

Psychological Research on Personal Innovativeness: Typological Approach

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Abstract – A holistic view of the innovation personality will allow a deeper understanding of the nature of innovativeness as a personal characteristic, which is reflected in the readiness for intensive activity in the uncertain future due to the ability to create new products and the desire for their practical application. The style of innovative thinking varies depending on the psychological type of personality. To identify the relationship between innovativeness and the characteristics of a certain activity, the results of the empirical study in which the test subjects developed a new product using the Method of Focal Objects (MFO) are presented.

Keywords – *typological characteristics, innovation personality, method of focal objects, creative product.*

I. INTRODUCTION

Nowadays, the psychology of innovation is a dynamically developing branch of psychology, in which there is a discussion about the innovation potential of a person (D.E. Klochko, E.V. Galazhinsky [1]); innovative disposition of a person (O.S. Sovetova [2]); and various aspects of innovation personality development (S.R. Yagolkovsky [3], V.D. Shadrikov [4]) In the works of the researchers mentioned above it is emphasized that the integral quality of innovation personality is the ability not to adaptive self-modification, when a person has to adapt to the dynamics of social life, but the ability to the sense production, which is equally aimed at changing the conditions of social life and self-modification. This typical feature of creativity is determined by both a set of personality traits and general characteristics of creative thinking as an attribute of an innovation personality type. It can be stated that the quality of innovativeness is the actualization of creative qualities in the creation of real creative products and is manifested in social interaction [5].

Innovative activities can not be separated from creativity. Innovation can not exist without creativity [6]. An innovator is a person who has a rather high level of both creativity and innovativeness, who is able not only to produce new original ideas, but to apply them practically [7]. S.R. Yagolkovsky defines innovativeness as the ability of a person to perceive new technological ideas as well as comprehend them and elaborate them creatively [3]. According to V.D. Shadrikov, the main features of creative thinking are [4]: the ability to find many different solutions under the same conditions and the ability to find consistent solutions to inconsistent situations.

It should be noted that the problem of the holistic research on innovativeness, both its content and dynamics, is a problem area of psychological science. In this work, the authors made an attempt to study innovativeness through the prism of personal characteristics in order to determine the personal innovativeness components of engineering students. Carl G. Jung's typology [8] and Robert Sternberg's theory [9] are the methodological foundations for this study. Robert Sternberg's tasks for solving problems of the real world enable to define a behavior type in the real-life situation in contrast to the creativity tests that generally assess divergent thinking.

Carl G. Jung's typology suggests that the personality types are divided into the two main poles (extraversion and introversion), which can be considered as steady personality patterns that along with other parameters (thinking, feeling, sensation and intuition) contribute to the psychological type identification - [8, 10]. As it is shown in the works of Briggs Myers [11, 12] an attitude to innovations varies depending on the personality type, and the authors [13] illustrate that intellectual styles depend on the personality type according to Jung's personality type theory. All mentioned above aspects make it possible to suggest that the styles of innovative activities also depend on a personality type.

II. METHODS

Innovativeness manifests itself in the readiness for active participation of a person in uncertain future through the development of abilities at diverse, new ways of self-expression in activities. One of such ways can be working on a real creative product, which is not generally looked at in the creativity tests known. As part of the research, the student's task was to develop a product using the Method of Focal Objects (MFO). MFO belongs to the methods of creative thinking activation along with the method of brainstorming, synectics, morphological analysis, the Questions as spurs to ideation of A. Osborn (Checklists), and etc. The idea of the method is to apply the features of randomly selected objects to the object being upgraded [6, 14]. The object being upgraded is as if it were in the focus of application and, therefore, is described as focal. The method uses associative search and heuristic features of the random search method (trial and error method). Thus, after properties and features of other objects have been applied to the object being upgraded the work on these ideas continues. The appeared combinations need to be worked further on, thus, the object is upgraded by obtaining different modifications of the

focal object. The method of focal objects liberates thinking and often leads to unexpected solutions [14] and can be applied to the development of new creative products that are technically quite simple. The creative products obtained were evaluated by

means of the sum of values according to the criteria: novelty, functionality, readiness, and design (Table I) [7].

TABLE I. CRITERIA FOR EVALUATING THE CREATIVE PRODUCT OBTAINED USING MFO

Criterion	Description	Points
Novelty	The idea is considered to be novel, if it suggests upgrading something known before, and the use of new material. The novelty of the idea is reflected in the expansion of the field of the known thing. It encourages to find new opportunities. The work gives a new look at the problem, a new way to solve it.	1 point – the work is standard and formal 2 points – there are elements of creativity in the work 3 points – creative approach makes the product distinct
Functionality	Possible range of use of the developed product. The adequacy of implementation. The criterion characterizes to what extent the idea is easy to use to solve this problem. It is described how useful and valuable the idea is if implemented. It is possible to note aesthetic features.	1 point – the product does not imply new ways of using it. 2 points – the product is developed fragmentary 3 points – the efficiency of its use makes the product distinct.
Readiness	It evaluates the complexity factor of the product developed. The backbone of the idea is stated precisely. The thoroughness of the creative product development.	1 point – the product is developed fragmentary 2 points – only the work algorithm is presented 3 points – the product is fully developed
Design	Designing the written part of the project. The clarity of the developed product.	1 point – the written part is not structured 2 points – an attempt was made to design it creatively 3 points – creative design makes the work distinct

The assessment of personal creative abilities was carried out by means of evaluation of creative personality characteristics by F. Williams and the Divergent Thinking Test of F. Williams adapted by E. Tunik [15], which are aimed at determining the intensity of such qualities as curiosity, imagination, complexity, the ability to take a risk, as well as fluency, flexibility, originality, readiness and name (of the picture).

The higher a person's self-evaluation of curiosity, imagination, the ability to take a risk and understanding complex problems, the more creative person he/she is. As our studies have shown, the values of personality creative characteristics are statistically interrelated with the values of divergent thinking.

The innovativeness index was evaluated using the method of N. M. Lebedeva and A. N. Tatarko that is called the Scale of Self-Evaluation of Personality Innovative Qualities [16]. The innovativeness total is formed by such factors as creativity, risk for success, and focusing on the future.

To measure tolerance for ambiguity we used Budner's Tolerance for Ambiguity Scale [17] comprising the following factors: novelty (tolerance to new conditions), complexity (tolerance to occurrence of difficulties and difficulties in various situations) and ambiguity — insufficiency of data on conditions in which activities will proceed, low degree of predictability and foreseeing of these conditions.

R. Sternberg's method (Real-World Problems) [9] is aimed at determining one of the three behavior types: adaptation, environment choice or environment formation. The adaptation type involves achieving a good balance between the needs and capabilities of an individual and the external environment, adaptation to the environment. A person of the environment formation type will strive for changing the surrounding conditions according to his/her needs. The environment choice

type involves choosing an alternative environment in which a person will achieve a better match.

Thus, the following psychometric techniques were used to investigate the personal characteristics of innovativeness:

- Evaluation of typological and personal characteristics of a person: The Keirseley Temperament Sorter (Temperament and Psychological Portrait);
- Budner's Tolerance for Ambiguity Scale;
- Investigating creative abilities: The Questionnaire for Personality Creative Characteristics of F. Williams and the Divergent Thinking Test adapted by E. Tunik;
- Investigating the peculiarities of the relation to surrounding reality: R. Sternberg's method (Real-World Problems);
- Evaluation of the innovation personality characteristics: the method of N. M. Lebedeva and A. N. Tatarko that is called the Scale of Self-Evaluation of Personality Innovative Qualities.

III. RESULTS

The study involved 56 participants that are students, master's students of Novosibirsk State Technical University, the faculty of radio engineering and electronics. According to the results of the innovativeness assessment, the largest number of students have an average mean innovativeness level - 69%; 31% of students have a high innovativeness level and a low innovativeness level is not presented in our sample. The fact that there are no students with a low innovativeness level can prove that the most creative and active graduates of the Bachelor's program enter the Master's program.

Psychological types according to the Keirsey Temperament Sorter (Temperament and Psychological Portrait) have been represented as follows:

SJ (sensory-planning type) 58 % is practical thinkers, their mind avoids everything that is ambiguous, they always think about business trying to introduce order, organization and finality into it;

SP (sensory-impulsive type) 13 % is artistic people, prone to risk, not always disciplined, but at the same time they are practical and sensible realists, consistently optimistic, very active, determined, are not drawn to abstract reasoning;

NT (intuitive-logical type) 10 % is theoretical thinkers seeking new knowledge for the sake of knowledge, prone to risky behavior and little focused on external criteria;

NF (intuitive-sensual type) 19 % is deeply interested in another person, when making decisions they rely on moral and ethical aspects and are easily caught up in other people's emotions.

The research has shown the significance of the differences according to the Mann-Whitney test in the intensity of innovativeness scales: risk for success and the overall innovativeness index prevails for intuitive types (NT and NF), and the creativity index for NF type is at the significance level of $p \leq 0.01$. It can be stated that intuitive type people are more innovative, which allows perceiving any information and look ahead both easily and openly. Besides, the authors have demonstrated that the structure of correlations between parameters of personal creativity and personal innovativeness differs for different types: for SJ and SP types the correlations with extraversion are significant and for NT and NF types the correlations with extraversion and intuition are significant.

According to the William's Questionnaire, the highest rates were recorded for the originality parameter (the mean value is 21.38), the readiness parameter (the mean value is 18.75) and the complexity parameter (the mean value is 17.1). The results obtained when using R. Sternberg's Theory demonstrate that the majority of subjects while interacting with the environment choose the formation strategy – 58 %, the choice strategy is less presented – 26 % and 16% of subjects chooses the adaptation strategy. Thus, the results obtained when using the study methods describe our sample of master's students as creative, ready to work in difficult situations and active while interacting with the environment.

The analysis of the relationships between personal characteristics and the creative product indices was carried out

using the Spearman rank correlation coefficient. The correlation analysis of correlations between the creative product characteristics carried out using the Method of Focal Objects (MFO) and the personal characteristics in the total sample ($n=56$) showed the following significant correlations

- the positive relationship between the typological intuition characteristic and the creative product novelty (according to MFO) ($R_s=0.34$; $p \leq 0.01$) can be explained by the fact that intuition motivates to find new possibilities of the creative product, and, consequently, the intuitive type, relying on premonitions and guesses is able to foresee future potential possibilities, motivated by a constant flow of new visions and presentiments and, probably, therefore, the creative product made using MFO differs in novelty;
- the positive relationship between the complexity parameter of the personal creative characteristic (by F. Williams) and the functionality parameter of the creative product ($R_s= 0.31$; $p \leq 0.01$) indicates that when developing functionality it is required to search for alternatives, and the possibility of the only correct solution is doubtful, the complexity is determined by the detailed images of the creative product, the functionality of the proposed ideas, thus, the complexity creative characteristic is aimed at developing a creative product based on a thought-out mechanism of work, that is functionality.

The analysis of psychological features of innovativeness was carried out in groups with a high innovativeness level and a mean innovativeness level separately. The following figures show the significant correlations obtained within the analysis of the relationships between personal characteristics and the creative product indices carried out using the method of focal objects in groups of students with mean and high innovativeness levels as it is shown in Fig. 1, in the group with a mean innovativeness level positive relationships between the design index and the characteristics of tolerance for ambiguity, such as novelty and complexity (according to S. Budner) were obtained.

The design index, which reflects the clearness of the developed product, does not require high innovativeness level, but the design of the written part of the work at the high rates of "novelty" and "complexity" can be done visually and creatively.

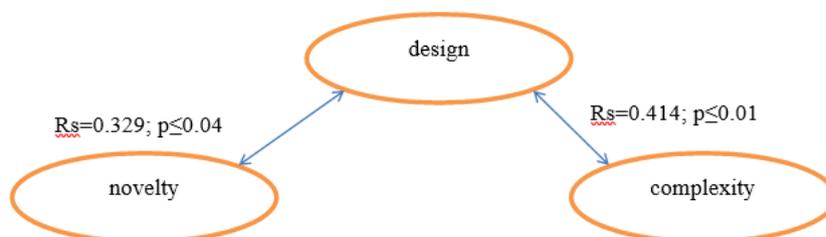


Fig. 1. Correlations between personal characteristics and the creative product parameters in the group of students with a mean innovativeness level

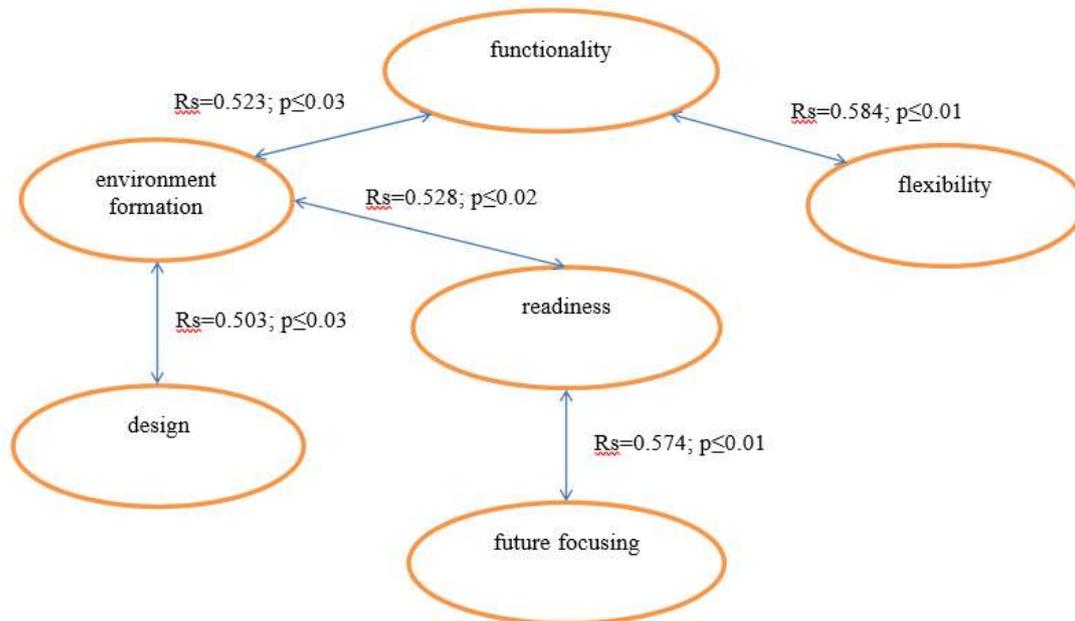


Fig. 2. Correlations between personal characteristics and the creative product parameters in the group of students with a high innovativeness level

Fig. 2 shows that there is a broader set of correlations in the group of subjects with a high innovativeness level than in the group of subjects with a mean innovativeness level taking into account the number and closeness of interrelated characteristics with the creative product parameters. The correlations between the environment formation parameter and such indices of a creative product as functionality, design and readiness were found out. The direct relationship between functionality and such characteristic of divergent thinking as flexibility (according to F. Williams) points out that developing a functional product requires flexibility, which characterizes the ability to provide creative solutions, allows you to think over the usefulness of the developed product. The environment formation behavior type reflects the human activity within interaction with the environment and its transformation, and makes it possible to make the product more developed, functional and future-focused, which shows the relationship between the readiness parameter (according to MFO) and the innovativeness characteristic such as future focusing.

The higher the index on the flexibility scale the more functional the product developed using the Method of focal objects (MFO) is. The more pronounced the environment formation behavior type the more developed the creative product obtained using the MFO is, with the readiness that is higher in people more focused on the future. Thus, it can be stated that the work successfulness using the method of focal objects is higher in people focused on the future, flexible and forming the environment.

IV. CONCLUSION

An innovator must develop new products with a well-thought-out mechanism that fulfill a certain goal. The reference

to the comparative analysis of the correlations between characteristics and creative product parameters in structures with different innovativeness levels enabled to reveal differences, and also to describe the characteristics that constitute innovativeness. Thus, the correlations between personal characteristics and the creative product indices within the personality structure in the group with a mean innovativeness level are represented by only two correlations with the design index of the creative product, which indicates less integratedness compared to the group of subjects with a high innovativeness level. According to the results of the study, it can be concluded that the subjects with a high innovativeness level are active and flexible within interaction with the environment, they work comfortably in an ambiguous situation, are not afraid of complexity and are able to develop a functional creative product. Intuition is an important typological characteristic associated with the novelty of the creative product, which suggests that intuitive types are more innovative. The study showed the prospects of using comparative structural analysis when investigating personal innovativeness, which enables to understand the essence of innovativeness and outline further ways of its studying.

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