Makerspaces

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Technology Integration | Pedagogy | Authentic Learning | Learner Agency | Constructionism | Experiential Learning

Makerspaces are experiential learning environments that facilitate creative activities, problem solving, collaborative learning, and in-depth exploration of disciplinary concepts. These spaces generally support active, hands-on, highly engaging learning experiences that promote learner agency, self-regulation, and product-oriented learning. Makerspaces commonly include technology such as 3D printers, cutting machines, laser printers, heat presses, dyers, and computers with various design software. Makerspaces also include less technological resources such as general arts and crafts supplies. In educational settings, makerspaces are commonly housed in library or lab settings, mobile carts, or within individual classrooms; however, makerspaces can also be found in communities' informal learning spaces like libraries and workshops.

Although makerspaces are an emerging movement, "making activities" (e.g., tinkering, crafting) date back to humanity's beginnings, and educational foundations for makerspaces began over a century ago (Blikstein, 2018; Gerstein, 2019). Experiential learning, child development through playing and building with authentic materials, student empowerment as changemakers in a malleable world, and using tools to construct and externalize knowledge within tangible artifacts are key pedagogical underpinnings of makerspaces (Blikstein, 2018; Gerstein, 2019b; Sanders et al., 2019). Fleming (2015) captured how these ideas connect to the essence of a makerspace: "If you build it, they will come; and if you let them build it, they will learn" (p. 16).

The maker movements' recent foundations are often associated with its contemporary advocates, a convergence of ideas, and opportune conditions (Ochs et al., 2019; Turner, 2018). As many countries envisioned workforces fueled by innovation, there was increased support for environments that could prepare learners to become creative problem-solvers (Hsu et al., 2017). Additionally, makerspace interest has been spurred by the integration of science, technology, engineering, and math (STEM); the growth of do-it-yourself communities; the incorporation of 21st-century skills; and the increased availability of digital fabrication technologies, tools to use when making, and research on makerspaces (Blikstein, 2018; Gerstein, 2019b). Figure 1 represents what some makerspaces might look like.

Figure 1

Fayetteville Free Library Makerspace by Leah Kraus and Mike Cimino, used under CC-BY License / image obtained from slide presentation.

Instructional Uses of Makerspaces

Makerspaces provide both formal and informal learning opportunities. They foster exploratory learning, disciplinary content knowledge, and multi- or transdisciplinary content knowledge. Makerspaces are touted as places that facilitate innovation, creativity, engineering design, probleming-solving, computing, and collaboration (Sharma, 2021). For example, Gurjar (2021) described a preschool makerspace in Italy that supported children's expression and creativity; Hughes et al. (2017) integrated Arduino and Chibitronics to teach computational thinking and mathematical ideas through creating and programming digital tangibles; and Davis et al. (2021) observed the intersection of literacy and media production in play-based makerspaces. As seen in Video 1, makerspaces can foster self-regulation, problem solving, and growth-mindsets for learners

Video 1

Learning Problem Solving and Growth Mindest in a Makerspace from Edutopia.

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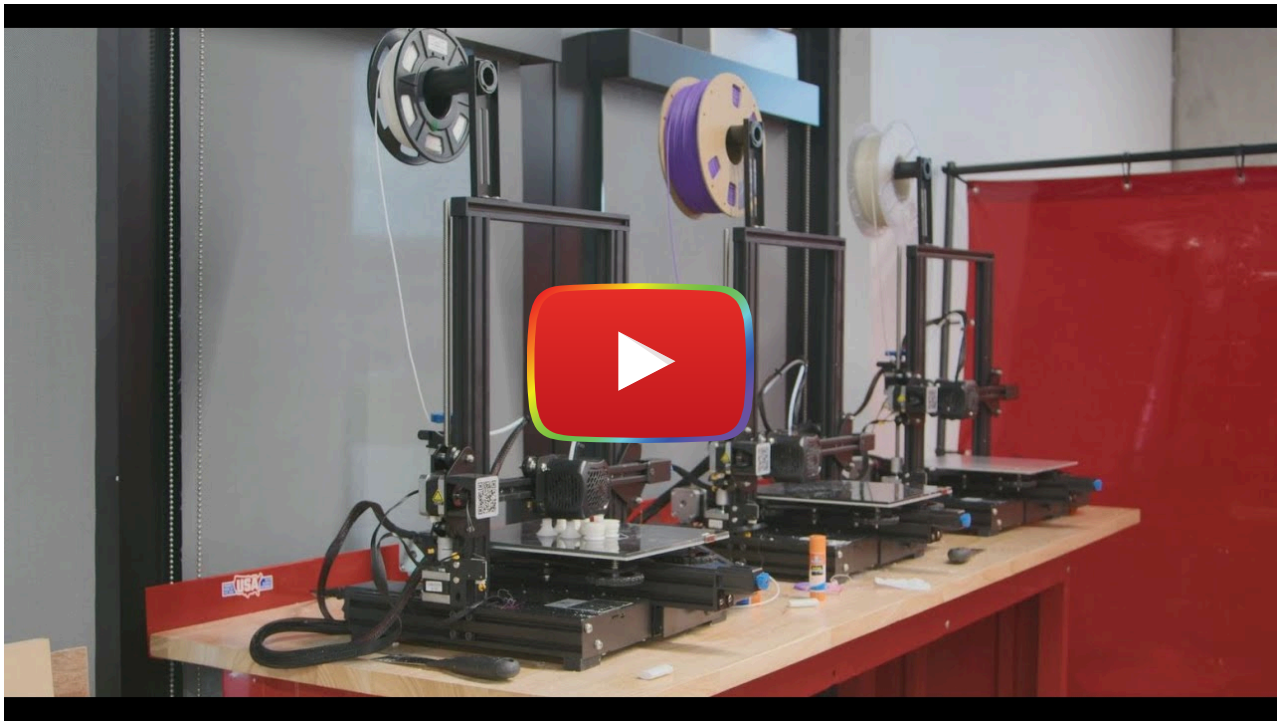
Post-secondary makerspaces focus on various content knowledge and skills (Breaux, 2017). Some have even been used to prepare teachers for integrating makerspaces into their instruction, increasing the desire for additional makerspaces (e.g., Dousay, 2017; Heredia & Tan, 2021). Neumann et al. (2021) described using the Maker's Workshop framework with preservice teachers to support their ability to guide, plan, and implement maker lessons, and helping these students align maker lessons/activities to required educational standards and curricular goals.

Makerspaces are often located in school and community libraries. Library makerspaces are intended to build upon consumption of knowledge opportunities with opportunities to collaborate, tinker, and create (Fleming, 2015). Given the diverse needs of learners who traverse library makerspaces, it is critical to design makerspaces with accessibility in mind, carefully attending to the physical layout and availability of resources (Ochs et al., 2019; Steele et al., 2018). In many communities, librarians and media specialists serve as champions of change who encourage participation in the maker movement, lowering barriers to making in their communities (see examples in Community Artifacts below).

In other cases, makerspaces may be stand-alone areas built into educational environments. For example, the STEM Action Center in Utah has its own Innovation Hub, a makerspace with 2,000 square feet dedicated to project-based, career-focused, hands-on learning (see Video 2).

Video 2

What is a Makerspace from STEM Utah.



Watch on YouTube

Makerspaces in Research

Most of the empirical research on makerspaces has been conducted in the United States within the field of education (Mersand, 2021; Sharma, 2021). The makerspace movement, however, has expanded globally. Recent international research has examined the design of inclusive makerspaces, establishment of maker ecosystems, and what varying cultures affirm as making, innovation, and expertise (Forbes et al., 2020; Giusti & Bombieri, 2020; Gurjar, 2021; Hira & Hynes, 2018; Jain, 2019; Lindtner, 2015; Matthee & Turpin, 2019; Tabarés & Boni, 2023; Valente & Blikstein, 2019).

Although much makerspace research is published in education journals, Sheridan et al.'s (2014) seminal comparative case-study on learning in makerspaces described how diverse spaces (a standalone community workspace, a church basement, and a children's museum) can be used as making/learning environments. Much of the research on makerspaces that followed focused on specific makerspace variables such as the various facilitators, roles, tools, and conditions that makeup makerspaces (Mersand, 2021).

Since the early 2010s, informal learning contexts (e.g., after school programs, libraries, workshops) have been the primary setting of research on learning in makerspaces (Halverson & Peppler, 2018; Mersand, 2021; Sharma, 2021). This trend is likely due to the tension created by standards-based curriculum in formal contexts (Rouse & Rouse, 2022; Sanders et al., 2019). Recently more scholars have shifted their focus to formal learning contexts (i.e., classrooms) to better understand how students learn in makerspaces (Rouse & Rouse, 2022).

Whether set in formal or informal learning contexts, the learning outcomes reported in makerspace research are most often affective outcomes, such as attitudes, beliefs, increased engagement, and development of maker identities (e.g., Chu et al., 2015; Davis & Mason, 2016; Kafai et al., 2014; Mersand, 2021). While some scholars report on outcomes associated with skills or content knowledge (e.g., Bull et al., 2017), such cognitive and psychomotor outcomes are not commonly the primary focus of makerspace research (Mersand, 2021; Rouse & Rouse, 2022).

Related Terms

Experiential Learning, Learner Agency, Problem-based Learning, Project-based Learning, Self-efficacy, Self-regulation, Third Places

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Community Artifacts

Fayetteville Free Library - This library-based makerspace offers an overview of makerspaces and some training resources for using various maker technologies.

The Maker Lab at Chicago Public Library - This is an excellent example of using makerspaces in a third place.

HackPGH - An exemplar of a makerspace as a community-based workshop

Maker Resources for K-12 Educators - A vast array of resources to support the many elements of successful makerspaces (e.g., designing, facilitating, sustaining, developing educators)

Nation of Makers - An American nonprofit that supports maker organizations.

Makerspaces: Remaking Your Play and STEAM Early Learning Areas by Michelle Kay Compton and Robin Chappele Thompson (2021) - A makerspace book for early childhood educators