

Chapter 23

Using Mathematics Digital Interactive Notebooks as Authentic Integrated Online Assessments

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ABSTRACT

In response to the global health crisis, K-12 mathematics teachers were forced to rapidly transition to online learning and assessment. The mathematics teacher educators in this study identified an unprecedented opportunity to design and facilitate more equitable assessments that leveraged emergent collaborative technologies. They replaced traditional written reflections with a digital interactive notebook (dINB) in a graduate synchronous online geometry and measurement course for practicing teachers. This prototype of an authentic integrated online assessment model emphasized cycles of reflection and revision based on instructor and peer feedback. While the K-12 teachers enrolled in this course valued the dINB as evaluative of their own progress toward content mastery, they faced challenges in realizing the full potential of this model to integrate formative, summative, and ipsative assessment functions in their own classrooms. Implications for the development of K-12 teachers' TPACK (Technological Pedagogical Content Knowledge) and their readiness to use more innovative forms of assessment in virtual learning are presented.

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INTRODUCTION

How am I going to restructure assessments? My traditional tests are just not going to work in a hybrid or remote learning setting - how can I accurately capture understanding and have a reasonable grading workload if I'm creating tasks where "cheating" is not an issue? (End-of-course reflection from Caitlin, K-12 mathematics teacher)

In response to the global pandemic in Spring 2020, teachers and teacher educators were forced to transition from face-to-face instruction to *emergency remote learning* (Hodges et al., 2020). The uncertainties surrounding the pandemic disrupted both K-12 education and the post-secondary preparation of classroom teachers. As online learning became the preferred or required mode of instructional delivery for many K-12 students, teachers focused on recreating their face-to-face classroom practices and supporting students and families as they navigated new technologies. They experimented with a wide array of online resources for collaborative mathematical problem solving and developed instructional strategies that emphasized critical thinking and creativity in their virtual classrooms. They used web-based learning management systems to build student-centered learning environments in which students could communicate their mathematical thinking in multiple ways with feedback from peers and teachers.

Despite the rapid emergence of creative solutions to the unique challenges of online learning, assessment may present the most significant challenge because classic paper-pencil mathematics tests with single answers do not easily transfer to online learning environments. Online test questions that rely on rote memorization or procedural recall are of questionable value when students have simultaneous access to digital apps and websites. Grading is so closely tied to these types of summative assessments, and as Caitlin suggested in the opening quotation, teachers may struggle to manage the logistics of administering and facilitating summative assessments in virtual classrooms. It is not enough to mirror traditional assessment pedagogies in K-12 online learning environments. The pervasive inequities in access to high-quality mathematics instruction during the pandemic called into question the validity of assessments that did not effectively elicit evidence of student reasoning.

Administering traditional assessments in online classrooms will continue to privilege students with more reliable access to computing and academic support at home. Quizzes and tests with single correct answers can dehumanize the goals of assessment (Shelton et al., 2020). Instead, traditional summative assessments should be redesigned to acknowledge both the possibilities and the limitations of available online platforms in the equitable evaluation of student knowledge. Thus, teachers must learn to implement authentic online assessment practices which challenge narrow views of success that "limit many students' opportunities to develop identities as mathematically capable learners and thinkers" (Louie, 2017, p. 489). As the demand for more accessible and meaningful K-12 online learning continues beyond the most urgent days of the pandemic, teachers will continue to face the challenge of innovating their approaches to assessment.

RESTRUCTURING ASSESSMENT IN THE ONLINE LEARNING ENVIRONMENT

While the aforementioned challenges are daunting, mathematics teachers and teacher educators have an unprecedented opportunity to rethink online assessments (Galanti et al., 2020). With a renewed focus on assessing conceptual understanding over correctness, teachers at any level can leverage the dynamic

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