This qualitative study will investigate the development of a district-sponsored “makerspace” and its influence on student learning and teacher professional development. Briefly, a makerspace is a physical workspace where participants experiment, share knowledge, and produce digital and physical products based on their interests. Typically located in a community setting, makerspaces may house expensive tools like laser cutters, power tools, and 3-D printers that are shared and maintained by users.

Informal descriptions of makerspaces online and in journalistic texts suggest they would be rich sites for the observation of interest-based, experiential learning by students, yet we found no empirical research on community or school-based makerspaces. In examining informal accounts, however, we were able to extrapolate what seem to be foundational learning principles, including:

- A strong community of practice with distributed expertise and leadership (Barton and Hamilton, 2005)
- Interdisciplinary and interest-driven learning where individuals share tacit and explicit knowledge (Gee, 2008)
- Apprenticeship with opportunities for legitimate peripheral participation (Lave and Wenger, 1991)

These principles align with the well-documented global shift in youth learning and communication practices seen outside of school, particularly in the realm of participatory media (Lenhart et al., 2008). The growing popularity of makerspaces among youth likely reflects their preference for learning in participatory out-of-school contexts that value “hanging out, messing around, geeking out” (Ito et al., 2009). Unfortunately, definitions of learning and teaching within schools have narrowed progressively due to restrictive interpretations of instructional standards, student achievement, and teacher evaluation. This limited confidence in student abilities and teacher skill consistently yields “unstimulating, rote-oriented teaching” (Darling-Hammond, 2010).

Recognizing the disparity between the opportunities for learning and engagement inside and outside of school, we will investigate how a makerspace culture characterized by open-ended
learning, sharing, and production might influence students’ acquisition of academic content knowledge and support teachers’ professional development.

Research questions include:

- What does student learning look like within a district-sponsored makerspace? What roles do students and teachers assume? What texts and artifacts count as evidence of student learning, and what tools and patterns of interaction enable it? How are standards and content tacitly and explicitly addressed? How is learning assessed?
- How can teacher inquiry into a makerspace enhance professional development?
- What constitutes a culture of “making” in a school-sponsored setting, and how might its underlying principles for teaching and learning challenge existing school structures and restrictive educational policy?

A key feature of this study is our intent to co-conduct the investigation with a cohort of teacher-researchers who will meet regularly throughout the academic year and participate in an intensive summer institute to analyze, reflect, and take action on the study’s findings.

We are uniquely positioned to carry out this investigation because of our long-standing professional development partnership with the St. Vrain School District, where the district-sponsored Center for Make/Hack/Play will be established in the 2012-13 academic year. The Center will provide a physical workspace, learning experiences, and resources for students and teachers that promote hacking/making/playing as ways of learning and knowing. While the Center will promote essential elements of learning related to the district’s STEM initiatives, the intent is also to broaden the focus to include the arts and humanities with the ultimate goal of bringing a culture of making back to classrooms.

The timing of the Center’s development combined with our existing positive relationship with the district will allow us to study the development of the makerspace and to examine an ethos of making in the context of inquiry-oriented professional development. The study promises to have significance for a vast number of educators because Colorado is a Common Core State Standards state preoccupied with student achievement as measured by standardized tests.

**Literature Review**

While some research connected to digital literacies explores the kinds of interest-based learning that might take place in makerspaces (Gee, 2004; Herrington, Hodgson, & Moran, 2009;
Ito et al., 2009; Knobel & Lankshear, 2007), empirical research on makerspaces is non-existent. Makerspaces are affiliated with the do-it-yourself “maker movement” in community settings, and links to education have only been touched upon (King & Porter, 2012; O’Brien, 2011; makerspace.com). Consequently, while our conception of relevant literature is largely speculative, we feel familiar enough with the contours of the maker movement to surmise that engaged learning, multiliteracies, and learning space theories will serve as useful lenses for viewing the learning and teaching present in the Center for Make/Hack/Play.

Engaged Learning

Informal descriptions of learning in makerspaces bear resemblance to the “flow experiences” described by Csikszentmihalyi (1990). As Smagorinsky has noted in relation to curricular design, students learn “by making, and reflecting on, things they find useful and important” (2008, p. xi). The project-based ethos of makerspaces suggests alignment with this premise, progressive education (Dewey, 1897, 1916), and inquiry-based learning (Beach, Campano, Edmiston, & Borgmann, 2010; Smith & Wilhelm, 2002, 2006; VanDeWeghe, 2009). Tremmel (2010) has argued that the failures of the Progressive Movement can be traced to misinterpretations of Dewey as excessively oriented toward interest-based activity at the expense of intellectual rigor. Yet as he and others have also noted, a middle ground is possible wherein teaching practices oriented toward student inquiry and engagement may simultaneously meet the expectations of instructional standards (Coke, 2008; Herrington, Hodgson, & Moran, 2009; O’Donnell-Allen, 2006, 2011).

Presumably, Smagorinsky’s premise above regarding the effectiveness of “making” for students also holds true for teachers, yet traditional models of professional development are oriented toward technical and behavioral aspects of teaching (Cochran-Smith & Lytle, 2009). More lasting and effective forms of professional development, however, can occur in a job-embedded, inquiry-based learning cohort like the one we will convene for this project. Such an approach honors teachers’ agency and capacity for knowing; strengthens teacher voices; allows them to reinterpret external mandates in ways that enable student engagement; and has potential for increasing retention in the profession (Goswami, Lewis, Rutherford, & Waff, 2009; National Writing Project, 2010; Nieto, 2003; Wells, 1994, 2001).
Multiliteracies

Current conceptions of literacy must move beyond the traditional paradigm of sound-letter recognition to include multimodal forms of communication and production “associated with information and multimedia technologies” (New London Group, 1996, p. 61; see also Anstey & Bull, 2006; Barton & Hamilton, 2000; Kress, 2003; Lankshear & Knobel, 2006). Revised definitions must also incorporate students’ cultural perspectives, language diversity, and sociocultural strengths (Meacham, 2001). Students in makerspaces likely demonstrate the multiliteracies embraced by today’s “always-connected generation” (Lenhart, 2009). These practices are characterized by increasingly sophisticated modes of media production and consumption (Norris, 2001; Warschauer, 2003; Ito et al, 2009).

Simply put, young people today are reading, manipulating, and producing texts in fundamentally different ways. An investigation of the multiliteracies present in makerspaces could help educators more productively negotiate this reality so they can tap students’ existing predilections for meaning-making, connect them to disciplinary learning, and prepare students for the demands of a rapidly changing world.

Spaces for Learning

The increased use of multiliteracies has shifted our understanding of learning contexts in ways that are relevant for conceptualizing makerspaces. This study will draw on the growing body of research on learning spaces, including “affinity spaces” where people with shared interests gather informally to learn (Gee, 2004); “third spaces” where formal and informal learning environments intersect (Gutiérrez et al., 1995); and “extra spaces,” those “digital contexts in which…youth practice literacy” (Kirkland, 2009, p. 8). Gutierrez (2008) has described the transformative nature of third spaces, and Kirkland likewise describes the potential extra spaces afford youth for creating meaningful texts with implications for their identity development.

Much of the value of this proposal stems from our intent to create a “productive hybrid cultural space” (Moje et al., 2004, p. 43) for students and teachers with a positive impact on their impulse to learn and direct their own learning. More research is needed to conceptualize learning spaces in expansive yet concrete terms; this investigation represents an empirical approach to developing this foundational work.
Conceptual Framework

An important facet of this study will be to examine the tension and interplay between interest-based learning and standards-based teaching as it unfolds in the emergence of the makerspace. Activity theory provides an appropriate framework for understanding cultural development and the development of individuals through their use of psychological tools (e.g., speech, writing, computers, the arts, etc.) to mediate goal-directed action in particular contexts (Cole, 1996; Engestrom, Miettinen, & Punamaki, 1999; Lee & Smagorinsky, 2000; Leont’ev, 1981; Vygotsky, 1978; Wertsch, 1991). We speculate that the location of this makerspace within a school setting will constrain its overriding motives. That is, while participants in community makerspaces are motivated to participate in the space primarily for the purpose of creating artifacts tied to their personal interests and expertise, students in a school-based makerspace must also meet externally imposed goals related to standards and curriculum. In particular, we are interested in what will count--from both students’ and teachers’ perspectives--as legitimate learning tasks and meaningful artifacts in the makerspace; what tools will be privileged in the facilitation of student learning; and what norms, values, and patterns of interaction will emerge as students and teachers renegotiate their traditional roles.

Research Methods

As previously mentioned, a cohort of teachers will assist us in the collection and analysis of data. Methodologically, teacher inquiry functions as a means for integrating practitioners as co-researchers and allowing their “indigenous knowledge” of the classroom space to inform the research (McIntyre, 2000). We will rely primarily on ethnographic methods to study the makerspace culture since this approach is compatible with both activity theory and teacher inquiry. Seeking an emic perspective of the setting, we will employ multiple methods of data collection, including participant observation, collection of artifacts and documents, interviews, and in situ audio-visual recordings of representative episodes of learning and teaching (Saville-Troike, 1989).

Data analysis will be ongoing, using a grounded theory approach for inductive coding of emergent patterns and themes for the purposes of theory development (Glaser & Strauss, 1965; Lincoln & Guba, 1985). A preliminary coding scheme will be formed in relation to salient
components of the developing makerspace culture; a more refined coding scheme will be developed as additional data is collected and triangulated (Goetz & LeCompte, 1981).

**Area of Inquiry**

Due to our focus on improving teaching and learning, our research strongly aligns with the area of inquiry concerned with “Teaching, Learning and Instructional Resources.” By investigating the learning that occurs in a school-sponsored makerspace in the company of teacher researchers, we anticipate that this study will help conceptualize makerspaces; provide a theory of action informed by a makerspace ethos that may also be relevant for developing more dynamic, engaging classroom learning opportunities for students; and contribute to a deeper understanding of meaningful professional development in a policy environment that currently inhibits teacher agency.

**Principal Investigators**

Assistant Professor Antero Garcia and Professor Cindy O’Donnell-Allen will serve as co-PIs in the study. We have co-written this proposal and intend to collaborate on every phase of the study from data collection and analysis to facilitation of the teacher inquiry group and other professional development activities associated with the project.
References


