Interactive Digital Activities in Real Analysis for In-Service Teachers

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*In this poster presentation, we present pilot data describing how secondary mathematics teachers enrolled in a fully online, Real Analysis course in the Southeastern United States engaged with interactive digital activities. Further, we describe what mathematical meanings were elicited in this context during semi-structured interviews where students engaged with mathematical tasks via the activities. These pilot data will inform two future goals. First, it will inform the design of interactive digital activities in our Advanced Geometry course. Second, it will inform our future work on a larger study about overall engagement with various touchpoints (i.e., ways to participate) in fully asynchronous classes.*

*Keywords:* Secondary Teachers, Real Analysis, Interactive Digital Activities

Mathematics teachers who seek promotion or to teach dual-credit classes at their jobs often pursue graduate education as a way to achieve the requirements for that promotion. As these teachers are full-time employed teachers, asynchronous online programs in graduate mathematics provide ways to achieve these professional goals. Our work exists in spaces like these that are very common across the United States. An important goal for us as mathematics educators is that even in asynchronous online environments, students engage in inquiry-based mathematics education (Laursen & Rasmussen, 2019). One way to achieve this is to include *interactive digital activities (IDA)* as ways to engage with our students remotely. Because there are many different kinds of IDAs we define each word within the term. An **activity** is a mathematical task where students actively build understandings related to a set of mathematical ideas. **Digital activities** can include applets (Moore, 2009), animations (Moore & Thompson, 2015), digital learning games (Mauntel et al., 2021), or activities that incorporate augmented or virtual reality (Kang et al., 2020). This list is not exhaustive; any activity that utilizes digital resources and engages students in mathematical activity could be considered a digital activity. Finally, there are **interactive digital activities**. These are activities where students are required to engage, in the moment, with some aspect (such as a slider, button, etc.) of the digital activity and get in-the-moment feedback (Zandieh et al., 2018). Therefore, the students' interaction depends on the nature of IDA and not all students will engage with the IDA in the same way.

Our research team collected pilot data to understand how in-service teachers engage with IDAs focusing on real analysis content and what mathematical meanings are elicited during this engagement. Our research questions are: *1) When students who are enrolled in an asynchronous online graduate mathematics class engage with interactive digital activities, what mathematical meanings are elicited? 2) How do students engage with interactive digital activities?* In this poster, we present preliminary results from semi-structured mathematical task interviews on polynomial asymptotes with six in-service teachers. The various ways in which the teachers interacted with the IDAs informed the possible meanings that could have been elicited. For instance, a teacher may have overlooked an aspect of the design of the IDA which then meant that the mathematics question they were answering was limited in scope. This work represents an initial attempt to understand how IDAs can be improved and used in asynchronous classes. The goal is to consider how these IDAs fit into larger engagement with mathematics, learning, other students, the instructor, etc. in online asynchronous classes for in-service teachers.

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