Motivation

- Movies are a real and tangible part of the world.
- Opportunity to develop reasoning skills and physics knowledge.
- Interesting context for educational researchers to examine what students transfer.
- Make further strides in helping students be informed skeptics of the future.

Background

Prior use of video clips in instruction:

- Dennis (2002) – exercises, "visual word problems"
- Everitt (1999) – "mini block reviews"

Little prior research of how students think of movies and their role in learning physics.

Overarching Goal

Investigate whether and how movies can be used to help introductory students to learn physics.

Research Questions

1. To what extent do students transfer learning from classroom and/or personal experiences to explain the physics underlying movie clips? Phase I

2. What factors mediate the cognitive processes through which students associate their prior knowledge with the movie clips? Phase II

3. To what extent can we use movie clips and supporting instructional materials to help students learn physics?

Framework: Transfer of Learning

- Contemporary perspective of transfer.
- Transfer from classroom / personal experiences to situations in action movie segments.
  - Lobato’s1 “actor-oriented” transfer perspective.

Did not pre-decide what should transfer, but examined everything students transferred.

1Lobato, (2003)
Phase I – Methodology

- Grounded Approach
- 8 video clips: Plausible and questionable physics.
- Individual, think-aloud, semi-structured interviews.
- Question strategy: Explore students’ connections to physics and personal experiences.
- Interviews videotaped, reasoning patterns analyzed.

<table>
<thead>
<tr>
<th>Video</th>
<th>Major Physics Themes</th>
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<tbody>
<tr>
<td>Pearl Harbor</td>
<td>Projectile motion</td>
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<tr>
<td>Speed (bus jump)</td>
<td>Projectile motion</td>
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<tr>
<td>Matilda</td>
<td>Newton’s laws and circular motion</td>
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<tr>
<td>Speed (bus turn)</td>
<td>Circular motion</td>
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<tr>
<td>Mission to Mars</td>
<td>Gravity and rotation</td>
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<td>Tommy Boy</td>
<td>Projectile motion and circular motion</td>
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<tr>
<td>Speed 2</td>
<td>Momentum and collisions</td>
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<tr>
<td>Tango and Cash</td>
<td>Projectile motion and electricity</td>
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</tbody>
</table>

Phase I – Data Sources

- 13 students
  - 5 in 1st semester algebra-based physics
  - 8 in 2nd semester algebra-based physics
- 3 physics experts interviewed
  - Faculty
  - Post-doc
  - Graduate student

Phase I – Results & Conclusions

Students

- Reasoned spontaneously about each clip.
- Used general physics terms, but relevant application lacking.
- Correctly pointed out instances of incorrect physics.
- More precise connections with everyday experiences than concepts covered in class.
- Tended to rely on physical intuition rather than on understanding of physics underpinnings.

Experts

- Few differences with students regarding major physics themes or concepts.
- Experts presented their themes and concepts in a more structured manner.
- Experts relied less on intuition or personal experiences, more on physics-based reasoning.

Research Questions

1. To what extent do students transfer learning from classroom and/or personal experiences to explain the physics underlying movie clips?
2. What factors mediate the cognitive process through which students associate their prior knowledge with the movie clips?
3. To what extent can we use movie clips and supporting instructional materials to help students learn physics?
Phase II – Methodology

- Drilling and prompting questions
- Incorporated stimuli
  - Toy setups, Demonstrations, and Drawing
- Culled from 8 videos to 4 videos based on:
  - Student engagement
  - Reasoning difficulty
  - Physics topics

4 videos
- Speed
- Matilda
- Mission to Mars
- Speed 2

Common theme: Newton’s laws

No intent to assess student understanding of these concepts, rather assess potential of these videos to help students learn.

Phase II – Data & Analysis

12 participating students:
- 6 non-science majors -- 2nd semester conceptual physics
- 6 engineering majors -- 1st semester calc-based physics

Videotaped, transcribed and coded each interview by two independent researchers.

Inter-rater reliability
- ~ 75% before discussion.
- ~ 95% after discussion.

Phase II – Results & Conclusions

Engineering vs. non-science students:
- Engineering students tended to rely more on intuition.
- Non-science students tended to cite personal experiences and knowledge from authority.
- Use of logic and concepts from class across all videos was relatively the same for the two groups.
Phase II – Results & Conclusions

In comparing videos for non-science students:
- In *Speed* and *Matilda*, tended to use more on concepts covered in class.
- In *Mission to Mars* tended to rely on intuition while explaining artificial gravity.
- Epistemic mode tended to change from reliance on authority to self-constructed knowledge as session progressed.

In comparing videos for engineering students:
- Relied less on classroom concepts and more on intuition for *Mission to Mars* and *Speed 2*.
- Tendency to rely more on intuition increased as session progressed.
- Tendency to construct personal knowledge decreased as session progressed.
- All through the videos they relied on logical reasoning and not on knowledge from authority.

Summary

Video clips may potentially help...
- keep students engaged in learning.
- motivate them to construct their own knowledge.
- Facilitate students to refine their own raw intuition\(^4\) toward understanding physics concepts underpinning each video.

\(^4\) Eby, (2001)

Current and Future Work

Phase III of project:
- Develop instructional material that utilizes action movie clips to learn a concept: e.g. Artificial gravity
- Pilot-test activity with small groups of students outside of class.
- Classroom implementation.

Thank You!

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