MAPPING STUDENT SOLUTION RUBRIC CATEGORIES TO FACULTY PERCEPTIONS

Andrew Mason[1], Brita Nellermoe[1,2]

[1]University of Minnesota, Twin Cities, Minneapolis, MN   [2]University of St. Thomas, St. Paul, MN
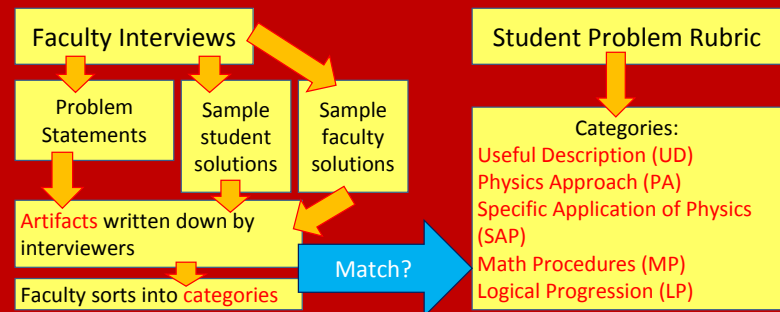
Rationale:

Previous studies centered around interviews with faculty members about problem solving (Yerushalmi et al. 2007, Henderson et al. 2007) yielded artifacts that may be analyzed using a recently developed rubric for analyzing student solutions (Docktor 2009). We investigate the feasibility of using the rubric and discuss some preliminary implications from data results.

Background

Faculty perceptions of problem solving: Participants studied problem statements, student artifacts and faculty artifacts, and discussed their thoughts. This task generated faculty artifacts, i.e. conversation topics. The faculty then categorized their own artifacts as the last task.

Rubric for assessing problem solutions: The rubric is comprised minimum set of problem solving categories by which a written problem solution may be evaluated on a scale from 0 to 5. Tested for validity, reliability, utility.
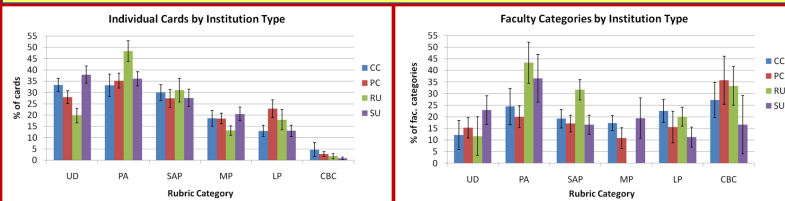
Categories can be used to examine beliefs and values expressed by faculty in interviews.

Faculty Interviews

Problem Statements → Sample student solutions → Sample faculty solutions

Artifacts written down by interviewers

Faculty sorts into categories

Match?

Student Problem Rubric

Categories:
Useful Description (UD)
Physics Approach (PA)
Specific Application of Physics (SAP)
Math Procedures (MP)
Logical Progression (LP)

Analysis

2 raters fit a) individual artifacts; b) faculty categories into rubric categories. Independent analysis of a 5-faculty sample; then split remaining faculty into groups of 12 and 13 for independent analysis. Agreement established to 80% by discussion.

Research Questions: -Do faculty artifacts/categories fit the rubric?
-What does the rubric tell us about individual artifacts and categories?

Percentage of Individual Cards into Rubric Categories

Percentage of Faculty Categories into Rubric Categories

Overall categories: Faculty attend more to PA, UD, and SAP. Only 2.5% of individual artifacts couldn't be classified (CBC), so student rubric is valid for categorization. However, a bit more difficult for faculty categories (25% CBC).

Individual Cards by Institution Type

Faculty Categories by Institution Type

Individual Cards by Interviewer

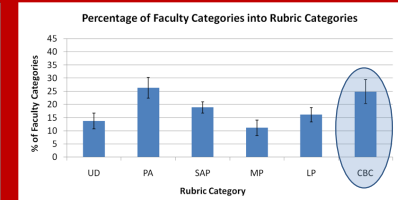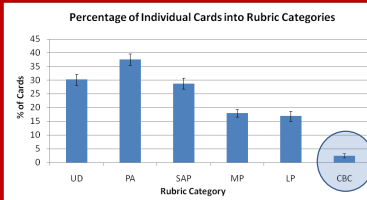**Percentage of categories by interviewer**

Institution types: Mostly the same. Research universities (RU) focus more heavily on PA and less on MP than community colleges (CC), private colleges (PC), and state universities (SU) do. SUs also exhibit a few slight differences from PCs and CCs.

Interviewer style: Individual cards' classification was independent of interviewer style, but interviewer 1's faculty categories easier to classify than interviewer 2's!
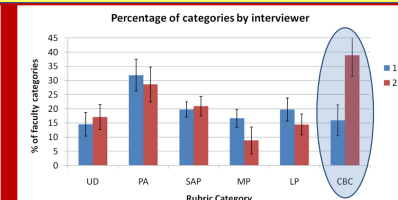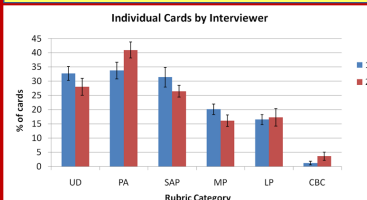
Preliminary interpretation: Interviewers have slightly different styles – affects rubric categorization faculty categories without affecting similar treatment of individual artifacts. Note that interviewers had no knowledge of scoring rubric.

Interviewer 1: focus on short, individual phrases; directs faculty more:
F5: "Do you want them specifically identified?" I1: *"Just tell me the names."* F5: "Well, one of the things… is definitely drawing a picture. I think that's… if not drawing at least have a mental picture in mind. … I think another piece… is identifying the tools that you're going to use to solve this thing. And by that I mean is it a conservation of energy, is it uniform circular motion…" **(4 artifacts total)**

Interviewer 2: focus on longer phrases, and maybe paraphrase for writing artifacts:
F6: "And I don't think it's something that happens overnight, I think it's something that has to develop through the years." I2: *"Ok."* F6: "Once in a while we'll spend one whole hour on just a problem and investi-gating. That happens. And then we have dead ends, and then we – Unfortunately there's sometimes not enough time to do that." I2: *"Anything else?"* F6: "Problem solving again is not something that you learn overnight. And I tell them that it's something that has to be developed. Just like if you're an athlete or dancer or piano player. But I really look at the analysis." I2: *"Ok."* **(2 artifacts total)**

Conclusions

Rubric categories have excellent fit to individual artifacts, very good fit to faculty categories

Faculty focus more on physical principle-related topics (PA and SAP); faculty categorization of artifacts consistent with rubric categorization of artifacts. Few differences between different institution levels.

Interviewing style doesn't seem to affect rubric categorization of artifacts, but does affect faculty categorization of artifacts.

References

E. Yerushalmi, C. Henderson, K. Heller, P. Heller, & V. Kuo (2007). Phys. Rev. ST Physics Ed. Research 3, 020109.
C. Henderson, E. Yerushalmi, V. Kuo, K. Heller, & P. Heller (2007). Phys. Rev. ST Physics Ed. Research 3, 020110.
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