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The makerspace experience and teacher professional development

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This study explored the use of makerspaces as a professional development activity when examined through the analysis of qualitative data reflecting participant experience. The data were gathered in the course of a professional development opportunity at a university during a conference held on campus. The researchers wanted to select an innovative form of professional development for implementation within a traditional conference format. Both to match innovation and to accommodate a traditional time frame (one hour), the concept of makerspace was chosen. Multiple makerspace sessions were developed as professional development opportunities. The participant, practicing teachers would be experiencing the makerspace as if they were students. The research team wanted to explore the experiences and perceptions of the participants from multiple perspectives, including those who participated as learners and those who participated as facilitators, or leaders as termed in this article. A phenomenological approach was used to analyze data collected from three instruments: participant survey; leader reflection; and observer protocol. The data collected allowed researchers to observe a makerspace experience from multiple perspectives, thereby providing insight into the use of makerspaces as professional development and within the educational setting as a whole.

Keywords: professional development; teacher; makerspace; education; qualitative; conference

Overview

An increased focus on practices that engage students in higher-level thinking about authentic content requires teachers to engage in a different way of teaching, which provides a need for methods of instruction that promote relevant content, higher-level thinking skills and learning in the classroom. Makerspaces are areas within or outside the classroom for students to construct knowledge rather than for teachers to directly instruct. Martinez and Stager (2014, p. 13) stated that ‘makers are constructing knowledge as they build physical artifacts that have real-world value.’

The maker culture has increasing relevance in the educational realm and is being described as a vehicle for cross-curricular, higher-order thinking in the classroom. Makerspaces are not confined to a space for participants to engage in making, but should be viewed as a mindset (Hlubinka *et al.* 2013). Makerspaces help develop a

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maker mentality, a mindset that can influence resilience (Yeager and Dweck 2012) in mathematics and science achievement (Blackwell *et al.* 2007).

Method

The purpose of this study was to explore the use of makerspaces as professional development when examined through the analysis of qualitative data reflecting participant experience. The data were gathered during the course of a professional development conference held on a university campus. The researchers wanted to select an innovative form of professional development for implementation within a traditional conference format. Both to match innovation and to accommodate a traditional time frame (one hour), the concept of makerspace was chosen. Five makerspace sessions were developed as professional development, including: STEAM Machines™ and Engineering Design; Build a Habitat; Tooling Around with Math; The Future of Music; and Bookmaking. The 25 participant, practicing teachers would be experiencing the makerspace as if they were students. The research team wanted to explore the experiences and perceptions of those involved from multiple perspectives, including makerspace participants, leaders and observers.

A phenomenological approach was used to analyze data collected from three instruments: participant survey, developed specifically for this study following the framework of the *Makerspace Playbook* (Hlubinka *et al.* 2013); leader reflection, modified from Buschang (2012) that was administered at the end of each workshop and measured participant perceptions of the makerspace; and observer protocol, including questions which paralleled the Professional Development Survey.

The data collected allowed researchers to observe a makerspace experience from multiple perspectives thereby, providing insight into the use of makerspaces as professional development and within the educational setting as a whole. A member of the research team inputted all data into Nvivo for analysis. Phenomenological methods were employed during data analysis (Moustakas 1994). Three members of the research team separately analyzed data units, and then the three team members collaborated to discuss the meaning of units and extract themes, reaching consensus. Emerging themes developed individual and composite descriptions of the data (Moustakas 1994). The results are the composite descriptions with themes and subthemes supported by the data.

Findings

The focus of this study was to better understand participant and presenter experiences while attending makerspace sessions. Table 1 presents a brief description for each of the themes and subthemes.

Discussion

Overall, participants in this study provided positive feedback about makerspaces, both in the context of the makerspace session as professional development and in the idea of a makerspace. Participants' experienced divergent reactions to the level of support they needed to feel comfortable in a makerspace setting. Some participants felt lacking in support and direction, while others reveled in the freedom to create.

Table 1. Theme and subtheme descriptions.

Theme	Description	Subtheme	Description
Emotional component of experience	How the educator-participants and presenters were affected by the collaborative and exploratory nature of the makerspace professional development	Confidence	The educator-participants and presenters noted confidence during the makerspace professional development
		Doubt	The educator-participants and presenters noted doubt during the makerspace professional development
Makerspace concept knowledge	The educator-participants' and presenters' descriptions of the professional development makerspace sessions	Creative	The educator-participants and presenters observed or commented on creativity during the makerspace professional development
		Engaging	The educator-participants and presenters observed or commented on engagement during the makerspace professional development
		Hands-on	The educator-participants and presenters observed or commented on hands-on participation during the makerspace professional development
		Presenter method	The educator-participants and presenters observed or commented on the presenter method during the makerspace professional development
		Collaboration	The educator-participants and presenters observed or commented on collaboration during the makerspace professional development
Educational setting	The educator-participants' and presenters' observations on the use of makerspace within the educational setting	Beneficial	The educator-participants and presenters observed or commented on the benefits of makerspace during the professional development
		Facilitates learning	The educator-participants and presenters observed or commented on the facilitation of learning during the makerspace professional development

Some participants struggled with the open-ended, problem-solving nature of makerspace sessions. However, if we want teachers to implement the type of best practices highlighted as effective in research, it is imperative that teachers are having the same type of experiences when participating in professional development. Makerspaces offer the potential to support teaching twenty-first-century skills such as

problem-solving and could help students gain skills for future careers. Further, the collaborative nature of sessions and subject-specific focus is in line with literature on effective practices for professional development (Kennedy 1999).

The educator-participants in this study were able to apply the makerspace concept as part of a professional development conference to see how the makerspace idea could be incorporated into the school setting with students. According to Kim (2011), creative thinking scores have been on the decline since 1990. The collaboration involved in solving problems to finish a product, as highlighted in makerspaces, could provide opportunities for students to use higher levels of critical thinking.

Makerspaces offer the potential for educational reform geared toward student engagement and critical thinking. Problem-solving and collaborative learning found in makerspaces could help encourage creativity in students. The ability to utilize tools and develop new skills to create objects (products) is important for the twenty-first-century learner. Creating makerspaces for learning and invention can help students grow and subsequently enhance their potential.

Disclosure statement

No potential conflict of interest was reported by the authors.

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