Assessing Student Conceptual Understanding: Supplementing Deductive Coding with Natural Language Processing Techniques

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Abstract

Assessing student conceptual understanding is a valuable method for gauging specific student learning outcomes but can be difficult and time consuming to measure. This research investigates the potential of automating some intermediary steps of a qualitative analysis of student Conceptual Understanding with tools from the field of Natural Language Processing (NLP), Computational Linguistics, and Cognitive Psychology. This investigation centers on interviews conducted with newly graduated engineers over the first three years of their professional lives. Lexical features of those interview transcripts were measured using a variety of open-source NLP software. A theoretical framework was developed to link those lexical indicators to features of Cognitive Load and Conceptual Understanding. Results of the application of NLP to create indicators of student conceptual understanding were compared to the results of a traditional qualitative assessment. It was found that certain lexical indicators, primarily the Uber Index, could be useful descriptors of Conceptual Understanding when certain conditions are met but that the limitations of the approach must further addressed in future research. Factors that limit this application include variances in text length and the magnitude of change in Conceptual Understanding in an individual.

Wednesday, March 16, 2016
1PM, Rogers 226