

Exploring Student Engagement With Concept Maps

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Successful students see mathematics as connected ideas (OECD, 2013). Concept maps can be used to visualize these connections (Jeong & Evans, 2021). Research suggests that concept mapping can lead to high-quality learning (Schroeder et al., 2018); however, there is little recorded usage of them in mathematics education (Jeong & Evans, 2021). Between 2019 and 2024, only 4 out of 50 studies in a meta-analysis on concept maps with measurable outcomes related to learning and/or engagement were explicitly about mathematics (Kefalis et al., 2025), underpinning the notion that research is needed to examine the efficacy and engagement of students with concept maps in mathematics. We will answer: how effective are concept maps at eliciting student engagement with the derivative?

In a supplemental instruction session (SIS), 16 multivariable calculus students created concept maps using up to 23 terms from a word bank (derived from known derivative frameworks (Likwambe and Christiansen, 2008; Zandieh, 2000)) and provided reasons for each connection they identified. We analyzed connection reasons using the Relational Scoring Method created by McClure and Bell (1990) with context-specific modifications by the authors (Figure 1). Procedural (P) and conceptual (C) relationships were the focus because P and C knowledge of the content is needed for student success (Rittle-Johnson, 2017). Scoring was chosen because it is one of the most common analysis tools for concept maps (Ekinici & Şen, 2020).

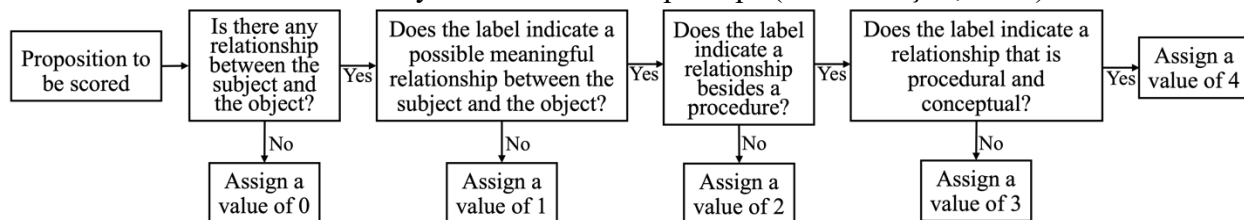


Figure 1. Modified scoring protocol.

As seen in Figure 2, the median number of words from students was 62. The median score of the concept maps was 66.5. More details about scoring and its implications will be discussed in future work. This study suggests that current approaches to analyzing concept maps make them an ineffective tool for deeply understanding student reasoning about the derivative. However, in future work, we will explore novel approaches to analysis that might bring new life to concept mapping for research.

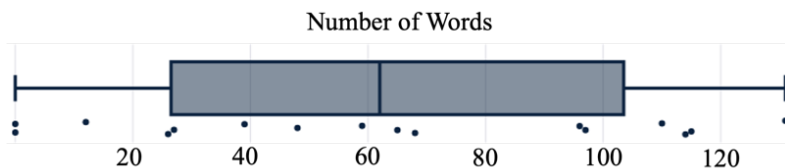


Figure 2. Number of words box plot.

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