

Becoming a STEAM-Teacher: Co-Construction of a Zone of Proximal Identity Development to Support Program Implementation

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Abstract: Exploring the role of teachers' *identities* in their appropriation of the goals, strategies, and materials of STEAM programs, we argue that teachers' "practice-linked" identities (Nasir & Hand, 2008) are consequential for implementation of STEAM programming. We analyze a STEAM program implementation that has shown promise for developing students' interests in STEAM-related futures. We explore how variation in implementation depends upon a *zone of proximal identity development* between program support staff and teachers.

Major issues

Just as they are important for student learning in disciplines, teachers' "practice-linked" identities (Nasir & Hand, 2008), we argue, are important in teaching diverse groups of students to develop STEAM interests and skills. In this paper, we explore how implementation success in MAKE depends upon the construction of teachers' *zone of proximal identity development* (ZPID). We ask the following questions: 1) How do teachers who express using the MAKE program successfully describe their identities with regard to STEAM? and 2) How do STEAM teachers work with program partners to develop a ZPID with regard to STEAM programming?

Perspectives

We approached this study with sociocultural perspectives that suggest teachers' identifications impact their pedagogical approaches (Luehmann, 2016). We see teachers as learners developing new "trajectories of identification" (Polman, 2010) as they engage in new experiences and work to appropriate new pedagogical tools. In order to build understandings around the trajectories that lead to feelings of success with STEAM programming, we draw upon Polman's (2010) notion of the zone of proximal identity development (ZPID). Polman (2010), citing Vygotsky (1978), suggests that identities develop socially in conjunction with cultural tools and practices. ZPID includes the trajectories of identity that an individual can see as possibilities for themselves given the ways they currently identify. We see teachers as potentially embodying trajectories of identity as a "STEAM teacher" in which they describe themselves as experts, learners, or novices in STEAM skills and programs.

Methods and data collection

MAKE (pseudonym) is an interest-driven approach to STEAM learning that can be implemented with students across grades. As the program expanded, the project team has sought to engage and support teachers with a variety of backgrounds in successful facilitation. Our evaluation focused on the conditions and processes that might explain variation in whether and how MAKE was taken up by educators. Our participants included 31 teachers who facilitated the MAKE program during the 2019-2020 school year. We drew upon qualitative methods to conduct semi-structured interviews, including questions around enactment, shifts in teaching, and feelings of support from administration and project teams. We then used a process of interpretive thematic analysis that began with topic coding and proceeded to thematic analysis coding (Braun & Clarke, 2006). As themes of teachers' identifications emerged, we refined our coding scheme and performed a second round of coding to examine teachers' articulations of their identities with regard to the MAKE program and to STEAM generally.

Findings

Throughout our analysis, we noted that teachers of the MAKE program identified within one of three broad categories, (1) those who were confident about their implementation of the program (2) those who were frustrated by the program constraints, and (3) those who expressed feeling insecure about their implementation.

Identifying as an expert with MAKE

Andrea was a STEAM teacher at a STEM magnet school. Andrea described herself as an expert who offered STEAM training at the district level and was "always looking for new resources." Andrea saw herself as both a STEAM *and* a MAKE specialist. Andrea explained that the program filled a gap in curriculum for her students. Because of her expertise, Andrea's administration positioned her as an instructional coach, supporting other

teachers co-teaching with a variety of STEAM resources across disciplines. For Andrea, the MAKE program was essential because it allowed her to support other teachers in developing the identities they needed to successfully integrate STEAM skills in their classrooms. Although Andrea had already positioned herself as an expert, she also identified within our interview as a learner and coach and was therefore able to envision a trajectory of identity that could change to incorporate MAKE as part of her identification as a STEAM teacher.

Identifying as an enthusiastic learner of MAKE

Fred's perspective was the common in our interviews. He described himself as a content area teacher who had become the "tech teacher." He went on to explain that he felt "definitely isolated" as the only STEAM teacher in his school. While time constraints meant that Fred did not engage much with the online communities that the MAKE team has established, he expressed feeling confident knowing that a community of practitioners were using the same materials. He also noticed differences in his students' learning that he attributed to MAKE. "They're capable of doing things they didn't think they were before...I can mess up, but I can also learn how to do something in the long run." Fred could see himself becoming a stronger teacher by using the program and hoped he would get to continue to incorporate MAKE program in the future. While not yet expert, Fred was able to co-construct with a community of practice supporting his learning how to engage students with MAKE a ZPID that allowed for feelings of success with the program, even during the pandemic.

Identifying as unsuccessful with MAKE

Mia explained that the MAKE program was new to her advisory classroom. When asked about her context, Mia described the MAKE program as an administrative mandate. Mia explained that she did not feel she had time to develop expertise with the program because the advisory period was intended to introduce students to so many concepts including the MAKE program. Mia acknowledged that although the training she attended had been "really helpful," she did not feel the support she wanted from her school community. "I think that's a real challenge for kids...Because it feels just like something extra that they're doing." She explained she did not have time to engage her students with the program and therefore struggled to identify with its principles and mission. For Mia--in contrast to Fred--the community of practice and support from program partners in how to implement the program was not sufficient as a means to develop a ZPID as a successful MAKE teacher.

Discussion and implications

These cases are representative of the broader themes across our data. Throughout our data analysis we noted that teachers who positioned themselves as "expert" with STEAM were less likely to adopt identities as MAKE teachers, unless they were supporting others. Teachers who had little experience with STEAM or whose settings did not provide support, struggled to position themselves as successful with the program. Teachers who expressed feeling most successful were those who had enough background in STEAM to develop trajectories of identity that allowed them to first imagine themselves as successful, but whose knowledge was also extended with the content in the MAKE program. Our data analysis illustrates the ways that teachers may need support in fostering a ZPID in order to successfully see themselves as knowledgeable in and capable of teaching STEAM. The degree to which they are able to do so is highly contingent on both their own goals and on their ability to co-construct with partners and communities of practice a means to learn to use STEAM tools to support student engagement and learning.

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