SCIENTIFIC REPRESENTATIONAL FLUENCY: DEFINING, DIAGNOSING AND DEVELOPING

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BACKGROUND

Research into the multiple representations (e.g. graphs, words, equations and diagrams) used by scientists for reasoning and communication has progressed from focussing one individual representations, to an integrated skill set we refer to as *representational fluency*.

Representational fluency incorporates making meaning from representations (metavisualization (Gilbert, 2008)), metacognitive awareness of the purposes and affordances of different representations (metarepresentational competence (diSessa, 2004)) with a recognition of the domain specific constellation of representational use with particular characteristics (representational competence (Kohl & Finkelstein, 2006).

METHODS

In 2012, we developed the Representational Fluency Survey (RFS) (Hill et al., In Press). To date this has been used with over 2000 physics students at The University of Sydney to diagnose representational fluency.

Initially, the results have been used to further define characteristics of representational fluency and diagnose variation of representational fluency across a cross-section of physics students at the university.

More recently, the RFS has diagnosed representational fluency development of first year students across the first semester of study at the university and informed the design of a sequence of 11 weekly online learning modules encouraging more varied representational use.

RESULTS

Two years of cross-sectional research revealed that there was a threshold of representational fluency distinguishable at The University of Sydney, specifically amongst the first year students. First year advanced students (those who scored well in high school physics) scored significantly better than those in the first year regular cohort (those who also did physics at high school with lower final marks). Notably, the regular students did not perform significantly better than those in the first year fundamental cohort even though fundamental students did not study physics in their final two years of high school.

Individual student responses were coded and analysed for the representations used and the results indicate that students with a higher representational fluency use more representations and use representational modes that are typically more symbolic and visual than students with a lower representational fluency.

2014 data will be added to 2013 data regarding the development of representational fluency across students' first semester of university and will be presented at the conference.

CONCLUSIONS

The RFS is a helpful tool that allows for the defining, diagnosing and development of representational fluency to take place. This has been demonstrated over multiple years of research in novel ways, helpful to the science education community.

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