Original Communication

I Need Somebody to Lean on

The Effect of Peer, Relative, and Supervisor Support on Emotions, Perceived Progress, and Persistence in Different Stages of Doctoral Advancement

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Abstract: In the literature, social support is depicted as an important determinant of whether someone completes their doctoral process. However, few studies actually test the impact of social support in sound quantitative designs. The present study provides an incremental understanding of the social support effect by (a) assessing the joint influence of three sources of social support (supervisor, academic peers, and relatives) on the emotions of doctoral students, their perceived progress and intention to persist; and (b) testing the interactions between these three sources of support and the doctoral stage of advancement. To this end, we carried out a longitudinal three-wave study with 446 doctoral students from two Belgian universities. The hierarchical regressions showed that (1) only supervisor support significantly predicted the outcomes of doctoral students and (2) the influence of social support on intention to persist was moderated by the stage of advancement in the doctoral journey. We discuss these results and their implications for further work on social support in light of existing literature on doctoral persistence.

Keywords: social support, persistence, doctoral students, time to completion, well-being, completion

Doctoral studies can be conceived of as lying at the pinnacle of education, gathering overachievers who have gone through an important selection process to reach it. However, despite formerly bright educational pathways, a large number of doctoral students fail to actually complete their degree (Jairam & Kahl, 2012). More precisely, Wollast and colleagues (2018 **[Author: add t… ferences list]**) registered a dropout rate of 50% in t… Belgian context. This prevalence of dropouts illustrates the inherent difficulties of doctoral persistence and completion. On the one hand, some authors (i.e., Stubb, Pyhältö, & Lonka, 2011) insist on the important difficulty present in the emotional layer of the doctoral journey, showing that doctoral students express many negative emotions (stress and exhaustion) during the process impeding their persistence. More precisely, a Belgian study showed a high level of mental-health issues among doctoral students, with 30% of them reporting feeling unhappy and depressed (Levecque, Anseel, De Beuckelaer, Van der Heyden, & Gisle, 2017). On the other hand, Martinsuo and Turkulainen (2011) discussed the difficulty doctoral students have efficiently progressing with their doctoral thesis, which in turn restrains their persistence. Substantiating these findings, a recent study (Devos et al., 2017) highlighted sense of progress the experience of doctoral students in their thesis (perception of moving forward) and limited experience of emotional distress as the two essentials to enable doctoral completion and persistence.

A source of explanation of the difficulties experienced in the doctoral journey lies in students' lack of social support. The literature largely claims that the need for social connections and support was one of the main determinants for the completion process of the doctoral studies (Bair & Haworth, 2004; Peltonen, Vekkaila, Rautio, Haverinen, & Pyhältö, 2017). Yet, empirical evidence of this influence is limited. Most studies that investigated this effect are qualitative (e.g., Gardner, 2007, 2009, 2010; Golde, 2005; Jairam & Kahl, 2012). The few available quantitative studies showed mixed findings (e.g., Ivankova & Stick, 2007; Martinsuo & Turkulainen, 2011) and suffer from methodological limitations (e.g., do not separately consider the sources of support, use cross-sectional design and limited sample sizes). Along this line, several authors (e.g., Devos et al., 2015; Jairam & Kahl, 2012; Peltonen et al., 2017) plea for further studies

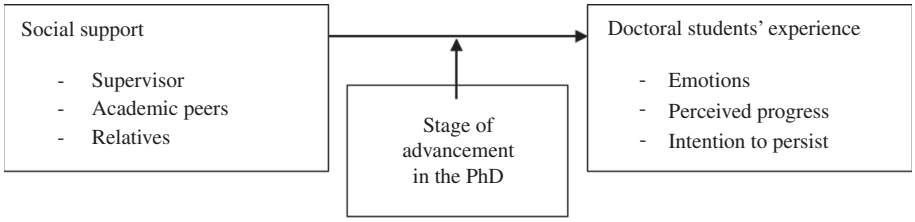

Figure 1. Overview of the expected relationships between types of social support and doctoral outcomes.

to overcome these limitations and provide a better understanding of the influence of social support on the doctoral process and persistence.

In order to address this issue, the present study tests the joint influence of three sources of social support (doctoral supervisor, academic peers, and relatives) on the outcomes of doctoral students (persistence, emotions, and perceived progress in the PhD process) using a sound longitudinal and quantitative design. Furthermore, we also investigate whether each of these influences varies as a function of where the students are in their doctoral journey (stage of advancement in the PhD). The anticipated links are presented in Figure 1.

Social Support

The role of social support in individual experience has received a lot of attention since Cobb's (1976) and House's (1981) seminal work on this construct. Social support is central to most theories in educational and organizational psychology and has been shown to lead to positive outcomes, such as coping with difficulties (coping theories, Cohen & Wills, 1985), decreasing stress (the job demand-control-support model, Karasek & Theorell, 1990), increasing task-related motivation (expectancy-value theories, Eccles & Wigfield, 2002), and promoting psychological adjustment (self-determination theory, Deci & Ryan, 2000). These effects have been shown in various contexts, such as work organizations (Shanock & Eisenberger, 2006), secondary education (Wang & Eccles, 2012), higher education (Tompkins, Brecht, Tucker, Neander, & Swift, 2016), and completion of master thesis (Dupont, Galand, & Nils, 2015).

In the domain of doctorates, social support is also depicted as an important determinant of student persistence and degree completion. According to Peltonen and colleagues **(re**[illegible] social support during the doctoral process can be defin[illegible] as "the social resources perceived to be available and provided to doctoral students by their social environment. This includes both formal and informal relationships within the researcher community, with peers, supervisors and other staff members" (Peltonen et al., 2017, p. 159). Based on House's taxonomy, Jairam and Kahl (2012) proposed three types of support in doctoral studies: affective support (i.e., attempting to "alleviate negative affect in another person and shows caring for another person," p. 317), practical support (i.e., offering "gifts, financial support, and taking care of chores for someone else," p. 319), and professional support (i.e., "providing feedback, advice, and assistance in solving specific professional problems," p. 318). Although distinct from one another, these different types of support have usually been found to be highly correlated (Semmer, Elfering, Jacobshagen, & Perrot, 2008 **[Author: add t**[illegible]**ferences]**; Wills & Shinar, 2000) and are therefore often combined into one global measure (Cutrona & Russell, 1990; Schonfeld, 2001).

Recently, Castellò, Pardo, Sala-Bubaré, and Suñe-Soler (2017) found that, upon asking doctoral students what would lead them to drop out of their program, one of the factors mentioned was the difficulty students have in socializing with and becoming part of the scientific community (i.e., quality of the relationship with the supervisor, integration into the research group, and – less frequently – socialization with the broader scientific community). In a recent qualitative study, Jairam and Kahl (2012) noted that the social networks of the participants were also comprised of broader sources of support such as academic friends (i.e., fellow graduate students) and family (i.e., spouses, children, siblings, parents). More precisely, the supervisor, the doctoral peers, and relatives (close friends and family) were identified as the main sources of social support (Bair & Haworth, 2004; Hopwood, 2010; Peltonen et al., 2017). This paper investigates two aspects of social support: supervisor support and broader sources of support consisting of academic peers and relatives.

Supervisor Support

Among the different sources of social support, that of the supervisor has received the most attention. Jones (2013) found that 15% of the research on doctoral studies focuses on the student-supervisor relationship. Several empirical studies investigated the role of supervisor support in the persistence of doctoral candidates as well as in other aspects of the doctoral experience (e.g., progress, emotions). We describe these studies below.

Supervisor Support and the Persistence and Degree Completion of Doctoral Students

Doctoral supervision is assumed to play a central role in doctoral completion. In their literature review on doctoral

attrition, Bair and Haworth (2004, p. 495) state that "the successful degree completion is related to the degree and quality of contact between a doctoral student and her or his supervisor(s) ... [S]imply put, where positive relationships are present, students were significantly more likely to complete their doctoral degrees." This is consistent with qualitative findings (Barnes & Austin, 2009; Castellò et al., 2017; O'Bara, 1993) showing that the students who completed their degrees reported more positive interactions with their supervisors and rated them as more approachable, more helpful, and more understanding than did noncompleters.

Yet, the positive effect of supervisor support has also been questioned. Ivankova and Stick (2007) found contrasting results in a mixed-method study. In the qualitative part of the study, participants asked about the role of supervisor support reported that general support (faculty, supervisor, peers, family, etc.) positively affected their persistence. But in the quantitative part of the study, supervisor support failed to predict doctoral persistence. Golde (2005), in an extensive qualitative study, also found an inconsistent relationship between attrition and incompatible advisory relationships (e.g., lack of interaction, trust, and intellectual support). This lack of support was perceived as detrimental to persistence – but only in scientific disciplines and not in the humanities.

In sum, the empirical evidence backing the positive influence of supervisor support on doctoral students' persistence remains limited. While some studies uphold this effect (e.g., Castellò et al., 2017), others found mixed results (e.g., Golde, 2005). The investigation of supervisor support deserves to be strengthened.

Supervisor Support, Research Progress, and Emotion

In addition to persistence, supervisor support has also been analyzed in relation to other aspects of the outcome of doctoral students, such as research progress and emotions.

Regarding progress and satisfaction, in a qualitative study Ives and Rowley (2005) found that these factors were higher when students developed a good interpersonal working relationships with their supervisors, felt involved in supervisor selection, and had topics that matched their supervisor's expertise. However, in a more recent quantitative study, Martinsuo and Turkulainen (2011) found no direct relationship between doctoral students' progress in coursework or in research and supervisor support (i.e., sufficient encouragement, support regarding the content of their studies, their research methodology, and other kinds of support).

Supervisor support has also been related to the emotion regulation during the doctoral journey. Jairam and Kahl (2012) identified the supervisor as one of the sources of support that could prevent the doctoral student from experiencing too much stress. Along this line, recent quantitative works (Cornér, Löfström & Pyhältö, 2017; Peltonen et al., 2017) highlighted a link between supervisor support and emotional distress indicators such as burnout and exhaustion.

In sum, several studies revealed a relationship between supervisor support, perceived progress with research, and emotions. Yet, these studies remain a disparate group (with only one or two studies done on each outcome), and some results are contradictory (e.g., with progress in doctoral work). Furthermore, it is surprising that the emotional aspect of student experience, which is central in the doctoral process (Cotterall 2013; Devos et al., 2016 **[Author: add to referenc**  Nutov & Hazzan 2011), has received only limited atte[illegible]n. Further insight into the role of supervisor support in the cognitive and emotional aspects of the doctoral experience is therefore needed.

Peers and Relatives Support

There is a growing body of evidence that the supervisor is not the only resource students may draw on (Jairam & Kahl, 2012; McAlpine & McKinnon, 2013; Peltonen et al., 2017). According to McAlpine and McKinnon (p. 265), "on a day-to-day basis students depended as frequently on peers, friends and family as they did on the supervisor, drawing on each relationship for different kinds of support (e.g., family for emotional needs and concrete help, peers for comradeship and critical but collegial feedback)."

In their literature review on doctoral attrition, Bair and Haworth (2004) highlighted the role of peers, concluding that peer interaction is positively related to persistence, as completers appear to be more involved with their academic peers than noncompleters. In her qualitative study contrasting the socialization experiences of doctoral students in high- and low-completing departments, Gardner (2010) found that the participants identified the other students in the doctoral program as a central source of support and mentioned this group far more frequently than their supervisor of faculty members. Jairam and Kahl (2012) also substantiated the role of academic peers and relatives in the successful completion of a doctoral degree.

Some studies went beyond the impact on persistence and completion. Martinsuo and Turkulainen (2011) highlighted that peer support was a significant predictor of the progress of doctoral students in both research and coursework. In a qualitative study of natural-science doctoral students, Vekkaila et al. (2012) found that collaborative academic contexts (e.g., research activities, taking courses, and academic meetings) were central to the key learning experiences of doctoral students. Finally, Jairam and Kahl (2012) also noted that the support of peers and relatives

would be helpful in emotion regulation during doctoral studies. Affective support from academic friends and family could particularly hinder stress appraisal and enhance the effective management of daunting tasks such as writing a doctoral dissertation.

These studies suggested a positive role of broader social support (e.g., peers and relatives) on the completion process of doctoral students, but they are few in number and mostly qualitative.

Moderators of Social Support

In addition to the assumption that social support positively affects persistence among doctoral students, little is known about the possible variations in this influence. Existing literature suggests that students' need for supervision may vary according to where they are in the doctoral timeline (McAlpine & McKinnon, 2013). Students are likely to need more supervision in the initial stages of their research and to enjoy more autonomy later on (Deuchar, 2008). Such assumptions were also substantiated by Odena and Burgess (2017), who suggest the importance of social support for the beginning doctoral student in order to gain confidence in continually pursuing the doctoral goal. Nevertheless, little in-depth work has been done to investigate this idea, and no previous study investigated this hypothesis in a sound quantitative design (McAlpine & McKinnon, 2013).

Purpose and Objectives of the Study

The literature review demonstrated the strong presumption that social support positively influences the experience of doctoral students. Yet, the empirical validation of this impact remains limited. As mentioned above, the literature points out five main limitations:

- First, the sample sizes used in previous studies are limited, so that previous findings should be confirmed using larger samples of doctoral students.
- Second, the quantitative studies barely consider the sources of support taken together, which impedes any comparison of their respective impacts (Martinsuo & Turkulainen, 2011).
- Third, most of the research is cross-sectional, creating a need to test the effects of social support in longitudinal designs that control for outcome baselines (Paglis et al., 2006).
- Fourth, social support has rarely been studied based on the emotional aspect of student experience. However, emotions are depicted as a central concept to the doctoral process (Cotterall, 2013; Devos et al., 2017; Nutov & Hazzan, 2011). Moreover, some recent studies showed a significant link between social support and emotions (Cornér, Löfström, & Pyhältö, 2017; Peltonen et al., 2017).
- Finally, several authors (McAlpine & McKinnon, 2013; Odena, & Burgess, 2017) postulated that students' need for supervision may vary according to their stage of advancement. However, such an assumption was never tested.

In order to overcome these five limitations, the present study tests and compares the influence of support from supervisor, peers, and relatives together on important outcomes of doctoral completion in the form of a large-scale, longitudinal, and quantitative study. Various aspects of the doctoral completion process are considered. Beyond the behavioral aspect of persistence, it also considers the cognitive and emotional aspects of engagement (Fredrick, Blumenfeld, & Paris, 2004): the perceived progress and the experienced emotions (Cotterall, 2013; Devos et al., 2016 **[Author: add to references]**; Nutov & Hazzan, 2011). With regard to the literature (e.g., Jones, 2013), the first hypothesis is that supervisor support remains predictive of doctoral completion outcomes even while considering other sources of support (Hypothesis 1). Together with the important affective support of academic friends and relatives (Jairam & Kahl, 2012), these two sources of support are expected to be predictive of experienced emotions (Hypothesis 2). Eventually, the hypothesis of a moderation of the effects of social support by stages of advancement in the PhD process will also be investigated. According to Deuchar (2008), a stronger impact of social support is expected at the beginning of the doctoral journey (Hypothesis 3).

Method

Procedure

We conducted a three-wave data collection at two Belgian universities (for more information about our national doctoral context, see Wollast et al., 2018 **[Author: add to references]**). At Time 1 (T1, December), we measured sociodemographic variables and outcome baselines (emotions, perceived progress, and intention to persist). At Time 2 (T2, June, 6 months after T1), we measured the stage of advancement in the PhD and the social support participants were receiving from their environment (i.e., from their supervisor, doctoral peers, and relatives). At Time 3 (T3, December, 1 year after T1), we measured the outcomes (emotions, perceived progress, and intention to persist in and complete their PhD). All doctoral students registered at the two universities received the online questionnaires (programmed in LimeSurvey) via their official university

e-mail address, which was also used to match the three questionnaires. Participants were assured of data confidentiality; the research design was submitted to our National Commission for Protection of privacy (CPP, https://uclouvain.be/en/study/inscriptions/vie-privee.html).

Participants

The questionnaire at T1 was sent to 3,230 doctoral students registered in the two universities and was completed by 962 of them, 605 of whom also answered the T2 questionnaire. A total of 446 participants completed all three waves of questionnaires (T1, T2, and T3). This latter sample is therefore the sample considered in the present study. Among this sample, 60.5% were women (mean age = 28.6). Most of them were being funded by a research grant (67.6%) (i.e., 4-year full-time funding for their doctoral research), 23.5% had a research assistant status (i.e., a 6-year contract in the university with part-time teaching and part-time research), and 9% had other types of funding or no funding at all. The participants were distributed across the four academic fields as follows: 15% in the human sciences, 23% in the health sciences, 27% in fields of science and technology, and 35% in the social sciences. In order to assess the representativeness of this sample, we compared it to the participants who completed only T1. These two subgroups did not display any statistical differences in age, father/mother highest educational degree, master grade, marital status, emotions, and intention to persist. Further, we obtained some information on the characteristics of all the doctoral students in our two universities and observed that our sample was similar to this population on the master grade, marital status, academic field, and nationality. Yet, there are also some differences between these samples: Participants who did not complete the study had a slightly higher perception of progress at T1 ($F(1, 915) = 6.65$, $p < .05$; $\eta_p^2 = .07$) and were more frequently men ($\chi^2 = 8.41$, $p < .05$; $V = .09$) compared to those who completed all three questionnaires.

Measures

Sociodemographic (Control) Variables

The following variables were included in the analyses in order to control for their possible influence on the outcomes: sex (men = 0; women = 1), age (years), nationality (0 = *[country removed for peer review]*; 1 = foreigner), father/mother highest educational degree (1 = primary school, 2 = secondary school, 3 = bachelor degree, 4 = master degree, 5 = PhD), marital status (0 = single; 1 = in a stable relationship), number of children, and grade obtained at the end of their master degree.

Stage on PhD Timeline as a Moderator

Participants stage of advancement in the doctoral process was measured by the following item: "Although the stages of the PhD are not necessarily a linear sequence, can you indicate which stage you are currently at? Three possible answers were proposed to the student: Planning – Executing – Finalizing. 71 (16%) PhD students reported being in the planning stage, 291 (65.3%) in the executing stage, and 84 (18.8%) in the finalizing stage.

Independent Variable (IV): Social Support

As discussed in the literature review, social support covers various dimensions, and the two main ones are affective and instrumental support (House, 1981). Our items, based on the questionnaires used by Overall, Deane, and Peterson (2011), Belmont, Skinner, Wellborn, and Connell (1988), Dupont et al. (2015) and Martinsuo and Turkulainen (2011), reflect these two dimensions. Yet, based on the existing literature and the factor analysis reported above, we combined them into one measure rather than considering them as separate measures.

Supervisor support (7 items, α = .89) refers to the support received from the doctoral supervisor. Because supervision situations differ from one another (e.g., one or several supervisors, formal or informal supervision, supervision by another member of the lab), we first asked the participants from whom they received most supervision; this person was thereafter called the "mentor," and the supervision items were completed in relation to him/her (e.g., "My mentor reassures me when I need it").

Academic peers support (5 items, α = .86) refers to support received from other PhD students from the participants' direct research environment (e.g., "The other PhD students in my research environment give me good advice on my doctoral research").

Relatives support (3 items, α = .68) refers to the support that doctoral students receive from their family and friends outside the university (e.g., "My relatives sometimes help me in carrying out tasks related to my PhD").

Dependant Variables (DV): Doctoral Students Outcomes

Seven items (7 items, α = .85 at T1 and α = .85 at T3) assess the positive and negative emotions experienced by the doctoral students when working on their PhD (e.g., "Recently, when I work on my PhD, I feel anxious and stressed out"). The items were based on those of Dupont, Meert, Galand, and Nils (2013). Negative items were reversed, and the scale can therefore be labelled as "positive emotions."

Perceived progress (3 items, α = .78 at T1 and α = .81 at T3) deals with doctoral students' feeling of moving forward and progressing in their doctoral work. It addresses the perceived speed of this progress in itself, with regard to what was planned, and compares it to that of other PhD students'

(e.g., "I have the feeling that I am not moving forward" – reverse item). Items were inspired by Devos et al.'s (2017) qualitative findings.

Persistence (6 items, α = .80 at T1 and α = .82 at T3) is assessed through the strength of participants' intention to persist in their PhD and complete it or, conversely, the extent to which they ever considered quitting it (e.g., "No matter what happens, I intend to finish my PhD"). The items are based on Hardre and Reeve (2003) and Galand and Hospel (2015).

Structure Validity and Normality of IVs and DVs

Support and outcome scales contained 5-point Likert items ranging from *completely disagree* (1) to *completely agree* (5). Two separate exploratory factor analyses (principal axis factoring analysis with Varimax rotation) were conducted, one for the support items and the other for the outcome items. We chose exploratory factor analyses over confirmatory factor analyses since the present scales were created for the purpose of the present study and have not yet been validated. Both analyses displayed three-factor structures corresponding to the three sources of support (supervisor, doctoral peers, relatives) and the three outcomes (positive emotions, perceived progress, intention to persist). The scale scores were obtained by computing the mean of the items contained in the scale. All items and results from these analyses are presented in the Appendix.

Further, the normality of the distribution of variables was checked with skewness and kurtosis indicators, which displayed values between −0.90 and .57 for the former and −.985 and .47 for the latter. The computed critical ratios showed significant deviations from the normality for supports and intention to persist. These variables should be considered as nonnormally distributed. Yet, considering that absolute values are not extreme, these departures from normality can be conceived as nonproblematic (Field, 2009; George & Mallery, ~~2010~~ **[Author: year 2003 in references. Please clarify]**).

Results

Analyses Conducted

In order to test our research questions, we conducted three separate linear hierarchical regressions (one for each outcome), in which we entered the baseline and control variables in Step 1, the stage of advancement in Step 2, the three social support variables in Step 3, and the interaction products between the *Z* scores of the support variables and stage of advancement in Step 4. Further, because some of the baseline measures at T1 were significantly correlated with perceived social support measured at T2, as social support variables we used the unstandardized residuals resulting from the regression of social support on the baseline measures. The results are identical with or without this manipulation, but doing it ensures that we are considering the influence of social support while controlling for its association with the baseline measures. Tolerance and VIF indicators were around .80 and 1.1, respectively, indicating no multicollinearity issue (O'Brien, 2007). Finally, in order to give a more in-depth investigation of the effect of stage of advancement, we performed ANOVAs with the three stages of advancement as the independent variable and social support as the dependent variable. We conducted the analyses using SPSS (v. 24.0).

Preliminary Analysis

Table 1 presents the correlational analyses. A preliminary finding is that the baseline levels of positive emotions, perceived progress, and intention to persist are strong

Table 1. Means, standard deviations, and correlations between the variables of interest

	M	*SD*	1	2	3	4	5	6	7	8	9	10
1. Stage of advancement	–	–	–	−.09	−.03	.07	−.07	.00	.03	.07	−.06	.09
2. Supervisor's support (T2)	3.62	0.98		–	.27**	.13**	.37***	.38***	.31***	.32***	.30***	.34***
3. Peers' support (T2)	3.81	1.02			–	.12*	.14**	.16**	.04	.12*	.08	.13*
4. Relatives' support (T2)	2.72	0.99				–	.12*	.10*	.18**	.14**	.08	.13**
5. Positive emotions (T1)	3.50	0.79					–	.59***	.60***	.46***	.62***	.50***
6. Positive emotions (T3)	3.42	0.78						–	.38***	.62***	.41***	.59***
7. Perceived progress (T1)	2.96	1.04							–	.63***	.48***	.38***
8. Perceived progress (T3)	2.95	0.96								–	.39***	.50***
9. Intention to persist (T1)	4.09	0.79									–	.69***
10. Intention to persist (T3)	4.02	0.84										–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

predictors of those outcomes 1 year later. This result suggests that these aspects of doctoral students' experience are stable over time. Moreover, analyses of the means and standard deviations in Table 1 show that doctoral students reported high intention to persist and positive emotions. The score on perceived progress was average. The students also reported high supervisor and peer support but average relatives support.

Few sociodemographic variables revealed a significant link with social support and doctoral outcomes. With regards to social support, age ($r = -.15$, $p = .004$) and grade obtained at the master degree ($r = .13$, $p = .019$) were related to peer support. Female students perceived more support from relatives than did their male counterparts ($r = .11$, $p = .023$). If we look at the doctoral outcomes, male reported higher levels on positive emotions ($r = -.19$, $p < .001$), perceived progress ($r = -.19$, $p < .001$), and intention to persist ($r = -.18$, $p < .001$). Positive emotions were also significantly related with age ($r = .13$, $p = .008$) and number of children ($r = .11$, $p = .039$).

The Direct Effect of the Three Sources of Social Support on the Outcomes of Doctoral Students

As Table 2 shows, supervisor support emerged from the hierarchical regressions as the only predictor of changes in the (three) outcomes from T1 to T3. If we control for baseline and sociodemographic variables, supervisor support remained respectively predictive of positive emotions ($\beta = .17$, $p < .001$), perceived progress ($\beta = .11$, $p = .014$), and intention to persist ($\beta = .15$, $p < .001$). Despite significant correlations with the outcomes, peer support and relative support didn't have a direct effect when considered together with supervisor support.

The Moderating Role of Doctoral Advancement Stages

First, we found that the stage of advancement in the PhD is a significant predictor of intention to persist ($\beta = .09$, $p = .028$). The more advanced students are in the doctoral process, the more they intend to complete their PhD.

Second, the interaction term between stage of advancement and supervisor support was statistically significant ($\beta = -.15$, $p < .001$), suggesting that the influence of supervisor support depends on the stage of progress in the PhD. These results were completed with a regression analysis decomposing the interaction term by the use of three dummy-coded variables, each representing a stage of advancement (Aiken & West, 1991). The regression results showed significant interaction effects on intention to persist for supervisor support with planning ($\beta = .17$, $p < .001$) and executing stages ($\beta = .11$, $p = .002$). However, Supervisor support × Finalizing was not significant ($\beta = .01$, $p = .877$). Figure 2 shows that the association between supervisor support and intention to persist is larger for students who are starting their PhD (planning phase), smaller for students who are carrying out their research (executing phase), and nonsignificant for those who are finalizing their work (finalizing phase).

Table 2. Hierarchical regression of the factors predicting doctoral students' emotions, perceived progress, and intention to persist (T3)

	Positive emotions				Perceived progress				Intention to persist			
	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
Baseline (T1)	.58***	.59***	.59***	.59***	.64***	.64***	.64***	.64***	.66***	.67***	.67***	.66***
Sex (women)	−.07	−.07	−.08	−.08	−.11**	−.11**	−.10*	−.11*	−.08*	−.09*	−.09*	−.10*
Age	−.03	−.04	−.05	−.04	−.01	−.01	−.01	−.01	.00	−.02	−.03	−.03
Nationality (foreigner)	.03	.04	.03	.03	−.08	−.08	−.08	−.08	−.01	−.01	−.01	.00
Father's diploma	.05	.04	.04	.04	.04	.04	.04	.05	.03	.03	.02	.01
Mother's diploma	.02	.02	.01	.02	.05	.05	.04	.04	.03	.03	.02	.04
Marital status (couple)	−.03	−.03	−.03	−.03	−.03	−.03	−.03	−.03	−.04	−.05	−.06	−.06
Number of children	.07	.07	.09	.09	.05	.05	.05	.06	.08	.08	.09	.11*
Master grade	.01	.00	.01	.01	.06	.05	.05	.06	.06	.05	.05	.08*
Stage of advancement (T2)		.04	.05	.04		.02	.04	.03		.10*	.11**	.09*
Supervisor's support (T2)			.16***	.17***			.10*	.11*			.14***	.15***
Peers' support (T2)			.03	.04			.07	.07			.04	.05
Relatives' support (T2)			−.01	−.01			−.04	−.04			.03	.03
Supervisor's support × SofA				−.02				−.07				−.15***
Peers' support × SofA				−.05				.00				−.07
Relatives' support × SofA				.02				.07				.01
Adjusted R^2	.38	.38	.41	.41	.45	.45	.47	.48	.48	.49	.51	.54
Change in R^2	.38***	.00	.03**	.00	.45***	.00	.02**	.01	.48***	.01*	.02**	.03***

Notes: *$p < .05$, **$p < .01$, ***$p < .001$; SofA = Stage of Advancement.

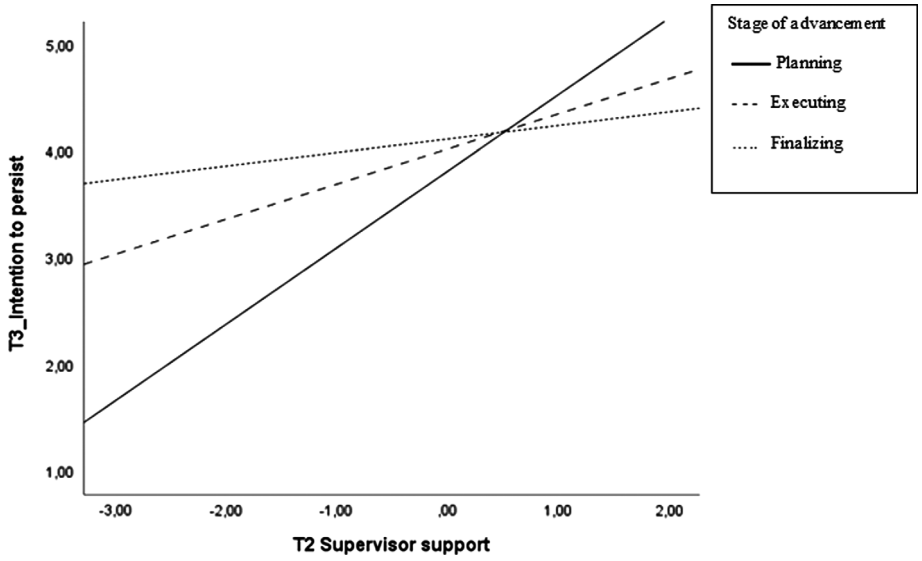

Figure 2. Influence of supervisor support according to stage of advancement on intention to persist in the PhD, Controlling for the outcomes' baselines and socio-demographic variables.

Discussion

The purpose of this prospective study was to extend previous research on the association between different sources of social support and important determinants of the doctoral journey through a sound quantitative design. To this end, the study tested, in a three-wave and large-scale study, (1) the influence of three sources of social support (supervisor, academic peers, relatives) on the outcomes of doctoral students (positive emotions, perceived progress, intention to persist) and (2) whether this influence varies according to the stage of the doctoral work.

The analyses were conducted controlling for sociodemographic variables and initial level of positive emotions, perceived progress, and intention to persist. Our results led us to qualify the findings obtained in previous studies which are discussed below.

The Effects of Social Support in the Doctoral Journey

The results from the present study (1) highlight the stability of doctoral student experience, (2) confirm the significant but modest main effect of supervisor support on doctoral students outcomes, (3) reveal that the two other sources of support had no significant contribution beyond supervisor support, and (4) suggest that the influence of supervisor support on intention to persist is moderated by the stage of doctoral advancement in the PhD (stronger at the beginning, weaker in the middle, and close to zero at the end). These results are both comforting and challenging.

First, results from the present study confirmed the importance of controlling for outcome baselines in order to have a more valid estimate of the role of social support. The strong effects of those baselines are unlikely to reflect a measurement effect, as the two measures were taken 1 year apart. It therefore suggests that students' experience is quite stable, something also observed in other educational contexts such as master-degree completion (De Clercq, Galand, & Frenay, 2013; Phan, 2009). Beyond the outcome baselines, the present study also provided interesting information about the remaining effect of sociodemographic variables in a multifactorial approach to doctoral completion. Except for sex, the results showed that no control variable remained predictive of the outcomes, which seems to highlight that social capital, age, nationality, or past performance can be offset by the support provided during the doctoral journey. The results about sex are more challenging: Women have a lower sense of progress and intention to persist than men, if we control for other background variables and sources of support. This gender effect was already highlighted in previous studies (e.g., Groenvynck, Vandevelde, & Van Rossem, 2013). Bostwick and Weinberg (2018) went a step further in this consideration and showed that females were more likely to drop out in academic fields with underrepresented female peers (such as sciences and technology). The effect of sex could therefore be specific to male-female composition in the proximal working environment. This assumption deserves further investigation.

Second, the positive role played by supervisor support agrees with previous studies claiming this effect (e.g., Bair & Haworth, 2004; Barnes & Austin, 2009; Golde, 2005; Lovitts, 2001; Mainhard, van der Rijst, van Tartwijk, &

Wubbels, 2009). The results also validate the first hypothesis on the remaining effect of supervisor support when controlling for other sources of support. It suggests that, even if it is important to consider other layers of the scholarly communities surrounding the students, the doctoral supervisor plays a central role. However, the influence of the supervisor remained modest, a reminder that, as stated by McAlpine and McKinnon (2013), "supervisors, while important, are not paramount in the doctoral journey" (p. 278).

Third, the lack of remaining significant contribution from doctoral peers and relatives invalidates our second hypothesis, which postulated a significant remaining impact of peer and relative support on emotions. This result suggests that these sources of support are not of utmost importance in the achievement of a doctoral journey. Similarly, Golde (2000) suggested that, although "the absence of social integration can have a negative effect on the quality of the students' experience, such absence is not a precipitator of attrition" (p. 222). However, these results also contradict some previous quantitative results such as Martinsuo and Turkulainen's (2011) findings that peer support is related to doctoral students' progress in research and coursework. The reason for this contradiction may lie in the methodological weaknesses of previous studies such as cross-sectional design and the lack of control for initial levels of doctoral outcomes. Yet, it could also result from contextual or measurement differences. On the one hand, we can assume that the doctoral experience is affected by the specificity of educational and institutional policy; thus, the effect of peer support could vary from one educational context to another (De Clercq, Roland, Brunelle, Galand, & Frenay, 2018). On the other hand, the measures of peer support vary from one study to another; for example, Martinsuo and Turkulainen (2011) used a broader measure of peer support including the perceived support from the whole academic society and the active participation of the doctoral student to this academic community. This stresses the importance of how social support is defined and measured.

Fourth, the varying effect of supervisor support on intention to persist according to the stage of doctoral advancement offers a new insight in these processes and validated our third hypothesis. This finding substantiated Deuchar's (2008) assumption that supervisor support is expected to have a stronger impact at the beginning of the doctoral journey. This result is also in accordance with motivational theories (Deci & Ryan, 2000; Eccles & Wigfield, 2002), which postulate that perceived support is particularly important at the beginning of a new task in order to promote motivation and subsequent engagement in this task. Further, the moderating role of this doctoral stage suggests that the effect of social support is likely to vary according to doctoral students' individual characteristics, which may explain the modest direct effect found in the present study. Interestingly, the stage of advancement only predicted intention to persist but not positive emotions and perceived progress. This makes sense: While subsequent doctoral phases increase the perceived probability of reaching the end of the PhD, they are no easier than earlier ones and are therefore not related to more positive emotions or perceptions of faster progress.

Limitations

Although the present study overcomes many limitations of previous ones, some limitations are important to keep in mind in while interpreting the findings.

First, study participation on a voluntary basis may impede the representativeness of the sample. The participants in our final sample were similar to the nonparticipants on some criteria (e.g., age, father/mother highest educational degree, master grade, emotions, intention to persist) but not on others (e.g., sex and perceived progress), and we cannot ensure that there are no other differences between the two groups. Future studies that use random selection within their population and mandatory participation in order to avoid the drop out would be worthy.

Second, because social support was only measured at T2, we cannot control for its impact at T1 and T3. This limitation prevents us from testing the directionality of the effects investigated. Moreover, the interrelations between the three dependent variables were not further investigated. Emotion, intention to persist, and perceived progress were all placed at the same time in the regression analyses. However, we can postulate that some of them are more proximal to doctoral completion. For example, Tinto's model of departure (1997) argued that intention to persist could be the most proximal predictor of actual persistence. Thus, we could conceive of perceived progress and positive emotions as antecedents of the intention to persist.

Third, because our measures of social support were self-reported, the responses were likely to be influenced by participants' state of mind. We controlled for baseline levels of the three outcomes, but other participants' characteristics likely also played a role. Moreover, relatives support scale showed a low reliability. Developing a better scale to measure social support could therefore be useful in future studies. This enriched scale could also be accompanied by complementary measures of support (e.g., observations, behavioral measures, supervisor rating, etc.).

Fourth, the doctoral outcomes investigated didn't include students' actual completion of the doctoral degree. Such objective measure could have enriched our investigation.

A fifth limitation pertains to the choice of the factors accounting for the variation of doctoral completion process. Both sociodemographic and social support variables were

found to have a modest impact on doctoral outcomes. Therefore, other factors could have been considered in the analyses. For example, internal motivation of the doctoral student could have been an interesting psychological dimension to add to the multifactorial consideration (Lynch, Salikhova, & Salikhova, 2018). Contextual characteristics (such as academic fields) could also be an interesting way of deepening our approach (Wollast et al., 2018 **[Author: add to ref[illegible]nces]**). Yet, this second factor would have implied a multilevel consideration of the process and a larger sample.

Perspectives for Further Studies on Social Support

Taken together, the nonsignificant role of doctoral peers and the modest and moderated role of supervisor support raise a number of important questions that call for further systematic studies in order to reach a deeper understanding of these processes.

First, more longitudinal, large-scale investigations of the different sources of social support are needed to provide a clear view of their joint influences. In order to go beyond the findings highlighted in this study, a cross-lagged panel model that considers the reciprocal effects between variables across timepoints could provide a more accurate picture of the impact of social support on doctoral outcomes.

Second, there is a need for investigating other moderating effects, that is, the contextual and individual characteristics that are likely to strengthen or weaken the impact of social support. According to Peltonen and colleagues (2017), future studies should analyze the pattern of interactions between doctoral students characteristics and the social support they receive – for example, how supervision is perceived and interpreted by students and the degree of fit between supervisory behavior and students' expectations and needs (Pyhältö, Vekkaila, & Keskinen, 2012).

Third, as suggested by several scholars (House, 1981; Jairam and Kahl, 2012), there is also a need to deepen our understanding of the different types of support offered by the different sources and their specific effect. For each source of support, it would be worth having a measure of different types of support (based, for example, on House's typology) in order to analyze (1) whether the different sources of support offer different types of support and (2) whether these different types of support act on different doctoral outcomes. For example, we could test Jairam and Kahl's (2012) assumption that supervisors offer more professional support, while peers offer more affective support. Such distinctions could offer an even better view of the actual impact of different social resources.

Finally, from an institutional point of view, special attention may be needed in order to help supervisors obtain access to the necessary time, resources, and training to better consider their students' needs and respond adequately to them. This improved consideration, especially important in the planning stage, could strengthen their impact on their doctoral experience (Mainhard et al., 2009).

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Appendix

Table A1. Results of the two-factor analyses conducted on the support and outcome items

Supervisor Support			
My mentor . . .			
– discusses with me the difficulties I face and possible solutions	**.79**	.09	.05
– reassures me when I need it	**.77**	.10	.02
– makes me feel that I am able to succeed	**.77**	.13	.02
– provides me with constructive feedback on my work	**.74**	.06	.06
– gives me good advice on how I should plan and carry out my research	**.71**	.10	.09
– shows that he/she respects me and values me	**.66**	.14	.03
– defines clear objectives for me	**.63**	.08	.19
Academic Peers			
The other PhD students in my research environment . . .			
– provide emotional support regarding the fulfillment of my PhD	.09	**.80**	.09
– show that they respect me and value me	.14	**.76**	.06
– express understanding and empathy when I am facing difficulties	.09	**.76**	.04
– and I discuss our respective research and give me good advice on my doctoral research	.07	**.73**	.04
– gives me good advice on my doctoral research	.15	**.68**	.09
Relatives			
My relatives (family and friends outside the workplace) . . .			
– give me good advice on my doctoral research	.00	.01	**.76**
– sometimes help me in carrying out tasks related to my PhD	.04	.02	**.71**
– provide emotional support regarding the fulfillment of my PhD	.12	.17	**.48**
Intention to Persist			
– I plan on getting to the end of my thesis	**.85**	.06	.05
– No matter what happens, I intend to finish my PhD	**.83**	.05	.01
– If the current conditions of my PhD should continue, I am not sure whether I will finish it or not (R)	**.65**	.29	.24
– I am seriously considering quitting my PhD (R)	**.53**	.13	.30
– I am certain of having made the right decision by enrolling in a PhD program	**.50**	.35	.21
– I have already thought of giving up on my PhD (R)	**.45**	.32	.29
Emotions			
Lately, when I work on my PhD, I feel . . .			
– discouraged, demoralized (R)	.17	**.69**	.38
– happy, fulfilled	.35	**.63**	.18
– confident, optimistic	.36	**.60**	.39
– satisfied, content	.32	**.58**	.33
– angry, rebellious (R)	.16	**.54**	.10
– anxious, stressed out (R)	.07	**.52**	.31
– ridiculous, ashamed (R)	.21	**.50**	.20
Perceived Progress			
– I do not progress as fast as the other PhD students in my research team (R)	.10	.07	**.72**
– I have the feeling that I am not moving forward (R)	.23	.33	**.69**
– I am progressing as planned	.19	.31	**.69**

Note: (R) = reverse scoring. **[please explain use of boldface]**