Overview of Evaluating the Uptake of Research-Based Instructional Strategies in Undergraduate Chemistry, Mathematics, and Physics

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Research-Based Instructional Strategies have been show to increase learning and retention of students in undergraduate STEM classes but have not been widely implemented in classrooms across this country. While there is research indicating the level of usage of RBIS across the country in gateway chemistry, mathematics, and physics courses, less is known about why instructors choose to use RBIS or not. We report on the design of an ongoing research study to assess the relative impact of individual, departmental, institutional, and disciplinary factors on instructional decisions in key courses for postsecondary STEM-intending students.

Key words: STEM, research-based instructional strategies, instructional practice, survey

There is persistent and mounting evidence that lecturing is *not* the best instructional strategy to support student learning, engagement, and retention which has led to repeated calls for a shift to student-centered instructional practice in undergraduate science, technology, engineering, and mathematics (CBMS, 2016; Freeman et al., 2014; Kogan & Laursen, 2014). Alongside these general calls for more student-centered instruction, researchers have developed many specific instructional strategies referred to as *research-based instructional strategies* (RBIS). Researchers have also demonstrated that RBIS can have a positive impact on student success in terms of learning, retention, persistence, and/or enjoyment of the content. Despite mounting evidence of the impact of using RBIS in classrooms and some student-centered approaches used, lecture (or didactic) approaches to instruction are still the norm in undergraduate STEM classes (Rasmussen et al., in press; Stains et al., 2018). This poster presents the current state of our research project focusing on current knowledge of uses of RBIS and how it lead to Phase 1 of our research study.

Our research project investigates the relative impact of factors which affect instructors' decisions to use RBIS in their classrooms. For this study, we are engaged with an investigation of introductory postsecondary chemistry, physics, and mathematics courses. These three courses are particularly important because they function as *gateway courses* – required of most first-year STEM-intending students, often high-enrollment, foundational for future coursework, and have demonstrably low passing rates (Koch, 2017). By considering instruction and instructors in three disciplines, we hope to learn more about variation across STEM fields. In particular, identify factors which impact across disciplines and which seem relevant in one but not others. This knowledge will support future efforts of change agents by identifying factors that affect the likelihood of using RBIS in classroom and which factors are likely to have the most leverage.

Prior research has identified certain factors related to RBIS usage in these three disciplines, and Phase 1 of our research study involves a national survey querying many of these same factors across all disciplines and all at once. This will allow for partial replication of other studies as well as combining those results across disciplines and factors to build a model of levers for instructional change at scale. It will also provide a data point regarding current levels of RBIS usage which will support further monitoring of the spread of RBIS across the country. Targeted factors include culture and context (e.g., Selinski & Milbourne, 2015), interactions with the education community (e.g., Henderson & Dancy, 2009), growth mindset (e.g., Aragón, Eddy, & Graham, 2018), and instructor attitudes (e.g., Fukawa-Connelly, Johnson, & Keller, 2016).

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