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Innovativeness in Future Engineers: Value and Motivational Characteristics

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The article presents the results of research concerning the peculiarities of value-motivational structure of engineering students with different levels of innovativeness manifestation. The obtained data allow introducing new practical technologies aiming at future engineers' motivational activity and innovativeness development.

Key words: innovativeness, innovative potential, value-motivational structure, engineering education.

Rapid changes in public consciousness developed under the influence of social-political and social-economic deformations are a problem sphere for modern psychology from the standpoint of theory and practice. Society is a community of people and if we want to build an advanced civilization, one has to start with a person's bringing-up and education.

One of the key factors of modern society's development and well-being is innovation. To support innovations, special financial and technical resources are allocated by the society and some organizations, since innovations are an important condition for viability, activity, and competitiveness of any company. Innovation provides intensive development of both economy and society, in particular. It contributes to the efficient solution of the problems faced by the government. However, when analyzing the problems of innovation support, they are, as a rule, considered in economic and managerial aspects, whereas psychological bases of developing personal innovational potential have not been adequately investigated

The issue of research in peculiarities of innovativeness development in modern society is conditioned by the necessity to develop new forms of personal development management. Searching for the boundaries among personal success, efficiency, and performance, new generations can apply

their activity for boon or bane both for themselves and society. The perspectives of psychological trends in innovativeness are connected with not only revealing peculiarities of the quality in the activity, but also implementing the efficient social-psychological and psychological-pedagogical techniques of managing personal characteristics to develop social creativity.

Based on the analysis and generalization of numerous theoretical investigations dealing with analysis of personal potential of professional development and psychology-acmeologic potential of professional activity, one can suggest that personal innovative potential is an integral complex of activity resulting from involvement in innovative process and consisting of interconnected and interdependent components: creativity (cognitive-prognostic component), innovativeness (dynamic-managerial component), and constructiveness (value-motivational component) [2; 5].

In foreign research the interest in innovativeness as a personal quality is presented in different concepts and approaches that are concerned with innovative behaviour, innovative potential of management, and cognitive styles responsible for a person's inclination for innovation (R.A. Bruce, T. Amabile, R.M. Kanter, M. West, M. Basadur,



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E.Hagen, M. Kirton, J. Farr, J.P.J. De Jong, etc.).

In contemporary psychology the term has two versions of pronunciation and spelling 1) innovativnost' (derived from English 'innovativeness') is directly borrowed from the English literature; 2) innovatsionnost' (derived from French innovation; Latin innovatio 'renovation', 'change'). The term «innovative» means 'relating to innovations'. From the semantic point of view the most appropriate version to denote personal quality is the term «innovativeness» [1; 4].

Innovativeness is a set of personal qualities relating to perception, evaluation, processing, efficient practical implementation of ingenious ideas developed in activity [3]. Innovativeness is connected with other personal characteristics, but fundamentally differs from creativity and enterprise. Creativity conveyed as intellectual activity is an integral part of an individual innovative potential. If creativity is considered as a set of qualities developing a new idea, innovativeness is a set of personal qualities implementing a creative idea into the reality [3].

As follows from the analysis of diversity in interpretation of enterprise it should be underlined that a result of enterprise is economic success expressed in money, whereas a result of innovativeness is professional success expressed in the form of new professional results. It is just innovativeness rather than enterprise is necessary to be developed in future specialists who are motivated for creative labour and activity [3].

The relevance of the research consists in the fact that at the moment there is an acute need for study in the value-motivational peculiarities of personal innovativeness, since individual and social values of a person as well as extrinsic and intrinsic motivations play an important part in innovativeness manifestation.

Despite a number of studies in characteristics of labour value-

motivational aspects performed in Russia (V.N. Myasishchev, K.A. Abul'khanova-Slavskaya, A.N. Leontiev, A.G. Kovalev, V.D. Shadrikov, Ye.P. Il'in, V.G. Aseev and others) and abroad (A. Maslow, F. Herzberg, V. Vroom, J. Adams, L. Porter, E. Lawler, H. Hechhausen and others), the novelty of our research consists in study of future engineers' value-motivational structure with different level of innovativeness manifestation.

To study the value-motivational characteristics of innovativeness we used the following techniques: 1) test of diagnostics in real personal value system developed by S.S. Buybnova; 2) questionnaire "Diagnostics of personal motivation structure"; 3) Self-esteem scale of personal innovative qualities developed by N.M. Lebedeva and A.N. Tatarko.

The research was performed at the Engineering department of Peoples' Friendship University of Russia. On the whole, the research involved 88 fourth-year Bachelor students aged 20-25, 58 boys and 25 girls.

Based on interpretation of the data obtained, the following levels of future engineers' innovativeness manifestation were established: the first group consisted of tested students with low level of innovativeness – 16 students; the second group included the students with the average level – 52 students; the third group was presented by the students with high level of innovativeness – 20 students. Then, the descriptive statistics of the innovativeness parameters was carried out in the reference set shown in Tab. 1.

The summary innovativeness index in the reference set varies from low level of innovativeness manifestation (1.5) to high one (4.58), on the creativity scale – 1.5-4.75, "risk for success" scale – 1.25-4.75, but on "looking for the future" scale – 1.75-5. On the whole, the average level of future engineers' innovativeness manifestation was revealed.

As a result of mathematical-statistical analysis using H-Kruskull-Wallis test, the

Table 1. Descriptive statistics of innovativeness parameters in reference set (N = 88)

Variables	Minimum	Maximum	Mean	Median
Creativity	2	5	3,75	3,5
Risk for success	1,5	5	3,1	3,25
Looking to the future	1,5	4,8	3,41	3,75
Summary index	2,25	4,92	3,42	3,58

statistical differences in future engineers' personal motivational structure were established in groups with different level of innovativeness manifestation (Tab. 2).

The significant differences of three groups with different innovativeness level were determined using the scales of «Life-support» (H = 22.662, p < 0.01), «Comfort» (H = 6.891, p < 0.05), «Communication» (H = 18.572, p < 0.01), «General activity» (H=8.135, p<0.01), «Creativity» (H=6.57, p < 0.05), «Social activity» (H = 11.966, p < 0.01). No significant differences were revealed regarding the scale of "Social status".

Correlation analysis of variable values and motivation in students' groups with different innovativeness level has shown that students possessing low innovativeness level highly value help and mercy to other people. A significant aspect for the given group is learning new things in the world, but they also attach great importance to other people's recognition and respect and influence on others. Besides, a distinguishing feature of the group with low innovativeness level is a trend to achieve high social status and communicate with other people.

Based on the significant correlations obtained one can suggest that future engineers having low innovativeness level

strive to exhibit their activity to influence positively the society. Communication is of significant value for the students of the given group.

Negative correlations between the value of "help and mercy to other people" and such an innovativeness parameter as creativity allow concluding that the higher respondents' level of creativity is, the lower importance they attain to mercy and help to those who need them. Presumably, the reason for this is the fact that the world of their own ideas is of prime importance for them, but the surrounding world takes the back seat.

Future engineers having average level of innovativeness attain importance to communication with others and learning new things. They value recognition and respect as well as their influence on the other people, lay emphasis on help and mercy, but they have a pronounced trend to material well-being and social status as attributes of prestige.

As a result of correlation analysis, the relationships between creativity and motif of creative activity were established in the group with average innovativeness level. It may be suggested that the students of this group develop something new for the sake of creative process itself that drives their activity.

Table 2. Statistical analysis of differences in expressing motivation types in three groups

variables	Average values in groups			Kruskall-Wallis H-test	Significance level
	1	2	3		
	(N = 16)	(N = 52)	(N = 20)		
Life-support	19,83	50,06	44,85	20,662	0,001*
Comfort	43,89	47,34	31,46	6,891	0,032*
Social status	42,47	38,38	47,83	2,395	0,302
Communication	59,89	42,27	28,13	18,572	0,001*
General activity	42,14	48,39	30,98	8,135	0,017*
Creativity	42,14	36,17	51,85	6,57	0,037*
Social usefulness	31,14	38,99	55,29	11,966	0,003*

For the future engineers with high innovativeness level to learn something new as well as to be respected by the others and to influence other people are of great significance (Tab. 3).

The key motifs of the group with high innovativeness level are drive for creative activity, achievement of desired social status, and life-support to achieve the necessary living standards. Social status as a value has a positive correlation with such a motif as *past-time and rest*. Engineering students attain great importance to social status, as achieving definite level of professional development will allow them to have enough past-time in future. At the same time, negative correlations between social status and the motifs: *“help and mercy to other people”* and *“love”* show that future engineers with high innovativeness level regard compassion, help, and love for other people as factors impeding the achievement of desired social status.

The students with high innovativeness level consider the value of *social usefulness* with *health*, which is necessary to become a good specialist. However, future engineers striving for success do not assign importance to their health, past-time, and rest, possibly, because the expected success is more significant for them. Such values as *high social status and management of people* correlate with *risk for success* scale. The students with high innovativeness level are ready for risk to achieve high social status and gain some power.

To improve psychological-pedagogical training of future engineers with different innovativeness level it is important to apply various interactive teaching techniques in learning process of higher school. For the students with low innovativeness level who have inclination to show their social usefulness and altruism, it is necessary to increase the innovativeness level by means of developing the motifs of social

Table 3. Correlation coefficients of value variables with motivation structure parameters (managers with high innovativeness level (N = 20))

Motifs \ Values	Life-support	Comfort	Social status	Communication	General activity	Creativity	Social usefulness
Past-time, rest	0,227	0,373	0,427*	0,086	0,321	-0,199	-0,244
High living standards	0,356	0,235	-0,036	0,042	0,231	-0,127	-0,371
Search for and delight of beauty	0,126	-0,045	0,04	0,01	0,223	0,11	0,123
Help and mercy to other people	-0,054	-0,221	-0,449*	-0,225	0,066	0,045	-0,049
Love	-0,054	-0,404	-0,478*	-0,361	-0,222	-0,299	0,062
Learning new things in nature, world, and human beings	0,268	0,151	0,152	-0,244	-0,213	0,288	-0,041
High social status and management of people	0,393	0,01	0,055	-0,117	0,267	0,009	-0,045
Recognition and respect, influencing other people	0,215	0,23	0,257	0,139	-0,043	-0,08	-0,315
Social activity to gain positive changes in society	-0,074	-0,068	0,093	-0,017	-0,033	0,088	0,144
Communication	0,27	-0,035	-0,233	-0,13	0,087	0,351	-0,096
Health	0,086	-0,349	-0,278	-0,059	0,055	0,379	0,408*

activity. The future engineers with average innovativeness level should participate in training developing personal innovative qualities as well as be involved in creative, and innovative activities.

The students with high innovativeness level need the professional activities to develop value-motivational structure as they are focused on social activity and responsibility. The motivational structure of the given group is known to be expressed in creative activity only without strong motivation for self-actualization in definite activity in which one can apply his/her creativity. For the given group it

is necessary to arrange training focused on understanding social usefulness of professional activity and help to other people.

The development of strategies of future engineers' education is to include a set of psychological courses focused on formation of value-motivation bases of their success. Psychological model of innovativeness development in future engineers' training consists of stages corresponding to the competence levels including different methods (diagnostics, interview, training) focused on developing a student's personal quality.

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