

The Added Value of a PhD in Medicine

- PhD Students' Perceptions of Acquired Competences

Henrika Anttila¹, Sari Lindblom-Ylänne², Kirsti Lonka² & Kirsi Pyhälä²

¹ Faculty of Behavioral Science, University of Helsinki, Finland

² Centre for Research and Development of Higher Education, University of Helsinki, Finland

³ Faculty of Educational Science, University of Oulu and Centre for Research and Development of Higher Education, University of Helsinki, Finland

Correspondence: Henrika Anttila, Siltavuorenpenger 1 a 00014 Helsingin Yliopisto Finland. Tel: 35-84-1527-0986; E-mail: henrika.anttila@gmail.com

Received: March 17, 2015

Accepted: April 5, 2015

Online Published: April 8, 2015

doi:10.5430/ijhe.v4n2p172

URL: <http://dx.doi.org/10.5430/ijhe.v4n2p172>

Abstract

PhD in the field of medicine is more common than in any other domain. Many medical doctors are driven towards PhD, but also students with other backgrounds (usually MSc) are conducting a PhD in medical schools. Higher education has invested a lot in developing generic and research competences. Still little is known about how PhD students themselves perceive the competence of future PhDs'. The aim of this study is to determine how medical PhD students perceive their future competences and whether there is a difference between MD PhD and MSc PhD students' perceptions. Moreover this study examines students' perceptions of their learning environment and their experienced well-being.

The data were collected from 163 medical PhD students. The survey data consisted of Likert type statements, open-ended questions and background variables. PhD students' perceptions of acquired competences were content analysed. The connection between conducted degree and emphasised competences were analysed using cross tabulation and χ^2 -test Perceptions of well-being and the learning environment were examined using descriptive statistics of scales.

The results showed that PhD students considered a wide variety of competences to be central to future PhDs'. Their perception of their future competences consisted of scientific and generic competences. All students emphasised scientific competences over generic competences but MSc PhD students emphasised generic skills more than MD PhD students. PhD students' perceptions of their well-being and the learning environment showed that PhD studies are a burdening and stressful process. However students also felt that they received feedback from the scientific community.

Keywords: PhD, Doctoral student, Doctoral education, Medical education, Generic competence, Scientific competence

1. Introduction

Medical doctors (MD) are most likely to obtain a PhD, when compared to other domains (OESC, 2014). A top-level specialist often has both MD and PhD degrees. Moreover, many medical schools PhD students hold previous studies in science (MSc). We wanted to see, what is the added value of a PhD degree for MDs and MScs. Although, one of the fundamental purposes of PhD education is to equip students for a constantly changing future, so that they are able to recognize problems and find ways to solve them, little is still known about how PhD students themselves perceive the competence of future PhDs' i.e. what should be learned during their doctoral studies. This study focuses on exploring medical PhD student's perceptions on their future competences.

Given that today research competences are seen valuable not only to academia but also to a broad range of employment sectors, an important aim is to better prepare PhD students to work outside of academia through emphasizing the acquisition of "generic competences" in doctoral education (EUA, 2009; Fiske, 2011; Gilbert, Balatti, Turner, & Whitehouse, 2004; OECD, 2012). PhDs' expertise can be reflected in terms of scientific and generic competences (e.g. EUA, 2007). *Generic competence* refers to a set of skills that are needed in a wide range of activities in education, training, working and generally in life (Barrie, 2006; Bennett, Dunne, & Carré, 1999; de La Harpe, Radloff, & Wyber, 2000). The competences typically include communication skills, cognitive skills and interpersonal skills (Barrie, 2006; Bennett et al., 1999; de La Harpe et al., 2000; Jones, 2009). A characteristic of

generic competences is that they are less domain specific, and hence more easily applied to different working contexts than scientific competences. However previous studies have shown that PhD students often face problems in mastering generic competences (Gilbert et al., 2004; Pyhältö, Toom, Stubb, & Lonka, 2012). PhD students for instance, reported that they suffered from lack of self-regulated learning skills, poor time management, experienced motivational problems and low self-confidence (Pyhältö et al., 2012).

Scientific competences, on the other hand refer to skills needed for conducting research, such as information seeking skills and methodological knowhow (Meerah et al., 2012). Also subject-related knowledge may be seen as scientific competence. Although, PhD students often learn necessary scientific competence by conducting their research some students have reported that they face significant difficulties in developing scientific competences such as constructing a theoretical framework, and selecting research questions and methods (Pyhältö et al., 2012). This may in the long run result in a negative attitude towards doing research in general (Murtonen & Lehtinen, 2003).

The development of scientific competence is mediated by the interaction between the student and the environment, and it regulates what skills and knowledge PhD students learn during their doctoral journey (Christensen & Lund, 2014; Vekkailla et al., 2012). Accordingly, it can either promote or inhibit meaningful learning (Lindblom-Ylänne & Lonka, 2000). At its best a learning environment provides a shared control for developing scientific competence (Pyhältö et al., 2012). For example, the experience of belonging to a scholarly community has been shown to be the key to a successful PhD process, promote engagement in learning and well-being (Austin, 2010; Gardner, 2010; Golde, 2000; Pyhältö, Stubb, & Lonka, 2009). However there is also evidence that working in a research group does not guarantee an experience of a membership (Pyhältö et al., 2009; Walsh, 2010).

Previous research on PhD students' well-being indicates that they quite often experience negative emotions such as stress and exhaustion during their PhD process (Gardner, 2007; Gardner, 2008; Golde, 2000; McAlpine & Norton, 2006). Stubb, Pyhältö & Lonka (2011) for instance showed that more than half of the PhD's in the field of medicine found their relationships with their scholarly communities burdening. Also attrition rates among PhD students have been reported to be high, the dropout rate range from 30 to 50% - depending on the discipline and country (Golde, 2000; Gardner, 2007; McAlpine & Norton, 2006). Research on undergraduate students indicates that reduced well-being during doctoral studies may have long-term effects on students' futures and working lives (Nurmi & Salmela-Aro, 2002). In addition previous studies have shown that PhD students who perceive themselves as active members of the scholarly communities reported less negative emotions, less lack of interest towards their doctoral studies, and less often considered abandoning their PhD studies (Pyhältö & Keskinen, 2012). Hence, by creating inspiring learning environments for PhD students we may not only be able to promote students learning but also their well-being.

2. The Aims

There is a gaping hole in literature on PhD student's perceptions on their future competences. The aim of this study is to determine how PhD students in the Faculty of Medicine perceive the competences of PhDs' and whether there is a difference between MD PhD and MSc PhD students' perceptions. Moreover this study examines students' perceptions of their learning environment and their experienced well-being. By understanding PhD students' perceptions of acquired competences, learning environment and well-being, we may provide tools with which to develop inspiring learning environments. The following research questions are addressed:

- What kinds of perceptions do PhD students in medicine have on doctoral future PhD's competences?
- Are there differences in how MD PhD's and MSc PhD's perceive their future competences?
- How do PhD students in medicine perceive their learning environments and experience their well-being?
- How experienced well-being and perceptions about their learning environment were related in their intentions to drop out, their research group status and working status?

This study was part of a larger national research project on PhD education in Finland (Stubb et al., 2011).

3. PhD Studies in Medicine

The University of Helsinki Faculty of Medicine offers three PhD programs: Doctor of Medicine, Doctor of Dentistry and Doctor of Philosophy. The PhD in Medicine requires a thesis, seminars, course work (40 European Credit Transfer and Accumulation System, ECTS) and a public defense of the thesis. The doctoral studies are heavily embedded in conducting doctoral research, and there is no extensive separate course work before launching the doctoral research. In addition to scientific competences, generic competences are seen as an important learning goal in Finnish doctoral education (e.g. Academy of Finland, 2011; Ministry of Education and Culture, 2006). Students

need to apply to enter PhD education and the license has, until recently, been valid for life. The average time for completing PhD in the field of medicine is 6 years and doctoral studies are typically funded by personal grants or wages from working outside the university (Saari & Moisio, 2012). In the field of Medicine 96% of PhD students complete their thesis as a summary of articles (Saari & Moisio, 2012).

4. Methods

4.1 Participants

Altogether 163 PhD students (age mean: 38; age median: 34; women 76%; men: 24%) from the Faculty of Medicine at the University of Helsinki completed a survey in 2006 (See Table 1.). The questionnaires were sent to all registered PhD students of the Faculty of Medicine (student database). The majority (58%) of the participants were conducting a Doctor of Philosophy degree (background MSc) and only 41% a Doctor of Medicine degree. The participants were all in various phases of their PhD studies: however the majority of them (64%) were according to self-reports in the last third of their thesis process. A majority (55%) of participants reported working full time on their thesis. The total response rate was 31%. In terms of gender, age and conducted degree our sample represented the population quite well (See Table 1.).

Table 1. Gender, conducted degree and age. Statistics of Gender, Conducted Degree, and Age in Faculty of Medicine in University of Helsinki According to Statistics Finland (from 2008) and the University's Statistics (2006)

		<i>Participants in this study</i>	<i>All students in the Faculty of Medicine</i>
Number of students	N	<i>f</i> =163	<i>f</i> =480
Gender	<i>Women</i>	<i>f</i> =129 (80 %)	<i>f</i> =352 (73 %)
	<i>Men</i>	<i>f</i> =33 (20 %)	<i>f</i> =128 (27 %)
Conducted Degree	<i>MD PhD</i>	<i>f</i> =94 (58 %)	<i>f</i> =255 (53 %)
	<i>MSc PhD</i>	<i>f</i> =67 (41 %)	<i>f</i> =225 (47 %)
Age	Median	34	35.3

4.2 Measurements and Data Collection

The survey data consisted of both Likert type statements and open-ended questions. The themes of the open-ended questions were: students' perceptions of scientific expertise, their ideas of the PhD process and its main regulators (e.g., problems and critical incidents), perceptions of themselves as a part of the scholarly community and perceptions of supervision. The scales included in the survey were designed to measure PhD students' perceptions of their learning environment, experienced stress, anxiety and exhaustion as well as their ideas about academic writing and themselves as writers. In addition to these, there were background variables at the end of the survey. The survey was sent to all the PhD students' at the University of Helsinki in the Faculty of Medicine. The contact information of PhD students was collected from the student register database. Students who did not have Finnish as their native language received the questionnaire in English. Before conducting the survey in research context, it was validated in a pilot study, including 45 PhD students majoring in natural sciences. After the pilot study minor modifications was made to the questionnaire form (e.g. what terms were used). This study followed the set of ethical research practice guidelines of Finnish Advisory Board on Research Integrity (TENK), Academy of Finland, University of Helsinki and Declaration of Helsinki. In addition research permission was given by the Faculty of Behavioral Sciences, University of Helsinki

4.3 The Instrument

PhD students' perceptions of future PhDs' competences were explored with an open-ended question: "What kind of competences should a PhD. have?" PhD students' perceptions of their learning environment were explored using a modified version of the MED NORD scales (Lonka et al., 2008; Stubb et al., 2011). The PhD students' perceptions of their learning environment were measured with 6 items that formed scales Atmosphere and Receiving feedback, (modified from Dahlin, Joneborg, & Runeson, 2005) (see Table 2). PhD students' perceptions of experienced well-being were measured with 10 items that measured Stress (modified from Elo, Leppänen, & Jahkola, 2003), Exhaustion (modified from Maslach & Jackson 1981) and Anxiety and Lack of Interest (modified from Mäkinen, Olkinuora, & Lonka 2004) (see Table 2.). The items measuring perceptions of learning environment as well as experienced well-being were ranked on a 1 (do not agree) to 5 (fully agree) scale. Students intentions to interrupt

their studies were studied with the question - "Have you sometimes considered interrupting your doctoral studies?" where students could answer either yes or no. The internal consistency (Cronbach's alpha) is satisfactory for each scale adopted in this study. Moreover PhD student's gender, research group status and working status were explored with the background variables.

Table 2. *The items and scales included in the questionnaire*

<i>Scales</i>	<i>Alpha</i>	<i>Items included in the scales</i>
Atmosphere	.643	"Doctoral education enhances a cold and impersonal attitude" "Doctoral education creates isolation and anonymity among students" "Relationships between doctoral students are very competitive"
Receiving feedback	.780	"My supervisors are supportive and I get personal attention from them" "I often get constructive feedback on my knowledge and skills" "I am treated respectfully"
Stress		'Stress' means a situation which a person feels tense, restless, nervous, or anxious or is unable to sleep because his/her mind is troubled all the time. Do you feel this kind of stress these days?
Exhaustion	.850	"I feel exhausted" "My workload is often too high" "Doctoral studies are too stressful for me" "I worry about the thesis in my free time"
Anxiety	.686	"I often fear that I will fail in my doctoral studies" "I am stressed out by the workload, deadlines and competition in doctoral studies"
Lack of Interest	.764	"I often have to force myself to work for my thesis" "It is difficult for me to find meaning in my doctoral studies" "I am not motivated by the content of my studies"

Internal consistency (Cronbach's alpha)

4.4 Analysis

The open-ended question on PhDs' competence was qualitatively content analysed (Mayring, 2000). All text segments in which PhD students reflected future PhDs' competences were coded to the same category. This resulted in altogether 437 text segments that were further analysed to identify what kinds of perceptions do PhD students in medicine have on doctoral future PhD's competences. The analysis constituted two main categories of PhDs' competences: (a) Scientific competence and (b) Generic competence. Scientific competence category consisted of three sub categories: domain specific research skills, scientific thinking and researcher development – Generic competence category consisted of four sub categories: communication skills, self-regulatory skills, interpersonal skills and pedagogical knowledge. The research group validated categories resulting from the content analysis and the ecological validity of findings was tested and verified by PhD supervisors of the Faculty of Medicine.

After formation of the categories, answers were classified according to whether the participants emphasised scientific or generic competences. The connection between conducted degree and emphasised competences were analysed using cross tabulation and χ^2 -test ($p < .05$). This phase of the analysis was carried out to explore whether there are differences in how MD PhD's and MSc PhD's perceive their future competences.

PhD students' perceptions of experienced well-being and learning environment were analysed using minimum, maximum, mean and standard deviation values. The relationship between experienced well-being and perceptions of the learning environment were measured with a Pearson product-moment correlation. A Student's T-test (significance level $p < 0.05$) was carried out to find out whether there were differences about perceptions of learning environment and experienced well-being between students' intentions to drop out. In addition a one-way analysis of Variance (Anova) (significance level $p < 0.05$) was conducted to measure whether PhD students' perceptions about their learning environment and experienced well-being were related to research group and working status.

5. Results

5.1 PhD Students' Perceptions about Doctoral Degree Holder's Competence

PhD students considered a wide variety of competences to be central to future PhDs' competence. Student's descriptions ranged from highlighting the importance of doing scientific research to generic competences that can also be applied outside of the scientific world. PhD students' perception of their future competences consists of scientific competence and generic competence.

A majority of PhD students (63%) reported more scientific competence than generic competence (See Table 3.). Students emphasised the importance of developing domain specific research skills, skills of scientific thinking and development as a researcher. They, for example, considered the methodological know-how and understanding of central theories of medicine as an important part of their future expertise. The PhD students also highlighted the importance of understanding the nature of scientific research, critical thinking, applying for funding, learning to study independently, and skill to create research groups and projects. In terms of researcher development PhD students described the development of the researcher identity and growing to be part of the scholarly community as an important part of PhD's competence

“To run statistics, the Stata program or any other statistical program, data collection, preparation of the questionnaire, substance knowledge”

“Skills to read scientific literature, to know the most relevant research methods and skills to do research plan [...] to know the basics of statistics, to act in the international research community.”

Further investigations showed that 37% of PhD students reported more generic competences than scientific competences (See Table 3.). For example the PhD students emphasised communication skills, self-regulatory skills, interpersonal skills and pedagogical knowledge. They also perceived communicational skills such as writing and publishing scientific articles, presenting and language skills and an ability to share information as part of future PhDs' competences. Students also emphasised self-regulatory skills for example controlling their own learning, self-control, self-critical assessments and the skills of critical thinking. Moreover students described interpersonal skills, such as social skills, teamwork skills and an ability to network to be an important part of competences to be obtained. Pedagogical skills, including teaching skills and supervising research, were also highlighted as part of PhD's core competences.

“To be co-operative, to be able to talk about research both scientifically and layman terms, to be able to solve problems, to work independently, to be critical”

“[...] writing and presentation skills, international co-operation, to be able to learn new things, flexible/creative thinking”

Further investigation showed that 75% of participants who emphasised generic competences over scientific competences were conducting MSc PhD degree (See Table 3.) Only 22% of MD PhD students emphasised generic competences. MSc PhD students emphasised generic competences only a little less (46%) than scientific competences (54%). Overall both groups emphasised scientific competences over generic competences. Our results showed that there were differences in how MD PhD's and MSc PhD's perceived their future competences.

Table 3. *PhD students' emphasised competences and the degree attempted*

Emphasised competences	MSc PhD	MD PhD	Total
Generic competences	<i>f</i> = 39	<i>f</i> = 13	<i>f</i> = 52
	75%	25%	100%
	46%	22%	37%
Scientific competences	<i>f</i> = 45	<i>f</i> = 45	<i>f</i> = 90
	50%	50%	100%
	54%	78%	63%
Total	<i>f</i> = 84	<i>f</i> = 58	<i>f</i> = 142
	100%	100%	100%
	59%	41%	100%

$\chi^2=8.52$, $df=1$, $p=.004$, *f*= frequency, %= per cent

5.2 Perceptions of the Learning Environment and Experienced Well-being

The descriptive analyses for scales measuring stress, exhaustion, anxiety, lack of interest, feedback, workload, atmosphere and worry with number of items, scale means, standard deviation, minimum and maximum Likert points are presented in Table 4. On average the PhD students experienced some discontent with the atmosphere of doctoral studies. Although doctoral students were not extremely satisfied with their learning environment, they claimed that they received enough feedback from their supervisors. At the same time PhD students reported that they experienced some stress, exhaustion, anxiety and lack of interest in their studies. Altogether the mean values were rather low (except for feedback), but there was a lot of variation between the perceptions of learning environment and experienced well-being.

Table 4. *Descriptive analyses of the scales (n= 163)*

Scales	N	Min	Max	Mean	SD
<i>Perceptions of learningenvironment</i>					
Atmosphere	3	1.00	5.00	2.3610	.82498
Receivingfeedback	3	1.00	5.00	3.2996	.93790
<i>Perceptions of experiencedwell-being</i>					
Stress	1	1.00	5.00	2.9939	1.18372
Exhaustion	4	1.00	5.00	2.9575	.93784
Anxiety	3	1.00	5.00	2.6196	.97139
Lack of interest	2	1.00	5.00	2.3006	1.05488

Number of items (N), minimum and maximum values, scale's mean values and standard deviations (SD).

Table 5 shows that PhD students who thought they received enough feedback reported the lowest level of stress, exhaustion and anxiety. They also reported experiencing less lack of interest in their studies. Moreover self-reported feedback correlated negatively with a poor atmosphere. Negative attributes such as discontent with atmosphere correlated positively with exhaustion and anxiety. At the same time a poor atmosphere was also related to lack of interest and stress. Stress, exhaustion, anxiety and lack of interest were all positively correlated to each other.

Table 5. *Pearson correlations between perceptions of the learning environment and experienced well-being*

	1	2	3	4	5
1. Stress (1. item)					
2. Exhaustion	.676**				
3. Anxiety	.522**	.585**			
4. Lack of Interest	.266**	.300**	.444**		
5. Receiving feedback	-.241**	-.298**	-.241**	-.383**	
6. Atmosphere	.158*	.263**	.191*	.325**	-.277**

Note: * $p < 0.05$; ** $p < 0.001$

The results showed that doctoral students' perceptions of their learning environment and experienced well-being were related to their intentions to drop out. Altogether 56% of participants had considered interrupting their studies at some point of their thesis process. Further investigation showed that these students experienced more stress ($t=2.581$, $df=158$, $p=.011$), anxiety ($t=5.493$, $df=158$, $p<.000$) exhaustion ($t=3.875$, $df=158$, $p<.000$) and lack of interest towards their doctoral studies ($t=6.212$, $df=158$, $p<.000$) than students who had not considered dropping out. Moreover students who had considered dropping out from their studies thought that they had received less feedback ($t=-4.281$, $df=158$, $p<.000$) and experienced a poorer atmosphere ($t=2.089$, $df=158$, $p=.038$) than those who had not considered withdrawing from their studies.

A majority of participants of this study (42%) reported working alone on their thesis, 39% in a research group and the rest (19%) both alone and in a group. Further investigations showed a relationship between doctoral students' perceptions of their learning environment and their research group and working status. Students who reported working on their thesis both in a research group and alone experienced receiving more feedback than students working alone. There were no gender differences in terms of perceptions about learning environment or well-being.

6. Discussion

6.1 Limitations of the Study

In the present study survey data were collected to capture PhD students' perceptions of their future competences. The study's response rate was moderate. However, the representativeness of the sample was sufficient. Previous studies (Cook, Heath, & Thompson, 2000; Krosnick, 1999) have shown that sample representativeness is a much more important criterion for evaluating the validity of a study than response rate.

The reflective and open-ended questions gave the students an opportunity to reflect on various aspects of PhDs' competences and provided rich data with which to identify and analyse how medical PhD students felt competences were obtained. However, further research, particularly longitudinal and comparative systemic designs are needed in order to examine what PhD students learn during their studies carried out in the faculty across an extended period of time.

6.2 Conclusion

In this study we explored medical PhD students' perception of PhDs' competences. Also participants' experienced well-being and perceptions about PhD studies as a learning environment were analysed. The results showed that the PhD students identified a variety of scientific and generic competences that are in line with the objectives set for PhD education (Bogle, Dron, Eggermont, & Henten, 2011; European University Association Publications, 2007). Further investigations showed that PhD students emphasised scientific competences over generic competences. This indicates that PhD students more easily identified competences that they face in everyday activities. The emphasis of research competences over generic competences supports the finding of previous studies suggesting that competences learned during the doctoral studies are highly related to the field of the studies (Gardner, 2007; Golde & Dore, 2004). A reason why generic competences were less emphasised may be that PhD students may not have the possibility to practice generic competences e.g. leadership skills during their studies. Therefore, students may not necessarily see that doctoral studies develop such capabilities. At the same time, a significant number of participants (37%) emphasised generic competences over scientific competences. This implies that students recognised the importance of generic competences in terms of their future. Moreover, especially MSc PhD students emphasised generic competences over scientific competences. This implies that learning generic competences during PhD studies may be more important for the MSc PhD students than MD PhD students. This may be due to the fact that MD PhD students have already graduated for a profession, whereas MSc PhD students may need to promote their learning and the value that a PhD would create for them.

Further investigation showed that PhD students perceived PhD studies as a burdening and stressful process. At the same time students felt that they received feedback from the scientific community. Their pattern of MED NORD answers was quite similar to undergraduate medical students, except that PhD students experienced receiving more feedback than the undergraduate participants in Lonka et al. (2008) study. Our findings are in line with the previous results of research on PhD students' well-being and learning environment experiences (Gardner, 2007; Gardner, 2008; Golde, 2000; McAlpine & Norton, 2006; Stubb et al., 2011).

PhD education is a significant investment from the society. Moreover, students in the field of medicine are more likely to obtain a PhD, when compared to other domains. Hence it is positive that medical PhD students themselves identified the added value of a PhD in terms of clinical work, patient care as well as other arenas of working life.

References

- Academy of Finland. (2011). The Graduate School Working Groups' Suggestions for Doctoral Training Development. Retrieved from http://www.aka.fi/Tiedostot/Tiedostot/Liitetiedostot/Tohtorikoulutus_joulukuu_2011.pdf
- Barrie, S.C. (2006). Understanding What We Mean by the Generic Attributes of Graduates. *Higher Education*, 51(2), 215–241. <http://dx.doi.org/10.1007/s10734-004-6384-7>
- Bennett, N., Dunne, E., & Carré, C. (1999). Patterns of core and generic skill provision in higher education. *Higher Education*, 37(1), 71–93. <http://dx.doi.org/10.1023/A:1003451727126>
- Bogle, D., Dron, M., Eggermont, J., & Henten, J.W.V. (2011). Doctoral degrees beyond 2010: Training talented researchers for society. *Procedia - Social and Behavioral Sciences*, 13, 35–49. <http://dx.doi.org/10.1016/j.sbspro.2011.03.003>
- Christensen, M.K., & Lund, O.(2014). Doctoral Education in a Successful Ecological Niche: A Qualitative Exploratory Case Study of the Relationship between the Microclimate and Doctoral Students' Learning to Become a Researcher. *International Journal of Higher Education*, 3(3) 103–113. <http://dx.doi.org/10.5430/ijhe.v3n3p103>
- Cook, C., Heath, F., & Thompson, R.L. (2000). A Meta-analysis of Response Rates in Web- or Internet-based Surveys. *Educational & Psychological Measurement*, 60(6), 821–836. <http://dx.doi.org/10.1177/00131640021970934>
- Dahlin, M., Joneborg, N., & Runeson, B. (2005). Stress and depression among medical students: a cross-sectional study. *Medical education*, 39(6), 594–604. <http://dx.doi.org/10.1111/j.1365-2929.2005.02176.x>
- de La Harpe, B., Radloff, A., & Wyber, J. (2000). Quality and Generic (Professional) Skills. *Quality in Higher Education*, 6(3), 231–243. <http://dx.doi.org/10.1080/13538320020005972>
- Elo, A., Leppänen, A., & Jahkola, A. (2003). Validity of a single-item measure of stress symptoms. *Scandinavian Journal of Work, Environment and Health*, 29(6), 444–451. <http://dx.doi.org/10.5271/sjweh.752>
- European University Association Publications (2009). *Collaborative Doctoral Education*. Retrieved from <http://www.eua.be/publications/eua-reports-studies-and-occasional-papers.aspx>
- European University Association Publications (EUA) (2007). *Doctoral Programmes in Europe's Universities: Achievements and Challenges*. Retrieved from <http://www.eua.be/publications/eua-reports-studies-and-occasional-papers.aspx>
- Fiske, P. (2011). What is a PhD really worth? *Nature*, 427(381). <http://dx.doi.org/10.1038/nj7343-381a>
- Gardner, S. K. (2010). Doctoral student development. In S. K. Gardner, & P. Mendoza (Eds.), *On becoming a scholar: Socialization and development in doctoral education*. (pp. 203–223). Virginia, USA: Stylus Publishing, LLC.
- Gardner, S.K. (2007). "I heard it through the Grapevine": Doctoral Student Socialization in Chemistry and History. *Higher Education*, 54(5), 723–740. <http://dx.doi.org/10.1007/s10734-006-9020-x>
- Gardner, S.K. (2008). What's too much and what's too little? The Process of Becoming an Independent Researcher in Doctoral Education. *Journal of Higher Education*, 79(3), 326–350 <http://dx.doi.org/10.1353/jhe.0.0007>
- Gilbert, R., Balatti, J., Turner, P., & Whitehouse, H. (2004). The generic skills debate in research higher degrees. *Higher Education Research & Development*, 23(3), 375–388. <http://dx.doi.org/10.1080/0729436042000235454>
- Golde, C. (2000). Should I Stay or Should I Go? Student Descriptions of the Doctoral Attrition Process. *The Review of Higher Education*, 23(2), 199–227. <http://dx.doi.org/10.1353/rhe.2000.0004>
- Golde, C., & Dore, T. (2004). The survey of doctoral education and career preparation: The importance of disciplinary context. In D. Wulff & A. Austin (Eds.), *Paths to the professoriate: strategies for enriching the preparation of future faculty*. Josey-Bass: San Francisco.
- Jones, A. (2009). Generic attributes as espoused theory: the importance of context. *Higher Education*, 58(2), 175–191. <http://dx.doi.org/10.1007/s10734-008-9189-2>
- Krosnick, J.A. (1999). Survey Research. *Annual Review of Psychology*, 50(1), 537–567. <http://dx.doi.org/10.1146/annurev.psych.50.1.537>
- Lindblom-Ylänne, S., & Lonka, K. (2000). Dissonant study orchestrations of high-achieving university students. *European Journal of Psychology of Education*, 15(1), 19–23. <http://dx.doi.org/10.1007/BF03173164>

- Lonka, K., Sharafi, P., Karlgren, K., Masiello, I., Nieminen, J., Birgegård, G., & Josephson, A. (2008). MED NORD - A tool for measuring medical students' well-being and study orientations. *Medical teacher*, 30(1), 72–79. <http://dx.doi.org/10.1080/01421590701769555>
- Mäkinen, J., Olkinuora, E., & Lonka, K. (2004). Students at risk: Students' general study orientations and abandoning/prolonging the course of studies. *Higher Education*, 48(2), 173–188. <http://dx.doi.org/10.1023/B:HIGH.0000034312.79289.ab>
- Maslach, C., & Jackson, S.E. (1981). The Measurement of Experienced Burnout. *Journal of Occupational Behaviour*, 2(2), 99–113. <http://dx.doi.org/10.1002/job.4030020205>
- Mayring, P. (2000). Qualitative Content Analysis. *Forum: Qualitative Social Research*, 1(2), 120–130.
- McAlpine, L., & Norton, J. (2006). Reframing our approach to doctoral programs: an integrative framework for action and research. *Higher Education Research & Development*, 25(1), 3–17. <http://dx.doi.org/10.1080/07294360500453012>
- Meerah, T.S.M., Osman, K., Zakaria, E., Ikhsan, Z.H., Krish, P., Lian, D.K.C., & Mahmud, D. (2012). Measuring Graduate Students Research Skills. *Procedia - Social and Behavioral Sciences*, 60, 626–629. <http://dx.doi.org/10.1016/j.sbspro.2012.09.433>
- Ministry of Education and Culture, Finland. (2006). *Development of doctoral education*. Retrieved from http://www.minedu.fi/OPM/Julkaisut/2006/tohtorikoulutuksen_kehittaminen?lang=fi&extra_locale=en
- Murtonen, M., & Lehtinen, E. (2003). Difficulties Experienced by Education and Sociology Students in Quantitative Methods Courses. *Studies in Higher Education*, 28(2), 171–185. <http://dx.doi.org/10.1080/0307507032000058064>
- Nurmi, J., & Salmela-Aro, K. (2002). Goal construction, reconstruction and depressive symptoms in a life-span context: the transition from school to work. *Journal of personality*, 70(3), 385–420. <http://dx.doi.org/10.1111/1467-6494.05009>
- Organisation for Economic Co-operation & Development (OECD). (2012). *Transferable Skills Training for Researchers: Supporting Career Development and Research*. Retrieved from <http://www.oecd.org/sti/sci-tech/transferableskills.htm>
- Organisation for Economic Co-operation and Development. (2014). *Online Education Database. Graduates by Field of Education*. Retrieved April 1, 2015, from <http://stats.oecd.org/Index.aspx?DatasetCode=RGRADSTY>
- Pyhältö, K., & Keskinen, J. (2012). Doctoral Students' Sense of Relational Agency in Their Scholarly Communities. *International Journal of Higher Education*, 1(2), 136–149. <http://dx.doi.org/10.5430/ijhe.v1n2p136>
- Pyhältö, K., Stubb, J., & Lonka, K. (2009). Developing scholarly communities as learning environments for doctoral students. *International Journal for Academic Development*, 14(3), 221–232. <http://dx.doi.org/10.1080/13601440903106551>
- Pyhältö, K., Toom, A., Stubb, J., & Lonka, K. (2012). Challenges of Becoming a Scholar: A Study of Doctoral Students' Problems and Well-Being. *ISRN Education*, 2012. <http://dx.doi.org/10.5402/2012/934941>
- Saari, S., & Moisio, A. (2012). *International Evaluation of Research and doctoral training at the University of Helsinki (2005–2010)*.
- Stubb, J. & Pyhältö, K., & Lonka, K. (2011). Balancing between inspiration and exhaustion: PhD students' experienced socio-psychological well-being. *Studies in Continuing Education*, 33(1), 33–50. <http://dx.doi.org/10.1080/0158037X.2010.515572>
- Vekkailla, J., Pyhältö, K., Hakkarainen, K., Keskinen, J., & Lonka, K. (2012). Doctoral students' key learning experiences in the natural sciences. *International Journal for Researcher Development*, 3(2), 154–183. <http://dx.doi.org/10.1108/17597511311316991>
- Walsh, E. (2010). A Model of research group microclimate: environmental and cultural factors affecting the experiences of overseas research students in UK. *Studies in Higher Education*, 35(5) 545–560. <http://dx.doi.org/10.1080/03075070903243092>