Integration of Social-Emotional Learning and Technical Education Across a Rural Grassroots Makerspace Network

6th International Symposium on Academic Makerspaces

ISAM 2022 Poster No.: 51

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Introduction

The pandemic has taken a significant toll on students of all ages, causing considerable learning loss, social isolation, stress, and trauma [1]. Over half of parents polled in recent surveys report that their children have fallen behind academically and socially-emotionally since the start of the pandemic [2]. This social and emotional learning (SEL) is a key component of education and human development, and the process by which youth and adults alike learn to establish and apply healthy identities and behavior. SEL strategies help people manage emotions, achieve personal and collective goals, demonstrate empathy for others, foster supportive relationships, and make responsible and caring decisions [3]. Alongside technical education skills, these competencies are essential for effective youth development and success. Studies show that social-emotionally intelligent students demonstrate better academic performance and school behavior, fewer behavior problems, build better relationships, and display fewer mental health issues [4]. Though it might be challenging to integrate such strategies into a traditional classroom, students still need a learning space to engage with peers, enhance their academic learning, develop important technical literacies, learn to regulate emotions, and communicate effectively. The unique and interdisciplinary nature of makerspaces provides an ideal training ground to foster such skills.

Here, we detail the initial design, deployment, lessons learned, and challenges of developing a robust SEL and technical education curriculum for a rural grassroots network of collaborative makerspaces across the Mountain West United States, with a particular focus on a fleet of mobile makerspaces and instructional 'Maker Crates' deployed to rural and remote communities.

Background

Of the 179 towns in Wyoming, 79% are considered rural. Throughout the State, there are eleven major brick-and-mortar makerspaces that offer access to introductory and advanced emergent technology and associated curriculum. These makerspaces are typically located in larger towns. Ultimately, this means that these facilities are less accessible to rural and remote communities, particularly during winter months. As a result, youth in Wyoming's rural and remote communities have limited access to experiential learning opportunities and are at somewhat of a competitive disadvantage compared to their counterparts living in more populous areas. During the pandemic, this was even more prevalent. Despite limited access, employers, manufacturers, and industry groups across Wyoming still routinely seek engineers and skilled employees with STEAM (Science, Technology, Engineering, Art, Mathematics) experience and literacies [5]. Effort must be made to ensure that youth in rural and remote communities have equitable access to similar technical skill and social-emotional learning opportunities.

To address the needs of these rural communities, in early 2022 we launched the Wyrkshop Mobile Makerspace (WMM) initiative. The goal of the program is simple: when students and educators cannot travel to traditional brick-and-mortar spaces, the makerspace comes to them. The initial WMM pilot program is comprised of four mobile makerspaces – two deployable trailers, one mid-sized cargo trailer – and a series of shippable 'Maker Crates' for smaller communities. These mobile spaces are equipped with cutting-edge technology centered around popular makerspace machinery, but are also accompanied by a robust library of Technical Education and SEL curricula designed by collaborative, interdisciplinary academic teams. The WMM fleet was designed to be dispatched throughout the State free of cost to some of Wyoming's most rural and remote communities.

Funding for the WMM project was made possible through support from Governor Gordon's Wyoming Innovation Partnership (WIP) initiative, a program focused on modernizing the State's higher education system to better align with its long-term economic future. WMM year one funds from this support cover curriculum development, equipment, vehicles and trailers, and personnel to get the mobile makerspace fleet operational.

New SEL and Technical Education curriculum was design and deployed within the Maker Access Pass (MAP) platform, a shared training and credentialing standard used by 64% (n=7) of Wyoming's major makerspaces. The MAP was selected as the platform to deploy this content due to its wide adoption across Wyoming makerspaces, the ease with which new SEL and Technical Education could be rapidly deployed across the state, and its ability to integrate new K-12

communities and mobile makerspaces at low cost, and with minimal barriers to entry.

Methods

The WMM team is comprised of a diverse range of leaders from around the State, including curriculum design experts, counselors, makerspace professionals, woodworkers, iron workers, industry specialists, and entrepreneurs. Together, the WMM team works to provide K-12 students in rural communities with access to technology and training curriculum infused with SEL and Technical Education activities and programming. These activities are custom-tailored to each piece of equipment in the mobile makerspace fleet. Schools are able to choose one of three packages catered to the needs of their community:

- Package One: A "Maker-Crate," smaller, shippable makerspace crates with introductory equipment. Able to be set up in a classroom, designed to fit into a car's trunk, and chartered for a minimum one-month term.
- Package Two: A larger 14-foot towable trailer, with a wide range of equipment. Able to be unpacked and set up in a classroom or library and chartered for up to a three-to-six-month term.
- Package Three: A 25-foot makerspace trailer, with the highest variety in equipment. Able to be chartered for up to a six-month term.

Each package option was developed through focus groups put together by the WMM team. These groups helped to highlight the need for multiple sizes and package options for the mobile makerspace fleet. Some counties and school districts throughout Wyoming are underresourced, but still deserve equitable access to equipment and training. Thus, we determined that the makerspaces should be free or low-cost to charter for a term or semester. Likewise, the focus groups allowed us to identify SEL and technical skills requested by employers and industry partners.

Each mobile makerspace is fully stocked with sufficient materials needed to operate the equipment, including 3D printing filament, vinyl, fabric, wood, paper, plastic, and K-12 crafting supplies as well as devices such as laptops, iPads, and virtual reality headsets. All the materials and access to these makerspaces are free of charge, and restocked between locations. Equipment access is freely available not just to K-12 groups, but for each community at large. Community members are expected to pay at-cost for materials. All users (K-12, community, or otherwise) are required to attend the appropriate courses through the Maker Access Pass. This is an intentional choice, since the MAP can effectively gate potentially dangerous equipment access only to safely-trained users.

These mobile makerspaces will be available to schools, libraries, 4-H extension offices, community groups, and deployed at statewide fairs and conferences. To apply, local K-12 institutions and community groups can reach out to the WMM Project Coordinator and reserve a time slot of up to a six-month term. Through an online form, applicants supply the WMM team with information such as location, intended use, desired equipment, maker demographics, and additional interested K-12 and community partners. At the close of each location's term, administrators are asked to participate in surveys to assess perceived increases in self-efficacy and creativity over time through use of the makerspace equipment.

Future Work

Special care must be made to ensure that the WMM program is sustainable in years to come. Phase 1 of the WMM initiative (design, development, and deployment of the pilot makerspace fleet) is complete, and the fleet in active rotation around the State.

Phase 2 is in development and is focused on establishing best practices for the dispatch and future deployment of the mobile makerspaces to new locations. We're also working to build awareness of this initiative across Wyoming and have collaborated with external partners to establish a statewide steering group with leaders representing the broader statewide makerspace network. Our team is reaching out to industry professionals to gather data on how they wish future employees to utilize makerspace equipment in their industries, and as well as gathering feedback on general technical education training.

Finally, we're laying the necessary foundation to secure sustained funding for the WMM program in subsequent years. Annual predictions for the number of students served are based on existing data collected through MAP. We predict that in the first full year of use we will reach an average of 600 makers, 4,800 in year two and 6,200 in year three.

Conclusions

Makerspaces are increasingly recognized as key locations to teach skills that may be otherwise difficult to teach in a traditional classroom, or which may be challenging to integrate into preexisting regulated curriculum. As such, makerspaces are uniquely positioned to equip youth and adults with programming infused with important social-emotional learning, technical education, and technical literacies. While these makerspaces resources may be available in larger towns, cities, and urban areas, they may be less accessible to rural and remote communities. To address this, we deployed a pilot fleet of mobile makerspaces furnished with state-of-the-art equipment and accompanied by a large library of SEL and technical education activities to help bring critical educational and professional development resources to smaller communities across the Mountain West United States. We hope that the data collected, best practices, challenges, and lessons learned from this initial pilot may help other makerspaces enact similar programs.

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