A Single Case Study of Smartpen-enhanced College Algebra Tutoring

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Students taking courses below calculus are an understudied population in undergraduate mathematics education, as are students with mathematics difficulty or disability. Students seeking additional help are likely to seek YouTube and other outside resources, which may not mesh with in-class instruction. Since secondary education research suggests that targeted tutoring is beneficial to students with mathematics difficulty or disability, this single case study investigated if there was a functional relationship between a Smartpen to create videos for a student with a mathematics disability to listen to during tutoring sessions and her achievement on synthetic division problems over a four week intervention.

Key words: college algebra, disability, single case design,

Students with mathematics difficulty and disability are an understudied population in undergraduate mathematics education. Additionally, while there has been research on college students with disabilities in multicultural and special education (eg. Getzel & Toma, 2008; Wisbey & Kalvodia, 2011), there has never been a study in undergraduate mathematics education focusing on this population of students (Speer & Kung, 2016), and college instructors receive no training in supporting students with disabilities.

Previous research at the secondary level indicated that targeted one on one tutoring is most effective at helping students through algebra, which is similar in content to entry level undergraduate mathematics courses below calculus (Burton, Anderson, Prater & Dyches, 2013). Struggling students are most likely to seek help using online resources such as YouTube (Dibbs, Rios, & Christopher, 2017), but YouTube videos are rarely targeted to the learning objectives or teaching technique of a specific course. Additionally, most YouTube videos intended for undergraduate mathematics students are often 10-20 minutes long and can be difficult for struggling students to follow (Dibbs, Rios, & Christopher, 2017). Although Smartpens have not been studied more in the context of a data collection instrument, group work, or online instruction (Czocher, Baker, Tague, & Roble, 2013; Dibbs, Beach, & Rios, 2018; Fisher & Raines, 2014; Tague & Czocher, 2013).

We conducted a changing criterion single- subject design with one participant enrolled in college algebra diagnosed with a mild learning disability. This design is to evaluate the outcomes of individuals instead of groups and compares the effects of different conditions on individuals. First we collected observation data by watching how the participant performed mathematics. After we have created a stable baseline, we then introduced the Smartpen videos. We used the smart pen during the intervention. We collected data weekly for four weeks. Although the visual inspection of the data revealed a moderate functional relationship between the Smartpen supported tutoring and participant achievement, the maintenance check indicated student retention of learning the material (synthetic division) beyond what the student reported in previous exposure. Furthermore, the social validity check following the conclusion of the intervention indicated that the participant found the Smartpen-supported tutoring to be more effective than the one on one tutoring she had received through both disability support services and the baseline phase of the study.

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