Exploring Students' Patterns of Reasoning

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AOK AAPT Nov 1, 2008

This work is supported by NSF under grant ESI-055494

THE NSEUS Project

- Investigating the impact of traditional and non-traditional university science content courses
  - Student perceptions of classroom environment
  - Student thinking about science
  - How college learning environment carries over to teaching in elementary schools
  - Student learning

Comparison between students' reasoning patterns in the two courses

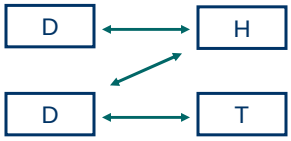
Types of Concepts

Descriptive Concepts	Hypothetical Concepts	Theoretical Concepts
Directly observable	Indirectly observable	Have to be deduced
Objects fall toward the Earth	Gravitational field	Gravitational force = mass x acceleration due to gravity
Objects dropped from same height/time will land at same time	Effect of air resistance	Newton's Laws & kinematics

Lawson et al (2000) and Nieswandt & Bellomo (2008)

Concept Links

Low level of understanding



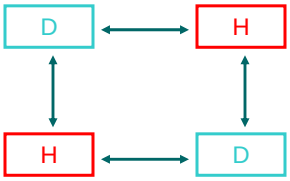
Higher level of understanding

Lawson et al (2000) and Nieswandt & Bellomo (2008)

Looking for the connections…

What happens when a feather and a hammer are dropped and how does this behavior differ on the moon when compared with the earth?

The feather and the hammer both fall due the pull of gravity. However, on the earth, air resistance effects the feather more than the hammer causing it to drop more slowly. Therefore, on the moon, the feather and hammer will land at the same rate while on Earth, the hammer will land first.



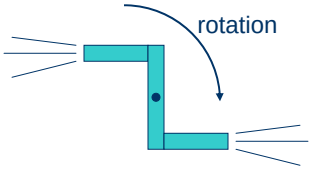
Determining the links

- Types of Knowledge
  - Factual
  - Schematic
- Types of Cognitive Reasoning
  - Levels of understanding
  - Application of concepts
- Can be quantified!
  - 0 = no evidence
  - 3 = answer is complete as can be expected

Question

One type of lawn sprinkler spins in a circle when water flows out of it. Looking down from above, the sprinkler looks as in the drawing.

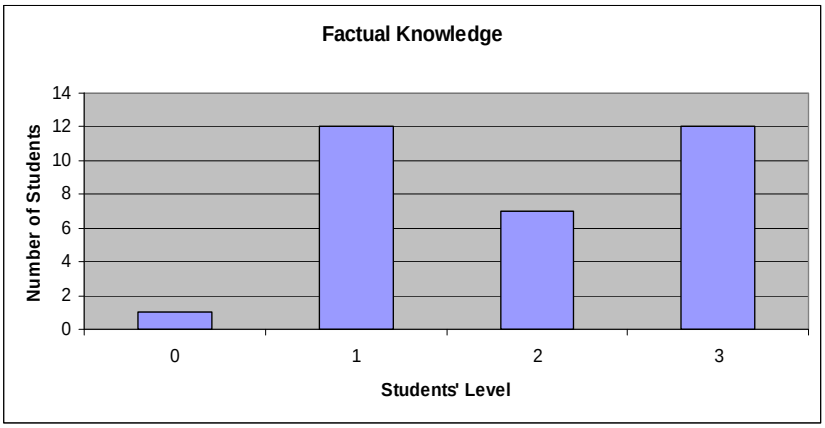
Use conservation of momentum to explain why the arms of the sprinkler rotate as shown when the water is on.



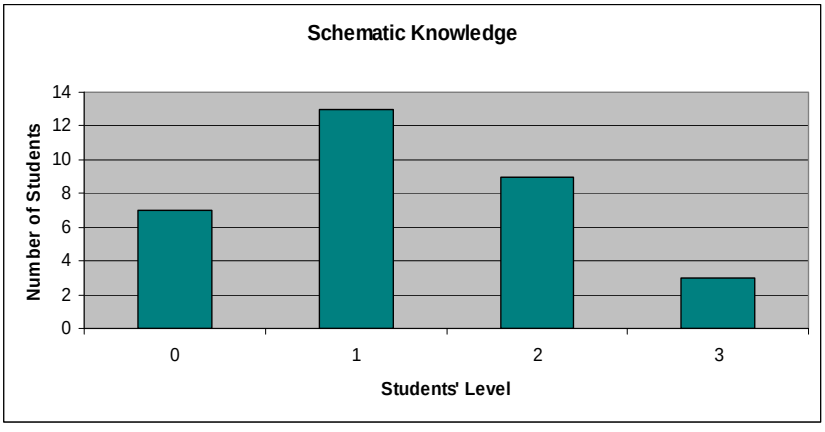
Student Response

The arms of the sprinkler rotate as shown because the momentum from the water pushes the sprinkler into rotation. Momentum is being conserved because there is a balance between water being shot out and how much the sprinkler is rotating.

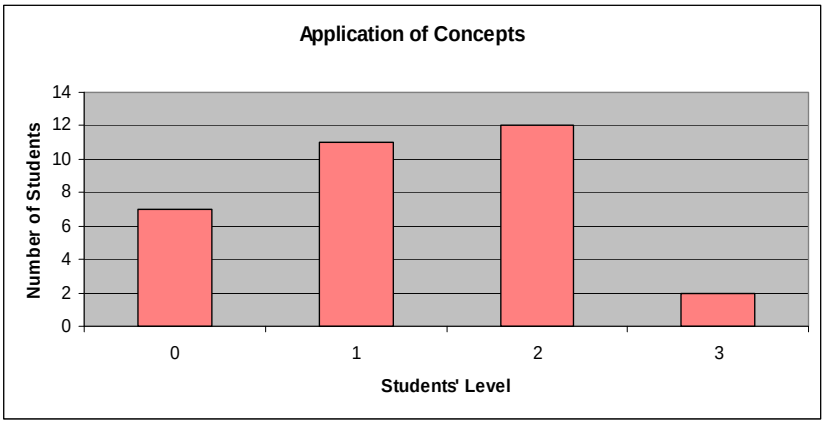
Summary of Student Responses



Summary of Student Responses



Summary of Student Responses



Future Work

- Reliability of coding scheme
- Begin work on NSEUS data
- Automate the coding process????

Thanks

- For more information contact:

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