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INTERNAL MOTIVATION AMONG DOCTORAL STUDENTS: CONTRIBUTIONS FROM THE STUDENT AND FROM THE STUDENT'S ENVIRONMENT

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ABSTRACT

Aim/Purpose: The present quantitative, cross-sectional study aimed to investigate objective and subjective factors in the self-determination of doctoral students in their educational activities. Objective determinants included major discipline and forms of academic and scholarly activity (that is, attending classes and writing papers), and subjective determinants included personal characteristics of the doctoral students, including dispositional autonomy and perceptions of environmental supports for students' basic psychological needs.

Background: The quality of students' motivation for learning has been linked with many different outcomes. Specifically, students who are more internally motivated (that is, who engage in learning activities for reasons that are personally important and freely chosen) demonstrate better performance outcomes and are more likely to choose and to persist in challenging tasks, to enjoy learning, to exhibit greater creativity, and in general to experience greater psychological well-being. Important questions remain, however, regarding the sources that affect student motivation, in particular at the level of graduate school. The present study expands on existing research by exploring contributions to students' motivation

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	both from the students, themselves, and from supports stemming from two interpersonal contexts: close relationships and the university environment.
Methodology	Participating in the study were 112 doctoral students from various natural sciences departments of a major university in the Volga region of Russia. Self-report measures included dispositional autonomy, motivation for various types of academic and scholarly activity, and satisfaction of basic needs for autonomy, competence, and relatedness in various interpersonal contexts. Analyses included descriptive statistics, comparison of mean differences, correlation, and structural equation modeling.
Contribution	The present study goes beyond existing research by considering both dispositional and situational factors that influence the motivation of doctoral students for their scholarly and academic activities, and by comparing the impact on motivation of close personal relationships with that of various interpersonal contexts in the university setting.
Findings	Doctoral students reported greater supports for their basic needs (for competence, autonomy, and relatedness) from their close personal relationships than in their university contexts. Students felt less support for their autonomy and competence with their research supervisor than in other university settings. The early stages of a scholarly activity, such as gathering sources and analyzing materials, were more likely to be characterized by external motivation, whereas the later stages, like the actual writing of a manuscript, were more likely to be internally motivated. When competing for variance, need supports from university-based but not from close personal relationships were significant contributors to students' internal motivation for scholarly and academic activity; this effect, however, was fully mediated through students' own dispositional autonomy.
Recommendations for Practitioners	The present study underscores the importance of creating an environment in the university that supports doctoral students' needs for autonomy, competence, and relatedness. Educators, and in particular research supervisors, should attend to the ways in which their policies and practices support versus undermine these needs, which are shown to play an important role in promoting doctoral students' own internal motivation for their scholarly and academic activities.
Recommendations for Researchers	Although in this sample need supports from university-based interpersonal contexts outweighed the role of need supports from close personal relationships, in terms of doctoral students' scholarly and academic motivation, it seems important to keep both contexts in mind, given the general importance of close relationships for motivation and other educational and well-being outcomes. As well, accounting for students' own dispositional attributes, such as their own personal tendency toward autonomy, seems a critical counterpoint to looking at environmental contributions.
Future Research	Future research should examine whether the mediational model tested in the present study applies to other samples of doctoral students, for example, to those from other disciplines, such as the humanities, and those in other cultural or geographic locations, where it is possible that close personal relationships may contribute more substantially to students' motivation than was the case in the present sample. As well, future studies would do well to include other relevant outcomes, such as academic grades, successful degree completion, and measures of well-being, in order to confirm previous findings of the link between internal motivation and various educational outcomes.

Keywords education, doctoral students, internal motivation, academic-scholarly activity, self-determination, psychological needs

INTRODUCTION

The success of any student depends first and foremost on his or her motivation. When it comes to learning at the doctoral level, motivational factors are critical, not only for the initiation and continuation of one's doctoral studies, but also for the successful preparation and defense of the dissertation. Motivation, in other words, is a critical ingredient in the ability to bring one's studies to completion. For this reason, instruments have even been designed specifically to measure these factors (Litalien, Guay, & Morin, 2015). Research on motivational factors is becoming especially relevant for transforming the educational system overall, and programs of preparation in doctoral studies in particular, transformation which is taking place in various countries and the effectiveness of which raise valid questions for the researcher (e.g., Alves & Azevedo, 2010; Radulian, 2006). The present quantitative study was conducted with the aim of identifying the factors influencing the motivation of doctoral students in a university. The specific cultural context is that data were collected three years after the introduction, in the country (Russia), of new standards of education at the doctoral level, standards which are focused primarily at students' preparation for teaching in the university. This cultural context will be described more fully, below.

The factors that influence motivation are multitudinous. Typically explored as the initial motives for deciding to begin doctoral studies are things like life planning and career orientation, as aspects of the broader life context of the individual (Wellington & Sikes, 2006). Studies in an Australian university (Brailsford, 2010; Guerin, Jayatilaka, & Ranasinghe, 2015), and studies of teachers in Poland and Portugal (Kowalczuk-Walędziak, Lopes, Menezes, & Tormenta, 2017) have shown that personal motives and professional development are the dominant factors in deciding to pursue a doctoral degree.

Another category of factors that influences motivation to pursue and complete doctoral studies pertains directly to the educational and research process, itself. A link has been found between the student's type of motivation and the student's attitude toward the activity of conducting research (Breen & Lindsay, 1999). In this regard, of interest are factors that act within the internal space of the university: its social contexts and the particular qualities of relationships within them, the forms and types of activity of doctoral students, and how different academic disciplines understand the meaning of doctoral study (Ferguson, Hovey, & Henson, 2017). All of these can significantly influence both the student's motivation to continue work on the dissertation, and its successful completion (Leech, 2012; Stenstrom, Curtis, & Iyer, 2015). In our view, in this context especially important is a more differentiated approach to motivation that takes into consideration its variations along the continuum of motivation, from external to internal.

Self-determination theory (SDT) (Ryan & Deci, 2017) is an approach to motivation, development, and personality that suggests that motivation can be distinguished along a continuum of relative autonomy, with more external forms of motivation (characterized by feelings of being pressured or controlled, or by the desire to obtain some reward or avoid some punishment) at one end of the continuum, and more internal forms of motivation (characterized by feelings of autonomy, choice, personal value, and interest) at the other end of the continuum. When people engage in activities in a particular domain for reasons that feel more internal, they tend to experience greater enjoyment, preference for challenging rather than easy tasks, persistence, creativity, and general well-being (Ryan & Deci, 2017). Importantly, research has provided rather extensive support for the link between internal or autonomous motivation and positive outcomes in the field of education (Chirkov, Vansteenkiste, Tao, & Lynch, 2007; Guiffrida, Lynch, Wall, & Abel, 2013; Leow, Lee, & Lynch, 2016; Lynch & Salikhova, 2016; Niemiec et al., 2006; Ryan & Lynch, 2003).

Research within the SDT tradition has found that more autonomous, internal motivation for activity in a particular domain can be supported through satisfaction of three basic psychological needs: the

needs for autonomy, for competence, and for relatedness (Ryan & Deci, 2017). *Autonomy*, as a basic need, refers to the ability to take initiative and to make choices that are personally meaningful and that align with one's core values. *Competence* refers to the ability to have an impact on one's environment and to attain desired outcomes. *Relatedness* reflects the fact that humans are inherently social beings and require meaningful and mutual connections with others. In environments that provide opportunities for people to satisfy these three needs, their motivation for activity within that environment tends to be more internal rather than external, and indeed motivation can change over time: under conditions of need support; motivation that was initially more external tends to shift along the continuum, becoming more autonomous or self-determined (Ryan & Deci, 2017).

As an additional consideration, it is important to point out that, in the SDT tradition, it is recognized that some people simply tend to be more oriented toward the experience of autonomy; as such, they tend to be more aware of opportunities the environment provides them to make personally valued choices and are less sensitive to pressures and external controls those environments may impose. This *dispositional autonomy* not only directly influences the quality of a person's motivation in various domains of activity, making it more likely that his or her motivation will be internal rather than external, but has been found to serve as a mediator of the impact of environmental need supports on motivation, and has been linked to a number of other outcomes, as well (Ryan & Deci, 2017; Weinstein, Przybylski, & Ryan, 2012).

Problem Statement

To date, limited research has been conducted from the SDT perspective with respect to doctoral students specifically. However, a qualitative study exploring students' initial motives for entering doctoral studies (Brailsford, 2010) identified a variety of motives, from those that might be considered more 'external' (for example, improving career prospects) to those that could be considered more 'internal' (such as for reasons of personal development, or intrinsic interest in the subject of study). Of particular relevance is research which, on the basis of a qualitative analysis of 29 interviews, identified how doctoral supervisors provide structure, involvement, and autonomy support to doctoral students (Devos et al., 2015). The authors wrote about the delicate boundary between structure and control, between autonomy support and chaos. The relationship with the supervisor is decidedly very important during doctoral studies, and for this reason has become a topic of research interest for a series of authors (e.g., Orellana, Darder, Pérez, & Salinas, 2016). Aside from the supervisory relationship, the role of colleagues or classmates has also been studied, and evidence for their impact on success in doctoral studies has been found (Booth, Merga, & Roni, 2016).

The basic research question for the present study is to identify the role of basic psychological needs in fostering the motivation of doctoral students for both their scholarly activities (that is, activities specifically related to research) and their academic studies, more broadly (including coursework). Further, we wish to clarify the contexts that contribute most substantially to the support of those needs for students in doctoral study. Mason (2012) has already found a link between satisfaction of these needs, through interaction with supervisors and peers, and the motivation to continue in one's doctoral studies. Of interest to us is the extent to which, in the environment or space of the university, doctoral students experience supports for the basic psychological needs, and whether the impact of this support varies in different types of academic and research-related activity. Likewise, it is important to understand the contribution of environmental supports for need satisfaction to doctoral students' internal motivation, and whether that link is mediated by students' own dispositional autonomy. In this way, the present study aims to extend our knowledge by exploring the contributions to student motivation for specific activities they engage in while at university, contributions both from the social context, in terms of need supports, and from the individual student, in terms of dispositional autonomy.

It is important to note that the present study investigated doctoral student motivation in one country, the Russian Federation. Traditionally, in Russia education at the higher levels has followed the Euro-

pean and, in particular, the German model, which included minimal academic coursework and a preferential emphasis on involvement in research activities under the direction of a research supervisor. Within the past few years, however, a new system has begun to be introduced which is much closer to the United States model of higher education; this newer Russian model places emphasis on an often heavy load of required academic coursework with accountability for attendance, intermixed and followed by more targeted research activities, also under an advisor's supervision, with expectations or even a requirement for publication of research results before a diploma can be awarded. Because of the potential importance of these changes for students' educational experience, in the present research we specifically considered doctoral students' motivation for academic coursework as well as for more specifically research-related activity.

Research Objective

As noted, the goal of the present study was to identify the factors that promote doctoral students' internal motivation in various interpersonal contexts in the university (e.g., in class, with peers or colleagues, and with a supervisor) for various types of academic and research-related activity. In order to reach this basic goal it was necessary to address several issues:

1. To identify the degree of satisfaction of the basic needs for autonomy, competence, and relatedness in the context of various relationships the student has within the university's space.

2. To determine the correlates of internal and external motivation for various forms and types of academic and research-related activity.

3. To assess the influence on internal motivation, both of the students' own dispositional autonomy, and of the supports for the basic needs (for autonomy, competence, and relatedness) that students experienced within the university's space.

4. For purposes of comparison, to assess the contributions of need supports from close personal relationships, outside the university context.

Hypotheses

Based on self-determination theory, we made the following predictions:

Hypothesis 1 (H1): Support for basic psychological needs for autonomy, competence, and relatedness (a) from close relationships and (b) from university-related contexts will have a direct and positive association with doctoral students' internal motivation for scholarly and academic activities; conversely, need satisfaction will have a direct and negative association with external motivation for these activities; however, these associations will be stronger for the university-related contexts than for the close personal relationships (given the more proximal salience of the former to the scholarly and academic activities being investigated).

Hypothesis 2 (H2): Higher levels of dispositional autonomy will be associated with more internal and less external motivation for scholarly and academic activities.

Hypothesis 3 (H3): The impact of psychological need supports on doctoral student motivation will be at least partially mediated through doctoral students' own dispositional autonomy.

METHODS

Participants and Procedures

The current research recruited 120 doctoral students enrolled at a major university in the Volga region of Russia. Of these, 112 elected to participate in the study, among them 58 men and 54 women, ranging in age from 22 to 45 years (median = 24, M = 24.7, SD = 3.2). Students who completed the survey were from six different institutes situated within the university: the Institute of Computational

Mathematics and Information Technologies, and the Institute of Mathematics and Mechanics (17 %), the Institute of Chemistry (18 %), the Institute of Geology and Petroleum Technologies (21 %), the Institute of Fundamental Medicine and Biology (30 %), and the Institute of Physics (14 %). Doctoral students had been enrolled in their graduate programs and attending classes for two months before the survey was administered. The study was conducted in the context of a class taught on the topic, "the psychology of higher education," which is included in the preparation program for future university teachers. Students had chosen voluntarily to participate in practical coursework in psychology, and completion of survey materials (also voluntary) was considered part of their practical growth in self-knowledge and of their study of the psychology of the student. Students could however opt not to participate in the study with no penalty and, as noted, some 8 of them did so.

Measures

All scales used in the present study have been previously translated and validated for use with Russian samples in prior research (see, e.g., Chirkov & Ryan, 2001; Lynch, La Guardia, & Ryan, 2009; Ryan et al., 1999; Sheldon et al., 2017). Because survey materials were administered to participants in Russian, they are not included here, but are available from the authors upon request.

The Index of Autonomous Functioning (IAF) (Weinstein et al., 2012)

Dispositional autonomy is the individual tendency to act autonomously in one's daily life and, as such, is thought to be similar to a personality trait (Weinstein et al., 2012). In order to measure dispositional autonomy, two subscales of the IAF, representing feelings of self-authorship (5 items, Cronbach's $\alpha = .56$) and low susceptibility to control (5 items, Cronbach's $\alpha = .66$), respectively, were administered. Items were scored on a scale of 1 (strongly disagree) to 5 (strongly agree). A composite score was computed by averaging across items (scale $\alpha = .70$).

Psychological Need Supports (La Guardia, Ryan, Couchman, & Deci, 2000)

As previously noted, satisfaction of basic psychological needs has been found to be associated with more internal motivation, in various domains and settings. In order to assess social-contextual supports for the satisfaction of doctoral students' basic psychological needs, 9 items (three each, for autonomy, competence, and relatedness) were administered five times: with mother and with a friend (to reflect close relationships), and with peer colleagues /classmates, research supervisor, and in class (to reflect university-related interpersonal settings). Items were scored on a scale of 1 (completely inaccurate) to 7 (completely accurate). Scores for each of the three basic needs were computed, for each of the 5 contexts, by averaging the three items for each need (α's ranging from .50 to .63 for autonomy, from .49 to .79 for competence, and from .65 to .77 for relatedness).

Self-Regulation for Learning (SRQ-L) (Black & Deci, 2000)

The quality of students' motivation can be more internal (or autonomous), reflecting personal value and choice, or more external, reflecting feelings of pressure or coercion. In order to assess the relative autonomy of doctoral students' motivation for activities undertaken while at the university, three items from the SRQ-L were adapted to reflect autonomous (or internal) reasons for acting and two items from the SRQ-L were adapted to reflect controlled (or external) reasons for acting. Specifically, participants responded to each of the 5 items on a scale of 1 (completely disagree) to 5 (completely agree) for each of six activities in which they might typically engage with respect to their university-related experience: "I write a scholarly text (thesis, article, etc.)," "I organize and collect data for research," "I search for and synthesize information about a research topic," "I attend a class at the university," "I discuss work with my scientific director/research advisor," "I discuss work with my colleagues / classmates." Composite scores for internal motivation were computed by averaging across

the three items for all six activities (α = 92), and scores for external motivation were computed by averaging across the two items for all six activities (α = 88).

Data Analytic Strategy

Initial analyses were conducted using descriptive statistics and independent two-sample Student's t-test. Initial analyses were conducted both in the cumulative sample and by academic discipline.

In order to test the respective contributions to doctoral student motivation of dispositional autonomy and of basic need satisfaction (in close relationships versus in the university context), structural equation modeling (SEM) (Byrne, 2016) was used. Among other things, SEM specifically addresses the issue of measurement error by including error in the model, and it also allows for the testing of a full model simultaneously, including multiple outcomes, which is a decided advantage over regression-based approaches (Byrne, 2016). Specifically, following recommendations by Byrne (2016), a mediation model was set up in which direct and indirect effects of satisfaction of basic needs for autonomy, competence and relatedness could be tested, along with possible mediation by dispositional autonomy (see Figure 1). As the first step in testing for mediation, the pathways from the proposed mediator (here, dispositional autonomy) are constrained to zero in order to test the direct effects of the predictors (here, the two need satisfaction latent variables) on the outcomes (here, internal and external motivation). At the next step in the analysis, the pathways from the mediator are freed up, and any drop in the magnitude of the direct effects are noted and taken as an indication of mediation.

Results

Results of the Comparison of Basic Psychological Need Satisfaction for Doctoral Students in Various Relationships, Both at University and with Close Others

A general overview of factors influencing doctoral students' motivation is provided in Table 1. As indicated, representing the objective factors that might influence motivation is the student's academic discipline, as determined by the department or faculty in which the student was enrolled (see sample characteristics, above). Reflecting more subjective sources of influence are students' perceptions of supports for their basic psychological needs, both from close relationships and from interpersonal sources in the university setting, as well as the student's own dispositional autonomy, or the tendency to experience oneself as the author of one's actions, combined with the tendency not to be susceptible to external pressures and controls from the environment.

Table 1. Factors affecting internal and external motivation of doctoral students

Objective factors:	Academic discipline
Subjective factors:	Basic psychological need supports (autonomy, competence, relatedness) from close relationships
	Basic psychological need supports (autonomy, competence, relatedness) from university relationships
	Dispositional autonomy (self-authorship, low susceptibility to control)

Although, based on prior research in the SDT tradition, we did not expect gender differences, we tested for them using an independent samples t-test. To our surprise, we found a few: in the present sample, women (M = 5.21) experienced greater autonomy support than men (M = 4.51) from their research advisors (t = 3.24, df = 114, $p < .01$). In addition, women (M = 5.23) experienced greater competence support than men (M = 4.68) from their research advisors (t = 2.28, df = 114, $p < .05$). Women also experienced greater relatedness supports from their friends (M = 5.96 vs M = 5.38; t = 2.81, df = 114, $p < .01$), classmates / colleagues (M = 4.13 vs M = 3.65; t = 2.07, df = 114, $p < .05$), and research advisors (M = 4.35 vs M = 3.59; t = 3.19, df = 114, $p < .01$) than did men.

Full-sample comparisons of doctoral students' experience of satisfaction of basic psychological needs are presented in Table 2.

Table 2. Basic psychological need satisfaction among doctoral students: Comparison by student's t-test of various contexts

Variables		1	2	3	4	5	*6*	*7*
1) with friend	Aut	-	3.97**	10.85**	12.61**	9.65**		
	Comp	-	-4.74**	5.67**	7.92**	3.87**		
	Rel	-	-3.78**	13.78**	13.52**	17.36**		
2) with mother	Aut		-	6.05**	7.79**	6.09**		
	Comp		-	8.69**	10.43**	8.00**		
	Rel		-	15.98**	14.54**	19.84**		
3) with colleagues / classmates	Aut			-	1.70	-.75		
	Comp			-	4.65**	-1.54		
	Rel			-	-1.14	3.47**		
4) with academic advisor/supervisor	Aut				-	-2.40*		
	Comp				-	-5.75**		
	Rel				-	4.43**		
5) in class	Aut					-		
	Comp					-		
	Rel					-		
6) in close relationships	Aut						-	11.81**
	Comp						-	9.53**
	Rel						-	21.22**
7) in university-related settings	Aut							-
	Comp							-
	Rel							-
Mean	Aut	6.23	5.81	5.01	4.84	5.09	6.02	4.98
	Comp	5.84	6.19	5.34	4.93	5.46	6.02	5.25
	Rel	5.62	6.07	3.83	3.96	3.45	5.84	3.74
SD	Aut	.97	1.24	1.22	1.26	1.24	.96	1.06
	Comp	.94	.99	1.20	1.37	1.14	.88	1.12
	Rel	1.25	1.21	1.30	1.35	1.22	1.05	1.09

NOTE: Aut: autonomy; Comp: competence; REL: relatedness.
***p < .001; *p < .01*

As can be seen, the need for autonomy was more satisfied in the context of relationships with a friend (*M* = 6.23), and then in descending order follow relationships with mother (*M* = 5.81), with the group in a classroom setting (*M* = 5.09), with peer colleagues (*M* = 5.01), and lastly with the supervisor (*M* = 4.84). Differences in the degree of autonomy satisfaction in relationships with a friend and with mother significantly differed from autonomy satisfaction in all other interpersonal contexts. In addition, differences among the university contexts were smaller and less clearly defined.

The need for competence was more satisfied in the relationship with mother (*M* = 6.19), and then in descending order followed the relationship with a friend (*M* = 5.84), with the group in class (*M* = 5.46), with peer colleagues (*M* = 5.34) and, lastly, with the supervisor (*M* = 4.93). As with the previous case, differences between close relationships and university relationships were statistically significant (*M* = 6.02 versus 5.25), but across university contexts there were no differences except for the classroom group and peer colleague contexts.

The need for relatedness was more satisfied in the context of the relationship with mother (*M* = 6.07), and then in descending order followed the relationship contexts with a friend (*M* = 5.62), with one's supervisor (*M* = 3.96), with peer colleagues (*M* = 3.83) and, lastly, with the group in class (*M* = 3.45). All differences were significant with the exception of the difference between supervisor and colleagues.

These differences are summarized in the comparison of the combined contexts of close relationships (with mother, friend) on the one hand and relationship at the university (with colleagues, the group in class, one's supervisor), on the other.

Comparing the various university contexts with each other demonstrates that the differences between them were not so substantial. Satisfaction of the need for autonomy was more supported in the context of the group in the classroom (*M* = 5.09), the need for competence was also more supported in the context of the group in the classroom (*M* = 5.46), and the need for relationships was more supported in the relationship with the supervisor (*M* = 3.96).

Table 3. Significant differences (by Student's t-test) for satisfaction of basic psychological needs among doctoral students from various academic disciplines

Variables		1	2	3	4	5
1) physics	Aut-m	-	-2.26*	-.24	.57	.04
	Comp-m	-	-1.40	.36	.80	.54
2) earth science	Aut-m		-	2.37*	2.79**	1.56
	Comp-m		-	2.22*	2.03*	1.31
3) biologists	Aut-m			-	.93	.76
	Comp-m			-	.25	.44
4) chemistry	Aut-m				-	-.41
	Comp-m				-	.00
5) mathematics and computer science	Aut-m					-
	Comp-m					-
Mean	Aut-m	5.69	6.36	5.76	5.47	5.67
	Comp-m	6.25	6.52	6.18	6.00	6.00
SD	Aut-m	1.05	.82	1.08	1.22	1.84
	Comp-m	.745	.48	.64	1.06	1.73

NOTE: Aut-m: autonomy with mother; Comp-m: competence with mother.
***p < .01; *p < .05*

As can be seen in Table 3, comparison of the university's various academic disciplines showed that differences in satisfaction of the needs for autonomy, competence, and relatedness were not significant, with the exception of the relationship with mother, for which there were some differences in autonomy and competence; for example, students in the earth sciences experienced greater autonomy and competence support from their mother ($M = 6.36$ and $M = 6.52$, respectively). Overall, support for the psychological needs in the various university contexts explored did not differ by academic discipline.

Results of the Comparison of Internal and External Motivation and Their Associations in Various Forms of University-Based Activity

The comparative analysis of indicators of internal and external motivation and their associations in various forms of academic and scholarly activity in the university are presented in Table 4.

Table 4. Indicators of internal motivation (IM) and external motivation (EM) and their discrepancy (RAI) in various forms of university-related activity, and their comparison by student's t-test

Variables		1	2	3	4	5	*6*
1) I write a scholarly text (thesis, article, etc.)	IM	-	3.60**	3.34**	2.44*	2.12*	9.39**
	EM	-	-1.78	-2.41*	-.66	-3.65**	-1.23
	RAI	-	3.65**	4.39**	2.11*	3.84**	8.49**
2) I organize and collect data for research	IM		-	.37	.044	-.08	7.36**
	EM		-	-1.29	.51	-2.79*	.05
	RAI		-	1.08	-.29	1.30	6.54**
3) I search for and synthesize information about a research topic	IM			-	-.29	-.44	7.23**
	EM			-	1.32	-1.32	.91
	RAI			-	-1.05	.45	5.67**
4) I attend a class at the university	IM				-	-.14	7.30**
	EM				-	2.48*	-.40
	RAI				-	1.42	5.71**
5) I discuss work with my research advisor	IM					-	8.26**
	EM					-	2.17*
	RAI					-	5.81**
6) I discuss work with my colleagues / classmates	IM						-
	EM						-
	RAI						-
Mean	IM	9.64	9.14	9.08	9.13	9.16	7.43
	EM	7.41	7.64	7.81	7.54	7.98	7.63
	RAI	2.23	1.50	1.27	1.59	1.18	-.19
SD	IM	2.25	2.20	2.17	2.12	2.25	1.98
	EM	1.89	1.70	1.92	1.79	1.96	2.07
	RAI	3.10	2.96	3.06	2.99	2.99	2.53

NOTE: RAI = relative autonomy index (calculated as [IM] – [EM]).
***p < .001; *p < .05.*

Internal motivation was greater with respect to writing scholarly papers (M = 9.64) and this significantly differed from other types of academic and scholarly activity, such as, for example (in descending order), discussing work with one's research supervisor (M = 9.16), organizing and collecting materials for research (M =9.14), attending class (M = 9.13), discussing work with colleagues and classmates (M = 7.43). A similar pattern emerged for the discrepancy scores, also known as relative autonomy, confirming the general tendency.

External motivation was highest when discussing work with one's supervisor (M = 7.98), and then, in descending order, when searching for information on a research topic (M = 7.81), organizing and collecting materials for research (M = 7.64), discussing work with one's colleagues and classmates (M = 7.63), attending classes in the university (M = 7.54), and writing scholarly texts (M = 7.41). Differences were significant between discussing work with a supervisor and all other types of activity, with the exception of seeking and systematizing information.

Results of the SEM Analysis

We wished to test the relative contributions of need satisfaction (from close relationships, and from interpersonal contexts within the university setting) to the quality of doctoral students' motivation for their various academic and scholarly activities, when taking into account students' own orientation toward acting autonomously. The full structural model testing mediation of the effect of need satisfaction on doctoral students' motivation via dispositional autonomy is presented in Figure 1.

As noted, SEM was used to test the mediation of the impact of basic need supports (from close personal relationships and in university contexts) on doctoral student motivation, through students' own dispositional autonomy (Figure 1). Results indicated that there was, indeed, mediation. When paths from dispositional autonomy to both internal and external forms of motivation were constrained to zero in order to test the direct effects, model fit was adequate (χ^2 (57) = 117.647, χ^2/df = 2.064, p < .01; CFI = .895, RMSEA = .092), and need support in the university context predicted both internal motivation among doctoral students (β = .44, p < .01) and external motivation among doctoral students (β = -.42, p < .01); the direct paths from need support in close relationships, however, were nonsignificant (p's > .2): students who felt their psychological needs satisfied while in the university setting felt more autonomous and less controlled in their motivation for carrying out their academic and scholarly activities. Doctoral students' dispositional autonomy was predicted by need satisfaction in the university context (β = .77, p < .01) but not from close relationships (p > .3); in other words, students were more likely to feel oriented toward autonomy, in general, when they experienced supports for their psychological needs while at university. When at the second step of the analysis the paths from dispositional autonomy to internal and external motivation were freed, model fit was again acceptable (χ^2 (55) = 111.051, χ^2/df = 2.019, p < .01; CFI = .903, RMSEA = .090). However, the direct paths from need support in the university context dropped to nonsignificance (p's > .5); given that the path from dispositional autonomy to internal motivation was significant (β = .41, p = .05) (the path from dispositional autonomy to external motivation was not, p > .1), this suggests full mediation. The impact of need support on doctoral student motivation was fully mediated through doctoral students' own dispositional autonomy. Notably, dispositional autonomy was, itself, predicted by need supports in the university context (β = .73, p < .01) but not by need supports from close relationships (p > .4). To summarize, doctoral students who felt supports for competence, relatedness, and autonomy in the context of relationships with colleagues and advisors in the university setting, and in the context of academic classes, reported feeling more autonomous in general (in terms of feelings of authorship and self-congruence, and low susceptibility to control), and this felt autonomy translated into more internal motivation for their academic activities in the university.

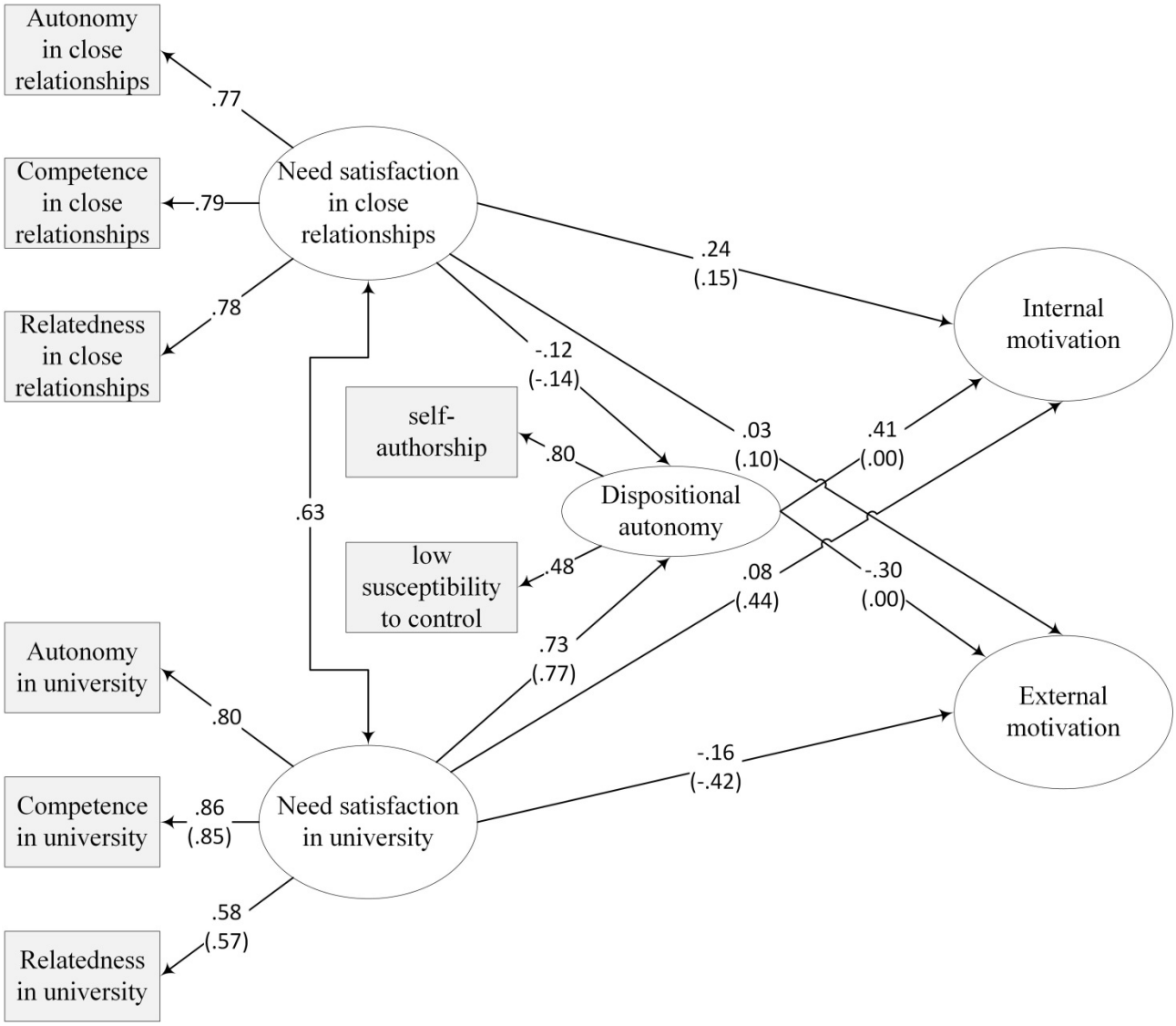

Figure 1. Direct and indirect paths from need support to doctoral students' motivation, with mediation through dispositional autonomy

Notes: Latent variables were used to represent all constructs, and the path coefficients, factor loadings, and residuals are standardized estimates. Values in parentheses represent those of the constrained model.

DISCUSSION

DOCTORAL STUDENTS' BASIC PSYCHOLOGICAL NEEDS WITHIN THE UNIVERSITY AND WITHIN CLOSE PERSONAL CONTEXTS

Tables 2 and 3 summarize key findings pertaining to doctoral students' experiences of psychological need satisfaction in various interpersonal contexts. As noted in Table 2, and consistent with much of the SDT literature, need supports tended to be higher in close personal relationships. Indeed, the boundary for the largest differences in doctoral students' basic psychological need satisfaction was located between the contexts of close personal relationships, on the one hand, and the university

setting, on the other: respectively for these settings, mean scores were 6.02 compared to 4.98 for autonomy, 6.02 compared to 5.25 for competence, and 5.84 compared to 3.74 for relatedness.

Results of the comparison between university contexts indicated that the differences between them were not so large, and there were no differences between doctoral students of different academic disciplines (Table 3). It is important to emphasize that supervisors in general supported the feeling of relatedness, but did not adequately support autonomy and competence, where we found the lowest scores among all of the various contexts studied. These results accord with the findings of other authors, who similarly have underscored the necessity of support from supervisors for doctoral students' autonomy, as well as a basic trust in their ability to act autonomously (Booth et al., 2016; Orellana et al., 2016).

As noted, we had made no predictions regarding gender effects, given that these are typically absent in most of the SDT literature; this is indeed consistent with the theory, which predicts that needs are universally important regardless of distinctions like gender or culture. For this reason, we note with some interest that we detected some effects in this regard: within the context of this particular university setting, women doctoral students were more likely than their male counterparts to report experiencing support for their needs for autonomy, competence, and relatedness from their research supervisors, and for their need for relatedness from friends and classmates. Although we have no cogent explanation for this result, we suggest that it warrants further attention in subsequent research.

Doctoral Students' Internal and External Motivation for Their Academic and Scholarly Activities

From the comparisons of internal motivation as expressed in various forms and types of academic and scholarly activity (Table 4), it is possible to conclude that the most highly internally motivated stages of scholarly activity were the finishing stages, associated with the composition of texts, whereas the beginning stages, associated with collecting materials and analyzing sources, were characterized by external control rather than internal motivation. As we saw, discussing work with one's supervisor appears to be a more ambivalent area of motivation, in which were expressed both internal and external motivation.

Comparing the various university-based social contexts, it can be observed that the least internally motivated was the motivation to discuss work with colleagues and classmates; in this situation doctoral students experienced the most highly controlled or external motivation. Attending classes, which similarly takes place in groups, was more internally motivated. One possible interpretation, of course, is that it was not so much a question of the atmosphere in the group as a desire not to show one's work to one's colleagues. We note this as a potential problem area, which requires further analysis, perhaps by means of qualitative methods. It is possible that ideas for optimizing the process of class participation and group work in the university may be needed.

Basic Need Supports, Dispositional Autonomy, and Doctoral Students' Motivation

As noted, we tested whether students' own level of dispositional autonomy, operationalized in terms of feelings of authorship and low susceptibility to control, would mediate the impact of environmental supports for psychological need satisfaction on students' motivation for their academic activities in the university. Indeed, this was the case (Figure 1). Although need supports from one's university surround (advisor, colleagues, classroom) had a direct effect predicting more internal and less external motivation, this effect was fully mediated through students' own dispositional autonomy. When doctoral students experienced support for their needs for autonomy, competence, and relatedness in their university environment, they themselves felt more autonomous (more authorship, less susceptibility to outside control), and this in turn led to greater feelings of autonomy with respect to their scholarly and academic activities. Notably, the importance of university supports eclipsed the

influence of close relationships, which did not significantly predict either dispositional autonomy or quality of motivation for scholarly activity.

These results provide general support for the predictions made on the basis of self-determination theory (SDT). According to SDT, environments that provide opportunities to satisfy needs for autonomy, competence, and relatedness tend to foster motivation for activity that is more internal, characterized by feelings of self-authorship and freedom to take initiative (Ryan & Deci, 2017). The present study is among the first to distinguish supports obtained from one's close personal relationships (here operationalized in terms of relationships with mother and with a friend) from supports obtained more specifically within one's academic and scholarly context (operationalized as relationships with advisor and colleagues, as well as in the classroom). In this light, it is, again, noteworthy that for the doctoral students in this sample, when competing for variance in students' experience of dispositional autonomy and in students' motivation for scholarly activity, only supports from the university-specific context emerged as significant. This finding was not entirely expected, given the importance of close relationships in providing need support that has been demonstrated in prior research (e.g., Lynch et al., 2009; Niemiec et al., 2006; Williams et al., 2006).

Limitations

Results are limited by the fact that they were obtained from only one university in Russia, which does not permit us to confirm the degree to which these particular findings are universal and can be extended to doctoral students in other countries or, indeed, in other regions of Russia. Further, doctoral students were drawn from various departments in the natural sciences only, which leaves open the question of whether other issues might be involved in the motivation of doctoral students in the humanities, for example.

The low internal consistency reliabilities (Cronbach's alphas) for two key study scales, the Index of Autonomous Functioning (IAF) and Psychological Need Supports (PNS), suggest caution in interpreting results of the current study. Results should be confirmed in independent samples in subsequent research. That said, internal consistencies of this magnitude have been reported in other published research using similar SDT-based scales (e.g., Leow et al., 2016, reported alpha of .68 for the autonomy items in the SRQ-L; Lynch et al., 2009, reported alphas for a scale measuring autonomy support as low as .59 and .67).

Another limitation is that the sample size (N = 112) was rather small, compared to most studies that use SEM (which typically include several hundred if not several thousand participants). A larger sample would have allowed more elaborate analyses to be conducted: for example, it might have been possible to create a more elaborate structural model using SEM, such as a multigroups analysis as a test of moderation by group membership, which would have allowed us to test whether, for example, the full model worked differently for different academic disciplines, or for women compared to men, and so on. As it was, our sample was only large enough to permit testing of the rather limited model depicted in Figure 1 (see, e.g., Wolf, Harrington, Clark, & Miller, 2013 for recent perspectives on sample size in SEM analyses).

Also, the focus of the present study was on the quality of doctoral students' motivation, whether more internal or more external in nature, and the resources and supports that tend to foster motivation that is more internal. Although much prior research has linked internal motivation with other outcomes of importance to students and their educators, such as persistence, performance, and even psychological well-being (see, e.g., Ryan & Deci, 2017), it would be important in future studies to confirm the links between internal motivation and such positive outcomes among doctoral students.

CONCLUSIONS AND IMPLICATIONS

Our study investigated factors that influence the quality of doctoral students' motivation for their academic and scholarly activities. We made three specific predictions (H1, H2, H3), which received partial support, and there were unpredicted results which also seem important to mention here.

1. In partial support of H1, psychological need supports from university-related contexts, but not from close personal relationships, were associated with more internal motivation for doctoral students' academic and scholarly activities.
2. In support of H2, students who were dispositionally more oriented toward autonomy were more likely to report autonomous (internal rather than external) motivation for their academic and scholarly activities.
3. In support of H3, the impact of psychological need supports on motivation was fully mediated through doctoral students' own dispositional autonomy. As shown in the test of the full model (Figure 1), when competing with each other, need supports from university-based contexts were more powerful predictors than were close relationships, both of doctoral students' dispositional autonomy and of their internal motivation for scholarly and academic activity.

Unpredicted, but noteworthy, findings included the following:

4. Satisfaction of basic psychological needs for autonomy, competence, and relatedness was significantly lower in the university space than in close relationships. The within-university contexts did not differ from each other, and there were no differences among students from different academic disciplines.
5. In terms of the supervisory relationship, the most highly satisfied of the needs was the need for relatedness, although autonomy and competence were less supported with the research supervisor than in other university contexts.
6. The finishing or final stages of scholarly activity, connected with the writing of a scholarly text, were more internally motivated, whereas the initial stages, connected with collecting materials and analysis of sources, were much more strongly linked with external control than internal motivation. It is possible to speculate that as students become more personally invested in their written work, their motivation becomes more internal, over time. More complex with respect to motivation was presenting one's work in interpersonal collaboration: discussion of one's work with one's supervisor was ambivalent with respect to internal and external motivation, while discussion with colleagues and classmates was substantially external in nature.

The study has a number of implications. Among others, and in line with prior research (Humphrey & McCarthy, 1999), the finding that need supports in the university setting fostered more internal motivation for scholarly activity (when examining direct effects) suggests that academic advisors, mentors in research apprenticeships, and faculty members in general should pay attention to ways in which they can support their students' needs for autonomy (for example, by encouraging students to identify and pursue their own research interests), competence (for example, by providing competence-related feedback to students on the successful completion of relevant tasks), and relatedness (for example, by promoting warmth in an atmosphere of collegial respect and trust). Providing opportunities to support and satisfy these needs within the university space, in turn, can contribute importantly to students' own internal motivation for engaging in their scholarly pursuits, motivation which can, ideally, sustain them through the challenging tasks associated with completing a doctoral degree, including the dissertation itself. In addition, the fact that the impact of such need supports was mediated, in the present study, through students' own dispositional autonomy suggests that students, themselves, bear some important 'ownership' and responsibility for their own academic outcomes. Indeed, recent research has underscored the important link between the experience of freedom and the experience of responsibility (Sheldon et al., 2017).

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Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

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