Transformation of mechanisms of the university first-year students' social adaptation: mathematical analysis tools

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Abstract. The article describes modern approaches to the transformation of the mechanisms of the first-year students' social adaptation to study at the university, taking into account the requests of students. The theoretical prerequisites of the research are formulated on the basis of the analysis of modern publications of the knowledge-intensive Scopus database of Russian and foreign scientific articles. The theoretical model of transformation of adaptation mechanisms has become the basis of empirical research. The analysis of the process of social adaptation to the training of the modern generation of first-year students was carried out by the survey method using the electronic educational environment of the University of the North Caucasus (Stavropol Krai, Russia). A total of 1,278 people took part in the survey. The results of the study allow us to identify key areas for improving the educational process at the university: the development of alignment programs within the educational program of the level of knowledge in the most significant subject areas (Mathematics, Physics, Chemistry, Social Studies, etc.), entering into the educational rhythm of the university training format, a deeper understanding of the nature of professional activity and the organization of professional socialization. The obtained theoretical conclusions and empirical research data provide an understanding of the transformation of the mechanisms of social adaptation to university education.

1 Introduction

The period of study at the university for each student begins with adaptation to new living conditions: spatial, educational, socio-psychological, household. The main task of this period of professional formation of the future specialist is to successfully and quickly enter into the educational and social processes of a new educational institution for first-year

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students. It should be noted that for an educational organization of higher education this is also an important stage in the entire period of study:

– updating the contingent of students brings new social and cultural practices to organizational processes;

– there is an expression of the expectations of first-year students from the process of studying at the university, the professional goal-setting of a new generation of future specialists is being implemented;

– the target request of the professional community for the training of graduates is specified.

All this can, in general, be characterized by a check on the stability of organizational culture, strategic development goals, and the relevance of the management system, the format and content of the main and auxiliary processes at the university.

In this regard, the university administration pays great attention to the process of adaptation of first-year students in the educational, scientific, socio-cultural and professional environment of the university. Numerous changes in life processes associated with digital innovations, improving the quality of life, including rural regions, whose graduates up to 70% join the ranks of first-year students of leading universities of Stavropol Krai (Russia), require systemic changes in working with the contingent of first-year students. Therefore, the development of mechanisms for the transformation of social adaptation to the university using modern tools of mathematical analysis is an urgent task of this study.

A large number of modern publications are devoted to the adaptation of students to study at the university. We give a brief overview.

Modern scientists see many different aspects in the study of social adaptation issues, it emphasizes the complexity and versatility of the process under study. This is why we pay attention to the information block related to physical well-being and satisfaction of the primary, basic needs of the personality of a young person who has just started studying at the university. In particular, it should be noted the block of nutrition, physical activity, and physical education classes.

The authors of the article E. Gahan, S. Farooqui, C.W. Leung, using qualitative research approaches, show that there is a problem of food security among college students [1]. It is associated with insufficient satisfaction of the need for normal nutrition, survival strategies and assessment of the impact of poor nutrition on the health and academic performance of students. The authors of the article come to conclusions about the strategies of students' actions to resolve the problem situation and include mechanisms of social adaptation. Among them are named economic approaches, survival tools; behavioural coping mechanisms; alternative ways of obtaining food; psychosocial and academic consequences.

The physical condition and well-being of young people is an important and one of the basic conditions for the active and successful inclusion of students at the initial stage of study in the social and educational processes of the university. The issues of students' adaptation to physical education are touched upon in the article by the authors J. González-Bernal, S. Gonzalez-Bernal, C. Salavera, J.M. Aguilar-Parra, M.J. González-Santos [2]. The authors propose a system of indicators for evaluating and analyzing the effectiveness of physical education in educational institutions, tested in the course of the study. In their conclusions, the scientists emphasize the importance of physical fitness and activity in the adaptation processes of students.

Excessive diligence in the educational process can be a sign of social maladaptation. This conclusion is reached by the authors of the article Y. Loscalzo, M. Giannini, investigating the psychological mechanisms of protection of students and their involvement in learning [3]. In their opinion, social anxiety and anxiety can be compensated by students due to high involvement in studies. Important from the point of view of new approaches to

the development of mechanisms of social adaptation of students is the recommendation of the authors: monitoring of students who are the most involved and diligent in their studies for their social maladaptation and social disorders.

A new challenge, to which it is necessary to give an appropriate response to the university management system of social adaptation of students, is associated with the development of multifunctional mobile communications. The authors of the article H. Chen, K. Wang, T. Lu, Yu Gao, J. Jan in analyzed the relationship of factors such as physical activity of students and dependence on mobile phones [4]. According to the authors, physical activity of students plays an important positive role in social adaptation in the university community. Based on a large sample population, covering more than 9 thousand students from 35 colleges in several regions of Jiangsu Province, and using valid diagnostic materials, the conclusions of the study were formulated: measures to develop physical activity will reduce dependence on mobile phones and have a positive impact on the psychological capital and social adaptation of students. This is an important conclusion for the transformation of the mechanisms of social adaptation of first-year students at the university at the stage of entering into academic activity [5, 6, 7].

The lessons of the COVID-19 pandemic are important for improving the social adaptation of students. In a number of publications, researchers draw attention to the fact that the success of social adaptation is associated with the psychological characteristics of the student's personality. Building positive social communications among students plays a significant role in social adaptation. The authors of the article are W. Kaur, V. Balakrishnan, Y.Y. Chen, J. Periasamy provide an analysis of risk factors for mental health and survival strategies in conditions of limited real interactions between students in study groups and with teachers [8]. The researchers concluded that a large network of real social contacts, in which relatives and friends of students are involved, is a good social support, a buffer against the mental consequences of COVID-19. These conclusions are typical for a number of other studies [9, 10].

The success of the adaptation of first-year students to study at the university is associated with their ability to overcome stressful situations. Scientists J.J. Keech, K. Hamilton offered an example of predicting behavioural reactions of young people to stressful situations [11]. Through understanding the students' attitude to certain problems, assessing their subjective vision of the social norm and perceived behavioural control, it is possible to predict with a certain degree of confidence the strategies of the subject's behaviour in a stressful situation. The importance of predicting behavioural strategies is considered in a number of publications [12, 13, 14].

The psychological well-being of first-year students and successful adaptation to university studies are associated with their educational experience in the family: willingness to overcome difficulties, support of loved ones, the opportunity to discuss emerging problems, etc. The family institute has been undergoing changes in recent years due to the negative informational impact on traditional family values. Effective counteraction mechanisms have not yet been developed to the required extent. Therefore, it is important to pay attention to the study of the family situation of students. The authors of the study X. Guo, J. Huang, Y. Yang pay attention to the need to take into account the stressful situations of young people which come from family experience [15].

The systematic selection of literature using the GoogleScholar and Scopus databases (2022-2021) showed the high relevance of the research topic – mechanisms and methods of studying and supporting the social adaptation of first-year students. Through the analysis of thematic discourses, the direction of actual transformations of the mechanisms of social adaptation is determined: monitoring the satisfaction of the actual needs of students in high-quality nutrition and physical activity in order to offer effective support programs; assessment of the presence in a virtual digital environment unrelated to current educational

practices or positive supportive social networks for timely corrective action by the educational system of the university; expansion of practices for predicting behavioural patterns of youth based on the study of attitudes, norm vision, past behavioural practices to support students in stressful situations; consideration of family educational experience and relationships in the family.

2 Materials and methods

The collection of primary sociological information was carried out on the basis of Stavropol State Agrarian University (Stavropol, Russia) among first-year students of all faculties: Agrobiology and Land Resources, Ecology and Landscape Architecture, Economics, Electric Power, Engineering and Technology, Biotechnology, Faculty of Veterinary Medicine, Socio-cultural Service and Tourism, Accounting and Finance. For acquaintance and active inclusion of first-year students in the processes of using the electronic educational environment of the university, the survey was conducted in an internal electronic local system. In total, 1,278 people from the number of first-year students enrolled in 2022 took part in the survey. In order to segment the results of the study by faculty and identify areas for improving the adaptation process of students not only at the university as a whole, but also locally, by training areas and profiles, participation in the survey amounted to 90% of the total contingent of first-year students.

The data obtained during the survey were processed in the SPSS Statistics program (version 23) and presented in a generalized form of statistical distributions. The questionnaire presents information blocks of questions that characterize the strategies of choosing a university and an educational program, self-assessment of educational and socio-psychological adaptation, factors contributing to this process, the level of involvement in extracurricular activities and plans for additional education within the framework of the main educational program.

3 Results and discussion

As part of the presentation of the results, we will focus on the factor analysis of strategies for overcoming difficulties by first-year students in the process of adapting to university studies. The total explained variance was 86.637%. 12 indicators, characterizing the actions of students in the process of overcoming difficulties, are rolled into 4 components during the statistical procedures of factor analysis. The data is presented in table 1.

Table 1. A complete explained variance of strategies for overcoming difficulties in the students' adaptation

Com-ponent	Initial eigenvalues			Sums of squares of extraction loads			Sums of squares of rotational loads		
	Total	Discrepancy %	Cumula-tive %	Total	Discrepancy %	Cumulative %	Total	Discrepancy %	Cumulative %
1	4.688	39.065	39.065	4.688	39.065	39.065	2.984	24.863	24.863
2	2.443	20.356	59.421	2.443	20.356	59.421	2.699	22.488	47.351
3	2.207	18.388	77.809	2.207	18.388	77.809	2.540	21.169	68.520
4	1.059	8.829	86.637	1.059	8.829	86.637	2.174	18.118	86.637
5	0.918	7.653	94.290						
6	0.316	2.637	96.927						
7	0.245	2.042	98.969						
8	0.105	0.874	99.843						

9	0.019	0.157	100.000				
10	0	0	100.000				
11	0	0	100.000				
12	0	0	100.000				

Compiled by the authors

The listed 12 approaches to overcoming difficulties by students at the initial stage of studying at the university were evaluated by the survey participants on a five-point scale. As a result of factor analysis performed by Rotation Method: Varimax with Kaiser Normalization (Rotation converged in 6 iterations) competencies were grouped into 4 structural components.

Table 2. Matrix of rotated components describing the structure of current strategies for overcoming difficulties at the initial stage of university studies

Approaches of first-year university students in overcoming difficulties of adaptation to learning	Component			
	1	2	3	4
1. The desire to learn	**-0.813**	-0.526	0.120	-0.169
2. The school habit of learning	**0.629**	-0.061	0.139	0.365
3. Advice and assistance from the tutor of the academic group	0.218	**0.823**	0.158	0.152
4. Cooperation in the group	**0.872**	0.426	-0.044	0.022
5. Friendly interaction with teachers	-0.151	-0.352	**-0.815**	-0.147
6. Low level of school preparation	-0.533	-0.476	**0.606**	-0.324
7. Unwillingness to spend time preparing for training sessions	**0.638**	-0.074	0.588	-0.041
8. Missing classes	0.089	**0.896**	0.013	-0.205
9. Health status	0.057	0.094	0.121	**0.950**
10. Unsatisfactory living conditions	0.144	-0.145	0.018	**0.920**
11. Insufficient motivation to learn	**0.610**	0.608	0.361	-0.231
12. There are no difficulties	0.009	-0.032	**-0.978**	-0.127

Compiled by the authors

Table 3. Interpretation of structural elements in strategies for overcoming difficulties at the initial stage of university studies

Structural component of the model	Variables determining the content of a structural component with a coefficient of factor loading	Interpretation of the structural component of the model
1st structural component	Cooperation in a group (0.872); desire to learn (-0.813); unwillingness to spend time preparing for classes (0.638); school habit of learning (0.629); insufficient motivation to learn (0.610)	Insufficient motivation and lack of desire to spend time studying is compensated by the school habit of studying and cooperation in the educational team (cooperation and habit)
2nd structural component	Missed training sessions (0.896); advice and assistance from the tutor of the academic group (0.823)	Unwillingness to get involved in educational activities and compensation with the support of the tutor (search and evasion)
3rd structural component	There are no difficulties (-0.978); friendly interaction with teachers (-0.815); low level of school preparation (0.606)	Difficulties of adaptation associated with a low level of training and poor relations with teachers (there is no positive strategy for getting out of maladaptation)

4th structural component	State of health (0.950); unsatisfactory living conditions (0.920)	Maladaptation is related to health and living conditions and there is no positive exit strategy

Compiled by the authors

Thus, the mathematical procedures of factor analysis, performed by the method of selecting the main components, distributed 12 options of approaches in overcoming difficulties of adaptation; they weregrouped into 4 structural components of the actual model of behaviour of students:

1. Insufficient motivation and lack of desire to spend time studying is compensated by the school habit of studying and cooperation in the educational team (cooperation and habit) (24.863%).

2. Unwillingness to get involved in educational activities and compensation with the support of the tutor (search and evasion) (22.488%).

3. Difficulties of adaptation associated with low level of training and poor relations with teachers (there is no positive strategy for getting out of maladaptation) (21.169%).

4. Maladaptation is associated with health and living conditions and there is no positive exit strategy (18.118%).

4 Conclusion

The theoretical analysis of scientific sources, empirical results of the study of maladaptation factors allow us to draw a number of conclusions that are important for determining approaches to the transformation of mechanisms of social adaptation of the university first-year students.

Through the analysis of thematic discourses, the direction of actual transformations of the mechanisms of social adaptation is determined:

– monitoring the satisfaction of the actual needs of students in high-quality nutrition and physical activity in order to offer effective support programs;

– assessment of the presence in a virtual digital environment that is not related to current educational practices or positive supportive social networks for timely corrective action by the educational system of the university;

– expanding the practice of predicting youth behaviour patterns based on the study of attitudes, the vision of the norm, past behavioural practices to support students in stressful situations;

– taking into account family educational experience and relationships in the family.

The relevance of transformation directions is confirmed by the results of empirical research. Behavioural models of first-year university students formed in the process of adaptation to learning:

1. Insufficient motivation and lack of desire to spend time studying is compensated by the school habit of studying and cooperation in the educational team (cooperation and habit) (24.863%). The strategy of the educational process management system at the university is to support and approve the learning rhythm, monitor and timely adapt socio-psychological interactions in the educational group.

2. Unwillingness to get involved in educational activities and compensation with the support of the curator (search and evasion) (22.488%). The strategy of the educational process management system at the university is to organize and stimulate the work of tutors of academic groups, taking into account the socio-psychological diagnosis of first-year students.

3. Difficulties of adaptation associated with a low level of training and poor relations with teachers (at the time of the study there is no positive strategy for overcoming

maladaptation) (21.169%). The strategy of the educational process management system at the university is to organize corrective general education courses to equalize the quality of training of students.

4. Malaptation of students is associated with the state of health and living conditions and there is no positive exit strategy at the time of the study (18.118%). The strategy of the educational process management system at the university is to timely diagnose and prepare targeted support programs for students both at the stage of entering the educational activity and throughout the entire period of study at the university.

References

1. E. Gahan, et.al., Health Equity, **6(1),** 595-602 (2022)
2. J. González-Bernal, et.al., International Journal of Environmental Research and Public Health, **19(16),** 10008 (2022)
3. Y. Loscalzo, M. Giannini, International Journal of Environmental Research and Public Health, **19(15),** 9413 (2022)
4. H. Chen, et.al., International Journal of Environmental Research and Public Health, **19(15),** 9286 (2022)
5. Y. Yu, et.al., Addictive Behaviors **125**, 107166 (2022)
6. Y. Sun, et.al., Journal of Environmental and Public Health, 5841017 (2022)
7. M. Balayeva, Vestnik Sovremennoi Klinicheskoi Mediciny, **15(2),** 15-21 (2022)
8. W. Kaur, et.al., International Journal of Environmental Research and Public Health, **19(15),** 8894 (2022)
9. X. Zhang, et.al., Journal of Affective Disorders, **285**, 97-104 (2021)
10. L. Filimonyuk, et.al., E3S Web of Conferences, **258**, 10017 (2021)
11. J.J. Keech, K. Hamilton, Stress and Health, **38(3),** 591-601 (2022)
12. S.K. Veerabhadrappa, S. Yadav, Journal of the College of Physicians and Surgeons Pakistan **31(5),** 608-609 (2021)
13. O.N. Kusakina, S.V. Sokolov, Lecture Notes in Networks, **582**, 171-179. (2023)
14. Y. Pichugin, V. Ivashova, et.al., E3S Web of Conferences, **376**, 05046 (2023)
15. X. Guo, et.al., International Journal of Environmental Research and Public Health, **19(12),** 7106 (2022)