Culturally Relevant Constructionist Design: A Design Principle for Low-Income School-Based Maker Experiences

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Abstract: This study introduces the notion of "Culturally Relevant Constructionist Design" in low-income classrooms as a design principle that highlights the importance of bridging young peoples' experiences with and in their community with a maker-centered learning environment. To this end, we conducted a two-year qualitative design-based research project that engaged 4th graders at a low-income school in Bangkok, Thailand to design and build social innovations to solve problems in their community inspired by the late Thai King Bhumibol. The King was the country's unifying figure and widely admired as "The Developer King," students made things that were personally and socially meaningful to their community.

The traditional education system isn't inclusively designed for everyone to succeed. In fact, barriers such as test scores, demanding curriculum, and grades screen out students (Hatt, 2007). The students who perform below expectations are often viewed as incompetent, without considering their other latent abilities. Academic performance isn't the sole representation of who students are, and by focusing only on achievement on traditional performance metrics, we miss the opportunity to see the students from multiple perspectives. We view making as a form of learning and expression that opens up more avenues for students, especially the marginalized, to cast who they are, who others think they are, and who they think they should become while creating connections to their personal interests and people around them. Through making, students take an active role in their own learning by creatively designing, building, and exploring their projects based on their personal and social interests. They are empowered to connect everything they wonder, know, and feel by making things (Martinez & Stager, 2013).

When examining the making process, not only is it crucial to recognize the knowledge and skills that students acquire through making, but also to recognize its contributions to students' sense of self as participants within a broader community (Dixon & Martin, 2017). To this end, we ground our work in socio-cultural views in learning. Our design approach for supporting school-based maker experiences in low-income communities emphasizes the importance of creating relevant cultural connections to students' learning experience.

This study introduces the notion of "Culturally Relevant Constructionist Design" in low-income classrooms as a design principle that highlights the importance of bridging young peoples' experiences with and in their community with a maker-centered learning environment. Research in culturally relevant pedagogy emphasizes the importance of holding high expectations and affirming views for all students. Culturally relevant pedagogy proposes that students' prior knowledge and experiences from their home and community should be deeply integrated into teaching practices. This framework explicitly encourages teachers to question the nature of the student-teacher relationship, the curriculum, schooling, and society (Ladson-Billings, 1995).

In their work on STEM-rich making at community-based clubs, Barton and Tan (2018) prioritizes the students' sociocultural contexts in their framework. Their goal is to empowers students by making solutions to authentically address real injustices in their everyday lives. Building on this research, we present a design principle to better support authentic making in formal classrooms located in low-income communities by engaging not just teachers and students, but also the broader community. We situate this research in a study conducted in a Thai elementary classroom located in a low-income community. We argue that the principle could be a model for other such schools, especially in developing countries. We conclude that Culturally Relevant Constructionist Design relies on three things: (1) a learning environment that reflects students' goals and values, (2) the engagement of community members and teachers in students' making processes, and (3) opportunities for students to make for others.

Culturally relevant constructionist design situates students' making experience in their local community. It supports students as they build and reify relationships between their community, teachers, and peers through the construction of artifacts created for others. Making and construction has been shown to be an effective method for supporting young people, who may face academic challenges, to excel and develop their own set of positive identities (Barton, et al, 2016). By making for others, such experiences open up avenues for learners to express themselves as they make connections with people who are meaningful to them (Holbert, 2016). Identity isn't only about how students view themselves, but also on how they are recognized by others (Gee, 2000). When teachers and community members are deeply engaged in the construction process with the learner, they have the opportunity to see the students from perspectives they may not usually observe. For example, they may discover

the student's interests, observe hidden skills, or simply find themselves in a conversation about a topic that isn't school related. These experiences are likely to counteract any deficit narrative the teacher or community member may have regarding the student (Hatt, 2007). Moreover, culturally relevant constructionist design considers students' values and goals, reflecting these values explicitly in maker activities. For example, in Little Builders, we draw on the students' collective admiration for King Bhumibol as a role model in innovating solutions to social problems by inviting students to create solutions for the betterment of their community.

To provide the empirical evidence supporting Culturally Relevant Constructionist Design, we conducted a two-year qualitative design-based research project. We engaged 55 4th graders at a low-income school in Bangkok, Thailand to design and build social innovations to solve problems in their community. We looked to the country's common admiration for the late King Bhumibol as a relevant entry point for making. The King was a maker who invented projects and used technology for the good of the country. Inviting the students to "follow the King's footsteps," they designed artifacts for community members and make as a team. The students participated in this study during a mandatory "Life Skills" class, which was co-developed and taught by the homeroom teacher. Students created projects from craft materials, hardware tools, and local made micro-controllers given to the school by Thai government.


Figure 1. (Left) Students interviewed the crepe vendor for their design insights.
Figure 2. (Right) Students delivered a locker desk to the school's security guard.

The preliminary results show the ways in which culturally relevant making in Thai classroom takes shape as a (1) way of establishing making as a part of connecting students, teachers, and community, (2) space for students to work together in unity, and (3) form for the students to follow the footsteps of their beloved Thai King. Students showcased their creative and innovative nature in tackling everyday problems for others in the community. Their projects were simple, yet unexpected. For example, a group made "Uncle Crepe Robot"—a used doll with megaphone pieces—as a marketing tool to invite more customers for a crepe vendor who experienced debt problems (See Figure 1). Another group made a locker desk for the school's security guard as her temporary work station, because her security kiosk was ruined by the seasonal monsoon (See Figure 2). Students are reflective of the values the late Thai King aimed to cultivate in his people - doing things that are useful for others with a creative spirit and drive for innovation. We believe that Culturally Relevant Constructionist Design is possible when students develop connections to people within their community. Additionally, the teacher must be involved in designing and facilitating students' learning experience. Students can be empowered by collaboratively designing solutions that have an impact on their community and themselves.

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