

6

This chapter explores the unique, often horizontal, peer education dynamics found in doctoral education, which are far less understood than the role of undergraduate peer educators.

Peers in Doctoral Education: Unrecognized Learning Partners

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The role of peers in U.S. doctoral education is a topic that has been minimally researched and has received only passing attention. Yet peers are an important part of every doctoral learning community. One possible explanation for the lack of attention given to peers in doctoral education is that pedagogically, doctoral education is generally thought of as an apprenticeship in which doctoral students learn primarily from one master: their advisor (Golde and Dore 2001; Kwiram 2006). Researchers from the Carnegie Initiative on the Doctorate, a five-year action and research project on restructuring doctoral education, identified the apprenticeship model as the signature pedagogy of doctoral education (Shulman 2004; Walker, Golde, Jones, Bueschel, and Hutchings 2008). Shulman (2004, 89) suggests that “one of the sturdiest and most distinctive features of doctoral education is that so much of the important teaching and learning takes place in a one-to-one apprenticeship between student and faculty member.” Although more research is needed to determine whether or not the apprenticeship model fully reflects how doctoral students learn to do research (Flores 2011), this model tends to overlook the larger environmental context of doctoral education and the role that different learning communities, including peers, can play in students’ development as independent researchers.

As previous chapters illustrate, peer support at the undergraduate level is recognized for having a significant impact on student retention, learning, and the social and emotional development of students. In doctoral education, peers are not generally considered to be educators or leaders as defined in the undergraduate literature (Cuseo 2010). The reason for this is that the terms “educator” and “leader” traditionally signify someone with more expertise and knowledge, resulting in more of a vertical learning process and relationship.

Instead, similar to the findings of Boud and Lee (2005), we have found that peer learning at the doctoral level is more of a horizontal process based on reciprocity. Therefore the concept of peers as educators or peer leaders does not capture the unique peer dynamics found in doctoral education. In this chapter, we argue that peers at the doctoral level are best understood as “learning partners.” In support of this assertion, we present empirical evidence from two different studies that show the role that peers can play in the development of doctoral students into independent researchers and members of their academic community. The first study looks at the role of the apprenticeship model in doctoral education, and the second study is an evaluation of interdisciplinary doctoral initiatives funded by the National Science Foundation Integrated Graduate Education and Research Traineeship (IGERT) programs. Finally, we conclude that additional research is needed to further understand the unique dynamics of peer learning in doctoral education.

Doctoral Education in the United States: An Apprenticeship Model

Doctoral education in the United States was originally inspired by the German apprenticeship model of science research from which U.S. college educators selectively adopted specific features in order to create a site for advanced learning and training in original research (Turner and Bernard 2000). As the U.S. model of doctoral education evolved, it combined the British undergraduate college with the German model to form a unique environment made up of departments and graduate schools. Although the fundamental aim and scope of doctoral education has been challenged and expanded over time, the primary purpose of the PhD remains to prepare students to become independent researchers in their fields (Council of Graduate Schools 1990).

Despite tremendous growth in the enterprise of doctoral education over time, little has changed in the structure of PhD programs and “the distinctive American model for doctoral education has remained the same” (Gumport 1993, 239). The core requirements in doctoral programs across the country consist of some combination of coursework, exams, and a thesis (Gumport 2005; Nerad 2008), although each discipline defines and implements these activities in different ways. Ultimately, doctoral programs facilitate students’ learning, and a faculty advisor oversees the successful completion of these requirements.

The advisor-student relationship has been studied by scholars of doctoral education and has commonly been described as an “apprenticeship relationship” (Golde 2008; Nyquist and Woodford 2000; Shulman 2004; Trow 1977; Walker, Golde, Jones, Bueschel, and Hutchings 2008). Golde and Dore (2001, 5) define the apprenticeship model as one where “students

work under the tutelage of their advisors, learning the intricacies of research and becoming increasingly independent scholars.” In other words, the apprenticeship model is based on a hierarchical and vertical relationship between a faculty member (master) and a student (novice) where, through close one-on-one interactions, students learn how to do research. The nature and structure of the advisor-student relationship share both similarities and differences across disciplines. For example, it is fairly common for an advisor to serve as the chair of a student’s dissertation committee. However, the timing of when a student begins to work with his or her advisor may differ. In a laboratory-based field of study, for example, students typically begin working with their advisor during their first year, whereas students in the humanities and social sciences may not select an advisor until much later in their program. Regardless of field, the main advisor officially carries the responsibility for guiding students through the program and through the process of becoming independent researchers. How the advisor carries out this task varies from field to field, but it may take place via interactions in weekly lab meetings, doctoral seminars, journal clubs, or during one-to-one meetings.

The predominance of the apprenticeship model in doctoral education often overshadows how other relationships might also be contributing in meaningful ways to doctoral students’ learning. Such relationships and networks might include interactions with other faculty members, postdoctoral scholars, research scientists, and peers.

What Do We Know About the Role of Peers in Doctoral Education?

Even though there is little empirical research on peers in doctoral education, they are considered to be important agents of community, learning, and development at this level of graduate work. Models of doctoral student socialization, which illustrate how doctoral students learn the values, skills, and norms of their discipline or field, recognize that students provide one another with emotional support, general advisement, and specific content knowledge (Austin 2002; Gardner 2007; Weidman, Twale, and Stein 2001). Such socialization processes are facilitated through formal interactions organized by a university or graduate program as well as through informal interactions among fellow students.

Formal Peer Pedagogies. Institutions and academic programs make various efforts to formally bring students together at the graduate level. One common approach, especially in large master’s or doctoral programs where individual attention by the advisor is not so pronounced in both the first year and after candidacy, is the use of student cohorts. Cohort-based programs are organized around a group of students who enter a program at the same time, get to know each other, and move together through the graduate experience

on a similar path and timeline. Weidman, Twale, and Stein (2001, 62) suggest that “the cohort influences the learning process, opens support mechanisms, and enriches the experience socially and emotionally” for students. For instance, students in a cohort may develop study groups and provide academic support to one another throughout their program. Further, students who take a series of courses together are more likely to build strong relationships, which may last over time. Weidman, Twale, and Stein (2001, 82) ultimately suggest that student cohorts can offer “social outlets, psychological release, and much needed emotional support.” Another example of a formally organized initiative was a project cosponsored by the Graduate Division at the University of California (UC), Berkeley. In an effort to encourage communication among graduate students working on related dissertation groups and the formation of dissertation writing groups, the Graduate Division created a database of abstracts of dissertations-in-progress so that doctoral students could make connections and form topical working groups that crossed traditional disciplinary boundaries. Within these dissertation writing support groups, students provided and received constructive feedback, learned how to accept criticism from others, and benefited from the structure and deadlines that the support groups provided. In these groups, students were mentors to one another and they learned how to engage in the peer review process, which is an important practice in the academic community.

Peer mentoring programs are another example of formal initiatives that have been organized across universities and within individual departments. Two examples include “The Graduate, 1996” at UC Berkeley and the Project for New Mexico Graduates of Color at the University of New Mexico. Typically in these programs more senior students are paired up with students in their first or second year of study. This definition of peer mentoring programs is similar to the concept developed by Cuseo (2010) for undergraduates. These programs are built on the premise that more advanced peers can provide a unique type of support to students given that they are largely “in the same boat.” For example, peer mentors can communicate their own experiences with respect to navigating the graduate program and the discipline at large, share how they coped with hardships, and recommend strategies for success. Unfortunately, peer mentoring programs are not available everywhere and the formal mentor-mentee relationship usually lasts for only a limited amount of time, although informal peer relationships may emerge from the mentor pairings.

Informal Peer Pedagogies. There are an infinite number of ways that doctoral students can interact informally. The following examples are used simply to highlight how and why informal peer interactions might be beneficial to doctoral students. In departments where there are significant numbers of graduate student teaching assistants, students may find themselves sharing an office space. A shared office space can allow for frequent informal

interactions and exchanges around teaching such as sharing teaching tips, exchanging information about general aspects of the program or exam preparation, and even assisting each other with the development and pursuit of students' research. In these workspaces students can also acquire information about writing groups, professional conferences, and relevant campus resources. Common space is an important mediator in any learning community, and shared offices for doctoral students can become important learning spaces through informal interactions.

In those disciplines that are organized around laboratories, there are even more opportunities for informal interactions between students. In laboratories, students are often working side by side, and they can easily turn to one another for questions and assistance. Although students can learn from more advanced peers in the lab, students may also have a particular expertise such as knowing how to use a specific instrument. As a result, students regularly gain knowledge from one another in their day-to-day interactions in the lab. In addition, students learn to become peer reviewers as they receive and give feedback on each other's research projects and processes.

All of these examples show how doctoral student peers are traditionally seen as "developers": those who provide psychosocial support and engage in information sharing and knowledge development (Kram 2001, quoted in Sweitzer 2009). However, more empirical research is needed in order to better understand the role of peers in doctoral education, particularly in terms of knowledge development relating to disciplinary research practices. One example of this type of research comes from Boud and Lee (2005), two Australian scholars who investigated how doctoral students learn with and from their peers. Drawing on examples from interviews with research students, Boud and Lee theorize about the role of peer learning in order to reconceptualize research pedagogy and bring attention to the role of peers in research education. More specifically, they note that peers learn from one another in a reciprocal manner and that peers can teach each other what it means to be a student, a researcher, and an academic.

New Research on Peers as "Learning Partners" in Doctoral Education

Two more recent studies on doctoral education provide additional insight into how the role of peers has developed in that setting. First, in her study on the apprenticeship model in U.S. doctoral education, Flores (2011) examined how doctoral students learned to do research and to what extent, if any, their apprenticeship relationships facilitated their learning. Primary data were collected through semistructured interviews with ten faculty members and twenty-one doctoral candidates from three disparate academic departments (bioengineering, comparative literature, and sociology) at

one research university. Findings showed that other apprenticeship relationships exist in doctoral education that go far beyond the traditional or classical definition between one master and one novice. Instead, students in this study were engaging in apprenticeships with multiple individuals such as other faculty members, postdocs, and peers within the different communities of practice in doctoral education (Lave and Wenger 1991). These apprenticeship relationships focused on a broad range of topics, including writing, research techniques, and presentations, and they varied in duration ranging from short-term to long-term interactions. Results from this study suggest the need to reconceptualize the apprenticeship model in doctoral education and to broaden the learning concept in order to better reflect the realities of how doctoral students are learning to do research in their field.

Focusing on the role of peers, several of the students in this study reported that talking to their peers about their research advanced their work because peers often pointed out limitations with their questions and comments. For example, one participant stated, “you really get a variety of feedback from friends . . . they tell you the holes in your research . . . people that are not involved in your research or close to it can ask some very simple questions that will [stump] you.” In some instances, students found feedback from their peers to be some of the harshest criticism they received.

Many of the students discussed how they learned specific methods or techniques from their peers. One student said the following when asked how she learned to do research:

I learned most of the things from graduate students. They'll tell you the minutia of adding A to B and mixing them, and all that kind of stuff. And while you can look for these kinds of things in a database, [your peers] will show you the ropes.

Some of the students talked about how often one person in the lab would be “the expert” on a particular research technique or instrument. In some cases, the expert was a peer, and students said that they regularly learned from each other.

In addition to these informal interactions, students also participated in a variety of formal peer settings such as student groups focused on reading, studying, writing, and the dissertation, which also contributed to their development as researchers. Regarding his writing, one student said, “a lot of us [students] interact and read things for each other . . . I'm always willing to read other people's stuff and you have conversations with them and you learn what they're doing and they read your stuff.” These groups were especially helpful to students when the feedback came from slightly more advanced peers who had a little more experience.

This study demonstrates that there is evidence of peers playing a role in how students learn to do research and scholarship across disciplines.

As expected from other research, peers served as agents of emotional, psychological, and personal support. However, this study illustrates how fellow students also teach each other the practices of research and scholarship.

The role of peers in doctoral education was also explored in the research conducted at the Center for Innovation and Research in Graduate Education (CIRGE) at the University of Washington. Throughout its nine years of existence, CIRGE has provided formative and summative evaluations for four National Science Foundation (NSF) funded Integrated Graduate Education and Research Traineeship (IGERT) programs. Since 1998, NSF has made over two hundred awards to more than one hundred universities through the IGERT program to support five-year university-based doctoral education programs that bridge multiple disciplines around specific problems or issues of concern. The goal of these programs is to “catalyze a cultural change in graduate education” by encouraging “collaborative research that transcends traditional disciplinary boundaries” and prepares students for a “globally engaged . . . workforce” (National Science Foundation 2010, para. 1).

CIRGE evaluation and research teams surveyed IGERT student fellows annually over a period of five years, conducted biannual interviews of faculty and key academic administrators involved in an IGERT, held numerous focus group meetings with all groups involved, and provided annual written and verbal feedback and recommendations to the IGERT program. On average, there were twenty to twenty-five doctoral students involved, six to eight core faculty, and three to five deans and department chairs. Overall, this evaluation work showed that learning from peers is absolutely essential for the successful training of students as interdisciplinary scholars. Students surveyed generally referred to their peers as critical agents in their learning, and faculty also noted the strong influence that students had on each other:

The peer interaction is where most of this [interdisciplinary learning] takes place. We [the faculty] provide many activities where they interact together: field trips, workshops and other opportunities allow them to do this. Even if we don't formally teach them how to think differently and integrate thinking from other disciplinary areas, we try to provide them many opportunities informally to do this. (Sadrozinski, Flores, and Nerad 2009, 6)

Many of the faculty recognized the important role that peers play in helping one another to learn how to communicate across disciplines. In one IGERT program, issues around disciplinary specific language and jargon became more problematic, and students taught one another how terms were defined and used in their respective disciplines. Faculty also described the value of developing different opportunities for peer instruction. For example, doctoral students were required to teach particular topics from their own discipline to students from other disciplines or present how another

field would look at a particular topic. In this way, students learned the limits of their own discipline, the investigative capabilities of other disciplines, and how to communicate and illustrate the different disciplinary lenses used to look at the world. A student illustrated this point through the statement that “it helps put my own discipline into an astronomical, biological, and geological context at the same time. This would not be possible without the patience of good lecturers and fellow students” (Flores and Sadrozinski 2010, 12). Experiences like this one pushed students to gain a wider and deeper understanding of disciplinary boundaries.

Over the past thirteen years, faculty from the various IGERT programs have learned from each other and have passed on information to other colleagues about the importance of structuring opportunities for students to interact with students from other disciplines and facilitate peer learning. Faculty members are increasingly scheduling field trips in order to provide opportunities for students to interact and create strong bonds. For example, a new IGERT program at Portland State University on Sustaining Ecosystem Services developed a fourteen-day field camp for incoming students in order to facilitate peer bonding. In addition, this IGERT lobbied for shared office and meeting space—learning space—for their students in order to help facilitate informal student interactions and peer learning. Graduate students have consistently acknowledged that getting to know one another was a major benefit of their IGERT program (Flores and Sadrozinski 2010).

Across the four evaluations conducted by CIRGE, students have indicated that peers have played a crucial role in their development as interdisciplinary scholars. Faculty members have increasingly realized the importance of facilitating team bonding and establishing learning environments that help to establish trust among students. The establishment of trust and community is particularly important in order to successfully engage in interdisciplinary activities.

Conclusion

Both of these studies have shown that peers do play an important role in learning within and across disciplines in doctoral education. In order to represent the important role of peers, the traditional apprenticeship model needs to be revised and expanded beyond the advisor-student dynamic. One theory that lends itself to this expansion is the theory of communities of practice by Lave and Wenger (1991). In their study of successful learning in apprenticeships outside of schools, Lave and Wenger found that newcomers became part of a community of practice by gradually acquiring the knowledge, skills, and values from experts through their participation in everyday activities. They observed that new members were not outsiders, but they were “engaged in activities that, though peripheral to the community,

[were] legitimate within the context of that community” (1991, 37). By participating at the periphery of a community of practice, and observing and interacting with others, new members could then move to the center of the community over time.

Given this theory, doctoral education can be viewed as a collection of communities of practice such as found in the department, lab group, or research team. Within these various communities, doctoral students are able to interact and learn not only from their advisor and other faculty, but also from one another. Peer-to-peer learning is distinct from faculty-to-student learning because it creates a horizontal learning dynamic that is based on reciprocity (Boud and Lee 2005). Doctoral students are adults who bring with them multiple types of expertise and experiences that they will share with each other in pursuit of the PhD. When interacting with their peers, students are likely to switch between being a learner and a teacher. In contrast, faculty-to-peer learning is more likely to be a vertical learning dynamic in which the student is learning more from the faculty member. Both types of learning dynamics are largely complementary, and they combine to form a rich experience of intellectual development and disciplinary acculturation for doctoral students.

Given these findings, the concept of peer educator and peer leader, as defined in the context of undergraduate education, does not fully capture the role of peers in doctoral education. Instead, we propose that the role of peers in doctoral education be reconceptualized to “learning partners” where students are more like colleagues who are learning from one another. Emphasizing mutual learning between peers can in fact help better prepare doctoral students for the role of an academic, in which practices like peer review are used regularly. In addition, thinking of peers as “learning partners” may help doctoral students to know that there is more than one “expert” to draw from. Finally, expanding the learning dynamic in doctoral education to include not only faculty, but also peers, helps to emphasize the role that the entire academic community has in generating new scholars.

In closing, we have found that doctoral students are learning within multiple communities of practice, and peers are important “learning partners” within these communities. Additional research is needed on the topic of peer learning in doctoral education to continue to capture the unique role of peers in doctoral education in various settings and disciplines. Further, since this article focused on doctoral education, additional research is needed on the role of peers in master’s programs since many new interdisciplinary master’s programs are being developed in the United States and worldwide.

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