The Role of Different Narratives in Recognizing Peer Expertise in Collaborative Programming Projects

Deborah A. Fields, Yasmin B. Kafai, Universtiy of Pennsylvania, 3700 Walnut Street, Philadelphia, PA 19104
Email: defields@upenn.edu, kafai@upenn.edu

Abstract: Much research has focused on identifying the role that various factors play in promoting interest and access in broadening participation in computing. Few studies have examined what happens once access is no longer the issue and the focus shifts to negotiating participation in collaborative programming activities. Peer experts, youth knowledgeable in programming, play an important role in providing assistance in group collaborations. In this paper, we examined two youth peer experts through a practice lens on identity with self- and others'-narratives to understand better what it means to gain recognition as a peer expert in a community. Our analyses suggests that becoming an expert involves acting and being received as such in practice, thinking about oneself as an expert (self-narrative), and having other people think about oneself as an expert (others'-narratives). We discuss these findings in terms of implications for supporting peer collaboration in computer supported collaborative learning.

Introduction

In this paper we address the issue of how expertise travels and what it means to gain recognition as a peer expert as a programmer in a local classroom community. More specifically, we focus on how young software designers develop personal agency with programming, move toward membership in a programming community, and gain status as experts amongst their peers. Rather than using peer or teacher ratings, we use an identity lens to understand how peer expertise is established in the context of a classroom community. This approach adopts a multi-facetted perspective by focusing on an individual's sense of self in creating things (Black, 2006), centralized participation amongst a group of people (Lave & Wenger, 1991), and how individuals are socially recognized by others (Gee, 2000/1). As part of a larger study researching youths' participation across multiple social settings in their lives, we focused on two case study youth and their interactions in small group projects during a 3-week, 6-session unit using a visual computer programming platform called Scratch in their 6th grade math class. Despite the youths' prior experience in Scratch and explicit positioning by the teacher as "experts," their peers rejected the more valuable expertise that they brought to the projects for several days. Through close video analysis of small group interactions, this analysis demonstrates the challenges the two youth encountered in being recognized in practice as being experts among their peers and the contrast in productive collaboration that occurred after their peers realized that the youths' knowledge was valuable to the project creation. At the end we discuss implications for supporting peer collaboration in computer supported collaborative learning.

Background

We draw on situated identity research to develop a framework to see becoming a peer expert as a set of interwoven *practices*: being 'named' as such by others, adopting a formal idea of oneself as an expert, and acting in social interaction. This framework is drawn from a situated meaning of identity that focuses on an individual within local social interaction (e.g. Lave & Wenger, 1991). This situated perspective frames people as acting in ways to position themselves relative to others in a local social setting, in other words we see identity at the intersection of the individual and the social (Holland, Lachiotte, Skinner & Cain, 1998). People neither have full ability to author themselves nor do others have full ability to position them; identity is iteratively shaped moment by moment over time through negotiations in social interaction. This means that being a programming expert cannot solely rest inside a person's idea of him- or herself. Instead, being an expert must be socially negotiated.

Further, we argue for three complementary lenses on identity: local acting and positioning in *practice*, the ways one thinks of oneself (*self-narratives*), and the ways that others think of one (*others'-narratives*). These lenses are mutually constitutive, and each builds on the others in interactive ways. A practice lens on identity accounts for the ways that a person's identity is both stabilized and changed during the course of interaction - how a social situation defines or constructs identity through practice and how an individual disrupts such construction through their actions (e.g. Wortham, 2006). A narrative lens on identity emphasizes self-understanding in the shape of narratives one tells about oneself. In particular Sfard and Prusak (2005) suggest defining identities as sets of narratives, "as collections of stories about persons or... as those narratives about individuals that are *reifying, endorsable,* and *significant*" (p. 16, italics in original). In this they suggest paying attention to the stories people tell about themselves or that others tell about them that influence 'who they are.' Here we draw together a practice lens on identity with self- and others'-narratives as further lenses on identity.

From this framework, becoming an expert involves acting and being received as such in practice, thinking about oneself as an expert (self-narrative), and having other people think about oneself as an expert (others'-narratives).

In the context of this paper, the two youth studied faced a situation where they had knowledge of programming that their peers did not and their teacher explicitly provided an others'-narrative that they were peer programming experts in front of the entire class. Despite this, they were not initially accepted as such by their peers, at least not in ways that would have allowed them to share valuable insights into programming. Previous research has shown that such students can be of great benefit in collaborative programming when teams are composed of both experienced and novice software designers (Ching & Kafai, 2008). The emerging informal "peer pedagogy" illustrates how those more advanced programmers are able to support and monitor their less experienced peers in programming design, with an eye towards facilitating rich learning experiences for the beginners. It is often assumed that others easily recognize such expertise. Indeed, age and status are often well established in classroom communities. Yet it is unclear how the process of negotiating expertise takes place within teams and what kinds of resources the more experienced designers draw upon in interactions. Further, in this paper we illuminate challenges in the recognition of peer expert status that impede such more expert peers from helping novice peers in useful ways.

Context and Methods

This study is based on a larger connective ethnography (Leander, 2008) of the two focus youth, Tyrone and Lucetta (both pseudonyms), across many social settings of their lives. Data collection drew from the three-pronged approach, including observations of a preceding after-school Scratch Club, the three-week Scratch Class, and across other subject areas at school and activities at home or with friends (practice); surveys of computing attitudes and monthly interviews with the youth (self-narratives), and careful attention to how others talked about the youth (others'-narratives). In addition we also collected their Scratch programs daily throughout the Club and the Class in order to analyze their developing skills as programmers. Though the focus of this paper is on the Scratch Class, analysis of the youths' participation in other settings provided information on how the youth learned Scratch, how they acted amongst their peers, and their typical kinds of participation in different subjects at school.

Two classes of twenty sixth-grade students each participated in using Scratch during a three-week unit in their math class in Spring 2008. In discussions with the teacher, the researchers designed a six-day unit where students made geometric art projects in math class to accompany a more general introduction to geometry. When possible, students with prior experience with Scratch were paired with the students who had no experience with Scratch. The projects involved a cycle of development, revision, and final presentations. During the first four days, students created the geometric art projects. At the end of the fourth day, they uploaded their projects to the Scratch website where students received constructive comments on their projects. At the beginning of the fifth day students eagerly went online to see their comments and engaged in a day and a half of intense revisions before presenting their projects to the rest of the class at the end of the sixth day.

Data analysis focused on the six days of kids' designing with Scratch in the class. Using an iterative video analysis approach (Erickson. 2006), we divided videos into short 1-2 minute interaction chunks and developed a two-step open coding based on grounded theory (Charmaz, 2000). Two categories emerged for the kind of programming and problem solving comments given by Tyrone and Lucetta: "procedural" suggestions and "conceptual" suggestions. "Procedural" suggestions refer to lower-level comments about single pieces of code and their functions. "Conceptual" suggestions refer to higher-level comments about the relationship *between* sets of scripts such as identifying conflicts and using sophisticated commands to link sets of scripts (loops, conditionals, and others). Below we describe how initially there was an underlying conflict between the novices' low-level comprehension of programming that focused on procedural understanding and Tyrone and Lucetta's higher-level comprehension that focused on conceptual understanding of the scripts.

Findings

Though both Lucetta and Tyrone came to the Class with prior experience in programming from an after-school Club, the partners in their groups did not recognize them as peer experts for several days. Instead, as we will demonstrate, the partners solicited and accepted low-level, procedural help while rejecting the higher-level conceptual help that both youth offered in the context of the programming projects. Though one might be inclined to think it was a problem of social personality, the lack of recognition exhibited itself despite very different ways of working within small groups. Below, we briefly describe Lucetta and Tyrone's prior experiences with programming, then move to illustrate the ways that their peers rejected their relative expertise with programming, how or when the peers shifted to recognizing Lucetta and Tyrone as peer experts, and the effects of this recognition on the small groups' projects.

Framing as Peer Experts in the Class

Both Tyrone and Lucetta were new to programming and most forms of digital design when they learned to use Scratch during the eight weeks of an after-school Club earlier in the Spring of that same year. By the end of the Club they had learned to use a number of scripts in Scratch, had worked on several projects, and had used the Scratch website to post, download, and remix projects. Though no one at the Club stood out as having any more expertise than others because they had all been learning to use Scratch for roughly the same period of time, this changed in the Scratch Class. The teacher (Ms. Franklin) and researchers purposefully framed students who had prior experience as "Scratch experts" and encouraged students to seek out help from them before asking the adults. In this way the teacher provided an others'-narrative to the experienced students by giving them the title of "expert" and directing them toward practices of teaching the "novice" students. The others'-narrative of being a peer expert in Scratch was a resource for identity development Yet though the others'-narrative was backed by the teacher's authority in the Class, by itself it was not enough to get the students to see Tyrone and Lucetta as peer experts.

Shifts in Identifying Tyrone and Lucetta as Peer Experts

At first sight, it appeared that because of personality differences Tyrone got along poorly with his partners while Lucetta got along perfectly with hers. In school Tyrone tended to ostracize peers outside of his close group of "geek" friends through his sarcastic sense of humor, especially girls. This applied to the girls who were his partners; he tended to explode in frustration when they did something he saw as incorrect and spoke in a negative, sarcastic manner about their mistakes. In contrast, Lucetta was a peacemaker among her friends and in the larger Class, reaching out to students who tended to be alone. Lucetta put her partner's interests first, making polite suggestions for things that they could do but generally following her partner's desires for the direction of the project. Yet despite these personality differences, whenever Tyrone or Lucetta offered conceptual level suggestions (invited and uninvited), their peers either ignored, argued against, or deflected the suggestions. For the first few days, only procedural answers were invited and accepted by their more novice peers.

For Tyrone, the small group interactions changed on the third day of the Scratch Class when he exploded with frustration. He stood up, interrupted his partners' planning conversation, and pointed to a command on the screen that was interrupting a series of commands and preventing the project from working. His partners, Carissa and Diana ignored his first attempt. When he tried again half a minute later, his voice rose and he elongated his words, emphasizing the code that was conflicting with others codes. Finally, one of his partners suggested taking a related command out, to which Tyrone agreed and Carissa finally seemed to understand that the codes were not needed for the project. This was the first time Carissa showed some understanding of the kind of interaction between scripts that Tyrone had repeatedly pointed out. This moment of intersubjectivity where Tyrone's partners finally seemed to understand the value of what he was saying for the project was a turning point in the group's collaborative activity.

Lucetta experienced a more quiet turnaround when her partner, Candy, began to recognize her as an expert on the fifth day of the Class. Earlier Candy had ignored Lucetta's suggestions, often saying they should just give up and start the project over. After they received online feedback on their project the girls played around with ideas for improving it, and at one of Lucetta's suggestions Candy replied in surprise, "Do you know how to do that?" This question points to the beginning of Candy's realization that Lucetta could accomplish desirable things in Scratch, a quiet turning point in their small group interactions. Throughout the remaining two days of the Class the two girls expressed excitement and problem-solved together, with both contributing to the building of the project in ideas and in the construction of scripts. Candy accepted all of Lucetta's suggestions, treating Lucetta as more of an expert.

Changed Interactions in Project Design

Despite their newfound acknowledgement of Tyrone's suggestions, Carissa and Diana did not straightaway implement his advice about taking out unnecessary scripts, so they did not see an immediate affect on their program. Still, their attitude toward him changed during this interaction. For the rest of period, rather than ignoring his uninvited suggestions, they responded to and implemented his advice. Understanding the need to make a set of scripts agree with each other seemed to lead to new respect for Tyrone's expertise. The group proceeded to work on their complex project. Later the girls responded more quickly to Tyrone's suggestions. They also began to include him in talk about the project, turning their heads to physically include him in their discussions of what they wanted to happen. Tyrone even made them laugh on occasion with his comments, further signaling his increasing inclusion in the group. In fact, Tyrone became a better teacher of Scratch, not just telling his partners what they should do, but explaining why things worked in certain ways, what effects some of their decisions would have, and what kinds of possibilities there could be in the program if they added certain sets of scripts. Still, sometimes Carissa and Diane ignored Tyrone's legitimate programming suggestions. In these situations Tyrone sometimes referred to a local authority – the researcher or another peer who had a higher reputation with programming – to back up his own instruction, again, in a sense creating his

own others'-narrative that supported his idea of himself as a peer expert. Thus Tyrone leveraged several narratives in pushing for recognition of his programming expertise: his own, his teacher, the researcher, and a more recognized peer expert. Further, his two partners now treated him as an expert in practice with positive results for their project.

In the small group interview after the Class, Tyrone and his partners reaffirmed this new narrative of Tyrone as an expert. Carissa and Diana said that it helped to ask Tyrone about things when they were stuck because "he's the expert," explicitly stating an others'-narrative of Tyrone as an expert. They also recognized that they learned to listen to Tyrone during the Class, who himself said that he learned "to be a better leader" and "It kinda felt like leadership skills - because I can naturally use the computer," echoing his teacher's comment from the first day that he was "the leader" in his small group. Consequently there were matching self- and others'-narratives about Tyrone as an expert/leader in programming in the Class.

Again, the case of Lucetta is less obvious than that of Tyrone. Though there had been an underlying conflict between Candy's novice understanding of programming and Lucetta's more sophisticated awareness, this conflict remained tacit because Lucetta did not explicitly appropriate Ms. Franklin's others'-narrative that she was a Scratch expert. Though she gently pressed on in her desire to make the project more complex and fix underlying problems, she often deferred to Candy and did not make loud exclamations of frustration when Candy ignored, argued against, or gave up on her comments. This was typical of a peacemaking role Lucetta took up in other areas of her life. Though Candy treated Lucetta differently in practice, she did not express succinct others'-narratives of Lucetta as an expert. The closest she came was in the interview after the Class, where Candy expressed, "Lucetta's really good with Scratch, so I think it helped me to become better with Scratch because I had never done it before." Here Candy provided others'-narratives that expressed respect for Lucetta's knowledge of programming in Scratch. Yet why did Lucetta not reiterate some o the most authoritative others'-narratives about her, such as that given by Ms. Franklin at the beginning of the Class? Perhaps because Lucetta already acted in a non-bossy, shepherding role and got along well with her partner, Ms. Franklin did not reiterate an others'-narrative of being an expert or leader to Lucetta as she had with Tyrone. Lucetta herself did not demonstrate Tyrone's frustration with developing a self-narrative as an expert, or at least of getting others to recognize her that way. Consequently though Lucetta acted like a peer expert with her higher level knowledge and was tacitly acknowledged as an expert in practice, the narratives of her as a Scratch expert were less succinct and clearly formed.

Discussion

In this paper, we focused our attention on the recognition of peer expertise in collaborative programming projects. Despite their teacher's publicly positioning them as experts and regardless of differences in how their small groups worked interpersonally, both Tyrone and Lucetta struggled to be recognized for their prior programming expertise with implications on their small groups' collaborative work.

We start our discussion by reflecting back on the use of three identity lenses to understanding peer expertise recognition. By understanding how students positioned themselves and how others (the teacher and peers) positioned them, we were able to better understand the coordination between different narratives, those of self and others. Most importantly, this highlights that recognition of peer expertise is not a one-way street but a process based on mutual recognition. For instance when Tyrone proclaimed that he learned "to be a better leader" it also coincided with his peers accepting his suggestions. Further, achieving status as a peer expert involved interactions amongst narratives by various others (the teacher, Tyrone's better known expert peer, small group partners), self-narratives by the two case study youth, and interactions in local practice where knowledge was shared and responded to within the small groups. Studying these three lenses allowed us to see relationships between self- and others'-narratives (e.g. between Ms. Franklin's narrative of Tyrone as an expert and leader and Tyrone's subsequent appropriation of these narratives with his peers) and between narratives and practice (e.g. between Ms. Franklin's narrative of the two youth as experts and their peers' treatment of them).

The study also highlights that while narratives are powerful artifacts in authoring people (both self and other), individuals also have power in determining which narratives to appropriate for themselves. One question raised in the study is why Tyrone appropriated and advertised the narrative of himself as a peer expert while Lucetta did not. Observations from the larger study suggest that one motivation for Tyrone was being a part of a "geeky" group of boys who prided themselves on producing with computers. In fact, Tyrone was the least competent of these friends in terms of creating media with computers, and his developing expertise with Scratch allowed him to participate at a deeper level with his peers. In contrast, Lucetta let the idea that she was an expert sit quietly in the background rather than brokering that narrative herself. She did not actively assist in the travel of this narrative with her partner and it did not appear to make as much of an impact in her life. One influence was likely the idea that she already thought of herself as more proficient in using computers than her family and friends, and her friends seemed to care more about social uses of computing (email and chat) than creating with computers. Another influence may be a gendered role she often took up with her friends and family, leading by supporting others' interests rather than her own. This points to the further complexity of motivations and

interests behind youths' appropriation of narratives.

The improved collaborative work on the programming projects illustrated here is further evidence that promoting peer pedagogy can be a productive way to facilitate computer supported collaborative learning and broaden participation in digital design practices. Of note, while the novices learned more about programming, Tyrone and Lucetta also deepened their knowledge of programming, using more complex scripts such as conditionals that they had not used in prior projects. Lucetta went so far as to say that Candy's ideas for the project had pushed her to develop some of this new programming expertise, commenting that they were not ideas she would have come up with on her own. It appeared that both youth were pushed deeper by working out some of the ideas their more novice peers expressed but did not know how to make happen.

Our paper is a complement to Ching and Kafai's (2008) paper on peer pedagogy that focused exclusively on how experts, as defined by age and experience, interacted with their younger peers in class. In their study, expertise was defined by having had prior programming knowledge from students' former year in a $4^{th}/5^{th}$ grade class, thus overlapping expertise with age. Our findings show some complications that can arise when the peer experts do not have outside status. Taking place in a single age classroom, Tyrone and Lucetta were not older than their peers nor did they have prior histories (narratives) of themselves as programmers with the other students in the sixth grade. Except for their teacher's statement calling them programming experts, they had little status to back up the suggestions that they made, even though their conceptual level suggestions were valid and helpful. Further research is needed to show whether peers who had more locally known histories as programmers or related experts would be able to provide higher level help without rejection by their partners. This research raises the question to what degree was the lack of peer recognition of Tyrone and Lucetta's relative expertise due to status or to an inability of more novice programmers to recognize the value of concepts with which they were unfamiliar.

In this paper we have illuminated some of the social and cultural barriers that can arise in helping youth develop identities as programmers and in using peer pedagogy to promote collaborative learning of programming. The learning evidenced in the groups' projects suggests peer pedagogy is a promising area in terms of learning programming, though the developing social interactions within the groups suggest that the path toward peer recognition, while important for collaborative learning, is potentially rocky. The complex interplay of narratives and practice reveals challenges in broadening participation in programming and promoting youths' identities as programmers with teachers and peers.

References

Black, R.W. (2008*). Adolescents and online fan fiction.* New York: Peter Lang.

Charmaz, K. (2000). Grounded theory: objectivist and constructivist methods. In N. K. Denzin, & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 509–535). Thousand Oaks, CA: Sage.

Ching, C. C., & Kafai, Y. B. (2008). Peer pedagogy: student collaboration and reflection in a learning through design project. Teachers College Press, 110 (12), 2601-2632.

Erickson, F. (2006). Definition and analysis of data from videotape: Some research procedures and their rationales. In J. Green, Camilli, G., & Elmore, P. (Ed.), Handbook of complementary methods in educational research. (3rd ed.) American Educational Research Association.

Holland, D., Lachicotte, W., Skinner, D., & Cain, C. (2001). *Identity and Agency in Cultural Worlds*. Cambridge, MA: Harvard University Press.

Lave, J. & Wenger, E. (1991). *Situated learning and legitimate peripheral participation*. Cambridge: Cambridge University Press.

Leander, K. M. (2008). Toward a connective ethnography of online/offline literacy networks. In D. Leu, J. Cairo, M. Knobel, & C. Lankshear (Eds*.) Handbook of research on new literacies.* New York: Erlbaum, 33-65.

Sfard, A., & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher, 34*(4), 14-22.

Wortham, S. (2006). *Learning identity: The joint emergence of social identification and academic learning*. Cambridge: Cambridge University Press.