An Identity Trajectory Analysis of a Scientist/Educator Engagement With a Large Urban District

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Abstract: Many reform learning environments rely on the involvement of researchers and disciplinary experts in authentic learning settings. But the ways by which disciplinary experts become effective collaborator in such settings is not well investigated. This paper presents an identity trajectory analysis of the engagement of a scientist/educator within a large urban school district. In the context of a comprehensive curriculum and professional development initiative, the educator participates in several different roles, including leadership, curriculum writing, and support of teacher work within schools. Within this setting, identity shifts through social interactions with others running the project, with district administrators, with teachers in schools, with students, and with the materials for the curriculum. Using Wortham's methodology of narrative analysis and framework of identity trajectory analysis, traced through analysis of the narratives created by the scientist/educator.

Introduction: The problem of identity, engagement, and science education

One of the major accomplishments of the learning sciences has been the development of ways to engage deeply in authentic learning environments while asking questions about many aspects of learning and for many different types of learners. The emergence of design-based implementation research (Penuel, Fishman, Cheng & Sabelli 2011), when accompanied by participatory strategies (Gomez, Kyza, & Mancevice 2019) bring researchers into collaboration with communities. In many cases, these researchers may be initially trained in disciplinary areas and the interaction with participants such as teachers and students in schools can require the researcher to undergo significant changes in identity (Skerett & Sevian 2010; Fayez 2010; Ye, Varelas, & Guajardo 2011).

As individuals from one area of activity to another, it is likely that they will experience shifts in identity. One way of construing this is through the notion of identity as a nexus of multimembership, where the individual includes several different participation activities in their self-narrative, reflecting different forms of participation within their work (Wenger 1998). For example, one may be a disciplinary expert with extensive training in the content and practices of a field. But when that individual participates in a classroom, there is also a status as a visitor with only a naïve understanding of the environment. For that individual, new forms of identity can develop through social interactions, activity in the shared space, and individual reflections. Ye et al (2011) used journals as a basis of evidence about self-reflective identity of graduate students in K-12 environments during a one-year fellowship in schools. Skerret & Sevian (2010) used interviews to capture the retrospective views of faculty as the basis for thinking about how roles changed These cases are rare examples of studies of how the identities of the disciplinary experts changed over time. In the present study, a longer timeline (four years) is examined to document the identity trajectory of a scientist/educator in more detail.

Many studies of identity position the individual with respect to previously characterized role definitions. More inductive work on identity grounds its findings in a less restrictive and more phenomenological framework. This can be done with the framework and analytical techniques of identity trajectory analysis created by Wortham (Wortham 2006). In this case, identity is framed as a boundary phenomenon, where the interactions of the individual at the boundary with others in their environment are examined for *events of identification*. These events reference larger, generally invariant, *sociohistorical models*. Within these settings, though, the events of identification become markers of emergent *metapragmatic models* of identity that the individual is actually implementing. Wortham has also developed analytical tools to describe one particular piece of evidence—self-narrative—as a means for thinking about identity (Wortham 2001; Sfard and Prusak 2005). This provides a coding scheme based on distinguishing the storytelling about an event from the narrated event and structures specific ways that the self/identity is represented within the event and the storytelling.

Following on the frameworks and analytical methods of Wortham, this paper uses narrated events about and by the scientist/educator as a means to construct a case study analysis around the research question: *What is the trajectory of the identity of a disciplinary expert in engagement with an urban school district, schools, administrators, teachers, and students?*

Context

This paper presents a case study analysis of the identity trajectory of one scientist/educator within their work in the context of a large urban school district in the Midwest of the United States. The scientist was originally trained

entirely within the discipline of chemistry and continues to do collaborative work in the field. But they also engage in work in chemistry education and, within this, participated in a curriculum and professional development project for high school science in the partner district. The project itself has been discussed both from a design perspective (Wink, Daubenmire, Brennan & Cunningham, 2008) and in terms of the outcomes of its inquiry-oriented approach (Daubenmire, Wink & Tarnoff, 2011). The project was done as part of a district initiative to support adoption of reform-based text materials—in this case the *Chemistry in the Community* textbook (ACS 2006). Schools enrolled in the project in three cohorts that, over three years each, implemented three years of new science instruction in biology, chemistry, and physics. Schools received all texts and supplies needed to implement the curriculum. In addition, project leaders created thirty model lessons for the curricula, referencing the details of the text and also the project's overall guiding principles (Wink et al 2008). Implementation in schools was supported by in-school coaches who were experienced teachers from the same district. Coaches would often co-teach lessons with the teachers and co-lead professional development sessions. The project helped with implementation by providing graduate assistants as "Fellows" who would visit a school on a weekly basis to help unpack and set up materials (Ye et al 2011). These individuals would sometimes assist during lessons, but not in an instructional role *per se.*

The scientist/educator for this study played multiple roles within this context. They were a co-PI for the overall project and a co-leader of the implementation of the chemistry portion of the project, including the writing of model lessons and the provision of professional development sessions. The scientist/educator was also assigned to the role of a support Fellow, providing the implementation support to three different schools over three years of implementation of the biology, chemistry, and physics curricula.

Methods

This study is done in the form of a case study to provide a rich description of the identity trajectory of the scientist/educator over a four-year period (Yin 2014). The data for this study comes from three sources. The main part of the data are taken from emails from the scientist/educator, each containing a narrated event, to project collaborators, teachers and district personnel working on the project, and to other science educators. A total of 2080 candidate emails have been identified and, within these, 79 specific narrated events have been extracted for further analysis. These data are supported by data in the form of materials created for the management of this and related projects, including the model lessons that the scientist/educator coauthored.

The 79 specific narratives were then analyzed following the methodology of Wortham (2001) to document the *narrated event*—what is said to have happened—and the associated storytelling—the dialogic interaction of the narrator with others (an example is shown in Figure 2 in the results). The narrated event indexes the interactions of the scientist/educator in the event, while the storytelling is then analyzed to identify the boundary events where the identity of the science educator interacts with others outside of the event. Once this is done, we characterize the narrated event and the storytelling using the analytical framework of an identity trajectory. The event/storytelling are coded as an *event of identification* (Wortham 2006) that references *sociohistorical models of identity* available to the participants. By comparing events of identification over time, we identify the presence of *metapragmatic models of identity* that suggest key elements of the identity trajectory.

Results

The results for this study emerge at two levels. The first level concerns the specific narrated events within the data. The second level is to consider how these analyses contribute to an identity trajectory analysis over time.

As an example of the results concerning specific events, consider a report from the second year of the project (Figure 1). At this point, the project was in the first year of implementation of the chemistry curriculum. The scientist/educator had, during the first year, initiated the project with their collaborators and coauthored the model lessons for chemistry. In this year, they were also working as a provider within the professional development sessions and, at one specific school, as a fellow in support of unpacking and laying out materials.

> I was in Mr. Y's class yesterday. I had prepared a particulate-level worksheet on molar mass and mass stoichiometry, showing the balancing of mass, not just atoms (they did that last week). Most of them fairly zipped through this. Mr. Y. was out today, at science fair. But he will be back tomorrow. I discussed with him having the students follow through on the exercise of Tuesday with some calculations based on symbolic formulas, like C3H6 or NaF. The students are working these problems with integer values for the atomic masses only. Maybe, just maybe, the idea of molar mass can then come in.

Figure 1. Narrative report on classroom implementation from project year 2.

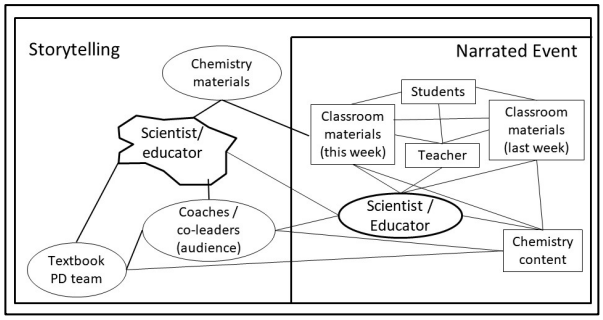

Figure 2. Analysis of Figure 1 text as narrative event and storytelling (Wortham 2001).

In Figure 2, the narration in Figure 1 is analyzed with respect to its status as a narrated event and as an act of storytelling. The analysis consists of documenting the components of the narrated events, which include both people (the scientist/educator, the teacher, and the students), materials (as written and distributed), and the chemistry content itself. Note that this analysis also involves positioning the materials and the content of the discipline of chemistry as agential within an activity system (Wink 2018). The narrated event contains several interesting interactions but here we focus in Figure 2 on the way the storytelling reflects a positioning of the scientist/educator with respect to their work with the teacher (as support), the materials (as author/content expert), and others on the project team.

The next stage of the analysis of an individual event is to describe the way something becomes an *event of identification* (Wortham 2006). In the case of the excerpt in Figure 1, this event of identification is described as "scientist/educator as providing content-aligned materials for classroom and teacher use." This event of identification is grounded in the event itself but also represents a claim of how the scientist/educator is positioned with respect to the school, the overall project, and the content of chemistry.

The second level of results is directed at the identity trajectory analysis using the 79 narrated events in the data for *events of identification*. Table 2 presents a partial listing (given space constraints) of narrated data and the events of identification that are associated with them. The timeline is reported relative to the six-year project cycle, with Year 1 being the proposal year and Year 3 being the first year of chemistry implementation.

Table 1: Events of identification indexing the identity trajectory of the scientist/educator.

Year	Month	Data	Event of identification
1	1	Description of scientist/educator within proposal materials.	PhD level disciplinary expert with experience in preservice teacher education and directing graduate students supporting schools.
1	10	Email to outside PD providers on the participating district schools.	Project coordination with position to represent the in-school community to national content/pedagogy experts.
3	4	Email to friends on failure to implement a lesson.	Limitation of scope of activity because of outsider role within schools.
3	6	Email to collaborators on implementation of model lesson and new materials (Figure 1).	Scientist/educator providing content-aligned materials for classroom use. (Figure 2)
4	3	Report on PD implementation for 2nd cohort of schools.	Role as PD provider representing detailed content and implementation knowledge.
4	4	Report on preparation of materials for classroom use.	Work to prepare for laboratory teaching and to bring chemical materials to the point of contact with students (Author 2018).
5	2	Report on implementation in a school for 3rd cohort school.	Status as expert in curriculum and materials with emergent limitations in the face of teacher layoffs.
5	10	Report on negotiations about curriculum alignment with a new school initiative.	Contingent position relative to other initiatives, school priorities, and district leadership changes.

The results exemplified in Table 2 constitute the basis for a description of the identity trajectory development. The events of identification involve the scientist/educator in a variety of relations with respect to other individuals, institutions, and the physical materials of the project. Over time, the sociohistorical model of identity of a *disciplinary expert* is consistently part of the models of identity. But another sociohistorical model begins to appear as a reference: that of *participant within the school*. This is seen, for example, when the status as

expert is combined with interactions surrounding the premature termination of the project. As a result, the scientist/educator moves from a metapragmatic model of identity of *outside expert* to that of *participant expert*.

Conclusions and implications

One of the important conclusions for this study concerns the nature of the social interactions that contribute to identity events for individuals in school settings. In the case of this scientist/educator, the data, exemplified by Figures 1 and 2, show many different interactions with teachers, with materials, and with the audience for the storytelling. The scientist/educator draws on scientific knowledge but, at that particular moment, also exhibits the ability to observe and report on learning in the classroom. Therefore, as we seek to engage more researchers and disciplinary experts in participatory work (Gomez et al 2019), it is important to develop these skills of observation and report in detailed ways. At the same time, the interaction of the scientist/educator with the disciplinary content—recasting the way to teach chemical stoichiometry—also points to opportunities to support reflection on content that speaks to its use in classroom settings. A second conclusion relates to the timeline and the outcomes of extended, identity-shaping engagement. The data in Table 2 covers a four-year span of work. This suggests the need to capture and analyze data of engagement over much longer periods than one year (compare Ye et al 2011) and also highlights the value of collecting naturalistic data over time (compare Skerrett & Sevian 2010).

The limitations of this work are those attendant on all case studies, compounded by limitations associated with self-analysis. However, it is hoped that the use of a consistent data analysis scheme for individual events and the identity trajectory provides indication of analytical generalizability for the results (Yin 2014).

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