A Pilot Study: Investigating Science Discourse Practices in STEM Undergraduate Classes using Decibel Analysis for Research in Teaching (DART)

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Introduction

- Undergraduate STEM teaching in the U.S. continues to be primarily lecture-based, yet research indicates that learning is enhanced when students are engaged through innovative practices such as productive discourse (Deslauriers, Schelwe, & Weimer, 2011).
- Productive discourse provides students with opportunities to talk about ideas, form arguments based on evidence, and engage in higher-level thinking (Chin, 2007; Kelly, 2007).
- Traditional methods of investigating teaching practices such as productive discourse include time- and resource-intensive approaches (Owens et al., 2017).
- DART provides a potential solution for quantifying and analyzing classroom discourse practices.

Objectives

- The purpose of this pilot study was to explore the utility of DART’s analysis of classroom audio recordings for investigating the relationship between productive discourse practices and student performance.

Method

- This pilot study took place in Dr. Jones’ Microbiology 20234 Course (83 students), during the Spring 2020 semester.

What is DART?

- Machine learning algorithm created by San Francisco State University (NSF-funded) to analyze noise patterns in college science classes (SEPAL, 2020).
- DART analyzes audio recordings of classroom sound, codes the sound level (decibels) over time (minutes), and reports the percentage of class time with no voice, a single voice, or multiple voices (Owens et al., 2017).

Discussion

- Although limited, this preliminary data helped establish the utility of DART as a feasible tool for investigating instructional practices involving discourse.
- DART has the potential to help faculty easily analyze the ratio of single-voice lecture to multi-voice non-lecture, and thereby assess their use of discourse practices.
- Increased assessment and reflection on the use of practices involving productive discourse could lead to improvements in student learning and performance.

Challenges

- Only two DART analyses and classroom observation visits were possible during this pilot investigation. Additional visits were scheduled but were cancelled due to COVID-19. Thus data collected was halted.

Future Research

- Further refinement of data collection and analysis is needed to continue to explore the relationship between DART, discourse practices, and student performance.
- The alignment of course objectives, instructional practices, and assessment, as well as reinforcement of concepts through lab exercises, reteaching, and review should also be considered in future studies.

Results

- Our classroom observations correlated with the DART analysis of classroom sound and were consistent with DART’s conservative estimate of the time spent in various voice modes.
- Single-voice modes were reported by DART when the instructor was lecturing, assessing students with clicker questions, and engaging students in question and answer dialogue.
- Multi-voice modes were reported by DART when a significant number of students were engaged in discussion for an extended period of time (> 5 minutes).
- Student performance was generally higher and more consistent on exam questions that correlated with opportunities for clicker assessment and extended discussion during class.

References

- Owens, M. T., et al. (2017). Classroom sound can be used to classify teaching practices in college science courses. PRWR, 7(4), 118-136.

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