Mentoring partnerships in a community technology centre: A constructionist approach for fostering equitable service learning

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Mentoring programmes have gained increasing popularity in institutions of higher education to support undergraduates in community service or outreach efforts. Many of these programmes partner mentors with inner-city youth, providing assistance in underserved communities while mentors gain experiences that connect theory and practice. Here we report on two years of fieldwork in a Community Technology Centre that created mentoring partnerships in which 36 liberal arts undergraduates engaged with local youth to design, create, and build technology projects involving graphics, video, music, and animation. We analysed over 200 field notes, which described their mentoring interactions over eight weeks and conducted exit interviews about their mentoring experiences. Our results indicate that mentors participated not just as more knowledgeable peers but also as facilitators, advisors, observers and, most importantly, as learners in this process. In the interviews, nearly all mentors reviewed assumptions about their own learning and mentoring, in addition to reflections about social issues. We discuss the importance of these findings for conceptualising mentoring as a partnership by creating more equitable interactions in service learning initiatives. We also address the role of constructionist activities in facilitating learning opportunities for both mentors and mentees.

Keywords: mentoring; constructionism; community technology centres

Introduction

Over the past few decades, mentoring has enjoyed a veritable renaissance in corporations, universities, youth organisations and religious and civic groups because it is seen as addressing both career-oriented and psycho-social issues faced by disadvantaged youth from under-resourced areas (Rhodes, 2002; Jacobi, 1991). While scholars and practitioners alike do not agree on a definition of mentoring, many base their efforts on a widely held view that mentoring involves acting as a guide, advisor and counselor to a mentee (Jacobi, 1991; Roberts, 2000; DuBois & Karcher, 2005). In recent years, this view of mentoring has come under critical review. Scholars, such as Sullivan (1996), have proposed a broader notion of mentoring, where mentoring is seen as less hierarchical but more relational and reciprocal between a mentor and a mentee. Such views of mentoring suggest designing mentoring initiatives that stress more equitable mentoring interactions and consider mentees and mentors alike as learners and teachers.

It is the purpose of this paper to illustrate how such an expanded notion of mentoring can be seen in an approach called mentoring partnerships. Mentoring partnerships build on features present in many successful efforts and have undergraduate students mentor in a Community Technology Centre (CTC) that provides local youth with access to creative design technologies.

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The partnership is built on the assumption that college youth, who often have unprecedented access to technology use in their daily lives and schooling, might be well positioned to work on technology projects with urban youth from underserved communities often described as the primary victims of the digital divide (Warschauer, 2004). Yet when faced with design technologies, most undergraduates, especially those from the liberal arts, have little experience beyond web browsing and game playing (Goode, 2004) and thus find themselves in situations at the CTC where they become learners of new creative technologies. For this reason, mentoring partnerships offer the possibility of a more equitable and reciprocal relationship that opposes the deficit perspective prevalent in many mentoring efforts (Villalpando & Solorzano, 2005). This perspective assumes that only mentors are the providers of advice and holders of knowledge found lacking in mentees (Walker, 1996).

Here we report on two years of fieldwork in a CTC that created mentoring partnerships in which over 36 liberal arts undergraduates engaged with local youth to design, create, and build technology projects involving graphics, video, music, and animation. The constructionist learning philosophy (Kafai, 2006; Papert, 1993) that guided the activities at the CTC emphasises the design and sharing of artefacts within a community (Resnick, Rusk & Cooke, 1998). Within this context, mentors can be seen learning about, with, and from mentees. We were particularly interested in how the mentoring interactions with CTC participants would develop given the CTC environment and the lack of technological experience of the undergraduates. We collected and analysed 213 field notes in which the mentors reported on their activities during the eight weeks at the field internship site to address the following research questions: How could we characterise the type of mentoring interactions reported by mentors? Who initiated the mentoring interactions? Did particular types of technology activities influence the type of mentoring? In addition, we conducted exit interviews in groups about their mentoring experiences.

Literature review

While mentoring is a popular activity, neither researchers nor practitioners have an agreed upon definition for the mentoring concept (Jacobi, 1991; DuBois & Karcher, 2005). When Roberts (2000) conducted an analysis of the mentoring literature covering the last twenty years in different fields, he arrived at the following definition: mentoring is 'a formalised process whereby a more knowledgeable and experienced person actuates a supportive role of overseeing and encouraging reflection and learning within a less experienced and knowledgeable person, so as to facilitate that person's career and personal development' (p. 162). It is clear from this definition, as well as the similarity of many others, that the knowledge and experience differential between mentor and mentee is seen as a defining trait of the mentoring situation.

Other scholars have proposed broader notions of mentoring, among them Sullivan (1996) who utilises the metaphor of a *muse* – women in mythology who acted as sources of inspiration and sparked the imagination of the artist – in her work to describe the mentoring process as relational and reciprocal:

> Thus, instead of a *helping model* of mentoring, which often assumes deficiencies in the adolescent [or student] ... a *relational model* [r]ecognises the diversity of needs and resources among girls [and boys] of varied backgrounds, assumes that both adolescent [/student] and adult possess vulnerabilities and strengths, and values the contributions of both partners in relationship (pp. 226–227).

In this view of mentoring both parties benefit from the relationship and there is also a stronger sense of reciprocity and multi-directionality. Sullivan calls for an *evocative relationship*, which she describes as, '[u]nlike mentoring, which may be more unidirectional, transitional, and ultimately facilitative of separation, these are relationships that are decidedly more mutual, marked both by constancy and connection' (p. 246). Here the mentor and the mentee are on a level playing

field in a mentoring relationship that is more inclusive and less restrictive for the roles of both mentor and mentee.

It is this expanded notion of mentoring that led us to review the research literature for the roles available to mentors. While mentors are often characterised as teachers and guides who provide information and advisement, assist in decision-making, and help identify mentee strengths and areas of improvement, there is in fact a rich literature that suggests mentors often assume additional roles in the mentoring interactions. In Flaxman's view (1992), mentors can take on various roles as teacher, advisor, supporter and companion. For this reason, Shapiro (1978), Hagarty (1986) and Clawson (1985) suggest a continuum approach (cited in Monaghan & Lunt, 1992) in which the mentor moves from apprenticing to friendship to peer support. In light of these discussions, Monaghan and Lunt (1992) state, '[a] danger in all of these approaches is their prescriptiveness…. We hold simply that a mentor relationship can be viewed in many ways' (p. 249). It is clear from this review that mentors can be seen playing many different roles (Lucas, 2001; DuBois & Karcher, 2005).

Noticeably absent from all of these discussions is a role that is of particular interest to us, that of the mentor as learner. Previous discussions of the learning benefits in mentoring include improved self-esteem, increased opportunities to interact with peers different than themselves, and master social competence (Barton-Arwood, Jolivette & Massey, 2000) and civic participation (Walker, 1996). However, these benefits are seen as outcomes and not as features of the mentoring process, itself. There is little discussion, if any, that expands the continuum of mentoring roles from teachers to learners and thus would be more inclusive of a view that sees mentoring as a reciprocal rather than a hierarchical relationship. Such a view of mentoring would also counteract the implicit deficit thinking present in mentoring approaches, which oftentimes assume a patronising undertaking, where urban youth need to be rescued from their self-destructive behaviour (Flaxman, 1992; Guetzloe, 1997; Kretzmann & McKnight, 1993). Moreover, mentees are seen as incapable of making the right choices due to their environment and their socialisation, and it is often assumed that they do not have human agency to change their conditions.

These expanded views of mentoring are in line with current discussions of service learning (Hart, 2006; Howard, 2006) that see mentoring efforts as a way to address the lack of social and academic capital available to marginalised youth. Researchers, such as Hart (2006), also argue that in service learning 'the relationship must be reciprocal, so that one member of the partnership is not privileged over another, and that all members of the partnership experience mutual benefits' (p. 27). He asks for mentoring to be a process

> of recognition through reflection on action, whereby students come to recognise how not only they are positioned by society, but to also understand how others are positioned within this same social context…. The act of reflecting moves from a simple individualistic notion of locating oneself within the service-learning experience to a broader understanding in which the individual must locate oneself in conjunction with the service-learning experience and its connection to a larger social and political context. (p. 27)

Learner roles in mentoring partnerships could provide such a context for reflection-on-action because mentors derive their understanding from engaging in reciprocal relationships as both teachers and learners across the continuum of mentoring. Hart and others (Butin, 2003; Daigre, 2000) align themselves with critical pedagogies that provide mentors with a lens through which to examine their service learning experience. We position that constructionist pedagogy is equally well suited to provide such opportunities for reflection-on-action (Papert, 1991) by placing mentors in service-learning contexts that allow for fluid shifts in mentoring roles and contributions in the relationship. While many service-learning efforts concentrate on schools, we chose an after-school CTC that promoted creative and design-based technology not often accessible to low-income youth (Warschauer, 2004).

In the context of our study, we examined mentoring that was reported by the undergraduate students in extensive field note reports over several weeks. Mentors also participated in a university seminar that provided a context for critical reflection on their mentoring experiences and issues around access to technology skills, content and resources in addition to gender, race and class issues. In the first step of our analysis, we characterised the range of different roles reported by the mentors in their field notes. Then we clustered these roles into five distinct groups that span a continuum: Teaching, Facilitating, Co-Constructing, Observing, and Learning. We also examined who initiated mentoring interactions as a further indicator for more equitable relationships. We then categorised the content of mentoring interactions to find evidence of which type of technology activities connected to which mentor roles. In addition, we interviewed mentors at the end about their mentoring experience where they reflected upon social issues related to the community and technology, and their own mentoring roles and learning with technology.

Context

Our study was conducted in a Community Technology Centre (CTC), which is part of a local community organisation based in a low-income, working class neighbourhood in South Los Angeles. The street on which the CTC is situated is home to both Latino/a and African American communities, where many other community organisations – particularly churches – are centrally located. The local community organisation has been in existence for over a decade, with the express vision to enhance personal growth and development among underserved youth by teaching self-confidence and career building skills that will enable them to lead self-fulfilling and productive lives.

The CTC is located in a strip mall accessible from the street and opens its doors in the afternoon for four to five hours. It serves primarily African-American and Latino youth, ages 8-18. Two full-time coordinators run the day-to-day operations and facilitate activities. The goal of the CTC is to provide members from underserved communities with opportunities to design, create, and invent with cutting-edge technologies, in order to become more capable, creative, and confident learners (Resnick, Rusk, & Cooke, 1998). Youth become members of the centre – at no cost to them or their families – and work on design-based projects based on their own interests. The CTC does not resemble a traditional computer laboratory; instead of rows of computer monitors lined up against the walls, four clusters of computers are strategically arranged around the room so that members can face one another, which provide opportunities for authentic interaction and collaboration. Design-based projects at the CTC are primarily created using editions of professional software such as Adobe Photoshop, Macromedia Flash and Bryce5 3D-animation.

Before we started our project in 2003, there were no regular mentors at the CTC, with the exception of one long-term volunteer. We sought out a partnership with the CTC, initiated by a technology development grant that involved the introduction and setup of a media-rich software design program for urban youth (Resnick, Kafai & Maeda, 2003). We offered an education minor course that focused on gender, culture and technology at a major public university on the west coast. This undergraduate course featured both a seminar and field internship component. As part of the course's field internship requirement, undergraduates became mentors at a CTC where they supported members in planning, developing and completing programming projects. Undergraduate mentors were never formally assigned to one particular member; rather, undergraduates were invited to spend time in the informal environment of the CTC and to feel free to take initiative with any members, as well as making oneself available to be approached by members. In the research literature this approach has also been called group mentoring (Herrera, Vang & Gale, 2002).

Methods

Participants

All the participating mentors were enrolled in our seminar and field internship component. A total of 36 students participated in the course; most of them were women (with the exception of nine men) and came from diverse ethnic backgrounds. Students were either in their third or fourth year of their undergraduate study. All students were informed about the research study and were given the option to sign a consent form, which would release their field notes and information from focus group interviews for research purposes. Only one undergraduate chose not to release her coursework and information to the research data pool and was subsequently excluded from any analyses.

Data sources

For this study, we collected a total of 213 field notes from the participating undergraduate mentors. Each undergraduate went at least once a week during the eight-week field internship component of the course and produced seven field notes between five to six pages long. We collected 34 field notes for each of the first five weeks, and then 28 and 17 for week six and seven respectively. The reduction in the total number of field notes for the sixth and seventh site visits is due to undergraduate scheduling difficulties and Clubhouse closures. Students were instructed to write their field notes immediately after their visits; during their time at the CTC, they could take short breaks to jot down observations but note taking was not permissible by the CTC during mentoring activities.

At the end of the seminar, we also conducted debriefing interviews with small groups of two to four undergraduates about their mentoring experiences. In these interviews, we used the following questions to start conversations between mentors: How did you see your role as a mentor at the beginning of the quarter? How do you see your role as a mentor now? What surprised you most in your mentoring experience? What was the hardest part about mentoring? What was the easiest? Each interview lasted about 15-20 minutes. All of the interviews were transcribed in preparation for later analyses.

Data analysis

Our two main sources of data were the field notes and the transcripts of the group interviews. We worked together to create a set of descriptive codes for the mentoring activities and contexts using the field notes collected during the first course. This process generated various mentoring activities that we condensed in iterative rounds to five roles: teaching, facilitating, co-constructing, observing, and learning. Our goal was not to account for all recorded mentoring interactions in the field notes but to focus on those that described sustained mentoring. We defined sustained mentoring as any activity where a mentor was interacting with a mentee over an extended period of time (a minimum of 15-20 minutes). In the field notes, either the length of the passage or the description of the amount of time that took place during the activity indicated this. We then coded all sustained mentoring interactions in field notes according to their focus: teaching, facilitating, co-constructing, observing, and learning.

Mentoring interactions were coded as *teaching* if the mentor dictated or controlled the majority of the content and structure of the interaction and there was evidence of intent to teach the mentee in a given activity with expressions like 'I taught', 'I showed'. In *facilitating*, the mentor led the activity by providing just enough support and guidance to allow the mentee to explore and discover an activity at their own pace. The mentee actively participated and provided input and may have even driven the content of the activity, but the mentor was seen as a source of

information/support that was called upon when needed. Words like 'helped', 'supported', 'showed', and 'encouraged' were used in describing these interactions. In *co-constructing*, the interaction was characterised by reciprocity between the mentor and mentee, where neither dominated the content or character of the interaction. These activities were co-constructed, where both mentee and mentor contributed and learned through the course of the interaction. There was noticeable give and take and a relationship of fairly equal standing within the activity was noticed. Words like 'we' and verbs like 'suggest' were frequently used in these passages. In *observing* (audience), the mentee led the content and character of the interaction but the mentor did not report that they were learning from the activity in their field notes, nor were the mentors seen as a source of information/guidance by the mentee. Words like 'observed,' 'watched', or 'questioned' were used. Finally, the code for *learning* was given to interactions where the mentee led with an intention to teach, and there was evidence that the mentor was learning from the interaction. The mentee was actively leading and explaining an activity with the mentor. Words and phrases such as 'learned', 'showed me', and 'I found out' were used. See Table 1 for example excerpts from field notes.

Table 1.   Field note examples for mentoring roles.

Mentoring role	Field note examples
Teaching	'I really enjoyed teaching them how to type because they were both so exited and enthusiastic about learning the correct way to type…Their typing forms greatly improved, but much work still needs to be done.'
	'I showed him how to upload a picture of him, and then I walked him through the editing process.'
	'I told her to place the white arrow on the picture that she wanted to download and press the right button on the mouse and click on "Save Picture As"…. I told her to do this for each individual picture. She had problems doing this so I had to ask her if I can use the mouse so I can show her what buttons she needed to press.'
Facilitating	'I sat next to John as he used trial and error to figure the solutions to the problems. Every now and then I would give him my input.'
	'He choose what games he played and I just guided him through the questions and asked him things to find the solution.'
	'I wanted to continue to give Paulina ownership over the project, so I tried to serve as an initiator of different experiments with the program, but intentionally conceded all decision making and design choice to her.'
Co-constructing	'We switched off controlling the mouse and tried to help each other by making suggestions. Jon would say things like, "OH! I think I know what we need to do." I would also say similar things when he was controlling the mouse, like, "AH, maybe you have to…." '
	'Rosie and I experimented with the glide function. We knew where we wanted the dolphin to start and end but we did not know the coordinates of the two places…. Rosie and I finally made the dolphin move the way we wanted it to.'
Observing	'I sat back while Marisol did all the work. She didn't ask for my input and I did not give it. Instead she would do something to the face and then look at me. Wait for a reaction and then move on.'
	'He showed me how many clams he had and was showing me the new levels he had completed. (He seemed to like showing me all his accomplishments because he just showed me without me asking.'

Table 1. *(Continued)*.

Mentoring role	Field note examples
Learning	'When it failed, Alex…came over and showed me how to build the coaster the right way…. Through his help I was able to understand how you have to go about making the rollercoaster and why it only allows you to use certain pieces at certain times."
	'I said, "Okay, but only if you help me because I've never done this before." [Isaac was a good teacher.] He taught me step by step.'
	'When I asked him how they were able to make movies he said, "OK. look I'm going to show you." He opened a new file and began to show me step by step how to make a movie.'

In addition, we coded each mentoring interaction for who initiated the interaction – the mentor, mentee or other – and for its content, distinguishing between design, games, web, homework, and social activities. Design activities involved the use of programming, 3D-animation, and graphic software such as Scratch, Kai's SuperGoo, Bryce5, Photoshop, KidPix, game design programs such as RPGmaker, and music production software. Game activities included both games on the computer, such as Roller Coaster (Tycoon), School Tycoon, video and online games, such as Whyville.net, as well as board and card games, foosball, and air hockey. Web activities involved web surfing with a mentee, while homework involved mentors helping mentees with their homework. We also created a 'personal' category to include all social activities and interactions between the mentor and mentee that establish and build upon the interpersonal relationship outside of the context of the other activities. Examples include a mentee or mentor sharing information about their lives to the other, advising, and/or listening. Four graduate students, in accordance with these three categories, coded all field notes independently. A subset consisting of 64 field notes was coded by all and revealed a reliability of 85–92%. The remaining field notes were then recoded independently.

For the group interviews, we identified three themes – social issues, mentoring, and learning – in the transcripts. We first identified pertinent segments in the interviews by highlighting them and then two researchers rated them independently according to the following definitions: Researchers coded for 'social issues' if students addressed in the interview topics such as perceived deficits, digital divide, and lack of resources in communities. Additionally, statements that addressed their mentoring roles were coded for 'mentoring', if students addressed their initial perceptions of who they were as mentors or who they saw their mentoring roles at the end. The mentors also addressed issues about their own learning when noting how much or how little they knew, and this was coded as 'learning' See Table 2 for examples of statements.

Researchers coded for themes rather than individual statements because these were group interviews and participants often expressed agreements with statements voiced by others; thus we did not expect every participant to repeat impressions. We also were not always able to identify speakers in the group conversations because the interviews were audiotaped and not videotaped.

Findings

Mentoring experiences

Our analyses of the field notes revealed that the undergraduate mentors sustained various mentoring interactions ranging from teaching to learning during the course of their field internship. The most frequent types were co-constructive interactions (n=152) followed by facilitating (n=122), observing (n=79), teaching (n=68), and learning (n=53). What is most interesting about this

Table 2. Interview examples for mentoring reflections.

Mentoring reflections	Interview statement
Social issues	'Didn't know compared to what they knew. Usually…mentorship…you usually go into…. It's often associated with like in a way with deficit thinking because like they need a mentor. They don't have this, so we are going to go in there and be a mentor. That's how it was associated in with my brain. Once I was there, it was completely not like that. So that was the biggest surprise.'
	'I think the hardest part was going in with like stereotypes like "oh these kids probably have broken homes or something." Let's be gentle with them and stuff. Like that affected me on how I interacted with them because I didn't want to meddle with. If something was going on and so the hardest thing was going in with those stereotypes and seeing how it affected how you mentored.'
Mentoring	'I was actually surprised because I really didn't think I was going to actually learn from the kids. When I went in I thought oh they are going to have to come with me and ask me for help. But after the roles begin to change I was like okay…I was really surprised.'
	'Oh, my biggest thing was seeing myself more of an authority, like teacher, guide, that I finally felt comfortable with last quarter. By this quarter I feel more like a friend, a member myself, and more comfortable to explore programs by myself and not just being there to help the kids.'
Learning	'We –yeah – I definitely thought it was a learning experience not only for them but for us. and I was actually kind of scared in the beginning of the quarter because it was a course on Culture, Gender and Technology and I know I 'm not that good at computers so I thought we were suppose to go there and help them with computers but when I got there it was them helping us and so going there and reflecting on it at home was a very effective learning experience by itself. It was definitely not what I expected.'
	'I learned that I could do these things. I never knew that there were programs like this that would help you create these stories like this. I thought it was really elaborate. I didn't know what programming meant. I thought it was like keys…like matrix. And it was so easy.'

distribution is the prevalence of mentoring interactions that place the mentor in the role of learner, observer or co-constructor: all roles which imply a more reciprocal and equitable relationship between mentor and mentees. Teaching and facilitating are still part of mentoring but they don't dominate the interactions as they would in a conventional setting. When we examined the distribution of roles in each student's mentoring, not one undergraduate reported just one role. Most mentors described multiple roles of mentoring during one visit as the following excerpts from one mentor's field notes illustrate:

…When I came back, Amanda had attracted a large crowd of both members and…mentors. This was mainly due to her Scratch animation involving a knight getting his head bitten off by a dragon. One member, Arnold…was really interested. Stacey [another mentor] and I asked if he wanted us to help him make something like that…Stacey and I taught Arnold some simple animation moves that allowed him to animate the characters… [Coded as: Teacher Role]

…Throughout the animation portion, Stacey and I found that he [Arnold] was narrating the whole project…. Stacey and I decided that we should include a sound clip of Arnold narrating the action…. Rather than constantly give him feedback, Stacey and I let him figure out what narrative voice to use since our interference might hinder his work. [Coded as: Observer Role].

After forming the basic animations and narration, we still had to figure out how to animate the soldier's beheading. Amanda…showed us some of her project so then we could understand how she

switched head graphics. We learned from looking at Amanda's animation grid that in order to switch graphics…[Coded as: Learner Role].

Our analysis of undergraduate mentoring profiles found some variation in both distribution and number of reported mentoring interactions. The average frequency of sustained mentoring was 14 interactions over the course of their visits, with a minimum of five and a maximum of 24 reported interactions. These differences might be due to the fact that some students spend more time describing a few interactions in more detail while others had numerous mentoring interactions but which did not all qualify as sustained interactions. Some students also had a slow start with their mentoring, interacting less with members during their first few visits. The mentoring profiles revealed that 16 of the 36 mentors covered the full range of mentoring interactions in the course of their internship while others reported a shorter range, from teaching to co-constructing or observing to learning.

Mentor roles also varied over time, as indicated by the distribution in Figure 1. While all mentoring roles were present at all time points, we see considerable fluctuations over the course of the weeks: co-construction and facilitation seem to change places at the beginning and at the end of the field internship. While we would not expect an even distribution of all roles at all times, it is unclear what provoked these variations. It is possible that mentors took on being facilitators more at the end once they became more familiar with the software.

Nearly one half of all mentoring interactions (48%) were initiated by mentors compared to one third by mentees (32%); co-ordinators, other mentors, or an unknown person initiated 20% of all sustained mentoring interactions. This finding confirms the central role that mentors play in the life of the CTC in engaging and sustaining activities. But these numbers also point out that mentees sought out these contacts, and thus indicated an active stance towards requesting assistance or suggestions by others. Figure 2 breaks down the types of interactions that took place between mentors and mentees. As indicated in the graph, the range of mentor interactions was
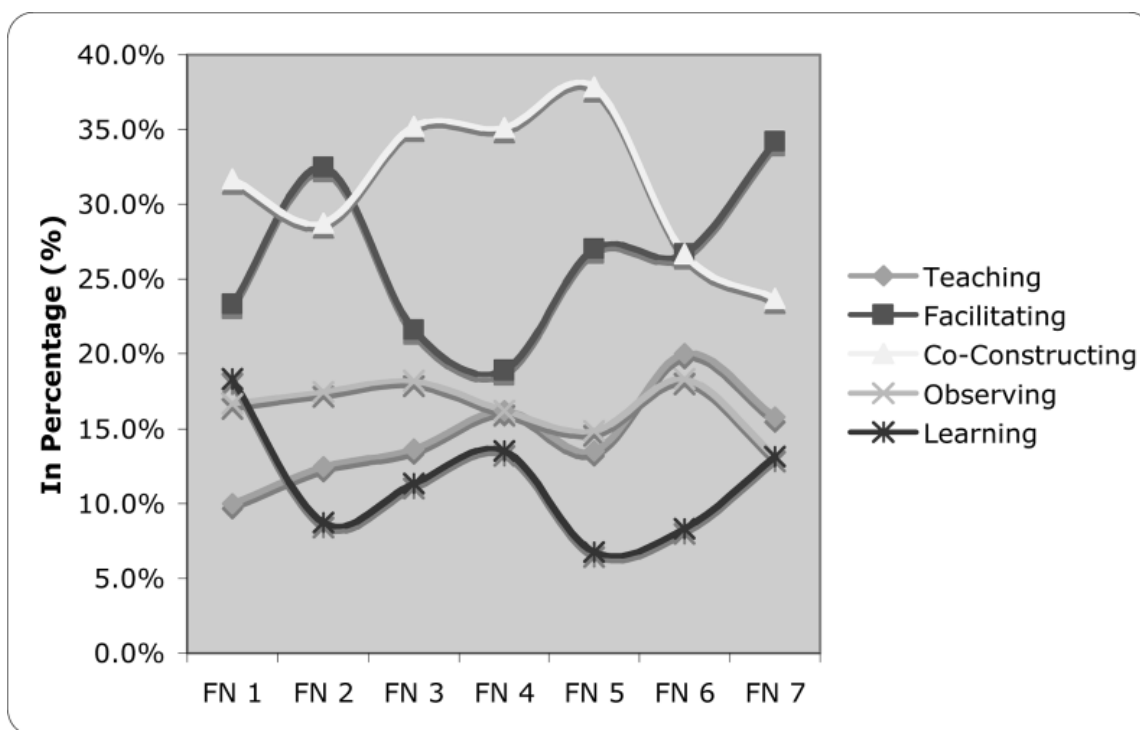

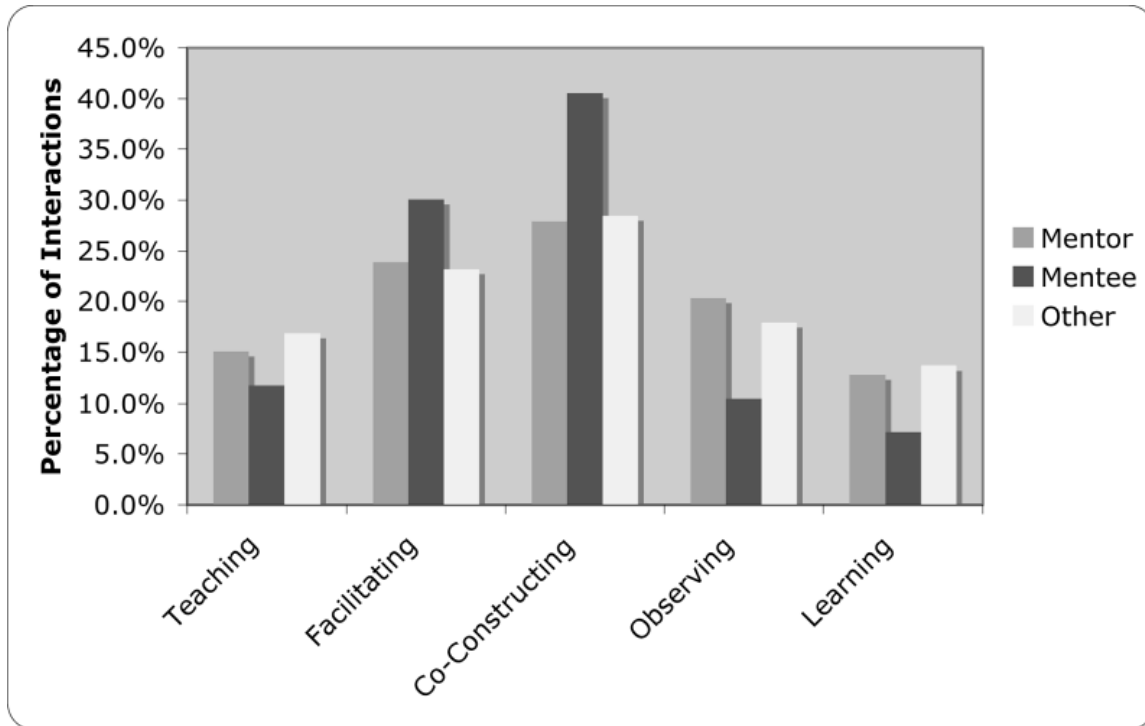Figure 1.   Mentoring interactions over time.

Figure 2.   Percentage of sustained mentoring interactions by role.

primarily between facilitator (25%), co-construction (30%) and observer roles (20%). For the mentees, they mainly participated in co-construction (40%) and facilitator (30%) roles. This data reveals that mentoring at the CTC was chiefly a co-constructed affair where both mentors and mentees collaborated to create projects. Moreover, this co-constructed mentoring activity leads to a more equitable relationship where both participants learn from each other.

When we examined the context of sustained mentoring, design activities took the lead with 43%, followed by games (30%), socialising (17%), and then web surfing and homework with 5% each (see Figure 3).

It should come as no surprise that design activities were most popular with co-constructive mentoring. In design activities, mentees often invited mentors to join them in an effort to create a program, graphic design or song and solicit their opinions as well as those of others. The following example illustrates how design activities can provide a context for a more equitable relationship between mentor and mentee:

> After we made the character's body move, I asked Jacob if he wanted to change any parts of the character. 'Yes and I want the background to be a jungle.'. … We asked [another mentor] what to do after this. She showed us how to save the picture on the server and in the Scratch folder. She labelled it 'nature Jacob'. We went back to the Scratch program and chose the background sprite.… We decided that we wanted the sleigh to fly. We used the glide control and the sleigh and reindeer glided, but then intersected at the top. We kept trying to figure out how to not make it do that. [The other mentor] came by and suggested that we change our x and y positions. [Coded as: Co-constructor Role].

But also other contexts, such as games, could invite a collaborative interaction between Mentor and mentee:

> One student who had never logged into Whyville – Laurent – asked for my help. I told him I too had never logged in and thought we could figure it out together… I found it helpful to really learn the in's and out's [sic] of Whyville with Laurent since we both did not know how to use it. [Coded as: Co-constructor Role].
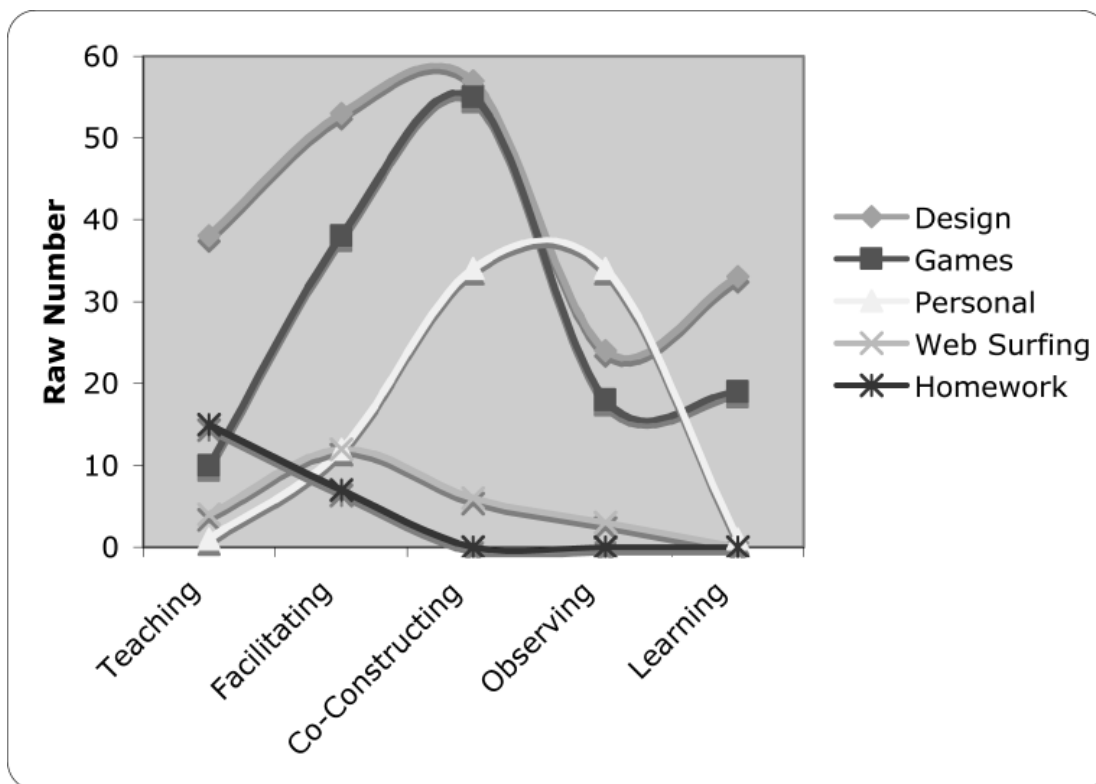
Figure 3.   Distribution of mentoring role by activity.

Mentoring reflections

The exit interviews, as well as previous seminar discussions, provided an opportunity for students' reflection-upon-action that Hart (2006) saw as a key component for engagement in critical service-learning. In five of the twelve group interviews, students brought up social issues associated with the community they visited, misconceptions they held initially about the CTC members and their lack of access to resources. One of the mentors articulated this very clearly in the following passage:

> [There are] a lot of preconceived notions people have going into the clubhouse.… I'm not going to sit here and lie and say that I didn't already have these fed assumptions of these kids. I did take into account that I'm going to work in Inglewood and South Central. I'm thinking…not because they are not intellectually capable of it, it's just the things they have been exposed to [up to] this day I am assuming is limited. I was completely wrong.

In addition, students' reported changes in perceptions of their roles as mentors, gaining an understanding that being a learner is an equally important facet of critical learning. In ten out of twelve group interviews, the undergraduates reflected on their own learning and understanding about technology, and in nine out of twelve group interviews, they addressed changes in their mentoring roles. The following excerpt illustrates how undergraduates perceived their multiple mentoring roles and learning with technology:

> I think it changed from being thought of as being a tutor/teacher and turned into something more like a supporter/companion…. But the most important thing I learned in this class was that you don't need to pick between roles. You could be at the computers and learning Scratch together, and it was like them teaching me something, and me teaching them something back, and us working together.

Themes in their answers often included being self-conscious about their lack of technology skills and knowledge as well as their lack of confidence in being able to learn these computer programs. Undergraduates often explicitly addressed their changed understanding of software design or programming:

> I think it [Scratch] changed my idea of what programming was. Because I first thought that programming was super boring and super hard and only the people who make the computers really know how to do it.

Reflections about their roles as learners were often connected to a perceived lack of understanding of technology but also contained more general assessments of mentors' room for learning far above and beyond what they thought they could do.

Discussion

In line with previous discussions in the research literature, our findings demonstrate that mentoring can comprise of different interactions ranging from teaching to learning. Mentoring thus should be seen as a continuum and not a set of prescribed roles. We noticed the fluidity of when and how often these different roles were applied over the course of the internship but no clear pattern could be discerned that would suggest a particular trajectory. We believe that the group mentoring arrangement in the CTC might have contributed to this fluidity because mentors were not assigned to particular mentees. While continued relationships were forged between some of the mentors and mentees, mentoring interactions changed more frequently depending on who was present, with what kind of needs and project ideas.

In addition to the group-mentoring situation, the focus on design activities in the mentoring partnerships facilitated a placement of mentors in the roles of learners and co-constructors. We found that learning roles were overwhelmingly associated with design activities. Most of the design software, including the computer programming, were not activities that the mentors had engaged in outside of the seminar or had encountered before. Nearly one quarter of all reported mentoring interactions focused on design activities, which might also explain the strong presence of co-constructive interactions in the field notes that put mentors and mentees on more equal footing. Previous discussions of the learning benefits of mentoring have addressed aspects such as civic participation, improved self-esteem, increased opportunities to interact with peers different than themselves (Barton-Arwood, Jolivette & Massey, 2000; Walker, 1996), but these benefits were seen as outcomes and not as features of the mentoring process itself.

We know from students' discussions that many of them initially conceptualised mentoring to be more like tutoring based on their prior experiences tutoring individual high school students or in programmes such as *America Reads!,* a programme in which college undergraduates tutor K-12 students in reading. Many of these traditional and worthwhile mentoring initiatives are built on an inherent knowledge differential between the mentor and mentee and thus often assume inadvertently a deficit perspective. The participation in mentoring partnerships led mentors to reflect on these assumptions and related social issues. These considerations covered the gamut from personal perceptions about youth living in underserved communities and what they can do to larger societal issues of who has access to technology resources and knowledge. The presence of the CTC visibly exemplified these disjunctures by offering high-tech resources in a low-income community unfamiliar to non-tech-savvy mentors coming from a privileged setting of a research university (Kafai, Peppler, & Chiu, 2007). These perceptions were largely challenged in their collaborations on design projects with CTC members, when mentors got to know their mentees on a personal level, when they learned from them, when they collaborated with them and when they taught them.

One limitation of our findings is the nature of our data: self-reported mentoring interactions described in the field notes by the mentors. We can assume that the field notes are not full accounts of mentoring interactions, but include biases from multiple perspectives. One possible bias comes from the selection of accounts reported in field notes. Mentors might only report interactions that they seem to see fit within the context of their field internship. In addition, a recency effect could also favour later interactions over earlier interactions and impact the detail of reporting because of the field-note-taking constraints imposed at the site. We hoped, by collecting field notes over several weeks and over several courses, to counterbalance some of these biases. We also need to acknowledge a learning curve that took place within the field internship as mentors got to better know the CTC and its members and thus started engaging in different interactions.

Conclusions

This study contributed to a growing body of research and practice on the connections between mentoring and community service learning (see special issue in *Mentoring & Tutoring*, 2006). We conceptualised mentoring as a partnership that would lead mentors to be in the role of learners and thus challenge a core assumption on who can be a mentor for whom. Our findings suggest that previous experience is a possible, but not necessary, prerequisite for mentoring. The idea of having mentors learn along with their mentees offers a promising venue to rethink key aspects of mentoring: it moves mentoring away from the deficit perception of mentees, it expands our notion of mentoring to include the learning of mentors and it allows us to consider a much wider range of mentors' backgrounds and contexts for mentoring activities.

We found that the learning roles were overwhelmingly associated with design activities. This finding may be of interest to other programmes wanting to stimulate a full range of mentoring roles in their settings. We think that constructionist learning activities which place both mentees and mentors in the role of designers offer a particularly promising avenue to consider contexts in which mentors and mentees partner with each other. Our research suggests that collaboration around projects in which both partners are learning can be an effective mentoring strategy. Mentoring partnerships within the context of service learning can be of benefit to all – the community, the mentees and the mentors.

Acknowledgements

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