Use of Physical Models to Facilitate Transfer of Physics Learning to Understand Positron Emission Tomography

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Project Overview
• Conduct teaching interviews using simple hands-on activities
• Examine students’ models of physics ideas relevant to Positron Emission Tomography (PET) image construction process
• Investigate the effectiveness of physical models to facilitate student understanding of PET technology

Research Questions
• What cognitive resources do introductory college students bring to bear when interacting with physical models?
• How does sequencing of different physical models affect activation of these resources?
• How do students transfer their physics learning from physical models to understand PET?

Methodology
• Teaching interviews conducted in spring 2006 at Kansas State University
• Learning context and transfer context constituted two sessions of the interview
• Participants: Students enrolled in an algebra-based physics course (N=16) (eight male, eight female)
• Interview video taped and transcribed
• Phenomenographic approach adopted to analyze the data

Activities Used in Teaching Interview

Computer
Detector ring
Annihilation spot
Computer
Computer
Detector ring
Annihilation spot
Cart activity
Light activity
Simulating behavior of particle using a ball
Example of PET problem

Major Findings of the Study
• Influence of prior experiences on complex situation
  a) Central tendency
  b) Use of perceived brightness and size of light to locate events
  c) Use of classical analogy to predict the outcome of electron-positron annihilation
• Effect of the sequencing of activities in triggering relevant ideas
• Evidence of non-scaffolded transfer
Central Tendency

- Source of two lights appearing on the circumference must be at the center of the circle
- The idea modified by challenging with the help of scaffolding activities

Students’ Responses on Positron-Electron Annihilation Outcome

- The production of only an even number of gamma rays possible by an annihilation
- Conservation in a line requires 1D motion of all objects

Students inappropriately rely on apparent intensity and size to locate source
Such reasoning is based on intuition

Types of Transfer Observed

**Spontaneous Transfer (ST):**
Immediately relate PET with the activities of the first session

**Non-Spontaneous Transfer (NST):**
Relate PET with the first session only after being asked if they had seen an activity similar to PET problem

**Semi-Spontaneous Transfer (SST):**
Relate PET back to the activities of the first session upon being asked the reason for their answer

**No Transfer (NT):**
Students do not transfer at all from the first session to the second session

Results of Types of Transfer

- Demonstrated different types of transfer from learning context to application context
- The active learning in first session helped students transfer ideas to second session
**Conclusions**

- Students tend to activate resources from everyday experiences
- Immediate hands-on activities are more influential than prior experiences in activating resources
- Proper sequencing of activities using physical models facilitates spontaneous transfer

**For More Information**

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**Introduction**

**Summary**

**Results**