Basic Psychological Need Satisfaction among Students in Higher Education

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Abstract
When students are internally motivated, they are most likely to maintain interest in learning, to persevere in their learning, and to experience greater academic success. According to self-determination theory, internal motivation is most facilitated by the satisfaction of the person's basic psychological needs: for autonomy, competence and relatedness. The purpose of this study is to identify the specifics of supporting students' basic psychological needs among doctoral students in various specialties. Data collection involved administration of the Psychological Need Supports scale, which assessed the satisfaction of basic psychological needs in the context of various relationships. Respondents were 463 doctoral students in six areas of education (physics, earth sciences, biology, chemistry, mathematics, information technology). The presence of differences in the degree of satisfaction and features of support of basic psychological needs in different relationships was revealed. In general, autonomy turned out to be the most satisfied need, and the need for relatedness turned out to be the least satisfied. In the system of close relationships (friends and mother), all three basic psychological needs were supported to a greater extent than in all systems of educational relations at the university. Comparison of various systems of relations at the university among themselves showed that the need for relatedness was most supported by colleagues and a supervisor, and the need for competence was supported by colleagues, while the need for competence was least supported by a supervisor, and the need for relatedness was least supported in the context of group classes. Patterns that emerged were stable over time. There were no differences in need satisfaction based on the field of study with one exception: doctoral students majoring in physics reported higher levels of support for the needs for competence and relatedness. The results provide guidance for supporting the internal motivation among students at higher levels of education.
Keywords: self-determination, basic psychological needs, need for autonomy, need for competence, need for relatedness, education.

Удовлетворенность базовых психологических потребностей у субъектов высшей ступени образования

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Аннотация
Внутренне мотивированные учащиеся в большей степени сохраняют интерес к образованию, более настойчивы в обучении и добиваются в нем больших успехов. Согласно теории самодетерминации, для внутренней мотивации более всего необходимо удовлетворение базовых психологических потребностей человека в автономии, компетентности и связанности с другими людьми. Цель данного исследования – выявление специфики обеспечения базовых психологических потребностей субъектов на высшей ступени образования. Для сбора данных использовалась шкала «Поддержка психологических потребностей», которая оценивает удовлетворенность базовых психологических потребностей в контексте различных отношений. Респондентами выступили 463 аспиранта по шести направлениям образования (физика, науки о Земле, биология, химия, математика, информационные технологии). Выявлены различия в степени удовлетворенности и в особенностях поддержки базовых психологических потребностей в разных системах отношений. В целом автономия оказалась наиболее удовлетворенной потребностью, а связанность с другими людьми – наименее удовлетворенной. В системе близких отношений (друзья и мать) все три базовые психологические потребности поддерживаются в большей степени, чем во всех системах отношений в вузе. Сравнение различных систем отношений в вузе между собой показало, что потребность в связанности с другими людьми больше всего поддерживают коллеги и научный руководитель, потребность в компетентности – коллеги, менее всего потребность в компетентности поддерживает руководитель, а потребность в связанности с другими людьми менее всего поддерживается в контексте групповых занятий. Выявленные закономерности стабильны во времени. Различия в удовлетворении потребностей в зависимости от области образования не обнаружились за одним исключением: аспиранты, специализирующиеся в области физики, сообщали о более высоком уровне поддержки потребностей в компетентности и связанности с другими людьми. Результаты дают ориентиры для поддержки внутренней мотивации у субъектов на высших ступенях образования.

Ключевые слова: самодетерминация, базовые психологические потребности, потребность в автономии, потребность в компетентности, потребность в родстве, образование.

Introduction

Relevance of the research

As proposed by Deci and Ryan (Ryan & Deci, 2017), self-determination theory (SDT) suggests, firstly, that the most effective motivation for the educational process is intrinsic motivation, and secondly, that such motivation depends on the satisfaction of the person's basic psychological needs for autonomy, competence and relatedness (Gordeeva, 2010). Satisfaction of these needs can be supported by certain technologies of the educational process at all levels of education. A special situation arises at the higher level of education, specifically, in graduate school at the doctoral level, where the role of one's own initiative, proceeding from the internal motivation of young researchers, becomes especially important. At the same time, there is no information regarding the role of various relationship systems in supporting the needs of doctoral students, or indeed regarding the extent to which the basic psychological needs are met, or whether need support varies depending upon one's field of study. The problem of increasing the effectiveness of education at its higher level requires the study of these issues in order to determine how best to improve the education space experienced by doctoral students during their time of study.

Problem statement

The creators of self-determination theory, Deci and Ryan (Ryan & Deci, 2017), describe the basic psychological needs as follows. The need for autonomy is understood as the desire of a person to feel like the initiator of his own actions, to endorse his own behavior. The need for competence means a person's desire to feel capable of achieving his goals, to cope with various tasks, deeds, situations and to discover the connection between his actions and the achievement of his goals. The need for relatedness means a person's desire to feel part of a community, to have close ties with other people. The satisfaction of these three needs is not only the basis for the emergence of intrinsic motivation, it is also necessary for the subjective psychological well-being of a person, his development and self-development.

Self-determination theory (SDT) is widely used in research in the field of education. Satisfaction of the three basic psychological needs is indeed positively associated with internal motivation (Gordeeva, 2010; Pulyaeva & Nevryuev, 2020), and this in turn leads to a more stable interest in educational activity, greater productivity, increased academic success and higher subjective well-being (Gordeeva, 2010; Guay et al., 2008). Internally motivated students show a greater interest in participating in project work, studying in more complex programs and taking advanced courses (Sethi & Scales, 2020). At the same time, lack of satisfaction of these needs is associated with a number of less favorable outcomes, in terms of persistence, enjoyment, and success (Ryan & Deci, 2017; Ryan, 2023).

According to SDT, the social environment plays an important role in supporting or thwarting the student's basic needs. With respect to academic success, researchers study mainly the role of mothers, teachers and friends as the most important figures in supporting students' basic needs and, consequently, their internal motivation (Chirkov & Ryan, 2001; Guay et al., 2008; Salikhova et al., 2019, 2021).

Indeed, prior research suggests that relationships with parents, teachers and friends have different effects on academic motivation, average academic performance and

perception of the school climate. Relationships with teachers predicted all three of these indicators, relationships with parents were associated with motivation and indirectly influenced the average academic performance through it, and relationships with friends predicted the perception of the school climate (Sethi & Scales, 2020). Relationships with peers and friends mainly contribute to satisfying the need for belonging and connection with others, which in turn affects such motivational elements as self-confidence, involvement in school processes, and ultimately an increase in academic performance (Murray-Harvey & Slee, 2007; Pretty et al., 2003). Similarly, students who have good relationships with classmates demonstrate a strong attachment to the university, which has a positive effect on their academic motivation (Li et al., 2013).

Parents play a big role in maintaining autonomy of their children: parental support allows children to exercise volition and to feel able to make their own choices (Bronte-Tinkew et al., 2006; Grolnick & Ryan, 1989; Hoeve et al., 2009; Niemiec et al., 2006; Ratelle et al., 2004, Verhoeven et al., 2012; Vrolijk et al., 2020). It should be noted that there are contradictory data on the impact of parents' support of basic psychological needs on the behavior of boys and girls: some studies show that parents have a greater influence on children of the same sex (Bronte-Tinkew et al., 2006; Hoeve et al., 2009), while others do not reveal such differences, pointing to the equal importance of parents' contribution (Verhoeven et al., 2012; Vrolijk et al., 2020). The results of some studies indicate that only support from the mother predicts a sense of autonomy in children (D'Ailly, 2003; Grolnick & Ryan, 1989). However, these studies were mainly conducted on a sample of adolescents in the context of problematic behavior.

Parental support is certainly important for school-age students and plays a leading role in the successful socialization of children (Chirkov & Ryan, 2001; Grolnick & Ryan, 1989; Sethi & Scales, 2020). However, the importance of the role of parents in supporting the need for autonomy persists even when students reach adolescence; its support from parents determines students' confidence in the ability to independently regulate their behavior and life (Grolnick & Ryan, 1989; Ratelle et al., 2004). This becomes especially important during the transition to independent adulthood, when the importance of parental support (Grolnick et al., 2000; Ratelle et al., 2004) increases during difficult, stressful periods (for example, when entering university).

Similar data were obtained regarding the role of teachers, who act as the central figure in the educational situation. Studies have found that teachers contribute to the maintenance of autonomous internal motivation of students not only in school (D'Ailly, 2003; Sheldon & Krieger, 2007), but also at the university (Lynch et al., 2018; Sethi & Scales, 2020; Sheldon & Krieger, 2007; Williams & Deci, 1996). Support from teachers, giving students the opportunity to grow, delegating authority to them, expanding their ideas about their own capabilities contributes to increasing academic motivation (Sethi & Scales, 2020).

The degree of support of basic psychological needs by a meaningful environment changes both as a person grows up and at different levels of education. Thus, it has been found that the degree of satisfaction of these needs among undergraduate and graduate students differs (Pulyaeva & Nevryuev, 2020), although the authors did not analyze whether the contribution of parents and teachers to support certain needs of these students is changing over time. Another study shows that the support of basic psychological needs is indeed an important factor of internal motivation at the level of doctoral education (Lynch et al., 2018). At the same time, the support of these needs in different systems of relations within the educational space has a more significant impact on the motivation of academic and scientific activities, compared with the contexts of relations with close people.

There is some evidence that the subject content of education affects the degree of support of basic psychological needs, and, accordingly, students studying in different specialties differ in the level of satisfaction of these needs. Thus, autonomy support by teachers turned out to be particularly important for medical students (Williams & Deci, 1996) and law students (Sheldon & Krieger, 2007), which mitigated the negative effect of the increased complexity and demanding nature of these academic programs.

Research aim and objectives

Given the findings regarding the role of the environment in supporting the student's basic psychological needs in the educational context, the following limitations of the existing research can be distinguished.

Firstly, most of the studies were conducted on samples of schoolchildren and students at the undergraduate level, while the specifics of satisfying and supporting basic psychological needs at higher levels of education, such as doctoral programs, have been studied relatively little.

Secondly, the influence of the attitude of parents, teachers and friends on academic motivation and the peculiarities of their support for the satisfaction of basic psychological needs have largely been the focus of research. However, at higher levels of education, for example, in doctoral school, the academic advisor, or research mentor, acts as a more significant figure of the environment, whose role in supporting the basic psychological needs of students has not been studied for all practical purposes. In addition, the studies do not differentiate between informal relationships with friends and more formal relationships in an academic group.

Thirdly, the specifics of satisfaction of basic psychological needs and the role of a significant environment in their support, and their dependence on the field of study at higher levels of education, have not been studied in practice.

To overcome the limitations above, we conducted an empirical study aimed at the following objectives: 1) to compare the satisfaction of the basic psychological needs of students at higher levels of education; 2) to identify the role of various systems of relations in the educational context in supporting the satisfaction of these needs; 3) to identify the specifics of satisfaction of basic psychological needs depending on the field of education; 4) to identify the time stability of the identified patterns.

Methods

Participants and procedures

463 doctoral students of Kazan Federal University (Kazan, Russia) took part in the study, including 258 men and 205 women (average age 24.3 years) studying in the fields of physics, earth sciences, biology, chemistry, mathematics and information technology. The study was conducted in four stages with first-year graduate students who entered the university in 2017-2020 within the framework of the discipline "Psychology of Higher Education" included in the program of training of doctoral students as future university teachers. Doctoral students voluntarily chose to participate in practical classes in psychology, and the completion of tests was part of the practice of self-knowledge and their study of the psychology of the student.

Measures

The Psychological Need Supports scale was used to collect data (La Guardia et al., 2000). This measure includes nine questions scoring on a seven-point scale the degree of satisfaction of each of the needs: for autonomy, competence and relatedness, three

questions for each need, so that a higher score means more support for each need. Each question is rated on a scale from 1 (does not correspond at all) up to 7 (fully agrees), with one item for each need being reverse scored.

The study's main goals reflected the primary relationships typical of a doctoral student at the university, namely: relationships with the research advisor or research mentor, relationships with colleagues, as well as relationships with fellow students in group classes at the university. As a background for comparison in the evaluation of relationship systems at the university, we used the contexts of relationships with mother and friends that have been widely used in prior research, which were also included in the survey packet used in the present study. Accordingly, participants responded to items five times, assessing the degree of need support in various relationship systems within the educational context of the university (advisor or mentor, colleagues, group classes at the university) and in close interpersonal relationships (mother, friends).

The scores for each of the three basic needs were calculated for each of the 5 contexts by summing up the scores for the three points of the test for each need.

Data analysis methods

As a result of data collection, four data arrays were obtained for each stage of material collection, which were analyzed both for the entire sample as a whole and separately for each of the student groups based on year of admission (for each subsample), as well as for each field of study.

The normality of the distribution was tested using the Kolmogorov-Smirnov criterion. Since the data distribution differed from normality, nonparametric tests were used: the Mann-Whitney U-test for independent samples and the G-test for dependent samples.

Results

Initially, a comparison of the degree of satisfaction of basic needs within different relationship systems was made both in the total sample and in each subsample determined in accordance with the year of admission based on the G-test (Table 1).

Table 1. *Comparison of the degrees of satisfaction of the basic psychological needs of doctoral students*

Scales		2017-2020		2017		2018		2019		2020	
		Z	p	Z	p	Z	p	Z	p	Z	p
Friend	Autonomy / Competence	-7.06	0.00	-3.40	0.00	-4.34	0.00	-2.44	0.02	-3.56	0.00
	Autonomy / Relatedness	-8.88	0.00	-3.23	0.00	-6.18	0.00	-3.00	0.00	-4.98	0.00
	Competence / Relatedness	-2.46	0.01	-0.46	0.65	-2.39	0.02	-0.31	0.75	-1.35	0.18
Mother	Autonomy / Competence	-2.46	0.01	-5.05	0.00	-4.06	0.00	-3.02	0.00	-1.26	0.21
	Autonomy / Relatedness	-2.21	0.03	-0.34	0.73	-3.82	0.00	0.00	1.00	-0.48	0.64
	Competence / Relatedness	-5.59	0.00	-4.83	0.00	-0.11	0.92	-3.04	0.00	-3.03	0.00

	Scales	2017-2020		2017		2018		2019		2020	
		Z	p	Z	p	Z	p	Z	p	Z	p
Close relationships	Autonomy / Competence	**-5.13**	0.00	**-5.00**	0.00	-1.87	0.85	**-2.81**	0.01	-2.82	0.01
	Autonomy / Relatedness	**-4.51**	0.00	**-2.53**	0.01	-1.88	0.19	**-2.23**	0.03	-2.76	0.01
	Competence / Relatedness	-0.98	0.33	-1.42	0.16	**-2.32**	0.02	-1.66	0.10	-1.35	0.18
Colleagues	Autonomy / Competence	**-5.89**	0.00	**-3.77**	0.00	-0.28	0.78	**-5.44**	0.00	**-3.19**	0.00
	Autonomy / Relatedness	**-16.10**	0.00	**-8.02**	0.00	**-8.46**	0.00	**-8.36**	0.00	**-7.04**	0.00
	Competence / Relatedness	**-13.42**	0.00	**-6.36**	0.00	**-8.29**	0.00	**-5.66**	0.00	**-6.00**	0.00
Advisor	Autonomy / Competence	**-8.48**	0.00	**-6.50**	0.00	**-2.09**	0.04	-3.94	0.00	-4.31	0.00
	Autonomy / Relatedness	**-16.45**	0.00	**-9.37**	0.00	**-7.33**	0.00	**-8.50**	0.00	**-7.47**	0.00
	Competence / Relatedness	**-12.13**	0.00	**-6.03**	0.00	**-6.36**	0.00	**-6.10**	0.00	-5.44	0.00
Group classes	Autonomy / Competence	**-4.88**	0.00	**-4.02**	0.00	-1.86	0.06	**-4.91**	0.00	**-2.95**	0.00
	Autonomy / Relatedness	**-18.30**	0.00	**-8.95**	0.00	**-9.71**	0.00	**-9.32**	0.00	**-8.30**	0.00
	Competence / Relatedness	**-15.92**	0.00	**-6.26**	0.00	**-10.74**	0.00	**-7.74**	0.00	**-6.50**	0.00
University-related settings	Autonomy / Competence	**-7.71**	0.00	**-5.36**	0.00	-0.26	0.79	**-6.44**	0.00	**-4.26**	0.00
	Autonomy / Relatedness	**-18.88**	0.00	**-9.58**	0.00	**-9.71**	0.00	**-9.28**	0.00	**-8.90**	0.00
	Competence / Relatedness	**-8.32**	0.00	**-7.65**	0.00	**-10.58**	0.00	**-7.99**	0.00	**-7.39**	0.00
Total	Autonomy / Competence	**-7.53**	0.00	**-4.98**	0.00	-0.62	0.53	**-5.82**	0.00	**-4.62**	0.00
	Autonomy / Relatedness	**-18.04**	0.00	**-8.60**	0.00	**-8.16**	0.00	**-8.98**	0.00	**-8.64**	0.00
	Competence / Relatedness	**-15.61**	0.00	**-5.20**	0.00	**-7.92**	0.00	**-6.01**	0.00	**-5.41**	0.00

Legend: z – standardized Mann–Whitney test statistic; p – significance, bold type denotes indicators whose values are statistically significant at $p < 0.5$.

Comparison of the satisfaction of basic psychological needs in the total sample for all systems of relations showed that the need for autonomy is the most satisfied, and the need for relatedness is the least (Fig. 1).
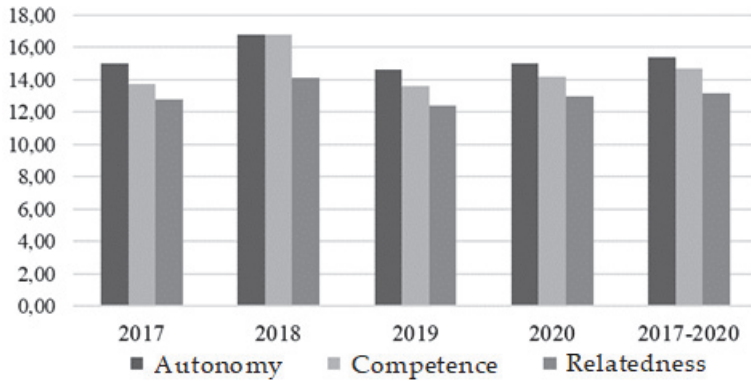
Figure 1. *Indicators of the scales of the Psychological Need Supports test in total for all systems of relations*

a) in close interpersonal relationships

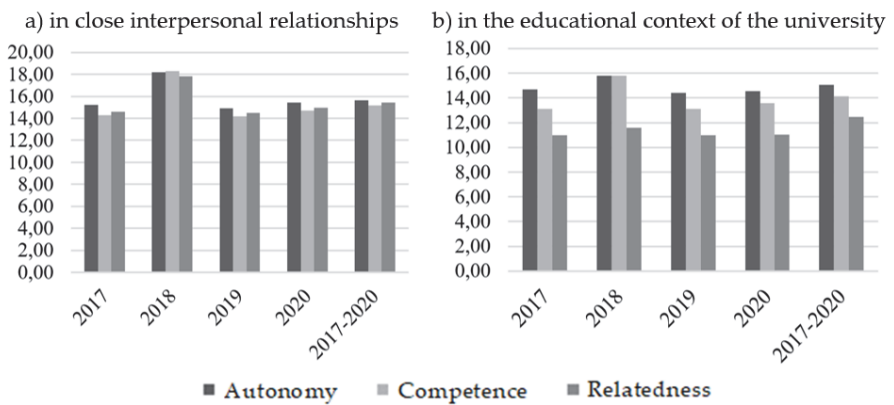b) in the educational context of the university

Figure 2. *Indicators of the scales of the Psychological Need Supports test in total in the systems of close relationships and relationships at the university*
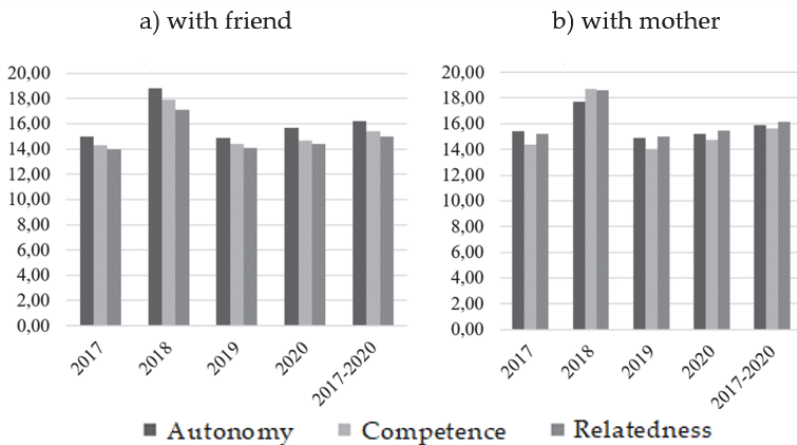
a) with friend

b) with mother

Figure 3. *Indicators of the scales of the Psychological Need Supports test in systems of close relationships*
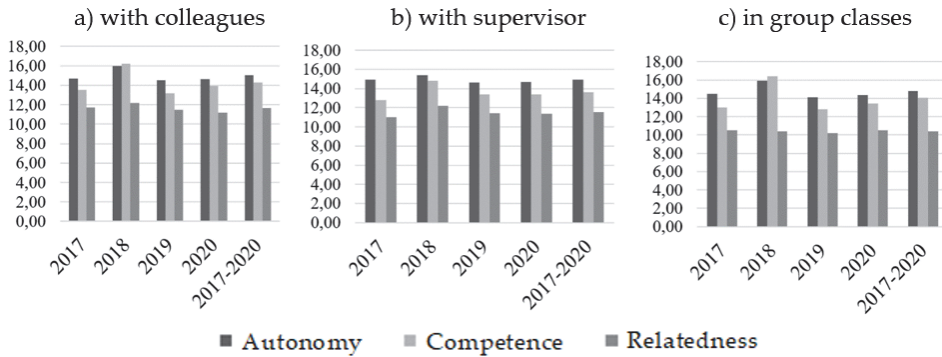
Figure 4. *Indicators of the scales of the Psychological Need Supports test in the systems of relations at the university*

A similar correlation is observed both in the system of relations at the university as a whole (Fig. 2b), and in a separate analysis of relations with colleagues (Fig. 4a), with a supervisor (Fig. 4b) and in group classes (Fig. 4c).

In the system of close relationships as a whole (Fig. 2a) and in relationships with friends (Fig. 3a), there were no differences in the degree of satisfaction of the needs for competence and relatedness, while the need for autonomy remained the most satisfied. In relationships with mothers (Fig. 3b), the need for competence was the least satisfied.

The revealed patterns were statistically significant and stable, as they were found when comparing the satisfaction of basic psychological needs in different systems of relationships among doctoral students of different subsamples.

The comparison of various systems of relations at the university with respect to the degree of their support for the basic psychological needs was carried out using the G-test (Table 2).

Table 2. *Comparison of support of the satisfaction of basic psychological needs of doctoral students in different systems of relationships*

					$\tilde{a}$			
	Year	Friend (F)	Mother (M)	Colleagues (C)	Advisor (A)	Group classes (Gc)	Close relationships (CR)	University-related settings (UrS)
autonomy	2017-2020	16.24	15.87	15.03	14.91	14.77	15.66	15.06
	2020	15.71	15.21	14.61	14.7	14.38	15.46	14.56
	2019	14.9	14.9	14.5	14.6	14.1	14.9	14.4
	2018	18.8	17.7	16	15.4	15.9	18.2	15.8
	2017	15	15.4	14.7	14.9	14.5	15.2	14.7
competence	2017-2020	15.43	15.6	14.29	13.64	14.02	15.18	14.12
	2020	14.68	14.75	13.91	13.37	13.44	14.71	13.58
	2019	14.4	14	13.2	13.4	12.8	14.2	13.1
	2018	17.9	18.7	16.2	14.8	16.4	18.3	15.8
	2017	14.3	14.4	13.5	12.8	13	14.3	13.1

relatedness							
2017-2020	14.98	16.17	11.68	11.52	10.39	15.43	12.45
2020	14.43	15.45	11.18	11.35	10.54	14.94	11.02
2019	14.1	15	11.5	11.4	10.2	14.5	11
2018	17.1	18.6	12.2	12.2	10.4	17.8	11.6
2017	14	15.2	11.7	11	10.5	14.6	11

	Year		F/M	F/C	F/A	F/Gc	M/C	M/A	M/Gc	C/A	Cs/Gc	A/Gc	CR/ UrS
autonomy	2017-2020	Z	-1.21	**-6.92**	**-6.46**	**-7.77**	**-6.77**	**-5.44**	**-6.84**	-0.15	-1.1	-1.39	**-7.21**
		p	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.27	0.17	0.00
	2020	Z	-1.06	**-3.1**	**-2.38**	**-3.42**	-1.62	-1.9	**-2.25**	0	-0.87	-0.55	**-2.87**
		P	0.29	0.00	0.02	0.00	0.11	0.06	0.02	1	0.39	0.59	0.00
	2019	Z	0	-1.47	-1.22	**-2.4**	**-2.49**	**-2.17**	**-3.02**	-0.53	-0.85	-1.7	**-2.38**
		P	1	0.14	0.22	0.02	0.01	0.03	0.00	0.59	0.4	0.09	0.02
	2018	Z	-2.59	-7.77	-7.88	-7.34	**-6.12**	**-4.85**	**-5.44**	-1.78	-0.77	-1.21	**-7.22**
		p	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.44	0.28	0.00
	2017	Z	-1.33	-0.63	-0.52	-1.66	**-2.57**	-1.36	**-2.44**	-0.9	-1.3	-1.89	-1.25
		p	0.18	0.53	0.6	0.1	0.01	0.18	0.02	0.37	0.19	0.09	0.21
cooooompetence	2017-2020	Z	-2.63	-9.19	-9.65	-9.37	-9.16	**-10.47**	**-11.37**	-3.25	-1.68	-1.16	**-12.33**
		p	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.25	0.00
	2020	Z	-0.23	**-3.56**	**-4**	**-4.31**	**-3.19**	**-3.22**	**-4.73**	-1.33	-1.42	-0.56	**-4.8**
		p	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.15	0.58	0.00
	2019	Z	-1.06	**-4.85**	**-3.2**	**-5.19**	-2.48	**-3.16**	**-4.21**	-0.76	-0.87	**-1.95**	**-4.75**
		p	0.29	0.00	0.00	0.00	0.01	0.00	0.00	0.45	0.39	0.05	0.00
	2018	Z	-5.47	-5.98	-6.9	-4.25	-7.77	-8.23	-7.47	**-3.81**	-0.69	**-3.95**	**-8.79**
		p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00
	2017	Z	0	**-3.52**	**-4.67**	**-4.74**	**-4.03**	**-5.45**	**-5.79**	-1.66	-1.9	-0.54	**-5.75**
		p	1	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.06	0.59	0.00
relatedness	2017-2020	Z	-9.51	-15.66	-15.06	-18.17	-17.99	-17.52	-19.7	-2.01	-7.95	-6.04	-19.51
		p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
	2020	Z	**-4.16**	**-6.84**	**-7.32**	**-7.91**	**-8.45**	**-7.92**	**-9.03**	-0.33	-1.52	-2.76	-9.35
		p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.13	0.01	0.00
	2019	Z	**-3.91**	**-7.44**	**-7.44**	**-9.12**	-8.7	-8.47	**-9.86**	-0.51	**-5.38**	**-4.1**	-9.73
		p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00
	2018	Z	**-5.39**	**-9.28**	**-7.99**	**-10.83**	-9.33	-9.46	**-10.66**	-0.58	**-4.44**	**-3.38**	-10.41
		p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00
	2017	Z	**-5.17**	**-7.29**	**-7.09**	**-7.99**	**-9.21**	**-8.84**	**-9.49**	**-2.28**	**-4.15**	-1.47	**-9.22**
		p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.14	0.00

Legend: ã – mean score, z – standardized sing test statistic; p – significance, bold type denotes indicators whose values are statistically significant at p < 0.5.

Comparing basic need support in different relationship systems across the four years showed that the need for autonomy (Z=-7.21; p<.01), competence (Z=-12.33; p<.01) and relatedness (Z=-19.51; p<.01) were more satisfied in the system of close relationships compared to university relationships. A similar result was noted among doctoral students of all years of study, the only exception being the data for 2017, for which there were no significant differences in autonomy support between the systems of close relationships and relationships at the university.

The same differences were also revealed when comparing the support of basic needs in close relationships and in the context of the university: friends and mothers supported all three basic needs to a greater extent than did colleagues, an advisor, or other participants in group classes.

Significant differences in the degree of satisfaction of the need for competence were revealed when comparing different relationship contexts at the university. Doctoral students indicated lower competence support by supervisors compared to colleagues (Z=-3.25; p<.01). And doctoral students in 2018 also reported that they felt less support of their need for competence from their supervisor compared to relationships with peers during group classes at the university (Z=-3.95; p<.01).

Doctoral students felt less support of the need for relatedness during group classes compared to their relationships with colleagues (Z=-7.95; p<.01) and compared to relationships with a supervisor (Z=-6.04; p<.01). At the same time, the need for relatedness was supported to a greater extent in relationships with colleagues compared to relationships with a supervisor (Z=-2.01; p=0.05).

When comparing doctoral students from different areas of education, differences in satisfaction of the three basic psychological needs, autonomy, competence and relatedness, were largely not significant, and reached significance (in accordance with the Mann-Whitney U test for independent samples) only when comparing physicists with doctoral students of other specialties (Table 3).

The most expressive differences were in satisfaction of the need for competence and relatedness: in various systems of relationships, satisfaction of these needs was higher for physicists than for doctoral students in other fields.

Table 3. *Comparison of the degree of satisfaction of basic psychological needs of doctoral students in physics (n=99) with doctoral students of other specialties*

Scales		Earth science (n=92)		Biology (n=93)		Chemistry (n=81)		Mathematics and Computer Science (n=98)	
		Z	p	Z	p	Z	p	Z	p
Friend	Autonomy	-1.91	0.06	-1.34	0.18	-1.28	0.20	-1.70	0,09
	Competence	-0.8	0.42	-1.54	0.12	-1.59	0.11	**-2.10**	**0,04**
	Relatedness	-0.65	0.51	-0.33	0.74	-0.88	0.38	-1.75	0,08
Mother	Autonomy	-0.61	0.55	-0.7	0.48	-1.5	0.13	-0.86	0,39
	Competence	-0.76	0.45	-0.75	0.46	-1.62	0.11	**-2.04**	**0,04**
	Relatedness	-1.29	0.2	**-1.98**	**0.05**	**-2.9**	**0.00**	**-2.54**	**0,01**
Close relationships	Autonomy	-1.26	0.21	-1.24	0.22	-1.77	0.08	-1.26	0,21
	Competence	-0.97	0.33	-1.43	0.15	**-1.95**	**0.05**	**-2.45**	**0,01**
	Relatedness	-0.6	0.55	-0.59	0.56	-1.89	0.06	**-2.09**	**0,04**

Colleagues	Autonomy	0.00	1.00	-0.47	0.64	-0.35	0.73	-0.66	0,51
	Competence	-0.51	0.61	-1.67	0.1	-1.23	0.22	-0.75	0,45
	Relatedness	-1.06	0.29	-0.32	0.75	-0.44	0.66	-0.88	0,38
Advisor	Autonomy	-0.36	0.72	-0.15	0.89	-0.66	0.51	-1.30	0,19
	Competence	-0.32	0.75	-0.88	0.38	-1.55	0.12	-1.45	0,15
	Relatedness	**-2.34**	**0.02**	-0.72	0.47	-0.35	0.72	-1.53	0,13
Group classes	Autonomy	-0.3	0.76	-0.24	0.81	-1.79	0.07	**-2.12**	**0,03**
	Competence	-1.46	0.15	**-2.37**	**0.02**	**-3.25**	**0.00**	**-2.44**	**0,02**
	Relatedness	-1.42	0.16	-0.74	0.46	-1.16	0.25	**-2.04**	**0,04**
University-related settings	Autonomy	-0.11	0.91	-0.33	0.74	-1.08	0.28	-1.54	0,12
	Competence	-0.66	0.51	-1.8	0.07	**-2.15**	**0.03**	-1.55	0,12
	Relatedness	**-2.26**	**0.02**	-0.81	0.42	-0.37	0.72	**-1.93**	**0,05**
Total	Autonomy	-0.71	0.48	-0.59	0.56	-1.55	0.12	-1.48	0,14
	Competence	-0.84	0.4	-1.88	0.06	**-2.12**	**0.03**	**-2.06**	**0,04**
	Relatedness	-1.75	0.08	-0.89	0.38	-1.36	0.18	**-2.50**	**0,01**
Needs satisfaction total		-1,00	0.32	-1.12	0.26	-1.82	0.07	**-2.30**	0.02

Legend: bold type denotes indicators whose values are statistically significant at p ≤ 0.5.

In addition, some differences were found between doctoral students in the field of Earth Sciences and Chemical Sciences: the former, compared with the latter, reported feeling more competent in group classes (Z=2.16; p<.05), and mothers also provided more support for their need for relatedness (Z=-2.09; p<.05). Among students of chemistry, supervisors supported the need for relatedness to the greatest extent (Z=2.02; p<.05).

Discussion

Considering doctoral students to be students successfully continuing their self-realization in science, it can be argued that satisfaction of basic psychological needs is the most favorable for maintaining internal academic motivation and success. Indeed, according to the results of prior correlational studies, satisfaction of the need for autonomy makes the greatest contribution to the formation of academic intrinsic motivation, the need for relatedness makes the smallest contribution, and the need for competence occupies an intermediate position (Daguplo, 2015; Poom-Valickis et al., 2019).

Nevertheless, it is possible to identify some problematic points with respect to supporting basic psychological needs at the university, which were identified in the present study. First of all, this concerns the general level of support of basic psychological needs in the systems of university relationships; secondly, this study draws attention to the roles of support of the needs for competence and for relatedness.

The results obtained indicate that doctoral students receive much less support of their basic psychological needs in the educational space of the university than in close

relationship systems. And although this is consistent with many other studies (Guay et al., 2008; Lynch et al., 2018; Vallerand et al., 1997), the role of supporting the satisfaction of basic needs by various systems of relationship in educational contexts should not be underestimated, given that their significant influence on academic success and motivation has been established (D'Ailly, 2003; Deci et al., 1981; Reeve, 2006; Sheldon & Krieger, 2007; Williams & Deci, 1996). Hence, the present study can be considered as offering a perspective and direction for improving both educational technologies and methods of interaction in various systems of relations at the university.

As found in the present study, in the various relationship systems at the university, the need for competence was supported to a lesser extent than the need for autonomy. At the same time, it is known that satisfaction of the need for autonomy in the relationship between the teacher and the student is closely related to the need for competence (Deci et al., 1981; Guay, & Vallerand, 1996; Janssen et al., 2021). Indeed, acting autonomously, one can demonstrate the ability to cope with the tasks set; however, the need to act autonomously (i.e. independently organize oneself, one's activities, initiate and control one's actions) is also a requirement that is typically expected by the doctoral student's research advisor or mentor. Moreover, in general, doctoral students pointed to the lower support of the need for competence by supervisors compared to colleagues (Z=-3.25; p<.01). And in general, the supervisor was the least supportive of the need for competence. The results obtained may be due to the fact that the tasks of the supervisor in the framework of his or her professional role include setting goals and assessing their implementation, which involves identifying not only the strengths of the work done by the doctoral student, but also its shortcomings. Relationships with colleagues, however, are typically more informal. Accordingly, it is important for supervisors to find a balance in strategies to support these needs at higher levels of education, i.e. to give not only constructive and timely criticism, but also to note the successes and strengths of the work done by students, that is, to provide competence feedback (Ryan & Deci, 2017). On the one hand, doctoral students should be able to independently choose and control their activities in accordance with self-selected goals and personal interests, reflecting the exercise of autonomy; on the other hand, the teacher should provide regular feedback, informing students about the success and quality of the task performed by them. Perhaps it is precisely the lack of a sufficiently high-quality competence feedback that serves as one of the reasons why the need for competence among doctoral students is satisfied to a lesser extent than the need for autonomy in the relationship with the supervisor and other teachers.

One more variant of the explanation of the obtained results can be suggested. As studies show, the need for competence among respondents often remains unsatisfied due to the fact that supervisors build their expectations regarding a student on the basis of inaccurate ideas about the student's abilities and his or her need for help from the supervisor (Janssen et al., 2021), so they set tasks that do not correspond to the level of the student's knowledge and skills. In this regard, the importance of an open discussion of these issues with the student should be emphasized, because the relationship of the supervisor with the student plays a key role in the success of the student's education. This is especially important for doctoral students as future potential teachers, advisors or mentors, and researchers.

Finally, the need for relatedness was, in the present study, the least supported within the various relationship systems at the university. In our opinion, the importance of this need should not be underestimated, since it affects the student's involvement in the educational process, their perception of the atmosphere in the educational institution and their attitude towards it, which are no less important for successful learning and

self-realization (Li et al., 2013; Murray-Harvey & Slee, 2007). As can be seen, the need for relatedness was more satisfied in relationships with colleagues and supervisors, and to a lesser extent during group classes. The reason for this may be that group classes involve some element of competition (competition for points, for the opportunity to speak, for the teacher's attention or approval, etc.), and to a lesser extent create a sense of unity and belonging, which can also be associated with the applied technologies for organizing the educational process.

The specificity of satisfaction of basic psychological needs, depending on the field of education, was, for all practical purposes, not revealed in the present study, with the exception of the field of physics, in which the satisfaction of all basic psychological needs was higher. An explanation of this requires research aimed at analyzing educational technologies and building the interaction of all participants in the educational process in these areas of training.

Conclusion and Recommendation

The study made it possible to reveal both the degree of satisfaction of basic psychological needs and the specifics of support of their satisfaction from an important environment at the highest level of education at the university. Based on the results obtained, the following conclusions can be drawn.

1) The need for autonomy was satisfied to the greatest extent among students of the higher levels of education, and the need for relatedness was the least satisfied. Satisfaction of the need for competence occupied an intermediate position. When comparing different systems of relationships at the university with each other, this pattern remained constant, with the exception of relationships with the mother, in which the degree of satisfaction of the need for relatedness was higher than the degree of satisfaction of the needs for autonomy and competence.

2) There were differences in the role of different systems of relationships in supporting the satisfaction of basic psychological needs: they were supported to the greatest extent by the close interpersonal environment (friend, mother), and to a lesser extent in various systems of relationships in the educational context of the university (colleagues, supervisor and participants in group classes).

3) Differences in the degree of support of basic psychological needs in various systems of relationships in the educational context were revealed: the need for relatedness was most supported by colleagues and supervisors, and the need for competence was most supported by colleagues. The need for competence was least supported by a supervisor, and the need for relatedness was least supported in a situation of group classes.

4) When comparing the degree of satisfaction of basic psychological needs with respect to the field of education, it was revealed that the greatest degree of satisfaction of the need for competence and relatedness was observed among doctoral students majoring in physics.

5) Comparison of the degree of satisfaction of basic psychological needs with respect to the year of admission did not reveal a significant and regular dynamics of changes in any direction, and one can observe some consistency in how the satisfaction of basic psychological needs was maintained in the system of relationships at the university.

The results of the study can be used in the development of programs to motivate students, create recommendations for effective interaction with students and doctoral students for supervisors and teachers of higher education. Because doctoral students can be considered as successfully self-fulfilling personalities in their chosen specialties, the patterns for supporting basic needs identified in this sample can be considered highly

significant for maintaining motivation and facilitation of student development at earlier stages of professional education.

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