Sociomathematical participation: Participatory culture and mathematics pre-service teacher education

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Abstract: Despite intersections between discipline-specific mathematics content and classroom social norms and learning practices, little research documents relations between social and mathematical activity as examined through social and digital media. Drawing upon complementary theoretical perspectives concerning social media and mathematical activity, this research investigated the participatory culture of mathematics pre-service teachers. Data suggest multiple social practices, including collective intelligence, distributed cognition, and appropriation, that were exhibited through a discursive classroom activity structure.

Introduction

Scholars are attentive to intersections among engagement with discipline-specific mathematics content and the social norms and learning practices of classrooms (White & Brady, 2010; Yackel & Cobb, 1996). Advances in educational technology have afforded researchers software designs and network-based devices that further delineate relationships between social and mathematical activity (e.g. Roschelle, Knudsen, & Hegedus, 2010; White & Pea, 2011). While many technologies and activities are designed to support students' familiarity with mathematics content, prior research has seldom documented how relations between social and mathematical activity may be examined through behaviors, media, and technology that are primarily social and participatory.

Participatory Culture and Mathematics Education

Digital and social media are changing classroom interactions. One significant change concerns participatory culture, or interactive and social practices with "relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship" (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006, p. 3). Participatory culture has fostered new digital literacies and impacted classroom teaching and learning (Gee, 2007; Lankshear & Knobel, 2009). Yet mathematics teachers often only use technology to model examples for students who then complete drill exercises (Niess et al., 2009). Within mathematics teacher education, little research examines social practices associated with participatory culture. With early career and pre-service teachers "digitally able" (Starkey, 2010), those enrolling in teacher education programs are likely to consider participatory culture "a commonplace way of socializing and learning" (Davidson & Goldberg, 2009, p. 13). This research investigated pre-service teacher learning at the intersection of participatory culture and mathematics education.

Theoretical Perspectives

This research drew upon theoretical perspectives about participatory culture, mathematical activity, and social practice. Participatory culture(s) are locations and patterns of social interaction and skill developed through collaboration and networking (Jenkins et al., 2006). Participatory culture includes membership "affiliations" in communities with similar interests, creative forms of media "expressions," "collective problem-solving" generating new knowledge, and "circulations" among media networks. Corresponding skills include play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, transmedia navigation, and networking, and negotiation. Concerning mathematics and social practice, learning norms can complement social practices. Yackel and Cobb (1996) distinguish sociomathematical norms as those aspects of mathematics discussions that are specific to students' understanding of mathematics. In contrast to purely social norms, a sociomathematical norm establishes an understanding for what counts as an acceptable mathematical explanation within a classroom. This research asked: What pre-service teacher participatory culture social practices and digital media representations correlate to mathematics education discussions?

Methods

This research concerned a classroom activity structure developed to examine the intersection of pre-service mathematics teachers (n=21) participatory culture with mathematics activity. Data were collected from online discussions about course texts. Six pre-service teacher groups convened weekly to answer discussion questions and create digital media representations. Data were analyzed to examine what social practices and digital media representations correlated to online discussions about mathematics, and if these instances suggest sociomathematical norms. A deductive coding scheme was created based upon eleven "new literacy skills" defined by Jenkins and colleagues (2006) (play, performance, simulation, appropriation, multitasking,

distributed cognition, collective intelligence, judgment, transmedia navigation, networking, negotiation); for example, the "collective intelligence" code was applied when pre-service teachers displayed an ability to pool knowledge and compare notes with others towards a common goal, "distributed cognition" when interacting with tools that expanded mental capabilities, "appropriation" when meaningfully sampling and remixing media content; and "transmedia navigation" when following information across multiple modalities.

Findings

Pre-service teachers generated 24 discussion representations about mathematics education. 14 were wiki-based; seven utilized the wiki-based course website to create text only representations, four included text and digital images, two multiple linked wiki pages with media, and one with embedded video. Pre-service teachers also created three digital media presentations hosted elsewhere online but embedded within the course wiki website, two blogs, one podcast, and four representations that featured other media. The 24 discussion representations included 42 instances of seven participatory culture social practices. Collective intelligence was exhibited in 15 instances, distributed cognition in nine, and appropriation in seven. Four social practices were not exhibited: performance, simulation, multitasking, and judgment. Multiple practices were used across all groups. Four groups exhibited both distributed cognition and collective intelligence in eight representations. For example, Group 1 exhibited distributed cognition and collective intelligence in three of four representations. Nearly one-third (seven of 24) representations exhibited at least three participatory culture practices, including three representations created by Group 1, and one each created by Groups 2, 3, and 6. This subset of representations included five of the eight pairings of distributed cognition and collective intelligence, and all instances of networking.

Conclusion

This research suggests that participatory culture practices, particularly collective intelligence, distributive cognition, and appropriation, were exhibited when pre-service teachers discussed and created representations about their developing knowledge of mathematics and mathematics education practices. With blended and online learning environments prevalent within higher and teacher education, the classroom activity structure described in this study may be useful within education settings that span multiple learning spaces and modalities to leverage students' tacit familiarity with digital and social media. For mathematics education researchers, these findings suggest that technologies and social practices associated with participatory culture might help establish sociomathematical norms, expanding the repertoire of behaviors and locations available for teaching mathematics.

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