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Innovative intelligence : a three-component vector model

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Key words: innovation, intelligence, analytical intelligence, creative intelligence, practical intelligence, innovative intelligence.

Summary

This 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 for innovative activity. The author introduces the concept of innovative intelligence and offers its three-vector model consisting of analytical, creative and practical intelligence. This approach can serve as the basis for the optimum formation of a creative group, its role structuring and rating of the level of readiness of a person for innovative activity.

Being an integral part of human spirituality, intellectual creativity represents itself as a social mechanism resisting the regressive vector in development of a society. The work of intelligence is a guarantee of personal freedom and self-sufficiency of the personal destiny. In general, the way a society treats its intellectual community is indicative of the health of that society. As for psychological science, one can make sure

that traditional psychological research has transformed intelligence into a private ability, having little to do with the real problems of human life. Despite a large number of papers dedicated to intelligence, both western and domestic psychologists increasingly criticise this concept as having no explanatory potentialities. Moreover, not only have the scientists failed to develop a true understanding of human intelligence after centuries of philosophical reflection and decades of serious scientific research, but they have not even managed to provide a satisfactory definition of this phenomenon.

Defining intelligence on the basis of a collective opinion was attempted repeatedly (Alder 1996: 190, Buzan 1991: 192, Dwek 191: 1999-235, Stenberg 1991: 367), e.g., at a workshop where the publishers of the *Journal of Education Psychology* surveyed key experts in intelligence testing. A wide variety of answers to the question of the meaning of “intelligence” led Professor of Harvard University E.G. Boring to joke that «intelligence is what the tests test» (Alder 1996: 22).

One can find 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. Gould).
- “Intelligence is an ability ... of solving new problems” (American psychologist Donald Sterner) (Alder 1996: 20).
- “Intelligence is an ability stipulating the general success of adaptation of a person to new conditions” (Russian psychologist V.N. Druzhinin) (Druzhinin 2000: 18).

Such definitions allow for the conclusion to be drawn that the researchers have no consensus whatsoever on the subject studied. Nor is there a shared position towards research of intelligence by psychometric / measurement models.

Psychodiagnostic methods of personal intelligence rating based on general personal abilities, in particular, measurement of intelligence quotient (IQ), are 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 1977);
- 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 (Frederiksen 1986);
- intellectual tests allow picking out persons with very low results; however, they cannot differentiate the less talented from those more talented; and it is often the most talented examinees who are not equal to the test tasks (Simon 1973).

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 socially immature and lack the skills needed to appreciate art or music, or engage in political thinking, etc. Similarly, young children with limited education, who have been brought in the countryside, or other natural setting, are more likely find their bearings in a strange location, than a city-dweller with a high IQ. They are sharp – or clever – irrespective of their education and IQ test results, which mostly measure the results of training.

A lot of people, who think they are clever, are not necessarily good thinkers. They often fall into an intellectual trap and this trap has two aspects.

Firstly, a person with a high level of intelligence can develop an opinion of a subject and then use their mental abilities to defend this opinion. The better this opinion is defended, the less necessary is it for

the person to search for 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 they are the cleverest among those around them (whether this is true or not) wishes to take pride in their mind. The quickest and most reliable way to take pride in one’s mind is “to prove to 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 of the practical use of the energy of an atomic nucleus up until 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 theory of relativity: “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 rating of intelligence 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 believe in such tests. However, the intelligence rated in this 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 impressive achievements of these people. Someone able to recollect facts, or to even reflect on them, does not necessarily know how to put them into practice. This article considers innovative intelligence. Innovative intelligence is a kind of mental ability used to achieve important purposes, create something new and previously unknown. People who possess 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 that is so highly 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 officers, etc. were overlooked, simply because they were deemed not to have the necessary abilities to attain their goals.

Currently, the educational process aims to form a person with developed **innovative thinking** skills, which are characterised as the highest level of human knowledge, involving the comprehension of contradictions arising in social relations, and their creative resolution on the basis of understanding whether the new idea matches human needs and concerns, or not.

Understanding **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 us to reach the conclusion that a person's successful innovative activity requires the development of three types of intelligence: analytical, creative and practical. These types of intelligence have been investigated in a number of papers, in particular, in the works of Professor of Psychology and Education of Yale University of Robert J. Sternberg (Sternberg 1991: 367). R.J. Sternberg operates with the concept of "intelligence of success", which is in 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 arrive at the 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 human intelligence new? The authors suggest it isn't. As early as the XV century, 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 abovementioned kinds of intellect, their ratio in the person is not equal". And later, he says, "The purpose of 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" (Taranov 2000: 231).

However, a person's concern with the three kinds of intellect does not exclude, but rather assumes the unity of human intelligence. We have to find out how this unity can be presented.

An explanation can come from philosophers' views of one of the main doctrines of 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 are 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 academic B.V. Rauschenbach explained that the theologians' difficulties in understanding and explaining the phenomenon of the Trinity was a result of 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 perfect, 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, the existence of one God and at the same time three of them is absolutely reasonable” (Rauschenbach 2001).

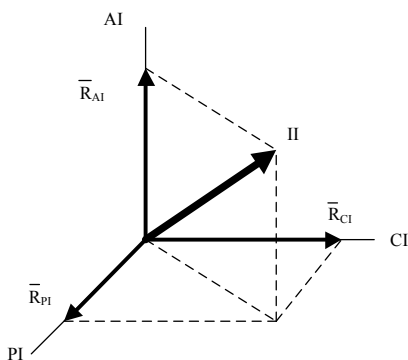
On the basis of this explanation, plurality of the nature of a person’s intelligence should be successful in innovative activity and can be characterised by the concept of innovative intelligence represented as a three-component vector model (Fig. 1).

The offered model of innovative intelligence (II) consists of the orthogonal vectors \overline{R}_{AI} , \overline{R}_{CI} и \overline{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 three components are in balance, and its possessor has a clear idea when and how to use these components of intelligence. Not only does the person with innovative intelligence have some abilities, but they also reflect 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 solution to a problem. Analytical intelligence is used at the stage of comprehension of a problematic situation and identification of the developed contradiction, as well as at the stage of searching for the most expedient ways to overcome this contradiction.

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



Creative intelligence is an ability to go beyond 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, the value of which is determined by the nature and 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).

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 very rarely met. As a result, the specific living conditions allow a creative person to use only a part of their 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. $V_{IP}^{TH} < V_{IP}^{IM} < V_{IP}^{UI}$.

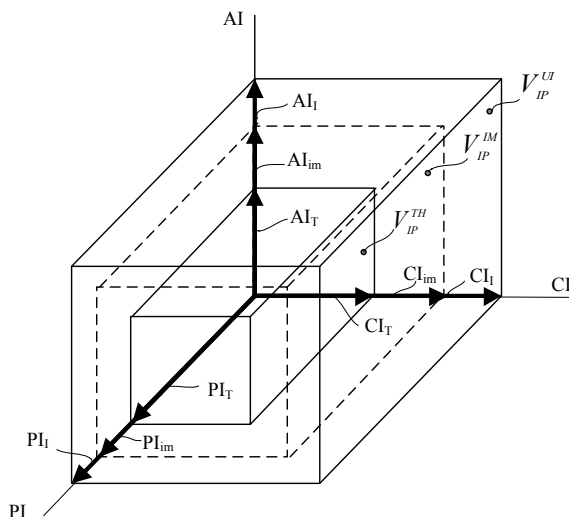
Having innovative intelligence means purposefully acting in three different directions: analytical, creative and practical.

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

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

- innovative intelligence is sensitive to changes and is not rigid or invariable;

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



- first of all, innovative intelligence assumes a balanced idea of when and how to use analytical, creative and practical abilities, in favour of knowledge i.e. it is aimed at the search for balance of the individual's abilities necessary to attain their goals;
- innovative intelligence assumes that the person realises their weaknesses and uses their strengths, which allows for the finding of 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 a way of thinking that allows a person to realise and analyse a contradiction that has 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 to possible consequences.

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

Innovative intelligence is most efficient in resolving badly structured problems, calling into being a strategy based on heuristic methods, which are informal, intuitive and sometimes risky (Chernoles, Kholodkova 2003, Chernoles, Kholodkova 2004a, Chernoles, Kholodkova 2004b, Chernoles, Kholodkova 2011). 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, reflections, practical and purposeful activity, etc., whereas schools and universities should make every effort, not to simply pick out talented students, but to create conditions for the manifestation and formation of their potential talents.

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