Development of Integrated Physics Identity through Physics Learning Assistant Experience

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Abstract: We propose that connections between persistence, career trajectory, and participation in a Physics Learning Assistant (LA) program can be explained using the concept of the *community of practice* and its intimate relationship to *identity*. Preliminary analysis of written artifacts and interviews suggests that membership in the collaborative physics education community of practice created through the LA program increases LAs' engagement in negotiation of meaning in both instructor and student roles and strengthens their physics identity.

Introduction

The Learning Assistant (LA) model, developed at the University of Colorado-Boulder and widely adopted (and adapted) at other institutions, provides undergraduate STEM students with coordinated experiences of content and curricular learning, teaching practice, and pedagogical coursework. LAs meet weekly with faculty to prepare for instruction, and facilitate discourse over fundamental disciplinary concepts in small-group instructional settings (see Otero, Pollock, & Finkelstein, 2010, for a detailed description). This model has been documented to lead to a number of positive effects on both LAs and students in LA-served courses, and to increase the number of STEM students choosing careers in teaching (Otero, Pollock, & Finkelstein, 2010). We analyze the experience of students in the Physics LA program at Texas State University in terms of the existing theoretical frameworks of *community of practice* (Lave & Wenger, 1991; Wenger, 1998) and *physics identity* (Hazari et al., 2010; Lock, Hazari, & Potvin, 2013), and explore the implications suggested by these theories for LA program adoption and adaptation. Regression models from studies by Hazari et al. (2010) and Lock, Hazari, and Potvin (2013) show that the physics identity construct strongly predicts intended choice of a career in physics; the goal of our current project is to understand the details of the impacts of participation in the LA experience on participants' practice and self-concept, in order to identify critical elements of LA program structure that positively influence physics identity and physics career intentions for students.

Theoretical Framework

We briefly describe the two theories named above, and build a correspondence between factors in the physics identity framework and community of practice theory. This blended theory is used to analyze video of LA interviews and written artifacts for evidence of shifts in LA identity.

Identity in Practice

Lave and Wenger describe participation in communities of practice and development of identity as deeply intertwined (Lave & Wenger, 1991; Wenger, 1998). Participation in a community of practice shapes and is shaped by the ways in which members of the community engage each other around their shared practice. Over time, the community develops a shared repertoire of resources for negotiating meaning, including language, stories, concepts, styles of interacting, and ways of accomplishing tasks. Identity, as shaped by this engagement in practice, is not an inherent or fixed quality of a person but rather a process of continuous re-negotiation – "a constant becoming" (Wenger, 1998, p. 154). Within this framework, Wenger (1998) identifies five characterizations of identity, four of which we find relevant to our current study: identity as *negotiated experience,* as *community membership,* as *learning trajectory,* and as *nexus of multi-membership.*

Physics Identity Self-Concept

Hazari and colleagues (2010) describe and empirically validate a theoretical framework for physics identity composed of four dimensions: *personal interest, student performance, competence,* and *recognition by others.* Assessment of physics identity is based on self-report, e.g., the dimension *competence* can be described as "belief in ability to perform required physics tasks." In a subsequent study, Lock, Hazari, & Potvin (2013) found that the dimensions of *performance* and *competence* formed a single factor; the theoretical framework was therefore simplified to three dimensions. We make use of this simplified framework in our analysis.

Relating Self-Concept and Practice

In order to relate the empirically tested physics identity framework to concepts from the more general community of practice theory, we build a correspondence between factors. The link between the two should help the physics community create effective interventions that positively influence physics identity and physics

career intentions for students. The dimension of (self-reported) *recognition* in the physics identity framework, as measured through survey items such as "My physics teacher sees me as a physics person" (Lock, Hazari, & Potvin, 2013), describes an element of identity as *negotiated experience*: the process of making meaning from the encounters and experiences of participation in a community of practice. The physics identity dimension of *competence/performance* describes an aspect of *community membership,* which defines identity through the forms of competence developed and valued by participants in the community. Changes in identity over time build a sense of *trajectory;* identity as *learning trajectory* incorporates past identities and possible futures into making meaning of the present, encompassing the physics identity dimension of *personal interest*. Identity as *nexus of multimembership* is defined by the work of reconciling forms of membership in different communities. This blended identity theory is the basis for our analysis of the LA experience, described below.

Methods

We examine written data sources and video of LA interviews for evidence of whether participation in the LA program has affected elements of LAs' identity, and if so, in what ways and through what program elements. Written data are drawn from multiple sources, including teaching reflections, program applications, and written programmatic feedback. A subset of experienced LAs (N=7 out of 18 LAs with more than one semester in the program) participated in loosely-structured clinical interviews; interview subjects were selected to include diversity of major, gender, career plans, and length of experience in the LA program. The interview protocol included questions probing both self-perceptions (e.g., *What parts of being an LA are you particularly good at? Has being an LA made you more competent at other things besides teaching?*) and practice (e.g., *Do you use the Help Center to study or hang out? Do you interact differently with faculty since becoming an LA?).* Video data from interviews was examined using insight-oriented analysis (Scherr, 2009), in which the authors, informed by the theoretical framework described above, collaboratively analyzed video episodes that we identified as providing insight into the impact of the LA program on participants' construction and perception of identity. Analysis of early interviews led to adjustments in the interview protocol based on emergent themes in the data.

Preliminary Findings and Implications

Our preliminary analysis suggests that participation in the LA program impacts LAs in ways that support both stronger "physics student" identity and stronger "physics instructor" identity, and that these identities are reconciled into a coherent integrated physics identity. Increased comfort in interactions with peers, near-peers, and faculty seems to be an important component of this identity development and reconciliation, and is facilitated by the increased informal interactions between LAs, faculty, and peers provided by content preparation sessions and by the Physics Help Center (a resource for students staffed by LAs and near faculty offices). These interactions also seem to support an expansion of LAs' perception of what constitutes competence: they learn to value and enjoy multiple ways of engaging in the physics community, including interactive examination of incorrect as well as correct reasoning, which re-purposes *saying wrong things* from a form of incompetence to an important component of competent engagement. Further work is planned to confirm these findings, including systematic coding analysis of an expanded corpus of interview data, and social network analysis of the physics student community.

References

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Acknowledgments

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