



## Factors that influence PhD candidates' success: the importance of PhD project characteristics

E. van Rooij, M. Fokkens-Bruinsma & E. Jansen

To cite this article: E. van Rooij, M. Fokkens-Bruinsma & E. Jansen (2021) Factors that influence PhD candidates' success: the importance of PhD project characteristics, *Studies in Continuing Education*, 43:1, 48-67, DOI: [10.1080/0158037X.2019.1652158](https://doi.org/10.1080/0158037X.2019.1652158)

To link to this article: <https://doi.org/10.1080/0158037X.2019.1652158>



© 2019 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 07 Aug 2019.



Submit your article to this journal [↗](#)



Article views: 43958



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 21 View citing articles [↗](#)

# Factors that influence PhD candidates' success: the importance of PhD project characteristics

E. van Rooij , M. Fokkens-Bruinsma and E. Jansen

Teacher Education, University of Groningen, Groningen, Netherlands

## ABSTRACT

High dropout rates, delay, and dissatisfaction among PhD students are common problems in doctoral education. Research shows that many different factors are associated with doctoral success, but these factors have not often been studied simultaneously. Moreover, characteristics of the PhD project are mostly neglected. In this study, we investigate which supervision, psychosocial, and project characteristics are related to satisfaction, progress, and quit intentions in a sample of 839 PhD candidates at a university in the Netherlands. Results of regression analyses show that experienced workload was negatively related to satisfaction and progress and positively to quit intentions. The quality of the supervisor-PhD candidate relationship, the PhD candidate's sense of belonging, the amount of freedom in the project, and working on a project closely related to the supervisor's research were positively related to satisfaction and negatively to quit intentions. The high workload of PhD candidates should be a major point of attention for universities who wish to increase their rates of PhD completion and PhD candidates' satisfaction. In addition, the 'match' between PhD candidate and supervisor is crucial, both personally – a good relationship – and academically, i.e. that the PhD candidate works on a topic closely related to the supervisor's research.

## ARTICLE HISTORY

Received 4 March 2019

Accepted 1 August 2019

## KEYWORDS

PhD candidates; PhD supervisor support; sense of belonging; workload

## Introduction

The doctoral journey is known to be challenging. Attrition rates support this notion: 33–70% of those who start their PhD never finish (Jones 2013). Also, Castelló et al. (2017) revealed that one-third of a sample of doctoral students who were still enrolled had at some point intended to drop out. In addition, of those who reach the finish line, the majority do so in (substantially) more time than initially planned. In the Netherlands, for example, only 10% manage to finish in the commonly prescribed four years and the average completion time is five years (Van de Schoot et al. 2013). High doctoral dropout rates challenge universities both competitively and financially because a large share of their research output depends on PhD students (Horta, Cattaneo, and Meoli

**CONTACT** E. van Rooij  [e.c.m.van.rooij@rug.nl](mailto:e.c.m.van.rooij@rug.nl)

© 2019 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

2018) and PhD education is costly (Bair and Haworth 2004). Delay is highly problematic for PhD students because in most cases it means that they receive no income anymore, because their employment contract or scholarship ends after a certain amount of time, regardless of whether or not the dissertation has been completed. Next to attrition and delay, another problem in doctoral education is PhD students' dissatisfaction. Comparable to job satisfaction, dissatisfaction about the PhD trajectory is tied to negative outcomes such as attrition and delay (Bair and Haworth 2004), but also to lower productivity and mental health problems such as worrying, anxiety, exhaustion, and stress (Pyhältö, Stubb, and Lonka 2009).

This makes it important to investigate which factors in doctoral education programmes are related to satisfaction, progress, and retention. Typically, researchers refer to three categories of doctoral success predictors: (1) institutional or environmental factors, including the departmental culture; (2) supervision-related factors such as the quality and quantity of supervision and the relationship between the supervisor and PhD student; and (3) individual PhD student characteristics like background characteristics (e.g. gender, age) and behavioural and psychological characteristics (e.g. personality, motivation) (Jiranek 2010; Manathunga 2005; Van de Schoot et al. 2013). However, a category that focuses on PhD project characteristics is lacking.

In the Netherlands, as in some other European countries like the Scandinavian countries and Belgium, PhD candidates are usually employees (i.e. they have an employment contract with the university and receive a monthly salary) and they work on their own research for the entirety of the PhD trajectory (Kehm 2006). This means that, in contrast to what is common in countries such as the US and the UK, there is no separate coursework phase that has to be completed successfully before continuing to the dissertation phase, and the master-apprentice model is widespread (Kehm 2006). Consequently, there are large differences between PhD students depending on the characteristics of their PhD project.

Therefore, in this study, we investigate how supervision factors, psychosocial factors, and project characteristics are related to doctoral success, where doctoral success is measured as being satisfied with the PhD trajectory overall, being on schedule (a proxy for progress), and considering quitting (a proxy for dropout). By increasing our knowledge of which factors are important in the doctoral journey, in particular in the context of doctoral education systems in which PhD candidates are seen as employees and the emphasis is on independent research, the quality of doctoral education can be improved and (timely) completion rates and satisfaction increased. Below we provide an overview of the literature on factors that are (hypothesised to be) related to successful PhD completion.

## Literature review

### *Supervision factors*

#### *Academic, personal, and autonomy support*

A strongly established finding in doctoral education research is the significance of high-quality supervision for PhD students' satisfaction and (timely) completion (e.g. Bair and Haworth 2004; Kolmos, Kofoed, and Du 2008; Pyhältö, Vekkaila, and Keskinen

2015; Skakni 2018; Spaulding and Rockinson-Szapkiw 2012; Stubb, Pyhältö, and Lonka 2011; Woolderink et al. 2015). Different aspects of PhD supervision have been investigated, such as the supervisor's availability, different types of support, and the quality of the supervisor-supervisee relationship (e.g. Bair and Haworth 2004). However, one of the drawbacks of many studies is the lack of a well-grounded theoretical framework (Devos et al. 2015). Hence, following Devos et al. (2015), we use self-determination theory to study PhD supervision – more specifically one of its so-called mini-theories, basic needs theory (Ryan and Deci 2017). Basic needs theory postulates that three basic psychological needs need to be fulfilled in order to experience autonomous motivation, which leads to positive psychological and behavioural outcomes such as wellbeing and learning (Ryan and Deci 2017). These needs are the need for competence, relatedness, and autonomy (Ryan and Deci 2017).

The need for competence refers to feeling successful in one's endeavours, to experience mastery (Ryan and Deci 2017). PhD supervisors can support this need in PhD students by providing academic support, which focuses on all research-related support (Overall, Deane, and Peterson 2011). As such, it can refer to providing support in obtaining academic skills, such as research techniques and academic writing, but also support in the development of process-related skills, such as planning and management. Research shows that academic support is related to (timely) degree completion and satisfaction (Devos et al. 2015; Johnston et al. 2016; Maher, Ford, and Thompson 2004; Overall, Deane, and Peterson 2011). Non-existent, little, or poor academic support is related to dissatisfaction, longer completion times, and even dropout (Devos et al. 2015; Maher, Ford, and Thompson 2004; Van de Schoot et al. 2013).

The need for relatedness is about connecting with other people, about caring about others, and feeling cared for (Ryan and Deci 2017). Supervisors can fulfil this need by providing personal support (Overall, Deane, and Peterson 2011). This type of support can be interpreted as the extent to which the supervisor shows he or she cares about the PhD student as a person. Many studies showed that aspects of personal support were related to PhD students' satisfaction, e.g. being friendly, understanding their private situations, and reassuring them in case of stress (Ali, Watson, and Dhingra 2016; Barnes, Williams, and Archer 2010; Basturkmen, East, and Bitchener 2014; Devos et al. 2015; Woolderink et al. 2015). Conversely, PhD supervisors' lack of interest is related to PhD students' quit intentions and actual attrition (e.g. Bair and Haworth; Lovitts 2001).

The need for autonomy concerns the experience of volition and freedom (Devos et al. 2015; Ryan and Deci 2017). For individuals to experience this need, autonomy support is important. Autonomy support in the doctoral context can be understood as giving the PhD student space and opportunity to make his or her own choices, encouraging autonomous behaviour, and treating the PhD student's point of view and ideas with respect (Overall, Deane, and Peterson 2011). A supervisor who provides a high level of autonomy support can be seen as the opposite of a very controlling supervisor who presses his or her own point of view (Devos et al. 2015). Research showed that perceived autonomy is related to continuing the PhD, to satisfaction, and to greater research self-efficacy (Mason 2012; Overall, Deane, and Peterson 2011). The opposite, controlling behaviour, is perceived as negative by PhD students (Devos et al. 2015).

In the PhD supervision literature, academic, personal, and autonomy support have rarely been explicitly studied in the context of basic needs theory. However, they

continuously appear in studies that concern PhD supervision, although they are referred to in varying terms (Devos et al. 2015).

### *Relationship, availability, and expectations*

The relationship between the PhD supervisor and PhD student is crucial as well, as many studies showed that the quality of the relationship is related to PhD students' thesis completion and their satisfaction (Bair and Haworth 2004; Cockrell and Shelley 2011; Lovitts 2001; Mason 2012; Shin et al. 2018; Woolderink et al. 2015) and that poor relationships can lead to attrition (Golde 2005). Hence, we also take the quality of the relationship, as perceived by the PhD student, into account in this study.

A very basic factor in supervision is the supervisor's availability, where availability does not only refer to frequent physical presence, but also to having frequent meetings with the PhD student, and providing timely answers to questions via email and feedback on the student's written work (Overall, Deane, and Peterson 2011). Several studies show that PhD students attach great value to their supervisors' availability, e.g. timely feedback, timely responses to questions, frequent meetings (Abiddin and West 2007; Pyhältö, Vekkaila, and Keskinen 2015; Woolderink et al. 2015). Moreover, some studies reported a relationship with frequent supervision and a lower attrition risk (Pyhältö, Vekkaila, and Keskinen 2015). In addition to the quality of supervision (support and relationship), quantity thus also seems to matter.

An aspect related to PhD supervision, that has – to our knowledge – not been explicitly quantitatively investigated as a factor that could be related to the PhD student's success, is what level of expectations the supervisor holds regarding the PhD student's achievement. Previous qualitative research shows that PhD supervisors expect high levels of commitment and independence from their PhD students and expect that their PhD students publish before submitting their thesis (Bøgelund 2015; Halse 2011). Anecdotal evidence (Anonymous 2016; Thesis Whisperer 2014) also reveals that some supervisors seem to expect quite a lot from their PhD students, e.g. that they publish all the papers that form their PhD thesis, only publish in high-impact journals, set up international networks, are involved in committees, work on side projects, etc. Although for some PhD students this may be achievable, for the vast majority it is probably not. Such high expectations can cause dissatisfaction and could even cause the PhD student to face a delay or consider quitting.

### *Psychosocial factors*

A considerable number of studies on doctoral education focus on psychosocial aspects, such as integration, socialisation, and support (e.g. Gardner 2007). Following Tinto's (1993) model of (undergraduate) student attrition, students need a certain level of integration in order to be committed to their studies, and this commitment subsequently leads to persistence. Tinto (1993) distinguishes two types of integration: academic (i.e. formal) and social (i.e. informal) integration.

In the doctoral context, academic integration refers to involvement in professional activities and opportunities, collaborating with researchers, frequent contact with colleagues, integration in the department community, and receiving (and providing) academic help from other doctoral students and from staff (based on Bair and Haworth 2004; Lovitts 2001;

Meeuwisse, Severiens, and Born 2010). Research has reported relationships between aspects of academic integration and PhD completion and progress (Golde 2000; Lovitts 2001; Maher, Ford, and Thompson 2004; Spaulding and Rockinson-Szapkiw 2012).

Social, or informal, integration can be seen as the quantity and quality of socialising with colleagues (fellow PhD students or other staff in the PhD student's department) outside of work and/or about topics that are not directly related to the academic side of work (based on Golde 2000; Meeuwisse, Severiens, and Born 2010). Examples of social integration are providing and receiving mental support from peers when needed, sharing holiday and weekend stories, and social activities such as having a beer together after work. Studies found support for the relationship between social integration aspects and completion, progress, and satisfaction (Bair and Haworth 2004; Lovitts 2001; Shin et al. 2018).

A third interesting psychosocial construct is sense of belonging, i.e. experiencing a sense of connectedness and the belief that one is important and matters to others in an organisation (O'Meara et al. 2017). Curtin, Stewart, and Ostrove (2013) found a positive effect on PhD students' sense of belonging in graduate school on their academic self-concept, which might imply that sense of belonging could also be connected to progress, retention, or satisfaction. Among undergraduates, connections have been reported between a sense of belonging and study progress (e.g. Meeuwisse, Severiens, and Born 2010).

### ***Project characteristics***

Recommendations in previous studies included a call for taking into account the doctoral task itself in studies on persistence and attrition (Devos et al. 2017). This is especially important in the European context, where the emphasis in doctoral education is on pursuing a research project in collaboration with one or more supervisors (Kehm 2006). Since in this system the doctoral student's research project is the one central task the student works on throughout the PhD degree, its characteristics may influence progress and satisfaction.

### ***Freedom***

First, in line with the supervision research that showed that doctoral students value autonomy (Ali et al. 2016; Levecque et al. 2017), the level of freedom PhD students have in the design and execution of their research project may be related to their success and satisfaction. In their qualitative study, Devos et al. (2017) found that about one-third of the non-completers were being forced to work in a direction that they did not wish to follow. Shin et al. (2018) reported a positive association between PhD students' freedom in making their own planning and in expressing their opinions on the one hand and satisfaction with their doctoral programme on the other hand.

### ***Workload and teaching tasks***

A second project characteristic that seems important is workload. As discussed in the Introduction, the number of PhD students who finish in time is low. Could this not simply imply that the workload of the PhD project is too high; that there is just too much that needs to be done in too little time? Research among academics shows a relationship between the experienced workload and the satisfaction and intention to stay (Fredman and Doughney 2012). There is little doubt that the workload for PhD students,

in general, is very high: 80% of PhD students who work on weekends do so because of time pressure (Kolmos, Kofoed, and Du 2008). A small number of studies found impacts of workload on PhD student outcomes. Pyhältö, Stubb, and Lonka (2009) showed that doctoral students who reported a higher workload more often considered quitting the programme. Castelló et al. (2017) listed the high demands of a doctoral degree, which interfered with people's personal lives, as responsible for dropping out as well.

In the Netherlands, where most PhD candidates have an employee status, they can be asked to teach or supervise undergraduate students as part of their contract. As such, the majority of PhD candidates in the Netherlands have teaching tasks at some point during their PhD (Sonneveld and Tigchelaar 2009). Teaching tasks add to the PhD candidate's workload, as they imply less time for research (Bradley 2009). Moreover, teaching may even take more time than expected, especially for PhD students who are typically inexperienced teachers (NUS 2013), which consequently can cause a delay in their research. Teaching tasks may also lead to dissatisfaction in case the PhD students are 'forced' by their departments to take on these tasks, even though they lack the time, will and/or skill (NUS 2013). Some studies point to PhD students' teaching tasks as a cause for delay (Maher, Ford, and Thompson 2004).

### *Stand-alone projects*

Studies showed that PhD students who regularly work in groups, i.e. on PhD projects that are closely related to each other or that are parts of a larger research project by a specific research group, complete their PhD sooner (e.g. Bair and Haworth 2004). Conversely, PhD students who work on stand-alone projects, i.e. projects that are not related to the research that other people in the same research group are working on, may be at risk of dropping out because they experience fewer opportunities for daily interaction and support from peers and faculty (Ali and Kohun 2006). These students may not consider themselves as a member of the scholarly community, which is related to reporting less satisfaction with their studies (Pyhältö, Stubb, and Lonka 2009). Moreover, PhD candidates working on stand-alone projects cannot benefit from beneficial group processes such as peer learning (Agné and Mörkenstam 2018). In addition, there are also accounts of PhD students who work on projects that are not closely related to their supervisor's research. Besides feeling isolated from their peers, these students may also feel intellectual isolation – they barely have opportunities to talk about their research because there are no experts nearby (Skakni 2018).

### *This study*

Our literature review shows that many factors are related to PhD students' success. Still, it is less clear what the relative importance of these factors is when they are all included in one model. This is why in this study we use regression analyses to study the relative importance of multiple factors that are hypothesised to be related to doctoral success. The research questions are the following:

- (1) Which supervision characteristics, psychosocial factors, and project characteristics contribute to the explanation of variance in PhD candidates' satisfaction with their PhD trajectory overall?



- (2) Which supervision characteristics, psychosocial factors, and project characteristics contribute to the explanation of variance in PhD candidates' progress, i.e. the extent to which they are on schedule to finish in time?
- (3) Which supervision characteristics, psychosocial factors, and project characteristics contribute to the explanation of variance in PhD candidates' intention to quit their PhD?

## Method

### *Participants and procedure*

The sample consisted of 839 PhD candidates at a research university in the Netherlands (response rate of 30.9%). Fifty-three per cent of the respondents were female. Forty per cent had Dutch nationality, 22% were from another European country, and 38% came from outside of Europe. The majority (41%) were pursuing their PhD in science, 30% in medical science, 20% in social science, and 10% in humanities. Twenty-eight per cent were in the first year of their PhD, 22% in their second year, 20% in their third year, 18% in their fourth year, 7% in their fifth year, and 5% in their sixth year or longer. The average age of the PhD candidates in the sample was 28.9 (*SD* 4.53, range 23–63). In the Netherlands, like in many other European countries such as Belgium and the Scandinavian countries, most PhD candidates are regarded as employees and receive a monthly income.

All PhD candidates were invited in May 2017 to participate in the survey via an email that was sent on behalf of the dean of the graduate schools who approved this study. Research goals were explained in this email, as well as information about data management and processing. Anonymity was guaranteed and participants had to give their informed consent before starting the survey. Participation was voluntary and participants were free to withdraw from the study at any time, without having to provide a reason for doing so. The survey was open for one month. Two reminder emails were sent to those PhD candidates who had not started or completed the survey. A total of 100 vouchers were allotted among those who completed the survey.

### *Instruments*

Whenever possible, we used items from questionnaires that have been validated and used in previous studies. The questionnaire was pilot-tested by 16 PhD candidates, who were asked to think aloud while completing the questionnaire. Hence, issues such as inconsistencies, unclear language use, and some items not being applicable to certain PhD candidates' specific situation, were identified and solved. [Table 1](#) provides an overview of all factors, including sample items, number of items, and reliabilities.

The supervisor support scales, i.e. autonomy support, personal support, academic support, and supervisor availability, were based on scales developed by Overall, Deane, and Peterson (2011). Reliabilities of the scales were almost as high as those in Overall, Deane, and Peterson (2011). In addition, we developed a scale about supervisor expectations, which had sufficient reliability, and one item that measured doctoral candidates' perception of the quality of the relationship with the supervisor. Many doctoral candidates



**Table 1.** Measurement characteristics of the variables used in this study.

Factor	Sample item	Number of items	Cronbach's alpha
<i>Dependent variables</i>			
Satisfaction	Overall, how satisfied are you with your PhD trajectory? (5-point scale: 'very dissatisfied' – 'very satisfied')	1	–
Progress	Are you currently on schedule with your work? (4-point scale: 'No, I have fallen very far behind and won't be able to finish in time' – 'Yes, I think I will be able to finish in time')	1	–
Intention to quit	Have you ever considered quitting your PhD project? (4-point scale: 'no, never' – 'yes, very often')	1	–
<i>Supervision characteristics</i>			
Autonomy support	My supervisor provides me with choices and options.	8	.81
Personal support	My supervisor expresses understanding and empathy when I experience difficulties.	13	.96
Academic support	My supervisor helps me to plan and manage the different research tasks I have to complete.	10	.92
Availability	My supervisor responds to my queries or requests for help within a reasonable time frame.	3	.85
High expectations	My supervisor expects me to publish in high-impact journals.	6	.70
Relationship	Overall, how would you describe your relationship with your supervisor? (5-point scale: 'very bad' – 'very good')	1	–
<i>Psychosocial factors</i>			
Academic relationships	Colleagues approach me to discuss their work.	8	.87
Social relationships	I regularly spend time outside work with my colleagues.	4	.85
Sense of belonging	I enjoy the atmosphere in my department.	5	.91
<i>Project characteristics</i>			
Freedom	I have the freedom to make my own choices about the direction of my project and the methods to be used.	6	.81
Workload	How would you describe the workload in your PhD project? (5-point scale: 'too high' – 'too low')	1	–
Stand-alone project	Is your project a stand-alone project, i.e. are you the only one working on that topic? ('yes' or 'no')	1	–
Project with close link to supervisor's research	Is your project closely linked to your supervisor's research? ('yes' or 'no')	1	–
Teaching tasks	Do you teach and/or supervise students? ('yes' or 'no')	1	–

have multiple supervisors, so in all supervision measures, we specifically asked students to focus on their daily supervisor, as he or she is most closely involved with the PhD candidate.

Project characteristics were measured by four separate items that addressed workload, whether the project is a stand-alone project, whether the project is closely related to the supervisor's research, and whether the PhD candidate has any teaching tasks (including supervision tasks). Furthermore, we developed a scale that measured the amount of freedom a PhD candidate experiences.

The scales regarding psychosocial factors – formal relationships, informal relationships, and sense of belonging – were based on scales that Meeuwisse, Severiens, and Born (2010) used in a study of undergraduate students. We rephrased the items to make them applicable to doctoral candidates in the Netherlands who in most cases are employees, e.g. we replaced 'fellow students' with 'colleagues'. Reliabilities of the scales in our study were comparable to the ones in Meeuwisse et al.'s (2010) study.

The dependent variable satisfaction was measured by asking PhD candidates on a 5-point scale how satisfied they were with their PhD trajectory overall. Progress was measured by asking doctoral candidates on a 4-point scale the extent to which they

thought they were on schedule with their work and on track to finish in time. Intention to quit was measured by asking how often the PhD candidates had considered quitting their PhD (see [Table 1](#))

## Analyses

We performed hierarchical multiple regression analyses to assess the impact of supervision characteristics, psychosocial factors, and project characteristics on satisfaction, progress, and intention to quit. In this way, we were able to investigate the individual contribution of each factor in explaining the three outcome variables. The groups of independent variables were entered into a blockwise multiple regression analysis. We controlled for the influence of background characteristics on the dependent variables by adding gender, nationality, discipline, and phase of the project in the first step.<sup>1</sup> Then, supervision characteristics were added in step 2, psychosocial factors in step 3, and finally project characteristics in step 4.

## Results

### Descriptives

Means, standard deviations, and ranges of all variables are displayed in [Table 2](#). In [Table 3](#), percentages are shown regarding PhD candidates' expectations to finish in time and how often they had considered quitting the PhD.

### Satisfaction: regression results

First, we wanted to know which factors affected PhD candidates' satisfaction with their PhD trajectory overall (see [Table 4](#)). In Model 1, background variables were entered.

**Table 2.** Descriptive statistics: Means, standard deviations, and ranges.

Variable	<i>M</i>	<i>SD</i>	Range
<i>Dependent variables</i>			
Satisfaction	3.72	.88	1–5
Progress	3.19	1.04	1–4
Intention to quit	1.40	.72	1–4
<i>Supervision characteristics</i>			
Academic support	3.68	.81	1–5
Personal support	4.02	.76	1–5
Autonomy support	4.06	.57	1–5
Availability	4.32	.76	1–5
High expectations	2.75	.60	1–5
Relationship	4.44	.74	1–5
<i>Psychosocial factors</i>			
Academic integration	3.61	.65	1.25–5
Social integration	3.53	.80	1–5
Sense of belonging	3.87	.71	1–5
<i>Project characteristics</i>			
Freedom	3.95	.62	1.67–5
Workload	3.59	.63	1–5
Stand-alone project	.50	.50	0–1
Project with close link to supervisor's research	.40	.49	0–1
Teaching tasks	.70	.46	0–1

**Table 3.** Descriptive statistics: Answers on the questions regarding being on schedule and considering quitting.

Are you currently on schedule with your work?	I was unable to finish in time and am currently on an extension or finishing my thesis in my own time.	No, I have fallen behind and I don't think I will be able to finish in time	No, I have fallen behind, but I still think I will be able to finish in time.	Yes, I think I will be able to finish in time.
%	11.1	12.5	22.6	53.8
Have you ever considered quitting your PhD project?	Yes, very often	Yes, often	Yes, sometimes	No, never
%	3.3	3.8	22.5	70.3

Gender, nationality, and phase of the project mattered: Men were more satisfied, European PhD candidates and PhD candidates in their final years less satisfied. These variables explained only 3% of the variance. In Model 2, we added supervision characteristics. Two of these affected satisfaction: More academic and personal support from the daily supervisor led to more satisfaction. In this model, gender and phase of the project were no longer significant predictors of satisfaction, but both European and non-European PhD candidates were less satisfied than Dutch PhD candidates. Model 2 explained 19% of the variance, a significant and substantial improvement compared to Model 1. Next, psychosocial factors were added in Model 3. Sense of belonging appeared to be a significant and substantial predictor of satisfaction. Nationality was still significant, but of the

**Table 4.** Results of the hierarchical regression analysis with satisfaction as dependent variable.

Predictors	Satisfaction			
	Model 1	Model 2	Model 3	Model 4
<i>Step 1: Background factors</i>				
Gender: male	.10*	.07	.06	.05
Nationality: EU	-.10*	-.10*	-.10*	-.08
Nationality: non-EU	-.08	-.13**	-.14**	-.11*
Discipline: social sciences	.08	.05	.04	.06
Discipline: medical sciences	-.01	-.04	-.03	-.04
Discipline: humanities	.07	.02	.01	.02
Phase of project: senior	-.10*	-.06	-.05	-.03
<i>Step 2: Supervision characteristics</i>				
Academic support		.14*	.08	.05
Personal support		.18*	.18**	.12
Autonomy support		.05	-.01	-.02
Availability		.00	.01	.01
High expectations		-.05	-.01	-.00
Relationship		.11	.11	.12*
<i>Step 3: Psychosocial factors</i>				
Academic integration			.05	.03
Social integration			.01	.01
Sense of belonging			.18**	.17**
<i>Step 4: Project characteristics</i>				
Freedom				.13**
Workload				-.09*
Stand-alone project				.02
Project with close link to supervisor's research				.18***
Teaching tasks				-.03
$R^2$	.04	.21	.24	.30
Adjusted $R^2$	.03	.19	.22	.27
$\Delta R^2$	.04**	.17***	.04***	.05***

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

supervision characteristics, only personal support still mattered. 22% of the variance in satisfaction was explained by Model 3. When adding project characteristics in Model 4, three characteristics played a role in explaining satisfaction: Freedom and a close link to the supervisor's research were positive predictors and workload a negative one. Only the background factor non-European nationality was still significant in this model. Moreover, of the supervision characteristics, only the relationship with the supervisor had an impact. Sense of belonging remained an important contributor. This final model explained 27% of the variance in satisfaction.

### **Progress: regression results**

The second research question was which factors explained variance in PhD students candidates' progress (i.e. being on schedule). The results are presented in Table 5. Model 1 revealed that, when including only background variables, PhD candidates in the medical sciences were less likely to report to be on schedule than PhD candidates in other fields. Also, logically, those in the first two years reported less often to be behind schedule than those in later years. Model 1 explained 11% of the variance in being on schedule. Supervision characteristics were added in Model 2, but none of these variables was significant. Adding psychosocial factors in Model 3 did also not lead to a better model, as none of these variables affected progress. However, adding project characteristics in Model 4 led to a significant increase in explained variance,

**Table 5.** Results of the hierarchical regression analysis with progress as dependent variable.

Predictors	Progress			
	Model 1	Model 2	Model 3	Model 4
<i>Step 1: Background factors</i>				
Gender: male	.07	.06	.05	.05
Nationality: EU	-.01	-.01	-.02	-.02
Nationality: non-EU	-.03	-.04	-.04	-.03
Discipline: social sciences	-.07	-.08	-.06	-.06
Discipline: medical sciences	-.13*	-.13*	-.11*	-.11*
Discipline: humanities	.01	.00	.02	.02
Phase of project: senior	-.30***	-.29***	-.29***	-.28***
<i>Step 2: Supervision characteristics</i>				
Academic support		.05	.00	-.01
Personal support		.02	.02	-.01
Autonomy support		.03	.00	.00
Availability		.00	.01	.01
High expectations		-.05	-.02	-.01
Relationship		-.02	-.02	-.01
<i>Step 3: Psychosocial factors</i>				
Academic integration			.00	-.03
Social integration			.04	.05
Sense of belonging			.07	.05
<i>Step 4: Project characteristics</i>				
Freedom				.09
Workload				-.14**
Stand-alone project				-.08
Project with close link to supervisor's research				.07
Teaching tasks				-.01
$R^2$	.12	.13	.14	.18
Adjusted $R^2$	.11	.11	.11	.15
$\Delta R^2$	.12***	.01	.01	.04***

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

because workload had a significant negative effect on progress. This model explained 15% of the variance in progress.

### **Quit intentions: regression results**

Finally, we wanted to know which factors were related to PhD candidates' intention to quit (see Table 6). In Model 1, gender was a significant predictor: Men less often considered quitting their PhD project. Furthermore, nationality and phase of the project mattered: Non-European PhD candidates less often considered quitting, and PhD students in the last years of their PhD had considered quitting more often than first and second year PhD candidates. These background variables explained 6% of the variance in intention to quit. In Model 2, these background factors were still significant. In addition, two supervision characteristics had an impact on intention to quit: academic support and high expectations. PhD candidates who indicated they perceived less academic support and who reported that their supervisor had high expectations more often considered quitting. Model 2 explained 19% of the total variance, a significant increase compared to Model 1. Then, we added psychosocial factors in Model 3. Sense of belonging made a significant and substantial contribution to the prediction of intention to quit. Those who felt less at home in their department were more likely to consider quitting. The background variables gender and having a non-European nationality were still significant, but the phase of the project not anymore. Regarding supervision characteristics, academic support was no

**Table 6.** Results of the hierarchical regression analysis with quit intentions as dependent variable.

Predictors	Quit intentions			
	Model 1	Model 2	Model 3	Model 4
<i>Step 1: Background factors</i>				
Gender: male	-.12**	-.09**	-.09*	-.09*
Nationality: EU	.06	.05	.06	.04
Nationality: non-EU	-.13**	-.12*	-.10*	-.12*
Discipline: social sciences	-.01	.02	.01	-.01
Discipline: medical sciences	.02	.04	.04	.05
Discipline: humanities	-.02	.03	.04	.03
Phase of project: senior	.12**	.08*	.06	.02
<i>Step 2: Supervision characteristics</i>				
Academic support		-.12*	-.07	-.03
Personal support		-.14	-.13	-.05
Autonomy support		-.01	.04	.05
Availability		-.02	-.03	-.04
High expectations		.13**	.11*	.08
Relationship		-.10	-.10*	-.11*
<i>Step 3: Psychosocial factors</i>				
Academic integration			-.09	-.08
Social integration			.08	.09
Sense of belonging			-.26***	-.26***
<i>Step 4: Project characteristics</i>				
Freedom				-.09*
Workload				.08*
Stand-alone project				.05
Project with close link to supervisor's research				-.09*
Teaching tasks				.08
$R^2$	.07	.21	.26	.29
Adjusted $R^2$	.06	.19	.24	.26
$\Delta R^2$	.07***	.14***	.06***	.03***

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

longer significant, but high expectations still were. In addition, the relationship with the supervisor was a significant predictor now: PhD candidates who reported a lower quality relationship with their daily supervisor more often considered quitting. Model 3 explained 24% of the variance, significantly more than Model 2. Finally, adding project characteristics in Model 4 resulted in three new significant predictors, namely freedom, workload, and a close link to the supervisor's research. PhD candidates who experienced less freedom, who reported a higher workload, and who indicated that their project was not closely related to their supervisor's research more often considered quitting. Gender and non-European nationality were still significant. The only significant supervision characteristic that remained in the final model was the quality of the relationship. Sense of belonging was still a substantial significant predictor. This final model explained 26% of the variance in intention to quit.

## Conclusion and discussion

### *Main findings*

This study investigated how supervision factors, psychosocial factors, and project characteristics influenced PhD candidates' satisfaction with their PhD trajectory overall, their progress (i.e. being on schedule to finish in time), and the extent to which they considered quitting. By including this wide range of independent factors in our model and by focusing on three aspects of doctoral success, we provide a comprehensive picture of which factors matter the most in explaining PhD candidates' satisfaction, progress, and intention to quit, in contrast to previous studies on doctoral education that usually focus on only one category of predictors, such as supervision (e.g. Agné and Mörkenstam 2018; Ali et al. 2016; Overall, Deane, and Peterson 2011) or socialisation (e.g. Ali and Kohun 2006; Gardner 2007). Moreover, this study provides insight into the role project characteristics plays in explaining doctoral success. PhD project characteristics have not often been investigated in relation to doctoral success, even though they are important, especially in doctoral education systems in which PhD candidates focus on their own research project for the entirety of the time of their PhD and the emphasis on coursework is low.

Using survey data from more than 800 PhD candidates at a university in the Netherlands, we found that our variables were able to explain substantially more variation in satisfaction (27%) and intention to quit (26%) than in progress (15%). A reason for the relatively low amount of explained variation in progress could be that we included PhD candidates from all years in our study. Junior PhD candidates – those in the first and second year of their PhD – more often than senior PhD candidates – those in the final years – indicated that they were still on schedule (60% vs. 46%). As Van de Schoot et al. (2013) also mentioned in their study, junior PhD candidates thus seem to be more optimistic about being able to finish in time. This optimism may disguise possible effects of supervision and psychosocial factors. However, regardless of this difference between junior and senior PhD candidates on the outcome variable progress, the relationship between the factors included in our study and progress was comparable for juniors and seniors. A more likely reason that we could not explain much variance in progress could be that there are many other factors that cause delay, which were not included in our study. Especially in the natural sciences, practical setbacks (e.g. broken or unavailable

equipment) can be a relatively straightforward but hard to fix cause of delay (Van de Schoot et al. 2013). Also, as studies in the last years have revealed, mental health issues are a factor that cannot be ignored. Percentages of 39–47% of PhD students suffering from mental health problems such as anxiety and depression have been reported (e.g. Evans et al. 2018; Levecque et al. 2017). Barry et al. (2018) found that ill mental health among PhD students was related to being behind schedule.

### ***Supervision characteristics***

The supervision characteristics included in the regression models were academic, personal, and autonomy support, availability, relationship quality, and high expectations. However, only the quality of the relationship made a unique impact on satisfaction and intention to quit. The importance of the relationship for retention and satisfaction is not surprising, as it is widely documented in the literature (e.g. Bair and Haworth 2004; Cockrell and Shelley 2011). In contrast to earlier studies (e.g. Barnes, Williams, and Archer 2010; Devos et al. 2015), however, we did not find independent effects of academic support, personal support, autonomy support, and availability. This could be because the quality of the relationship was highly correlated ( $r > .59$ ) with the supervisors' availability, academic, personal, and autonomy support.

### ***Psychosocial factors***

The psychosocial factors formal integration, informal integration, and sense of belonging were included in this study. Neither type of integration was related to the outcomes. Sense of belonging, however, made a substantial contribution to both satisfaction and intention to quit, so feeling at home in the department where one is pursuing the PhD is crucial. That formal and informal integration were not unique predictors of any of the outcomes does not mean they do not matter. An indirect effect of formal and informal integration on the intention to quit and satisfaction is likely, as formal and informal integration was highly correlated with a sense of belonging ( $r > .62$ ) but only to a small extent to intention to quit and satisfaction. O'Meara et al. (2017) already showed that having supportive professional relationships (academic integration) led to a higher sense of belonging in PhD students.

### ***Project characteristics***

Relatively new in the research on doctoral success was our focus on project characteristics. We took into account the amount of freedom PhD candidates experience, their workload, whether or not their project is related to other projects in the department and to the supervisor's research, and whether or not the PhD candidates have teaching/supervising tasks. Workload appeared to be a crucial factor, as it was related to satisfaction, being on schedule, and intention to quit – it was the only factor related to all three outcomes. The relationship between workload and doctoral success could be direct and indirect. First, it could mean that PhD candidates have too little time and too much to do, which impedes their ability to finish their thesis before the end of their contract. The high workload could either be caused by too much work directly related to their PhD research (e.g.



running many experiments for one study, doing analyses that require acquiring new skills, or doing elaborate field research) or be caused by work not directly related to their PhD thesis (e.g. administration, side projects, tasks for their supervisor, etc.). Second, and perhaps more importantly, a high workload and its consequences (e.g. life-work balance problems, no time for relaxation, hobbies, family and friends, etc.) can lead to a decreased mental health. This likely negatively affects PhD students' progress and satisfaction and may cause them to consider quitting. Regardless of whether the relationship between workload and doctoral success is direct or indirect, the high workload of PhD students is a crucial problem that is related to satisfaction, delay, and attrition.

Freedom was related to satisfaction and intention to quit and thus also appeared to be an important project characteristic to take into consideration when studying doctoral success. The importance of freedom can be related to the study by Devos et al. (2017) that showed that non-completers often reported having been pushed by their supervisors into research directions they did not wish to pursue.

Working on a project that is not closely related to the supervisor's research was also related to dissatisfaction and considering quitting. This shows that – in addition to the importance of a good relationship – a good academic match between PhD candidate and supervisor is important, as Ives and Rowley (2005) and Gube et al. (2017) also emphasise.

## Limitations

Several limitations should be taken into account. First, all data were measured at one point in time. A shortcoming of cross-sectional research is that the direction of the relationships that are found between variables is unclear. For example, we assume that the negative relationship between a sense of belonging and intention to quit means that a low sense of belonging *causes* PhD candidates to regularly think about quitting. However, it may as well (also) be the case that *because* PhD candidates often think about leaving the doctoral programme, they do not invest much in their relationships at work anymore and consequently experience a lower sense of belonging. Thus, our study sheds light on which variables are associated with satisfaction, progress, and quit intentions, but not on the direction of these relationships.

Second, the data were self-reported and may be biased by someone's current mood. Moreover, regarding the questions about the supervisor, halo error could bias the data. This means that respondents' overall positive attitude about the supervisor influences evaluations their individual attributes – this undermines the respondents' ability to discriminate among theoretically different aspects of the person's behaviour (Nisbett and Wilson 1977). As a consequence, the correlations between the distinct aspects of supervisor behaviour could be inflated. In our study, we found high correlations between different supervision support types: PhD candidates who rated their relationship with the supervisor as good, also reported high academic support, high personal support, high autonomy support, and high availability. This could indicate halo error. Some correlation was expected between the different types of support, but based on the literature on contingency frameworks on PhD supervision (Boehe 2016) we expected more differentiation, e.g. that supervisors who provide high levels of personal support do not necessarily also provide high levels of academic or autonomy support.

A third limitation is that, although the sample size was large, the results were from only one university. The findings may thus not be generalisable to other universities, especially not to universities in countries with different conditions and a different culture surrounding doctoral education. One of these differences concerns payment. In the Netherlands, where most PhD candidates have an employment contract, financial concerns are hardly an issue, which is also why we did not include funding as a variable in our study. In other countries, however, where not all PhD students are funded, it is found that funded PhD students finish faster and perform better than non-funded PhD students (Horta, Cattaneo, and Meoli 2018). Another important difference is that doctoral education in the Netherlands consists of more or less independent research. There is no coursework phase, such as in the United States. This could explain our finding of the importance of project characteristics, which may be less important in other countries where PhD students do not have their own project in the first years.

Finally, the sample included PhD candidates whose contract has already ended, while they had not managed to finish their dissertation yet (11%, see Table 3). By definition, they scored significantly and substantially lower on progress than those PhD candidates who were still working on their thesis within their employment contract. However, we did not find any significant differences between this group and third and fourth year PhD candidates on any of the dependent and independent variables included in our analyses except progress.

### ***Implications for research***

This study provides an overview of which factors are uniquely related to doctoral success outcomes when other factors are controlled for. However, insight in the relationships between the independent variables and how certain relationships between independent and dependent variables exactly function is lacking. Future research should focus on obtaining more insight in these relationships, for example by testing structural equation models and investigating interaction effects, moderation and mediation. Furthermore, longitudinal research is needed to gain knowledge on how supervision, psychosocial factors, and project features might change through the years, e.g. do project characteristics such as workload and freedom change over the years? In addition, qualitative studies are needed to validate the findings and to offer explanations of why and how certain factors such as freedom and sense of belonging are important. Finally, a category of important correlates with PhD students' success is missing in our study, namely mental health aspects. Recent work from – among others – Levecque et al. (2017), Virtanen, Taina, and Pyhältö (2017), Stubb, Pyhältö, and Lonka (2011), and Cornwall et al. (2018) reveal that depression, exhaustion, anxiety, stress, cynicism, and feelings of inefficacy are common among PhD students. Because such aspects of ill-being affect their engagement in the doctoral journey (Stubb, Pyhältö, and Lonka 2011; Virtanen, Taina, and Pyhältö 2017), it is likely that they also affect their satisfaction, progress, and quit intentions.

### ***Implications for practice***

A major point of attention is PhD students' workload. High workloads are a common and persistent problem in academia, even to the point where working overtime is normal

(Kinman and Jones 2008). While there is a lot of research that shows the negative effects of high workloads on individuals' mental health, our results now also reveal that a high workload is related to PhD students being less satisfied, less likely to be on schedule to finish in time, and to consider quitting more often. To decrease PhD students' workload, awareness of the risks of working too hard among both PhD students and supervisors seems an important first step. It should be emphasised that it is not normal to work in the evenings and in the weekends and in your holidays and that this should not be expected. Supervisors could play an exemplary role in changing the culture by relatively simple actions such as not sending emails after hours and encouraging their PhD students to take time for relaxation in weekends and to use all or at least most of their annual leave. Furthermore, PhD students should be protected from taking on a PhD project that is too large and from taking on too many extra tasks, such as teaching, supervising, and side projects. Supervisors play a major role here as well; they could help the PhD student to demarcate their project to a doable size and not ask them for too many other tasks, and – in addition – intervene when other people ask the PhD student to do certain tasks. This latter aspect is important because it can be hard for PhD students to say 'no'.

A good relationship and a close link with the supervisor's research were associated with fewer quit intentions and more satisfaction. First of all, this reveals how important it is that before a new PhD student starts, it is ensured that he or she will get along with the supervisor and vice versa. This is in line with the ever increasing literature about the importance of a good fit (or match) between the student and supervisor, both academically and personally (Gube et al. 2017; Woolderink et al. 2015). Also, throughout the PhD trajectory, both supervisor and PhD student should keep investing in the relationship, and regularly explicitly discuss mutual expectations and evaluate whether the supervisor's support meets the PhD student's needs. Next, besides this personal fit, there should be a good fit regarding the topic the PhD student plans to work on. Supervisors should be wary of taking on PhD students who work on topics that are not sufficiently related to their own work, even though this could be tempting in case these PhD students bring their own funding. Graduate schools could play a role in ensuring a good fit on a relationship and a work level, as they are usually involved in the hiring process. Moreover, they could emphasise the importance of explicitly discussing and evaluating mutual expectations.

Freedom also mattered. Making sure PhD students experience enough freedom to contribute to their development as independent researchers (and, as our study showed, to contribute to their satisfaction) but not so much that they are left to their own devices is a difficult balancing act. Among others, Overall, Deane, and Peterson (2011) have discussed this thin line between offering freedom and taking a hands-off approach. These authors concluded that effective supervision will consist of regular meetings in which academic support is provided while simultaneously giving PhD students room for their own ideas and opinions.

Last, sense of belonging made a substantial contribution to retention and satisfaction. Sense of belonging could be monitored by the graduate schools by yearly surveys and could be discussed during supervision meetings. Departments could take actions to create an environment that makes it easier to experience a sense of belonging, e.g. by organising both academic and social activities, by making sure everybody knows each other, and by monitoring whether the culture is open for everyone who is working in the department.

## Note

1. Because nationality was a categorical variable with three values (Dutch, European, and non-European), dummies were used with Dutch as the reference category, because the majority of PhD students were Dutch. For discipline, three dummies were used (social sciences, medical sciences, and humanities), with natural sciences as the reference category.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## ORCID

E. van Rooij  <http://orcid.org/0000-0001-8080-468X>

## References

- Abiddin, N. Z., and M. West. 2007. "Supervision Practices for Foreign Graduate Research Students." *American Journal of Applied Science* 4: 360–370.
- Agné, H., and U. Mörkenstam. 2018. "Should First-Year Doctoral Students Be Supervised Collectively or Individually? Effects on Thesis Completion and Time to Completion." *Higher Education Research and Development* 37 (4): 669–682.
- Ali, A., and F. Kohun. 2006. "Dealing with Isolation Feelings in IS Doctoral Programs." *International Journal of Doctoral Studies* 1: 21–33.
- Ali, P. A., R. Watson, and K. Dhingra. 2016. "Postgraduate Research Students' and Their Supervisors' Attitudes Towards Supervision." *International Journal of Doctoral Studies* 11: 227–241.
- Anonymous. 2016. "What Should I Do About My Supervisor's High Demand?" *Academia Stack Exchange*, September 25. <https://academia.stackexchange.com/questions/77341/what-should-i-do-about-my-supervisors-high-demand>.
- Bair, C. R., and J. G. Haworth. 2004. "Doctoral Student Attrition and Persistence: A Meta-Synthesis of Research." In *Higher Education: Handbook of Theory and Research*, Vol. XIX, edited by J. C. Smart, 481–534. The Netherlands: Kluwer Academic.
- Barnes, B. J., E. A. Williams, and S. A. Archer. 2010. "Characteristics That Matter Most: Doctoral Students' Perceptions of Positive and Negative Advisor Attributes." *NACADA Journal* 30 (1): 34–46.
- Barry, K. M., M. Woods, E. Warnecke, C. Stirling, and A. Martin. 2018. "Psychological Health of Doctoral Candidates, Study-related Challenges and Perceived Performance." *Higher Education Research & Development* 37 (3): 468–483.
- Basturkmen, H., M. East, and J. Bitchener. 2014. "Supervisors' On-Script Feedback Comments on Drafts of Dissertations: Socialising Students Into the Academic Discourse Community." *Teaching in Higher Education* 19: 432–445.
- Boehe, D. M. 2016. "Supervisory Styles: A Contingency Framework." *Studies in Higher Education* 41 (3): 399–414.
- Bøgelund, P. 2015. "How Supervisors Perceive PhD Supervision – And How They Practice It." *International Journal of Doctoral Studies* 10: 39–55.
- Bradley, K. 2009. *Teaching as a PhD Student*. Coventry: University of Warwick: History at the Higher Education Academy.
- Castelló, M., M. Pardo, A. Sala-Bubaré, and N. Suñe-Soler. 2017. "Why Do Students Consider Dropping out of Doctoral Degrees? Institutional and Personal Factors." *Higher Education* 74 (6): 1053–1068.
- Cockrell, C. N., and K. Shelley. 2011. "The Relationship Between Academic Support Systems and Intended Persistence in Doctoral Education." *Journal of College Student Retention: Research, Theory & Practice* 12 (4): 469–484.

- Cornwall, J., E. C. Mayland, J. Van der Meer, R. A. Spronken-Smith, C. Tustin, and P. Blyth. 2018. "Stressors in Early-Stage Doctoral Students." *Studies in Continuing Education*. Advance online publication.
- Curtin, N., A. J. Stewart, and J. M. Ostrove. 2013. "Fostering Academic Self-Concept: Advisor Support and Sense of Belonging Among International and Domestic Graduate Students." *American Educational Research Journal* 50 (1): 108–137.
- Devos, C., G. Boudrenghien, N. Van der Linden, A. Azzi, M. Frenay, B. Galand, and O. Klein. 2017. "Doctoral Students' Experiences Leading to Completion or Attrition: A Matter of Sense, Progress and Distress." *European Journal of Psychology of Education* 32: 61–77.
- Devos, C., N. Van der Linden, G. Boudrenghien, A. Azzi, M. Frenay, B. Galand, and O. Klein. 2015. "Doctoral Supervision in the Light of the Three Types of Support Promoted in Self-Determination Theory." *International Journal of Doctoral Studies* 10: 439–464.
- Evans, T. M., L. Bira, J. B. Gastelum, L. T. Weiss, and N. L. Vanderford. 2018. "Evidence for a Mental Health Crisis in Graduate Education." *Nature Biotechnology* 36 (3): 282–284.
- Fredman, N., and J. Doughney. 2012. "Academic Dissatisfaction, Managerial Change and Neo-Liberalism." *Higher Education* 64 (1): 41–58.
- Gardner, S. K. 2007. "'I Heard It Through the Grapevine': Doctoral Student Socialization in Chemistry and History." *Higher Education* 54: 723–740.
- Golde, C. M. 2000. "Should I Stay or Should I Go? Student Descriptions of the Doctoral Attrition Process." *The Review of Higher Education* 23 (2): 199–227.
- Golde, C. M. 2005. "The Role of the Department and Discipline in Doctoral Student Attrition: Lessons From Four Departments." *The Journal of Higher Education* 76 (6): 669–700.
- Gube, J., S. Getenet, A. Satariyan, and Y. Muhammed. 2017. "Towards 'Operating Within' the Field: Doctoral Students' Views of Supervisors' Discipline Expertise." *International Journal of Doctoral Studies* 12: 1–16.
- Halse, C. 2011. "Becoming a Supervisor': The Impact of Doctoral Supervision on Supervisors' Learning." *Studies in Higher Education* 36 (5): 557–570.
- Horta, H., M. Cattaneo, and M. Meoli. 2018. "PhD Funding as a Determinant of PhD and Career Research Performance." *Studies in Higher Education* 43 (3): 542–570.
- Ives, G., and G. Rowley. 2005. "Supervisor Selection or Allocation and Continuity of Supervision: Ph.D. Students' Progress and Outcomes." *Studies in Higher Education* 30 (5): 535–555.
- Jiranek, V. 2010. "Potential Predictors of Timely Completion among Dissertation Research Students at an Australian Faculty of Sciences." *International Journal of Doctoral Studies* 5: 1–13.
- Johnston, L., K. A. Sampson, K. Comer, and E. Brogt. 2016. "Using Doctoral Experience Survey Data to Support Developments in Postgraduate Supervision and Support." *International Journal of Doctoral Studies* 11: 185–203.
- Jones, M. 2013. "Issues in Doctoral Studies – Forty Years of Journal Discussion: Where Have We Been and Where Are We Going?" *International Journal of Doctoral Studies* 8 (6): 83–104.
- Kehm, B. M. 2006. "Doctoral Education in Europe and North America: A Comparative Analysis." In *The Formative Years of Scholars, WennerGren International Series*, Vol. 83, edited by U. Teichler, 67–78. London: Portland Press.
- Kinman, G., and F. Jones. 2008. "A Life Beyond Work? Job Demands, Work-Life Balance, and Wellbeing in UK Academics." *Journal of Human Behavior in the Social Environment* 17 (1–2): 41–60.
- Kolmos, A., L. B. Kofoed, and X. Y. Du. 2008. "PhD Students' Work Conditions and Study Environment in University- and Industry-Based PhD Programmes." *European Journal of Engineering Education* 33 (5–6): 539–550.
- Levecque, K., F. Anseel, A. de Beuckelaer, J. van der Heyden, and L. Gisle. 2017. "Work Organization and Mental Health Problems in PhD Students." *Research Policy* 46: 868–879.
- Lovitts, B. E. 2001. *Leaving the Ivory Tower: The Causes and Consequences of Departure From Doctoral Study*. Lanham, MD: Rowman and Littlefield.

- Maher, M. A., M. E. Ford, and C. M. Thompson. 2004. "Degree Progress of Women Doctoral Students: Factors That Constrain, Facilitate and Differentiate." *The Review of Higher Education* 27 (3): 385–408.
- Manathunga, C. 2005. "Early Warning Signs in Postgraduate Research Education: A Different Approach to Ensuring Timely Completions." *Teaching in Higher Education* 10 (2): 219–233.
- Mason, M. M. 2012. "Motivation, Satisfaction, and Innate Psychological Needs." *International Journal of Doctoral Studies* 7: 259–277.
- Meeuwisse, M., S. E. Severiens, and M. Ph. Born. 2010. "Learning Environment, Interaction, Sense of Belonging and Study Success in Ethnically Diverse Student Groups." *Research in Higher Education* 51: 528–545.
- Nisbett, R. E., and T. D. Wilson. 1977. "The Halo Effect: Evidence for Unconscious Alteration of Judgments." *Journal of Personality and Social Psychology* 35 (4): 250–256.
- NUS (National Union of Students). 2013. *Postgraduates Who Teach*. [https://www.nus.org.uk/global/1654-nus\\_postgradteachingsurvey\\_v3.pdf](https://www.nus.org.uk/global/1654-nus_postgradteachingsurvey_v3.pdf).
- O'Meara, K., K. A. Griffin, A. Kuvaeva, G. Nyunt, and T. Robinson. 2017. "Sense of Belonging and Its Contributing Factors in Graduate Education." *International Journal of Doctoral Studies* 12 (12): 251–279.
- Overall, N. C., K. L. Deane, and E. R. Peterson. 2011. "Promoting Doctoral Students' Research Self-Efficacy: Combining Academic Guidance with Autonomy Support." *Higher Education Research & Development* 30 (6): 791–805.
- Pyhältö, K., J. Stubb, and K. Lonka. 2009. "Developing Scholarly Communities as Learning Environments for Doctoral Students." *International Journal for Academic Development* 14 (3): 221–232.
- Pyhältö, K., J. Vekkaila, and J. Keskinen. 2015. "Fit Matters in the Supervisory Relationship: Doctoral Students and Supervisors' Perceptions About the Supervisory Activities." *Innovations in Education and Teaching International* 52 (1): 4–16.
- Ryan, R. M., and E. L. Deci. 2017. *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*. New York: Guilford Press.
- Shin, J. C., S. J. Kim, E. Kim, and H. Lim. 2018. "Doctoral Students' Satisfaction in a Research-Focused Korean University: Socio-Environmental and Motivational Factors." *Asia Pacific Education Review* 19: 159–168.
- Skakni, I. 2018. "Doctoral Studies as an Initiatory Trial: Expected and Taken-For-Granted Practices That Impede PhD Students' Progress." *Teaching in Higher Education* 23 (8): 927–944.
- Sonneveld, H., and A. Tigchelaar. 2009. *Promovendi en het Onderwijs* [PhD Candidates and Education]. <http://www.phdcentre.eu/inhoud/uploads/2018/02/Promovendienhetonderwijs.pdf>.
- Spaulding, L. S., and A. J. Rockinson-Szapkiw. 2012. "Hearing Their Voices: Factors Doctoral Candidates Attribute to Their Persistence." *International Journal of Doctoral Studies* 7: 199–219.
- Stubb, J., K. Pyhältö, and K. Lonka. 2011. "Balancing Between Inspiration and Exhaustion: PhD Students' Experienced Socio-Psychological Well-Being." *Studies in Continuing Education* 33 (1): 33–50.
- Thesis Whisperer. 2014. "When Good Supervisors Go Bad..." *Thesis Whisperer*, August 27. <https://thesiswhisperer.com/2014/08/27/when-good-supervisors-go-bad/>.
- Tinto, V. 1993. *Leaving College: Rethinking the Causes and Cures of Student Attrition*. 2nd ed. Chicago: The University of Chicago Press.
- Van de Schoot, R., M. A. Yerkes, J. M. Mouw, and H. Sonneveld. 2013. "What Took Them So Long? Explaining PhD Delays among Doctoral Candidates." *PLOS ONE* 8 (7): e68839.
- Virtanen, V., J. Taina, and K. Pyhältö. 2017. "What Disengages Doctoral Students in the Biological and Environmental Sciences From Their Doctoral Studies?" *Studies in Continuing Education* 39 (1): 71–86.
- Woolderink, M., K. Putnik, H. van der Boom, and G. Klabbers. 2015. "The Voice of PhD Candidates and PhD Supervisors. A Qualitative Exploratory Study Amongst PhD Candidates and Supervisors To Evaluate the Relational Aspects of PhD Supervision in the Netherlands." *International Journal of Doctoral Studies* 10: 217–235.