

Innovative intelligence: three-component vector model



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The paper considers the limited nature of the existing psychodiagnostic procedures designed to make an objective evaluation of human intelligence and the level of its readiness to innovative activity. The authors introduce the concept of innovative intelligence and offers its three-vector model consisting of analytical, creative and practical intelligence. The approach can serve as the basis for optimum formation of a creative group, its role structurisation and rating of the level of readiness of a person to innovative activity.

Keywords: innovation, intelligence, analytical intelligence, creative intelligence, practical intelligence, innovative intelligence.

Being an integral party of human spirituality, intellectual creativity represents itself as a social mechanism resisting the regressive vector in development of a society. Work of intelligence is a guarantee of personal freedom and self-sufficiency of the personal destiny. In general, the way the society treats its intellectual community is indicative of the health of the society. As for the psychological science, one can make sure that traditional psychological research has transformed intelligence into a private ability having little to do with real problems of a human life. Despite a large number of papers dedicated to intelligence, both the western and the domestic psychologists increasingly criticise this concept as having no explanatory potentialities. Moreover, not only have the scientists failed to develop true understanding of human intelligence after centuries of philosophical reflexions and decades of serious scientific research, but they have not even managed to give a satisfactory definition of this phenomenon.

Defining intelligence on the basis of a collective opinion was attempted repeatedly [8-11], e. g., at the workshop when publishers of Journal of Education Psychology surveyed key experts in intelligence testing. A wide variety of answers to the question of the meaning of «intelligence» made Professor of Harvard University E. G. Boring joke that «intelligence is what the tests test» [8].

One can produce a number of working definitions of intelligence given by present-day psychologists at various times:

- «Intelligence is an ability to find an adequate way of reaction to a situation connected with the environment» (American psychologist Robert Franklin).
- «Intelligence is an ability to solve problems in a creative way» (American psychologist Steven G. Guld).
- «Intelligence is an ability ... of solving new problems» (American psychologist Donald Sterner) [8].
- «Intelligence is an ability stipulating the general success of adaptation of a person to new conditions» (Russian psychologist V. N. Druzhinin) [1].

The definitions allow concluding that the researchers have no consensus whatsoever on the subject studied. Nor is there a shared position towards research of intelligence by psychometric/measuring models.

Psychodiagnostic methods of personal intelligence rating based on general personal abilities, in particular, measurement of intelligence quotient (IQ), is now widely used despite covering only a tiny and not the most important part of a much wider intellectual range.

The limited nature of the psychometric rating instrument is stipulated by the following facts:

- tests are too fragmentary to measure intelligence as a whole;

- not only is the information contained in intellectual test ratings insufficient to explain the observable performance (Howe, 1988), but no intelligence test can indicate the reasons of the differences in performance (Anastazi, 1983);
- the test indicators contain none of intelligence at all, it is «in some other place», in particular, among the indicators of success of real activities (Mc Nemar, 1964; Frederiksen, 1986);
- intellectual tests allow picking out persons with very low results; however, they cannot differentiate less talented from more talented ones; and it is often the most talented examinees who are not equal to the test tasks (Simon, 1958, Friedman, 1999).

There are a lot of kinds of intelligence that manifest themselves in different ways. For example, a person with a high IQ can be absolutely immature in the social aspect and have neither skills to perceive art or music nor political thinking, etc. A person can show no «brains» in these contexts whatever academic qualification it might have. Even a ten-year-old street urchin, especially if he is growing in countryside and has closer relations with the nature, can get his bearings in some everyday situations faster and more adequately than a lot of adults with high IQ. They are sharp — or clever - irrespective of education and IQ test results, measuring mostly the results of training.

A lot of people thinking they are clever are not necessarily good thinkers. They often get into an intellectual trap. The trap has two aspects.

A person with high intelligence can generate an opinion of a subject and then use his/her mental abilities to protect this opinion. The better protected is this opinion, the less necessary is it for the person to search an alternative or listen to anybody. If you know you are «right», why should you?

The second aspect of the mind as a trap is that a person having grown up thinking that he/she is the cleverest among those around him/her (and this opinion may be true) wishes to take a pride in his/her mind. The promptest and the most reliable way to take pride in the mind is «to prove other people that they are not right».

The intellectual traps were often unavoidable even for very bright and outstanding scientists.

For example, Ernest Rutherford was critical about practical use of the energy of an atomic nucleus up to the last years of his life. In 1937, one month before his death, he argued that «Everyone who regards atomic transformation as an energy source talks rubbish». Nor did his learning match the «murderous» conclusion concerning the relativity theory: «It is just nonsense. Our work did not particularly need it». In this respect, the critical abilities of a scientist surpassed the constructive ones.

The intelligence rated by IQ tests or something similar is often used at entrance or graduation examinations. A lot of people do well in such tests, thus showing their academic boldness — at least from the point of view of those who believes in tests. However, the intelligence rated in such a way is inert as it does not cause purposeful actions. As a result, the test score or the school or university grades can become the most impressing achievements of these people. The one able to recollect the facts or even to

reflect over them does not necessarily know how to put them into practice.

This article considers innovative intelligence.

Innovative intelligence is a kind of mental abilities used to achieve important purposes, create something new, unknown before.

The people having innovative intelligence are those who managed to acquire, develop and implement the whole range of thinking skills rather than those who rely only on the «passive» intelligence so much valued in educational institutions.

Schools and universities often overlook talented people because of the way the teachers rate their IQ. That is why a lot of potentially outstanding engineers, doctors, military men, etc. can be thrown overboard only because they were persuaded that they did not have abilities to attain their goals.

At the present stage, the educational process aims to form a person with developed innovative thinking characterised as the highest step of human knowledge, comprehension of contradictions arising in social relations, their creative resolution on the basis of understanding whether the new matches or mismatches human needs and concerns.

Understanding of an innovation as a complex process of creation, propagation and use of a new practical tool (innovation) aiming to meet human needs varying with development of sociocultural systems allows concluding that a person's successful innovative activity requires development of intelligence in three directions: analytical, creative and practical. The above—mentioned aspects of intelligence have been investigated in a number of papers, in particular, in the works by Professor of Psychology and Education of Yale University of Robert J. Sternberg [11]. R. J. Sternberg operates with the concept of «intelligence of success», being in its turn stipulated by analytical, creative and practical intelligence.

Analytical intelligence is necessary to solve problems and evaluate the quality of ideas.

Creative intelligence is first of all necessary to give a correct formulation of problems and generate productive ideas.

Practical intelligence is necessary to implement these ideas and efficiently use them in daily life.

Is such an approach to understanding of human intelligence new? We do not think so. It was as early as in the XV century that the Italian philosopher Pietro Pomponazzi wrote: «All people should be concerned with three kinds of intellect (intellectus): speculative (speculativus), practical (practicus) or operative (operativus) and functioning (factivus). As there is no person who would not have any of these three kinds of intellect unless the person is crippled or immature... However, it is necessary to know that though a person is not quite deprived of the three above—mentioned kinds of intellect, their ratio in the person is not equal». And later, he says, «The purpose of the mankind's intellect in general is to be concerned with three kinds of intellect due to which people communicate with each other and live and one is useful and necessary to the other» [6].

However, a person's concern with the three kinds of intellect does not exclude, but assume the unity of human

intelligence. We have to find out how this unity can be presented.

Explanation can come from philosophers' views of one of the main doctrine of the Christian belief, viz. the Trinity. «The Trinity is referred to as the God who is a kind of plural, triple to be more exact, but not in difference of substances, but in the features of Persons... there is no multiple gods or masters because the three Persons have only one essence or substance, absolutely indivisible and solitary», Pierre Abelard wrote in the XII century.

In the XV century, the German philosopher and theologian Nikolay Kuzansky noticed that «those who represent the Trinity as the Father, the Son and the Holy Spirit approach tritheism, ... incomparably closer to the truth are those who proclaim the Trinity to be unity, equality and connection... but, alas, these important concepts cannot yet be found in the scriptures».

Witty as always, though probably too categorical, the Russian academician B. V. Rauschenbach explained the theologians' difficulties in understanding and explanation of the phenomenon of the Trinity with their ignorance of vector analysis: «In my opinion, tritheism is an elementary concept, and theologians could not understand it because they did not know mathematics. Some of them thought that the God is one entity, i. e. God the Father, the Son and the Holy Spirit. But in our prayers, we mention both the Father and the Son and the Holy Spirit. To prove that the concept of the Trinity is logically perfectly, I gave a vector as an example. A vector is known to have three components to be set in three directions. Three vectors in three main directions and one vector is the same, i.e. the Trinity. Therefore, existence of one God and at the same time three of them is absolutely reasonable» [7].

On the basis of this explanation, plurality of the nature of intelligence a person should have to be successful in innovative activity can be characterised by the concept of innovative intelligence represented as a three—component vector model (Fig. 1).

The offered model of innovative intelligence (II) consists of the orthogonal vectors \vec{R}_{AI} , \vec{R}_{CI} and \vec{R}_{PI} representing analytical intelligence (AI), creative intelligence (CI) and practical intelligence (PI), respectively.

It is obvious that innovative intelligence will be manifested in the most effective way when all of the

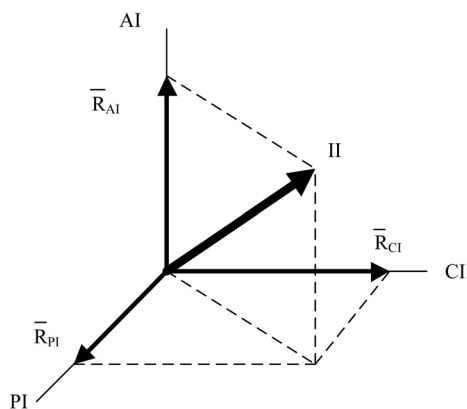


Fig. 1. Three-component vector model of innovative intelligence (II)

three components are in a balance, and its possessor has a clearly idea when and how to use these components of intelligence. Not only does the person with innovative intelligence have some abilities, but he/she also reflects over when and how to use them to the best advantage.

Analytical intelligence, which is the first component of innovative intelligence, means a deliberate turn of thinking processes to finding a sensible decision of the problem. Analytical intelligence is used at the stage of comprehension of a problem situation and identification of the developed contradiction, as well as at the stage of search of the most expedient ways to overcome this contradiction.

Creative intelligence is an ability to go beyond the conventional standards and generate new ideas to solve problems. A creative nature is always distinguished by obvious synthetic thinking, viz. an ability to see the connections hidden from other people.

The third aspect of innovative intelligence, practical intelligence, is an ability to transform theory into practice and abstract ideas into tangible results.

Practical abilities are necessary to consider some generally good ideas and identify those with a feasible potential.

So, creativity makes a «bridge» between analytical and practical intelligence. The central span of this «bridge» is creative intelligence.

So, success in innovative activity depends on the balance of all the three components of innovative intelligence. It is important that each component should not fall below a threshold level whose value is determined by the nature and the field of innovative activity. A set of threshold values of (AI_T), creative (CI_T) and practical (PI_T) intelligence stipulates the minimum level of competence making productive innovative activity possible, i. e. assigns the threshold volume of innovative efficiency V set by the respective ultimate individual levels of analytical (AI_I), creative (CI_I) and practical (PI_I) intelligence (Fig. 2).

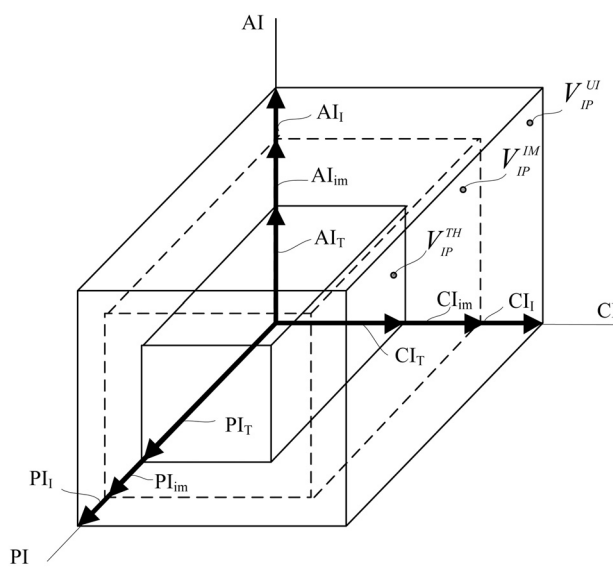


Fig. 2. Model of the implemented volume of innovative productivity

The gap between the threshold V_{IP}^{TH} and the ultimate individual volumes V_{IP}^{UI} characterises the range of the person's innovative productivity.

Implementation of an individual volume of innovative productivity is only possible on condition of suggestion of creative ideas at a proper time and place. However, such conditions are extremely rarely met. As a result, the specific living conditions allow a creative person to use only a part of his/her abilities limited to the implemented levels of analytical (AI_{Im}), creative (CI_{Im}) and practical (PI_{Im}) intelligence and the implemented volume of innovative productivity corresponding to them V_{IP}^{IM} (Fig. 2); i. e. $V_{IP}^{TH} < V_{IP}^{IM} < V_{IP}^{UI}$.

Having innovative intelligence means purposeful acting in three different directions: analytical, creative and practical.

Innovative intelligence manifests itself most efficiently when it balances all the three components.

Unlike intelligence, which is based only on the IQ test results, innovative intelligence has a number of differences:

- innovative intelligence is sensitive to changes and is not hard and invariable;
- first of all, innovative intelligence assumes not so much knowledge, as a balanced idea of when and how to use analytical, creative and practical abilities, i. e. it is aimed at search of balance of the individual's abilities necessary to attain his/her goals;
- innovative intelligence assumes that the person realises his/her weaknesses and uses his/her strong features, which allows finding the ways to resolve problems.

The structure and the features of the three-component vector model of innovative intelligence considered give grounds for the following definition: innovative intelligence is the way of thinking allowing a person to realise and analyse the contradiction having arisen in culture and remove it by putting forward an idea and a creative decision absent at the previous stages of development of the culture and subsequently contribute to its socialisation in the culture with account of possible consequences.

Comparison of the definition with those given by R. Franklin, S. Guld, D. Sterner and V. Druzhinin shows that they actually characterise special cases of manifestation of innovative intelligence by the person taking part in the complete cycle of an innovative process.

Innovative intelligence is most efficient in resolution of badly structured problems calling into being a strategy based on heuristic methods, which are informal, intuitive and sometimes risky [2-5].

In conclusion, it is important to emphasize that the levels of each component of innovative intelligence acceptable for innovative activity is a result of a rather

long process full of impressions, events, reflexions, practical purposeful activity, etc., whereas schools and universities should bend every effort not so much to picking out talented students, as to creation of conditions for manifestation and formation of their possible talents.

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Инновационный интеллект: трехкомпонентная векторная модель

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В статье показаны ограниченные возможности существующих психодиагностических процедур, объективной оценки уровня интеллекта личности и ее готовности к инновационной деятельности. Авторы вводят понятие «инновационный интеллект», в виде трехвекторной модели, состоящей из векторов аналитического, творческого и практического интеллекта. Такой подход является основой для объективной оценки творческого потенциала личности, оптимального формирования творческой группы, ее структурирования.

Ключевые слова: инновации, интеллект, аналитический интеллект, творческий интеллект, практический интеллект, инновационный интеллект.