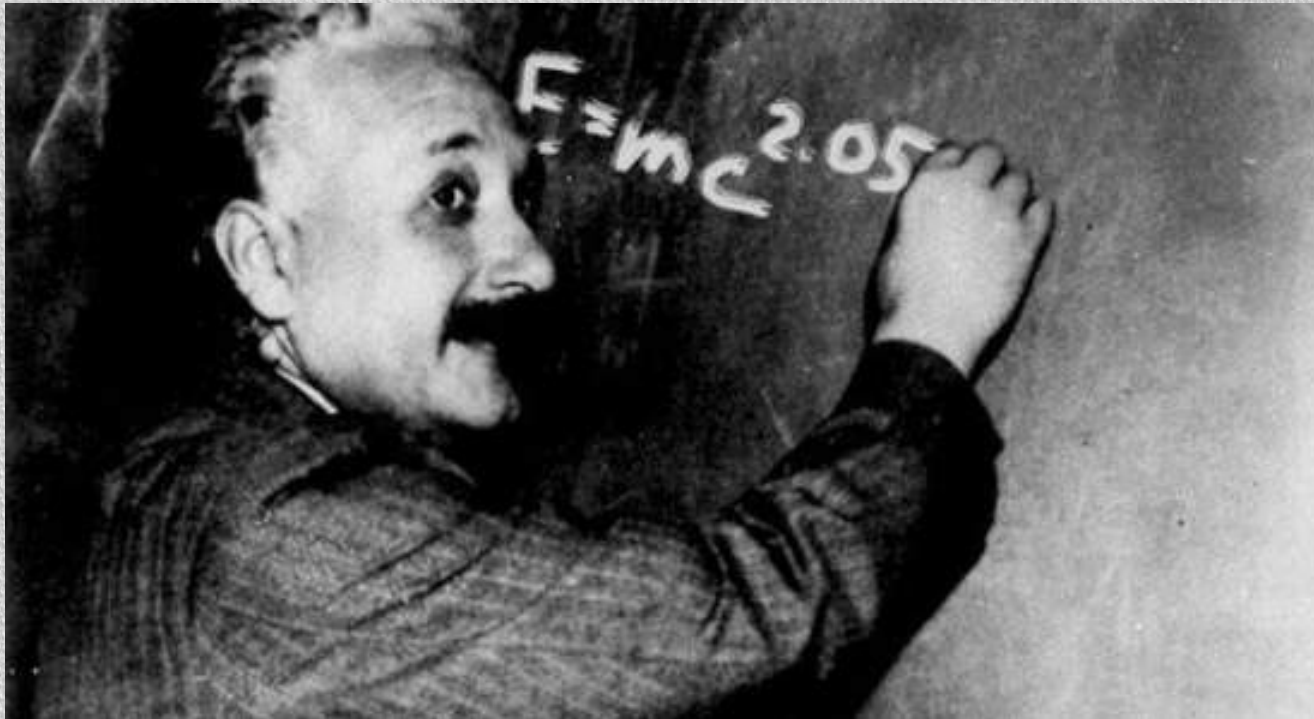


Hands-on Instruction!

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

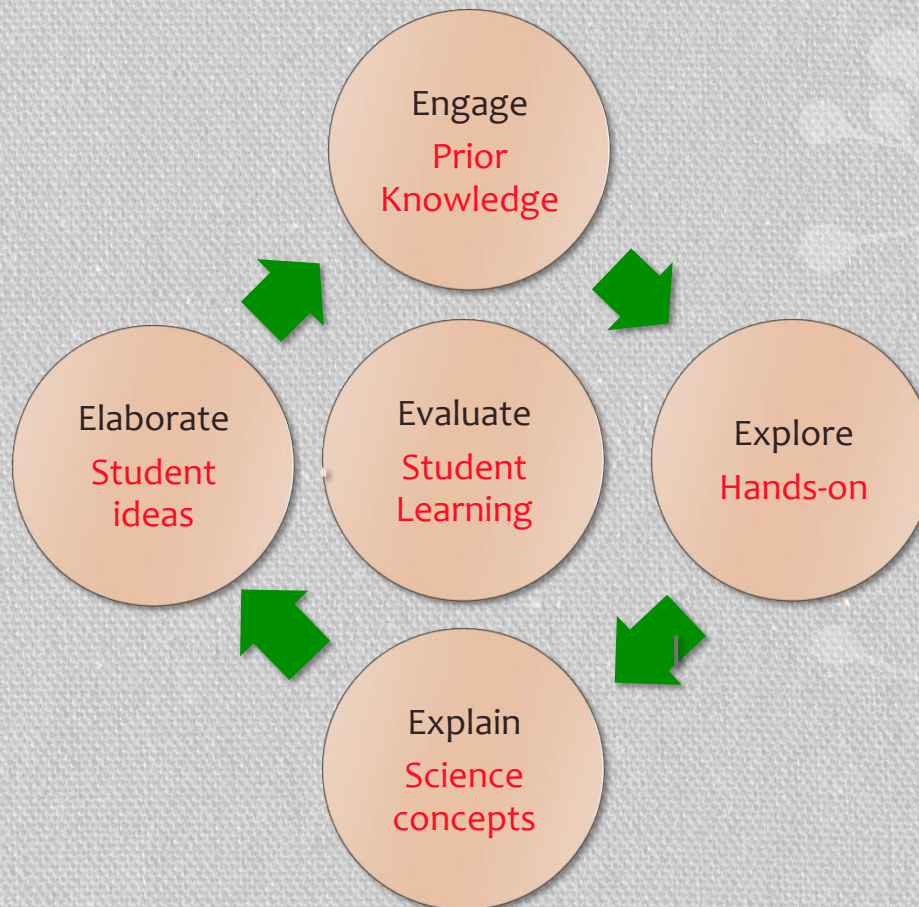
Questioning

Designing Solutions

Sharing Results

5-E Learning Cycle Model Lesson

- Model for inquiry learning and problem-solving



5-E Learning Cycle Lesson: Engage

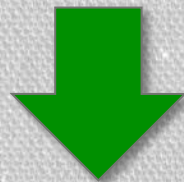


Why do you think the water stay in the straw?

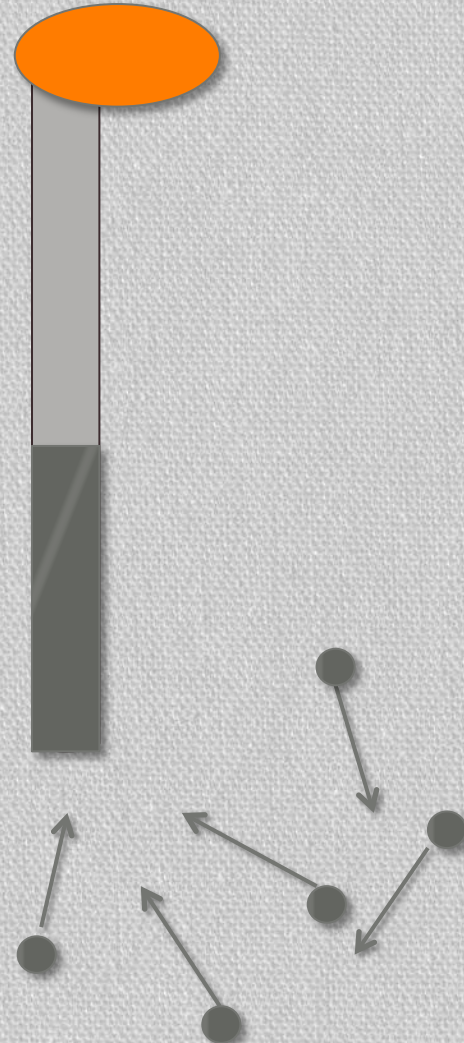
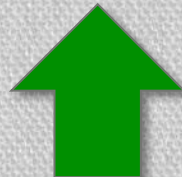
5-E Learning Cycle Model

Explain

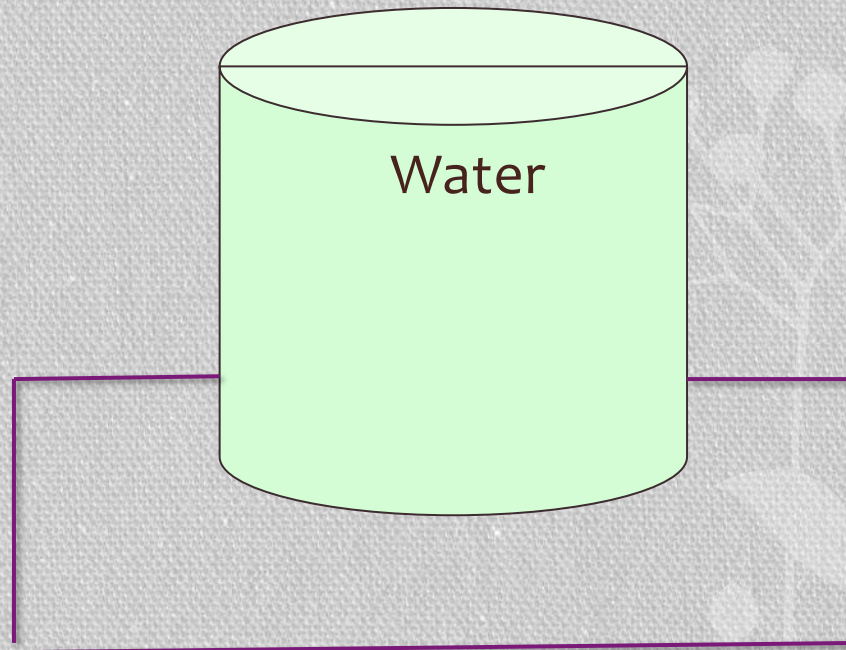
Force Gravity



Air Pressure =
force/area



5-E Learning Cycle Lesson: Explore

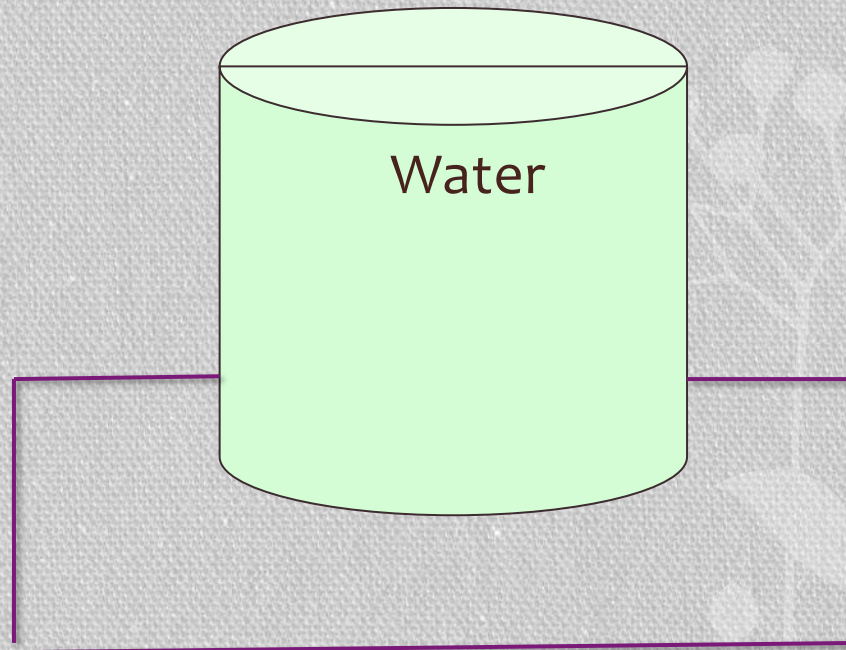


What do you think will happen to the water?

Prediction Question

Discrepant Event

5-E Learning Cycle Lesson: Explain

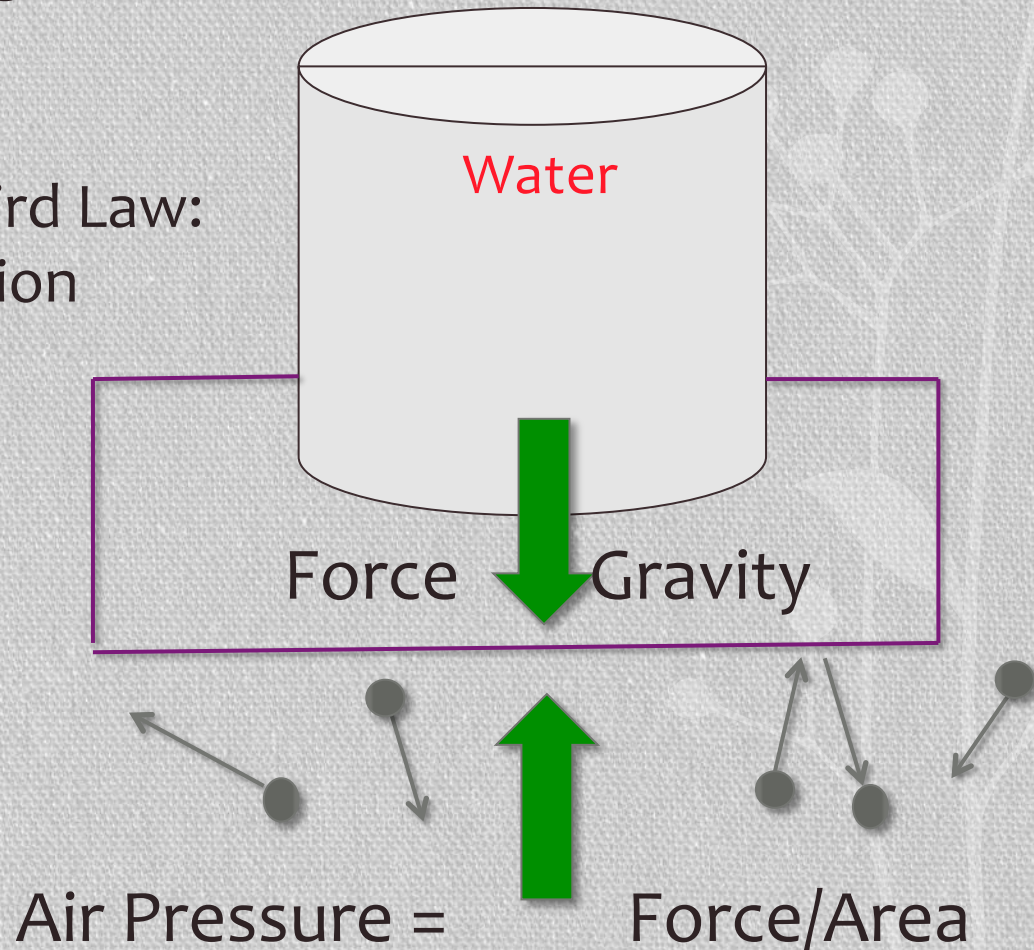


Draw a diagram and label the forces.

5-E Learning Cycle Lesson: Explain

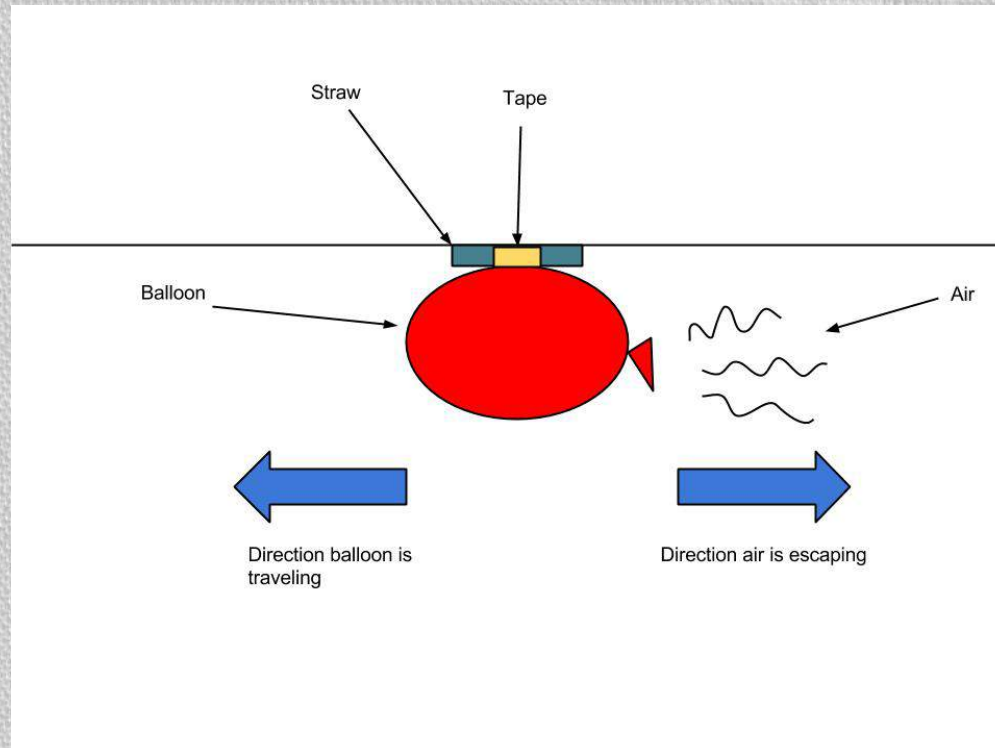
Explain diagram and forces

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



[Link to design activity](#)

5-E Learning Cycle Lesson: Elaboration

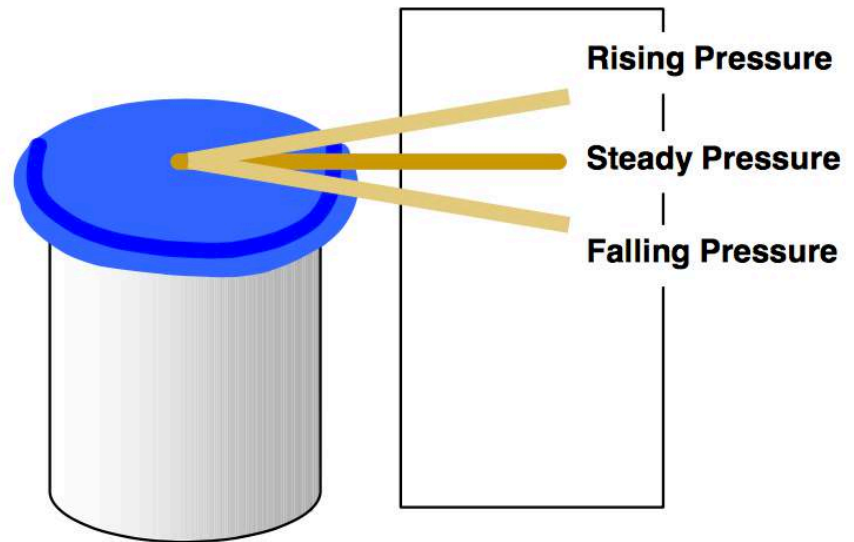


Southeast Regional Climate Center

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

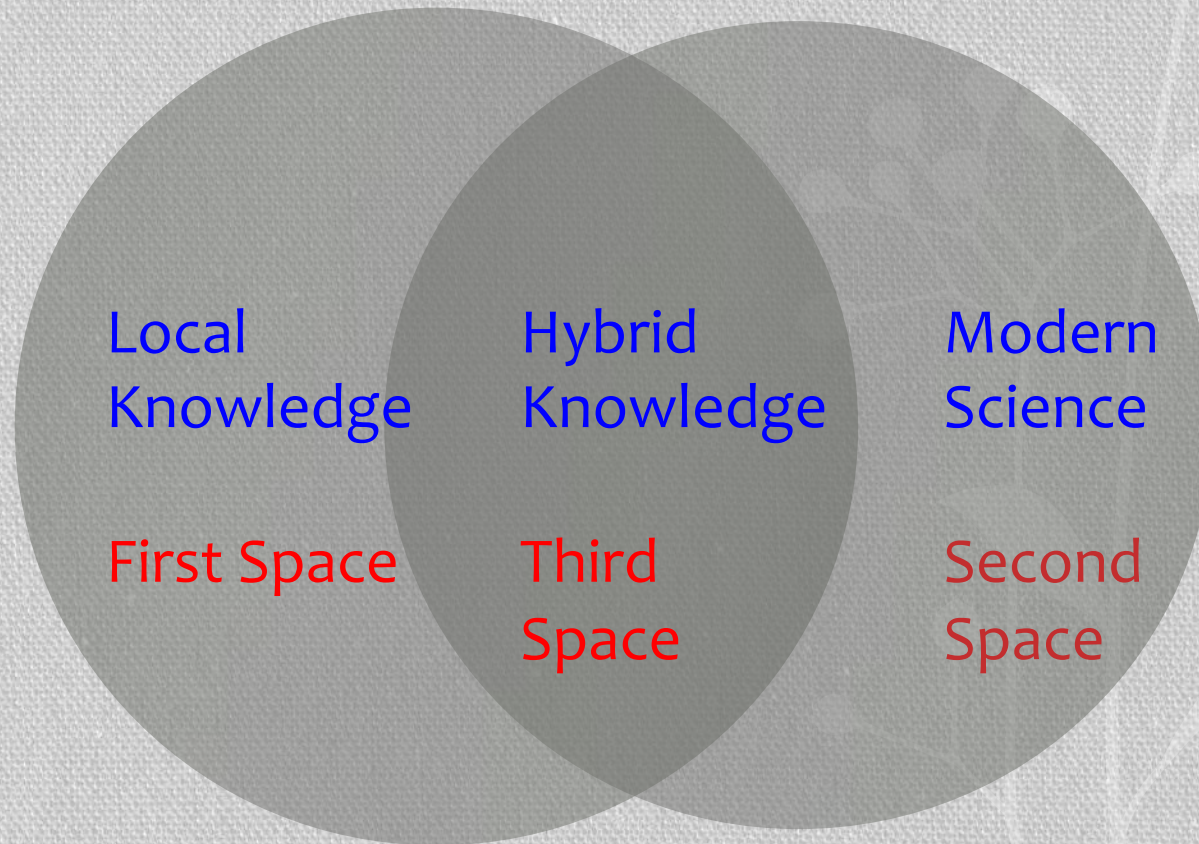
- * critical thinking

- * analyzing evidence

- * problem-solving and design



Third Space Theory: Connecting local knowledge with modern science



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

Local environmental and/or agricultural Issue	Science, Engineering, & Agricultural Practices	Science Core Ideas Cross cutting concepts	Community Resources	Student Activities

Science

Engineering and Agricultural Practices

Asking Questions

Defining Problems

Developing and Using Models

Planning and Carrying Out Investigations

Analyzing and Interpreting Data

Using Mathematics and Computational Thinking

Constructing Explanations

Designing Solutions

Engaging in Argument for Evidence

Obtaining, Evaluating, and Communicating Information

Place-based STEM Education: 5-E Model Lesson

Title	
Purpose/Rationale	
Science Core Ideas	
Science, Engineering, Agricultural Practices	
Materials and Community Resources	
Safety and Class Management Issues	
Engage	
Explore	
Explain	
Elaborate	
Evaluate	