International Journal of Science Education

ISSN: 0950-0693 (Print) 1464-5289 (Online) Journal homepage: http://www.tandfonline.com/loi/tsed20

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To cite this article: Erika Löfström & Kirsi Pyhältö (2015): 'I Don't Even Have Time to be Their Friend!' Ethical Dilemmas in Ph.D. Supervision in the Hard Sciences, International Journal of Science Education, DOI: 10.1080/09500693.2015.1104424

To link to this article: http://dx.doi.org/10.1080/09500693.2015.1104424

Published online: 27 Oct 2015.

International Journal of Science Education, 2015
http://dx.doi.org/10.1080/09500693.2015.1104424

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'I Don't Even Have Time to be Their Friend!' Ethical Dilemmas in Ph.D. Supervision in the Hard Sciences

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This study focused on exploring students' and supervisors' perceptions of ethical problems in doctoral supervision in the natural sciences. Fifteen supervisors and doctoral students in one research community in the natural sciences were interviewed about their practices and experiences in the doctoral process and supervision. We explored to what extent doctoral students and supervisors experienced similar or different ethical challenges in the supervisory relationship and analyzed how the experiences of ethical dilemmas in supervision could be understood in light of the structure and practices of natural science research groups. The data were analyzed by theory-driven content analysis. Five ethical principles, namely non-maleficence, beneficence, autonomy, fidelity and justice, were used as a framework for identifying ethical issues. The results show that one major question that appears to underpin many of the emerging ethical issues is that the supervisors and students have different expectations of the supervisory role. The second important observation is that doctoral students primarily described their own experiences, whereas the supervisors described their activities as embedded in a system and elaborated on the causes and consequences at a system level.

Kewords: *Supervision; Doctoral study; Ethical issues; Science*

Introduction

Supervision is a cornerstone of doctoral education. It contributes to degree completion, length of time to candidacy, doctoral student well-being and satisfaction with the doctoral experience, and development of competencies (Case, 2008; Meyer, Shanahan, & Laugksch, 2005; Pyhältö, Stubb, & Tuomainen, 2011). In addition, the supervisory relationship provides a framework for learning ethical codes of conduct and ethical decision-making (Alfredo & Hart, 2011; Gray & Jordan, 2012). Faculty members and graduate students alike believe that values are

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learned in interactions with faculty (Mathur & Offenbach, 2002). Supervisors who function as ethical role models and take on the role of mentors strengthen the likelihood of their students adopting ethical codes of conduct (Gray & Jordan, 2012). However, exposure to unethical practices could signal that it is acceptable to engage in non-ethical behavior, and that doing so will bear no serious consequences (e.g. McCabe, 1993). Students pick up ethical standards and norms by observing faculty and peers and by participating in the practices of their scholarly communities. Thus, it is not irrelevant what kind of ethical dilemmas doctoral students encounter in the supervisory relationship and how those dilemmas are handled.

Our prior study (Löfström & Pyhältö, 2015) detected differences between the ethical dilemmas experienced by supervisors and doctoral students in the natural sciences and those encountered in the behavioral sciences. We concluded that, to a certain extent, the differences emerged from the different ways of organizing doctoral education in the two fields. In this article, we examine the experiences of supervisors and doctoral students in the natural sciences in greater depth in order to understand how the experienced ethical dilemmas manifest in the context of natural science. Doctoral candidates in the natural sciences often work intensively in relatively strong academic communities that include several doctoral students and scholars at various stages of their careers who collectively focus on solving shared research problems related to the groups' projects. There are many aspects to this kind of organization of research and supervision that potentially align with current notions of supervision of doctoral research as a multi-level systemic activity in a community of practice (Austin, 2002; Hopwood, 2010; McAlpine, Jazvac-Martek, & Hopwood, 2009; Pyhältö, Stubb, & Lonka, 2009; Stubb, 2012). Although these environments can effectively be geared toward supporting the students in developing expertise and becoming members of their academic communities, little is known about the nature of ethical dilemmas related to the supervision encountered in these environments. In the present investigation, we endeavor to understand the nature of ethical dilemmas in the supervisory relationship in a natural sciences research community.

The Natural Sciences as a Context for Doctoral Study

In science, socialization of doctoral students into the community typically takes place through informal and tacit learning (Ahlberg, 2008; Nersessian, 2006). Research education in the sciences, both at the undergraduate (Hunter, Laursen, & Seymour, 2007) and the graduate levels (Feldman, Divoll, & Rogan-Klyve, 2009; Nersessian, 2006), occurs primarily through apprenticeship in research groups. Graduate students' interactions with faculty in the course of research work in the laboratory is an effective way of establishing students' absorption of professional values (Mathur & Offenbach, 2002). Yet there has been fairly little research conducted on graduate student learning in research groups (Feldman, Divoll, & Rogan-Klyve, 2013).

Research community-based doctoral education in the sciences typically involves doctoral students engaging in closely organized groups. In this model, the doctoral students are usually associated with a lead researcher's project. They share laboratory

space and have several mentors in addition to their primary supervisor and engage in more interaction with each other than do students in loosely organized groups, which are focused on individual research and dyadic relationships between the lead researcher and the doctoral students (Feldman et al., 2013; Hakkarainen et al., 2014). In a tightly organized group, laboratory is the center of action for all research activities (Feldman et al., 2013) and provides an agentive learning environment for doctoral students to engage in.

As students' methodological and intellectual proficiency increases through apprenticeship in research groups, their participation becomes more integral to the group's core activities (Feldman et al., 2013). This can be seen as legitimate peripheral participation (Lave & Wenger, 1991; Wenger, 1998; see also Green, 2006; Lee & Roth, 2003), which evolves gradually as the student engages more intensively in the everyday practices of the community and its members (Green, 2006; O'Donnell et al., 2009; Tobbell, O'Donnell, & Zammit, 2010). Through the distribution of knowledge and skills, all members of the group have the opportunity to contribute to the group's goals.

If doctoral students perceive that faculty encourage them to take part in activities typically associated with the research community, it will have a positive influence on the students' socialization in the role of scientist and scholar. Students' socialization is facilitated through the mechanisms of interaction, fit with the expectations and acquisition of knowledge and competencies residing primarily in graduate education and situated within institutional control and culture (Weidman & Stein, 2003).

Ethical Issues in Supervision

Prior research on ethical aspects of supervision has identified a variety of embedded problems, such as incompetent and inadequate supervision, supervision abandonment, intrusion of supervisor views, abusive and exploitative supervision, dual relationships, encouragement to commit fraud and authorship issues (Goodyear, Crego, & Johnston, 1992; Löfström & Pyhältö, 2012, 2014, 2015). In order to identify how or why something is an ethical issue, we analyzed which ethical principle, if any, was at risk. As a framework, we applied common ethical principles, which underpin ethical guidelines and codes of conduct, including the national guidelines followed in the target university (Finnish Advisory Board on Research Integrity, 2012). These principles include (1) *respect for autonomy*, (2) *avoiding harm* (non-maleficence), (3) *benefiting others* (beneficence), (4) *being just* (justice) and (5) *being faithful* (fidelity). Karen Kitchener (1985) has described what these principles mean in the context of university counseling and advising. The context of this study—doctoral supervision—has similarities with those described by Kitchener in the sense that focus is on academic individual and collective processes geared toward scaffolding students' development and empowerment. Thus, the five-principle model was deemed appropriate in the analysis of ethical dilemmas in supervision.

Respect for autonomy refers to the right to self-determination, the right to privacy and the right of individuals to make decisions concerning their lives. Lack of autonomy can cause problems for early doctoral students and early career academics (Löfström &

Pyhältö, 2015). Similarly, in many academic departments the tradition of teacher and researcher autonomy has been taken to mean that it is not appropriate to intervene in a colleague's activities, even when there may be reason to do so (Golde, Bueschell, Jones, & Walker, 2009). Non-maleficence entails the necessity of avoiding psychological, physical or social harm. However, doctoral students may experience substantial levels of stress and distress (Anderson & Swazey, 1998; Hyun, Quinn, Madon, & Lustig, 2007). One reason for this may be that the students who work with laboratory-based data depend highly on the results of their tests. Much is invested in the success of these tests, and consequently, these students may feel that their progress in doctoral studies is beyond their influence (Kurtz-Costes, Helmke, & Ülkü-Steiner, 2006).

Beneficence involves making a positive contribution to the welfare of others. The lack of beneficence involves failing to support others who need it when one is in a position to provide that support; for instance, a supervisor failing to attend to the supervision needs of a student could imply a breach of beneficence (Löfström & Pyhältö, 2014). A supervisor who considers a student's concerns and questions carefully signals to the students that he or she is interested in the student's development. In turn, a student who responds with respect to ideas presented, even while disagreeing with them, signals to the supervisor a commitment to learning (Golde et al., 2009).

Justice includes fairness, impartiality, reciprocity and equality. Supervisors struggle with the notions of fair and equal treatment of students. They take equality to mean allocating the same amount of time to each student. The supervisors' principle of allocating the most time to the students who need the most support is problematic in light of the idea of equal time and support (Vehviläinen & Löfström, 2014). Deuchar (2008) has demonstrated that not all doctoral students have the same supervision needs, which makes the notion of fairness as equal time allocation and support, harbored by some supervisors, problematic and potentially involves ethical considerations. Feelings of unfairness may hamper collaboration (Kligyte et al., 2008), which is often a cornerstone of work in science laboratories. Furthermore, relationships depend on *fidelity:* without keeping promises, and showing loyalty, truthfulness and respect for others, it will be very difficult, if not impossible, to sustain a functional relationship over time.

There are some indicators that doctoral students and supervisors do not have similar perceptions about the problems embedded in various supervisory activities. Doctoral students have, for instance, been found to emphasize social support, interaction with researchers, and adequate funding as key resources in their studies (Gardner, 2007). Also doctoral students' and supervisors' perceptions about the frequency of supervision have been shown to differ (Pyhältö, Vekkaila, & Keskinen, 2015). Supervisors have been found to emphasize resources, particularly funding, as well as student characteristics, such as motivation, self-direction and aptitude, as central ingredients of completing a doctoral degree (Gardner, 2009). The guidance that supervisors offer may not always be the type of support that doctoral students expect, which may be the result of the incompatibility of the experiences of the two parties (Deuchar, 2008). The findings indicate that supervisors and doctoral students may perceive supervision activities and related roles differently. Consequently, ethical problems may also be perceived differently.

This study focused on the ethical dilemmas emerging in doctoral supervision in the context of the natural sciences. Ethical issues in supervision as identified from the students' and supervisors' perspectives have been reported in the authors' earlier work. Supervisors have been shown to struggle with issues of exploitation and conflicting expectations on the supervision relationships. Supervisors often tried to solve the ethical dilemmas they encountered with focus on the individual relationship, whereas it may have been fruitful to scrutinize the dilemmas through the norms and practices of the scholarly community (Löfström & Pyhältö, 2012). Doctoral students perceived abandonment and exposure to environments that threaten their psychological well-being as the most common ethical dilemmas. Students, too, were oriented toward solving the dilemmas they encountered, but were often unable to identify resources and support (Löfström & Pyhältö, 2014). Furthermore, supervisors and doctoral students were shown to perceive different ethical issues, which suggests that there is a 'grey area' where the two parties meet neither at an experiential nor at a conceptual level (Löfström & Pyhältö, 2015).

In this article we focus on the ethical dilemmas emerging in doctoral supervision in the context of the natural sciences. We posed the following research questions: To what extent do doctoral students and supervisors experience similar or different ethical challenges in the supervisory relationship? How can the experiences of ethical dilemmas in supervision be understood in light of the structure and practices of doctoral education in a natural sciences context?

Method

Context and Participants

In Finland, doctoral studies are centered on conducting research, which equals 75% of the work toward a doctoral degree. A master's degree is required for admission to doctoral education, but no extensive course work is required before undertaking research. Students begin their research projects at the beginning of their doctoral studies. A solid research plan, however, is the admission requirement for doctoral studies. In the hard sciences, the majority (81%) of doctoral candidates pursue article-based dissertations. These consist of three to five internationally refereed journal articles co-authored with the supervisor and other senior researchers complemented by what is usually an independently authored summary. The summary draws together the theoretical and methodological underpinnings of the research and synthesizes the findings in a way that establishes their contribution to the field (Pyhältö et al., 2011). The remaining doctoral students write a monograph, which is published as a book, usually in the monograph series of the student's faculty or department.

The present research took place in a natural sciences research unit in a research-intensive university in Finland. In this sense, the study investigates a particular case: a scholarly community, its supervisors and a selection of its doctoral students. The scholarly community can be described as a tightly organized group (cf. Feldman et al., 2013) in which the students typically are associated with the principal investigators' projects, but

may have several mentors, and in which all the members share laboratory space for all their research activities. With its strong research focus, this scholarly community is comparable to other hard science communities in research-intensive universities. The community was selected for this research based on this criterion.

Data were collected from eight supervisors (female: 1 and male: 7) and seven doctoral students (female: 2 and male: 5). All supervisors held Ph.D. degrees and typically supervised several doctoral students. All supervisors and students were members of the same research team consisting of people with different disciplinary backgrounds and specializations. Although the team has a specific research focus, its members may have different backgrounds within the natural sciences.

Doctoral Students and Supervisor Interviews

The doctoral supervisor interviews included questions on three themes in order to obtain a broad view of the supervisors' work: (1) the doctoral process, (2) supervision practices and (3) oneself as a supervisor. The semi-structured interview contained eighteen questions on different aspects of the supervisors' work and six background questions on the participants' working history, years of supervising and current position.

The doctoral students were recruited from among the participants in research seminars in the supervisors' scholarly community. The prospective participants were informed about the aims and the procedures of the research, and they were given an opportunity to ask questions. Subsequently, an invitation along with an information letter was sent to all individuals enrolled in doctoral studies in the selected research community. *The doctoral student interviews* targeted three major themes: (1) the doctoral students' experiences in the dissertation process, (2) supervision and (3) how the individuals perceived themselves as doctoral students. The interviews focused on both past and present experiences. Background questions asked in connection with the interviews pertained to the choice of discipline or subject, the time spent on their studies, the stage of their studies, the estimated time until graduation, the form of the dissertation and engagement in the studies full or part time (cf. Stubb, 2012).

The interview protocol was validated by the members of the research group. The protocol was also piloted with doctoral students. The interviews lasted 60–90 minutes and were transcribed verbatim. Participation was voluntary. Owing to the sensitive nature of some of the data, we have not provided background information for the quotations in our Results section. Where possible, we have neutralized references to the interviewees' gender. When we use the singular pronouns he or she, these may or may not accurately describe the participant's gender. These measures were necessary in order to protect the identities of the individuals participating in the research. Doctoral student quotations are referred to as DS and supervisor quotations as S.

Analysis

The data were analyzed using theory-driven content analysis (cf. Marshall & Rossman, 1995; Vaismoradi, Turunen, & Bondas, 2013). As the framework, we applied five

common ethical principles in order to identify ethical issues in the data. The analysis focused on overt ethical issues either explicit in the interviews or suggested as ethical issues by the interviewee, as well as on latent ethical themes evolving from the interviews (cf. Braun & Clarke, 2006). The unit of analysis was a whole episode or theme. The interviewee could sometimes return to the same theme or event several times during the interview. These reoccurring descriptions have been treated as one episode. In order to establish whether an identified dilemma or problem was ethical in nature, the units were subjected to the question: 'Which ethical principle is compromised by this event/action/procedure/practice and precisely how is the principle compromised?'

After identifying which ethical principle was at stake, if any, we created condensed descriptions of each unit of analysis. In these descriptions, we distilled the core issue from a lengthier interview transcript. The descriptions helped us identify commonalities, which eventually led us to form sub-themes within the main themes describing five ethical principles. For instance, the sub-themes we identified for non-maleficence were exploitation, misappropriation and dual relationships. All of these could potentially cause harm to the individuals involved. Similarly, for the principle of justice, we identified sub-themes of inequity and unfair assignment of credit for contribution. Both compromise the fair treatment of individuals. The same participant could have more than one ethical issue in the same category, but generally this was not the case.

The analysis was conducted by the first author. Between the iterations the authors discussed the interpretations. There was a high level of agreement on the choice of units and their categorization within the sub-themes. The discussion pertained not so much to whether the authors agreed on the categorization, but rather, to the selection of units to be included in the analysis. One such discussion pertained to whether or not to include ethical issues attributable to the structures of the doctoral programs, since these might influence the participants' experience of fairness. We decided to exclude structural issues in general. Another discussion pertained to the identification of the role of the life situations of the students in their experiences of ethical dilemmas in the Ph.D. process. We decided to include units in which, based on our interpretation, lack of supervisory compassion worked against the principle of beneficence. The interviews were conducted in Finnish. All research participants were fluent in the Finnish language. The analysis was conducted with the original transcribed interview texts. Only the excerpts chosen to illustrate the categories were translated into English.

Results

We identified on average 3.9 ethical issues per student and 2.9 issues per supervisor. All five ethical principles appeared in the data, but did not surface equally in the student and the supervisor data. Non-maleficence boiled down to concerns over *exploitation,* both among supervisors ($f = 13$) and doctoral students ($f = 4$). Supervisors ($f = 5$), but no students, discussed dual relationships. Beneficence was perceived to be at stake both by the students and the supervisors, but whereas supervisors ($f = 5$) were concerned with their role and probed its boundaries, the students experienced threats to their

well-being and a lack of community ($f = 5$). Doctoral students were not concerned about their autonomy, but they encountered issues that threatened fidelity, namely supervision abandonment ($f = 6$) and inadequate supervision ($f = 2$), and justice, namely inequity ($f = 3$) and unfair authorship ($f = 2$). The supervisors were unconcerned about these issues with the exception of supervision abandonment ($f = 3$).

Maleficence

Maleficence took the form of exploitation, misappropriation and dual relationships. Supervisors were concerned with how to provide financing for the doctoral students in their projects, thereby securing their employment and opportunities to continue working in the research group. At the same time, the financing meant that students were asked to do tasks that were not specific to their research at that particular point in time, although the experience could pay off later on. Exploitation in the form of delegating too many tasks to doctoral students at the expense of their dissertation research was recognized as a dilemma:

> In a way, the problem is that we have all sorts of activities going on, projects requiring this and that. Our current staff numbers are not sufficient for doing all that work, so everyone may end up needing to do a bit too much, and this concerns the doctoral students as well. Primarily, they don't do just their Ph.D. dissertation all the time, but they are saddled, so to speak, with tasks that connect with their dissertation, but sometimes loosely. You may have to organize meetings that might not be exactly in your area or other similar administrative tasks, but less so. But then there could be things that are related to a project and tasks that are specifically related to the dissertation research. In a way, the dissertation work is facilitated if one is in a larger environment. Group size matters, because there it is easier to distribute the tasks evenly. (S7)

Supervisors are aware of the risks of exploitation and actively interfere when they regard a situation unsustainable. Nevertheless, not all situations are solved efficiently, and the doctoral student is left with the feeling of toiling away on other people's projects.

The following explanation of how the work is organized may show why keeping individual students' work load reasonable might be a challenge. While the unit has worked out a way to run its projects, the work is organized primarily around themes or topics rather than around individual research, and this could be one of the reasons that some individuals feel burdened with a workload heavier than that of others:

> And then there is a climate of flexibility. I think that if all funders knew how we function, we would not get praise exactly. Although I think this is close to being optimal. We have a bunch of projects and we have a bunch of people, and we say that with these people we are going to do these projects. But not like this person does this project and that person does that project and then we tie them up in those projects and keep rigorously to this scheme so that when the project ends, we start to think where we place that person next. Instead, the person can be involved in a bigger theme that cuts across several projects. And we get all the projects done, and we can get some level of job security for the duration of the doctoral process. (S6)

The supervisors recognized situations in which doctoral students had expectations of their professors other than that of a supervisory role, such as close friendship or a therapeutic relationship. The supervisor quoted below had experienced a supervision relationship in which he or she felt that a doctoral student expected a therapeutic relationship, and the supervisor had allowed it to go on for a while before realizing the necessity of defining the boundaries of the supervisory role:

> Some expect you to know everything. Some expect, quite realistically, guidelines and setting timetables. Some expect friendship, and that's a critical, difficult thing. I don't even have time to be a friend! And that possibly causes feelings of unfair treatment and all sorts of nasty things … So like if someone comes in and cries, for instance about difficulties in their private life, however cruel it may sound, after a week I have to say that this belongs to other institutions, and I will not listen to it for years, because it is unreasonable that someone forms this kind of therapy relationship with me. … Being a therapist and a close friend to your supervisee just isn't appropriate. (S3)

The doctoral students' experiences of exploitation mostly took the form of the community failing to support a decent work–dissertation research balance:

> Interviewer: Do you feel that you have gotten support from others?
> DS5: Yes, in my work, but not necessarily for my dissertation. The boss saddles me with all sorts of other tasks. … It is like the boss always complains that I have done all sorts of jobs that don't contribute to publications, and to encourage me, the boss says that 'This is all my fault.' And I'm like, yeah, that helps a lot. (DS5)

The fact that doctoral students engage in team work with academics at various stages of their careers and focus on several projects simultaneously could sometimes blur the boundaries of supervision responsibilities and work distribution, which may result in some individuals finding themselves doing excessive work without a primary supervisor to turn to. Doctoral students may be concerned about the continuation of supervision or work contracts and may find it difficult to refuse work. Because of their lack of experience, they may not be able accurately to assess what constitutes a reasonable work load. Also senior academics work long days and set examples for their less experienced colleagues. However, supervisors are better placed to evaluate what can reasonably be expected of a (usually) novice researcher in a given time frame, and thus, it can be expected that they will both intervene when they recognize that someone is juggling too many or too demanding tasks and also work to prevent such situations from emerging by planning and coordinating activities better.

One doctoral student reported experiences of misappropriation and attributed this to the high level of competition in the research community.

The doctoral student has observed the purloining of ideas, which has made him more cautious in his cooperation with other individuals in the group. The student aptly recognizes how a competitive environment can influence people's moral judgment. Science communities may be particularly competitive, because success in the field requires academics to set up their own laboratories, and they rely significantly on external funding: the research is equipment intensive in the sense that experiments and tests often require expensive laboratory equipment and technologies and

specialized technicians. With the simultaneous processes involved in close collaboration and competition, the origins of ideas may become blurred, and some individuals may deliberately try to take advantage of those who are sharing their ideas.

Beneficence

Lack of beneficence was the result of the supervisor or the scholarly community failing to provide support or benefit to the doctoral student when this could reasonably have been done. The following is an example of a doctoral student who, at first, appeared pleased with the freedom, but when prompted to describe what kind of support he received, the downside of all that freedom presented itself as the lack of interest in the student as an individual and the pressures of coping with getting a Ph.D.:

> DS4: Basically, I was told to go ahead and do things, go places whenever I asked 'can I do like this, may I do like that'. But nothing particularly personal, like 'how are you doing?' Very rarely. I don't even remember that the supervisors would have asked, 'How are you hanging in there?' You have to say so yourself if you have too much work; it depends on you. You have to say it. So not that kind of understanding and support. It depends on the supervisor. My supervisors were not very interested in students' personal lives [slight laughter]. It would not have taken that much from the supervisor to ask once in a while, 'how's it going?' Nothing more. But it was like there was no time for that. Or depends on the supervisor. They did not understand that that is important. Could be also a gender issue. Partly at least, I think. Here I had a supervisor who did not ask about these things. But then I spent two semesters in [another country], and there I had a male supervisor who was very sympathetic so in that sense I did get an experience of a caring supervisor, who made sure that I don't overwork. That was a great experience. But, of course, everything has its good sides. Here I had freedom and over there it was more controlled, like how I do my stuff. What I might perhaps have hoped for from the supervisors is that they would have engaged more in what I was really doing and be more interested in that.

The quotation shows that the student recognized the necessity of voicing experiences of work overload, but at the same time, found it difficult to ask for pastoral support, as this may be seen as entering a more personal level of communication not appropriate in the supervision relationship, especially if the request is presented by the doctoral student.

Well-being could also be threatened in other ways. One student sometimes felt exposed to situations that were too difficult and which he did not have the competencies to deal with:

> But when you are alone in those situations as a novice, and you are not able to fend for yourself, or like describe your viewpoints, then you are left with a bad taste in your mouth. Like 'thanks for sending me all alone to a workshop all the way to [another country] to have this experience!' I suppose you learn, but they have not been encouraging situations at all. (DS5)

It may be neither possible nor necessary to protect doctoral students from all the knocks and blows that may result from, for instance, disputes over epistemological, theoretical or methodological questions that more experienced academics may

expose them to. This is an inherent part of scientific work. Doctoral students may also be differently prepared for being 'on the spot', and one of the students raised the point that it was useful for his development to be exposed to a challenging situation from the very beginning.

The issue here is for supervisors to recognize which 'scaffolds', that is, support, preparation, mock presentation training and advice a student needs. It is hardly appropriate that students repeatedly have unpleasant experiences with scholarly debates.

One of the doctoral students discussed the lack of community. While the student collaborated with peers outside the particular research group, he missed stronger connections to peers and academics in his local scholarly community:

> I have certain people with whom I cooperate more, but these individuals are in a different location, because my topic is cross-disciplinary. I would have hoped for … or I don't know what it is like to work in a large project, clearly, where you are one of the team members. That kind of group support has been lacking. That has bothered me some. (DS6)

Supervisors explored the boundaries of their legitimate roles. This was, however, not role confusion as in dual relationships, but rather a realization of how one must act out one's legitimate roles in order to 'be beneficial' to one's environment. In the following quotation, the supervisor has struggled with integrating the roles of supervisor and team leader and assumed the authority necessary for executing all simultaneous commitments:

> Somewhere in the process I essentially understood my role. Even if I were not able to be the mentor-supervisor, I have to keep the reins in my hands, kinda like in an entirely different way than so far. In my case, they always get a bit mixed up, the leadership and the supervision. So I needed to admit this to myself. … In the aftermath of this one problem case last fall, I realized I needed to have a more professional take on leadership. (S3)

Autonomy

A supervisor brought up the issue of supervisors allowing their doctoral students to surpass them at some point. This is essentially what apprenticeship in science is all about: teaching a novice the trade so that he or she can independently master and develop the field or the profession. Inherently, scientific endeavors should take knowledge beyond what is known, and this may mean that students surpass their supervisors in the contributions they make to science. While the supervisor quoted here is explicit on the need for science to work this way, it might not automatically be the attitude of all senior academics. Supporting doctoral students' autonomy implies the need for supervisors to allow the students to assume authority over their research topic. A research group that functions as an agentive learning environment allows its members, including novices, to find a niche for creating expertise:

> I came back and got my first doctoral student to supervise, and I taught [the student] how this system that I had built works, and of course the process went on and on and I was involved all the time, and I was asked all the time about this and that, but then suddenly

> came a moment when I was not asked about things anymore, but that fellow worked independently in the lab and knew more about it than I! (S2)

The students did not pose ethical dilemmas with regard to their autonomy. Instead, the students mentioned how they appreciated the ways in which their supervisors supported their own decision-making, that is, their autonomy as novice researchers.

Fidelity

Supervision abandonment was the largest single category of ethical concerns among the doctoral students. Some students experienced supervision that was not sufficient or adequate. Abandonment, however, was typically unintentional, but once it happened, students found it difficult to do anything about the situation. The following is an example of a student whose main supervisor is affiliated with another university. Due to the supervisor's illness, the student was left to his own devices. The problem was allowed to continue for more than a year before the teams were able to work out a decision that would benefit the student:

> My main supervisor is at [university] and he is ill. He has [disease], which has resulted in me not getting much supervision. I have always travelled and have in principle been employed at our department all this time, so it is a mutual [employment] between the two universities. So I have been drifting and not getting much supervision, but it should change this spring or maybe has changed a bit already. Last year I spent half of the year at[university] and half at [university] so now it has been decided that I stay here in [city] and just go to [the other city] to finish off our mutual things. It has probably been a good decision … In my view, the supervisor's boss should have intervened. But they just took it like it's just a doctoral student complaining again instead of acknowledging that they don't have it under control. It's easy to blame the other university instead of both admitting that they don't provide me any supervision. (DS1)

In the quotation above, the doctoral student had recognized the supervisor's superior as someone who might have intervened in the situation. This would have been an adequate response to the problem, but it appears that the clashing cultures of the two universities may have come in the way of solving the problem efficiently. It is necessary to recognize ways in which the surrounding community can intervene faster. Waiting for appropriate supervision for years is too long a time: it is inefficient use of institutional resources and public funds. Also parental leave had caused unintentional supervision abandonment. Parental leave, however, is usually known in advance, and this gives the community the chance to prepare for it well ahead. A prerequisite for remedying such situations is better planning and management of human resources in the community.

The following excerpt describes a situation that does not appear to be unintentional abandonment. The doctoral student views the lack of professorial time and person-related aspects as the reasons for his lack of adequate supervision. The excerpt raises questions about the timing of the supervision. Why has the supervisor not been actively involved before? Has the supervisor been aware of the student's inadequate supervision? Formal supervision agreements should reflect the actual work commitments. If the formal agreement cannot be carried through, then it should be amended to correspond

with reality. In this way scholarly communities can assure that those who engage in supervision are properly acknowledged for their input:

> From my main supervisor I get almost nothing. He is a co-author of one of my papers, but otherwise nothing really. But we have agreed that next fall when I start to write the summary of my articles, he will be more involved … It is the professorial level. These things depend so much on the person. It depends on the professor. In a way, people on the most experienced level don't have time for it. I have given up hope … It has so far been a formal agreement. (DS6)

Supervisors grappled with balancing supervision and other commitments. They emphasized the necessity of finding time for their doctoral students, but also recognized the difficulty of making sufficient effort:

> You kinda get a guilty conscience for never really putting in the effort and having time to familiarize yourself as properly as you perhaps should. (S5)

One supervisor had had the experience of being left without proper supervision when doing a Ph.D., and found that this boosted his learning and provided a model for supervision. However, it is hardly an efficient model to be recommended for doctoral training:

> In fact, I got very little supervision. So I had maybe too little supervision, but on the other hand, in retrospect, it was really was a rather good thing that I learned to think for myself in all those things, because no one necessarily came and told me that this you should do like that. Twice you fail and the third time you get it right. (S2)

Justice

The doctoral students brought up ethical issues, potentially breaching the principle of justice. These breaches pertained to experiences of inequity and unfair assignment of credit for their contribution to the project. Two students discussed the experiences of inequity based on the disciplinary background:

> It is also the situation. I have not reacted much to the lack of supervision, because I think a doctoral student must do the work himself or herself. But in the end you notice the difference if one person does not get the same support as others. So that's what it is. My background is in [discipline] so there is a different supervision culture than in [discipline], so I have reacted weakly to it because lack of supervision is normal in my background discipline. I don't feel that this is unusual. (DS2)

One doctoral student felt that he did not receive the same quantity and quality of supervision as other doctoral students because he had not demanded it. Such notions may contribute to experiences of unequal treatment among students.

Another form of breaches of justice takes place when individuals feel that the results of the work they have done is not credited to them. This was the experience of one of the students. The student found that there were no ways to remedy the situation without hampering the social relationships so vital for the everyday functioning of the laboratory:

> Sometimes I have had the feeling that someone else has received the credit for the work I have done. That bothers me. (DS1)

In the long run, however, social relationships, and consequently the quality of the work, are likely to suffer even more if such experiences become more common among doctoral students and others in the research community.

Discussion

The results of this study suggest that supervisors and doctoral students in the natural sciences confront different ethical issues. The main conclusion we draw based on our analysis is that one of the major questions that appears to underpin many of the emerging ethical issues in these data is that the supervisors and doctoral students have different expectations of the supervisory role (cf. also Halse, 2011). The quotation from a supervisor in the title of the article, 'I don't even have time to be their friend!', captures the dilemma. The differences in expectations manifested among the supervisors primarily as a concern for project management and doctoral students as workers. The doctoral students, however, hoped for and expected their supervisors to be concerned about them as persons in both personal and work-related ways. The expectations of supervisors and doctoral students appear to clash in a way that potentially could cause misunderstandings and discouraging experiences. The supervisors in this study found themselves juggling numerous commitments and responsibilities as project leaders and as employers of doctoral students and other staff, which may have contributed to the ethical dilemma.

A substantial portion of the ethical dilemmas in these data pertained to non-maleficence, typically exploitation. Simultaneously, only the students raised concern about well-being, which is a beneficence-related ethical issue. One reason for the lack of evidence of this aspect in the supervisor data and the relatively high frequency of exploitation issues may be that the supervisors had adopted a more task-oriented approach than the students. Doctoral students often provide a significant work force for projects, and while engaging in the core activities of the group, that is, producing research, there is the implicit assumption that learning and development as researchers occur as by-products. The challenge here is that if the work is not meaningful and its goals are not clear to the student, the anticipated learning and development may not take place. Rather than being concerned about how the student is doing personally and psychologically, the supervisors focus their concerns on how to secure financing for their students and promoting research. By securing financing, the supervisors may feel that they are encouraging the doctoral students in precisely these activities. In this way, the supervisors may be more focused on assuring that there are sufficient infrastructures and resources for the students to engage in the various activities of their research groups. However, the students might not experience such support as encouragement to participate, if they are expecting the supervisor to engage with them at a more personal level. The lack of pastoral and emotional support, when students feel that they need such support, could appear to be neglect, even though for other students a

'hands-off' approach might be exactly the right kind of support for their development as independent young researchers (Deuchar, 2008).

The second key conclusion to be drawn from this study is that the doctoral students primarily described their own, personal experiences, whereas, as might be expected, the supervisors had a more holistic view of the doctoral study and supervision processes and elaborated more on causes and consequences at the system level. In order to develop appropriate supervision, both perspectives are valuable and necessary to map out. Research communities benefit from knowledge of about which aspects of doctoral studies and supervision the students experience ethical challenges with. Likewise, in order to understand how those individual experiences fit into a broader framework of multiple supervisory commitments, project management, financing, infrastructures, interactions among group members, and professional standards and values, the supervisors' views of causes, relations and consequences are essential.

The result according to which supervisors and students tackle different ethical issues suggests that there may be aspects of the supervisory relationship and process for which there is no shared understanding. The lack of shared understanding reflects the differences in supervisors and students' views on what constitutes supervision, for instance, the nature of communication in the supervision dyad and the support needed (e.g. Deuchar, 2008). It is difficult to solve any problems, including ethical ones, if the parties have different understandings of what the problem is. Articulating expectations, commitments, responsibilities and challenges is a necessary step in the direction of solving the issues. This appears particularly vital in counteracting non-maleficence and beneficence-related ethical dilemmas (e.g. exploitation, well-being).

Issues pertinent to the students' perspective in this study were threats to the principle of fidelity, which emerged especially in supervision abandonment. Post-doctoral students, senior members of the scholarly community and peers provide an important, yet often under-used resource, although in the scholarly communities in the sciences, the activities are typically organized around research groups and laboratories, as was true in this case. Feldman et al. (2013) urge professors to acknowledge the importance of peer mentoring in the research laboratory and to consider training students in peer mentoring. There is plenty of evidence that students in this study also receive support from more senior peers in their research group. This suggests that in many cases there could be inconsistencies between formal and actual supervisory responsibilities. The formal supervision agreements steer students' expectations in certain directions. When the expectations are not met by the assigned supervisor, students may interpret this as lack of commitment or even neglect. Supervision agreements that prompt all parties to consider their duties, rights and responsibilities have become more common and may help all parties consider more carefully their role in the doctoral process (Hockey, 1996).

The aim of this case study was not to generalize results from the present sample to a population. However, the fact that five relatively universal ethical principles have been applicable in the analysis of these data and the data collected in another disciplinary context (Löfström & Pyhältö, 2012, 2014) suggest that the study has value in terms of transferability. The study describes the experiences of supervisors and doctoral

students in one research-intensive science community in Finland. While there is national variation in how doctoral studies are organized, there may be more features in common in the way research is organized in science laboratories. The study highlights the importance of recognizing that supervisors' and doctoral students' conceive of ethical issues differently. This interpretation is amplified by the study design involving supervisors and students from the same case research community.

Had we asked specifically for ethical dilemmas or problems in the interviews, the results might have been different: On the one hand, direct questions about ethical issues in supervision may have heightened the participants' awareness of such issues and consequently produced more conscious responses. On the other hand, direct questions may have triggered more 'filtered' responses. In this sense, we feel that we have been able to capture ethical issues in an authentic 'state', just as they appear in the participants' thoughts. Future research on the ethical problems experienced in doctoral supervision may benefit from a focus on those problems in which a significant discrepancy existed between the supervisor and the student views. Another avenue for future research involves the relationship between ethical issues in supervision and team structure and culture, that is, how the culture of the team, group structure and type of research conducted within the team may have bearings on what ethical issues emerge, and how they are discussed, handled and ultimately solved or left unsolved.

Acknowledgements

The authors would like to thank Jenni Keskinen, Ph.D., for her contribution to the data collection, and the anonymous reviewers for their helpful comments on an earlier version of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Academy of Finland [grant number 252813] to the first author and the University of Helsinki [grant number 2106008], [grant number 7630108] to the second author.

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