1. BACKGROUND
Facilitate the development of conceptual schema using case reuse.
- Conducted semester long treatment in algebra-based physics.
- Two individual interviews conducted at mid- and end-points of semester.
- Asked to rate problem pairs of varying similarity

2. QUESTIONS
- To what extent do students focus on principle similarities and differences?
- Given problem pairs, how do students’ similarity ratings of the pairs change after the group learning interviews?
- How do student ratings compare with faculty ratings?

3. THEORY
1. Surface and Principle Differences
   - Surface different problems: Multiple contexts can be associated with a principle.
   - Principle different problems: Problems are not associated by the same principles.
   - Principles are basic rules or assumptions.

4. METHODOLOGY
Four Categories of Pairing
- Principle Similarity (PS)
- Principle Difference (PD)
- Facial Similarity (FS)
- Facial Difference (FD)

Students are given 8 problem pairs in the order of A, A, B, B, C, C, D, D

Type A: Pairs are FS and PS
- Facial Similarity (FS): both roller coasters
- Principle Similarity (PS): both no friction

Type B: Pairs are FD and PS
- Facial Difference (FD): roller coaster vs. gun
- Principle Similarity (PS): both no friction

Type C: Pairs are FS and PD
- Facial Similarity (FS): both roller coasters
- Principle Difference (PD): friction vs. no friction

Type D: Pairs are FD and PD
- Facial Difference (FD): roller coaster vs. gun
- Principle Difference (PD): friction vs. no friction

5. RESULTS

Interview 1 Ratings

Interview 2 Ratings

Interview 1 & 2 Ratings

Interview 2 & Faculty Ratings

Differences between B & C in Interview 2 negligible compared to Differences between B & C in Interview 1

Differences between A & B, B & C are no longer significant

Significant Differences: A > B (p-value 0.000) B < C (p-value 0.003) C > D (p-value 0.008)

Significant Difference: C > D (p-value 0.014)

Students’ end-semester ratings for three of the four problem types are similar to four volunteer faculty ratings.

6. Summary
- Given problem pairs with facial differences:
  - Students are seemingly unfocused on Principle Similarities during 1st interview.
  - Students begin to focus on Principle Similarities during 2nd interview.
- Student rating of problem Type B (Surface Different and Principle Similar) increases significantly.
- Student rating of problem Type B looks more expert-like.

REFERENCES

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