

# Examining Conceptual Understanding of Pre-Service Elementary Teachers

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# Course for Elementary Teachers

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- *P.E.T. - Physics for Elementary Teachers*
- *Inquiry-Based Curriculum*
- *Forces, motion, energy and other concepts*
- *3-4 sections of 32 students at SELU*
- *Required for all elementary ed. majors*



# Focus of Conceptual Understanding

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- *focus: objects moving at a constant speed*
- *Two main student ideas*
  - ***Newtonian:*** *no net force is needed to move at constant speed*
  - ***Force=Motion:*** *a net force is needed in the direction of motion*



# Methods

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- *Compare force and motion responses to test items*
- *P.E.T. students*
- *Traditional Algebra-Based physics students*



# Force and Motion questions

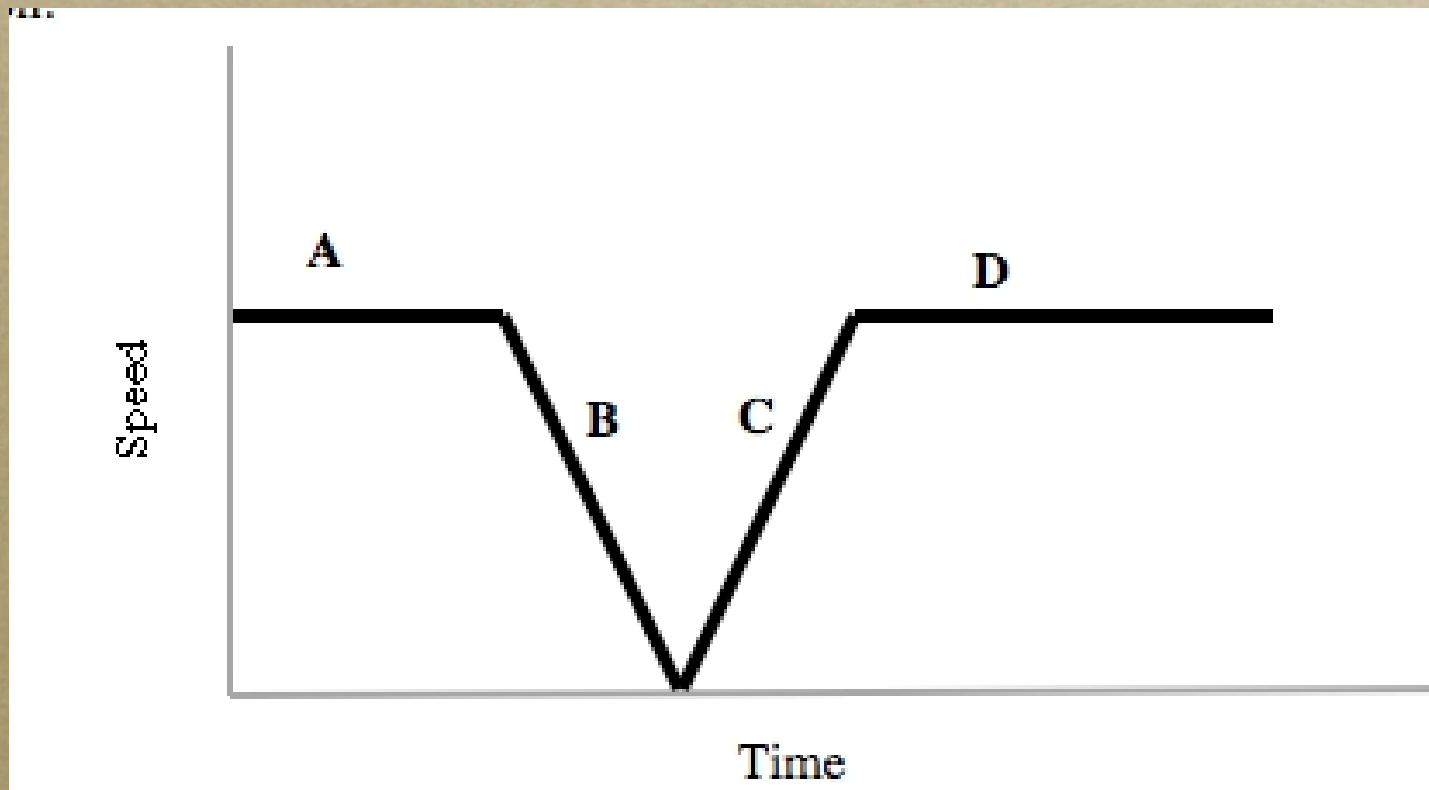
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- *5 Items exploring student ideas of force and motion.*
- *Multiple-choice with written explanations*
- *Given to both P.E.T. classes and to the algebra-based physics classes*



# Item 1

- *The following is the graph for an object with only one force acting on it. For each segment, is there a force acting on the object? In which direction?*

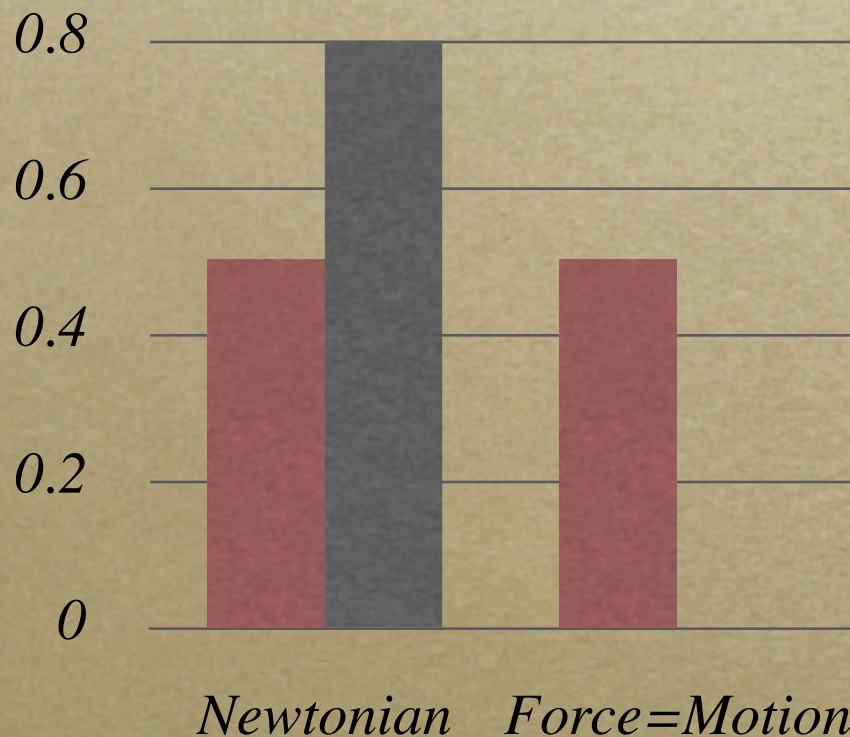




# Analysis

## ○ *Section A - Constant Speed:*

■ PET      ■ Physics  
*n=22*      *n=56*



*Significantly different responses (physics was more likely to answer Newtonian)*



# Sample explanations

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- *Newtonian: “There is no force. No force is needed for constant motion”*
- *Force=Motion: “Yes, there is a force in the direction of motion. If there were no force, it would stop.*
- *Other (speeding up segment - C): the force moves in the opposite direction because of gravity*



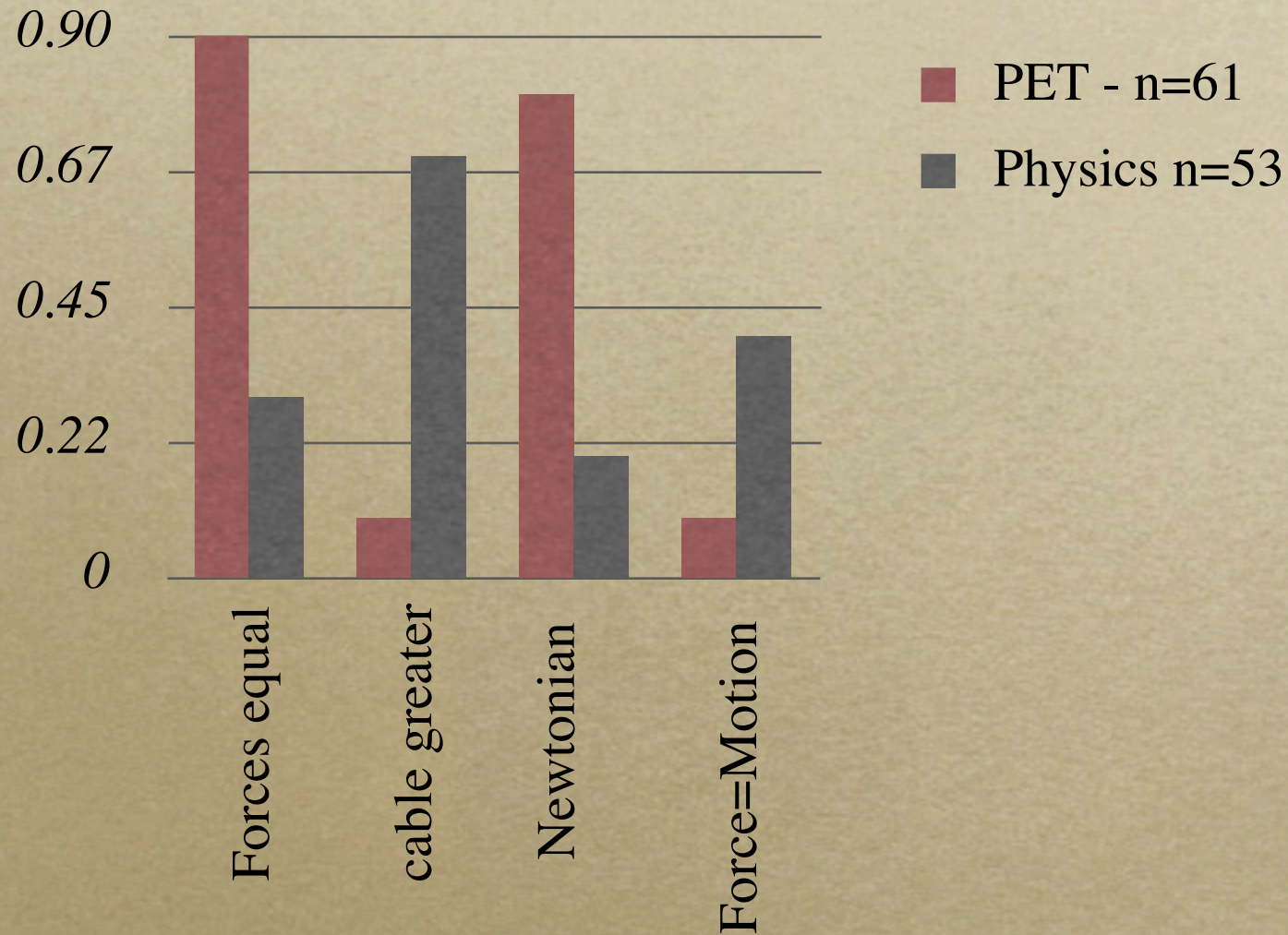
## Item 2

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- *An elevator moves upwards at a constant speed. Which describes the forces acting on it*
  - *cable is stronger than gravity*
  - *cable is equal to gravity*
  - *cable is weaker than gravity*



# Responses





# Responses

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- **Force=Motion:** “*the cable is stronger because if it were equal, the elevator would not move. If it were weaker, the elevator would be going down.*”
- **Newtonian:** “*There are equal. Balanced forces are the same as no force. No force is needed for constant motion.*”
- **Other:** “*The cable must be stronger, otherwise the elevator would never move.*”



# Summary

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- *Force and constant speed - this is a difficult idea*
- *P.E.T. students sometimes perform better than physics students, but sometimes worse*
- *Possible question interpretation problems*