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## **On Some Approaches to Evaluation of Well-formedness of Noncognitive Skills**

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***Abstract:***

*The article describes approaches to evaluation of noncognitive skills on the basis of formalisation of certain definitions allowing to render this process automatic.*

***Key Words:*** *evaluation techniques, noncognitive skills, cognitive skills, evaluation of knowledge and skills (KaS), behavioural invariant, behavioural patterns*

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## **Introduction**

At present the educational paradigm in Russia is subject to changes manifesting in aims and results of teaching at schools: besides formation of cognitive skills needed for achievement of results in school subjects, the emphasis should also be put on meta-subject and personal achievements conditioned by well-formedness of ‘noncognitive skills’.

By saying ‘cognitive skills’ we mean an ability to acquire knowledge unassisted [1], as well as methods of knowledge acquisition (for example, reading, writing etc.)

Based on analysis of several definitions from different literary sources [2,3], by noncognitive skills we mean ‘thought patterns, behavioural patterns and feeling patterns’ which an individual develops during whole his life and which in some way participate in the process of studying. Here also belong personal attributes associated with socio-emotional or behavioural expressions of an individual in the process of education, which are objects of development within school or they influence formation of cognitive skills [0].

Definition of success in studying is traditionally associated with academic record, in particular with the results obtained with the help of different evaluation techniques (testing, oral examination, written tests etc.). This approach to success is applicable to evaluation of noncognitive skills also.

The level of formedness of cognitive skills may be assessed with the help of several tests for learners’ abilities to obtain knowledge, especially with the help of subject tests as this procedure is quite formalizable. However, the task of evaluation of formedness of noncognitive skills is more difficult.

Within the research dedicated to development of evaluation model for noncognitive skills it is necessary to strictly formalize certain definitions and approaches.

## **Methodology**

Abovementioned definitions are of general nature, so we shall provide definitions for noncognitive skills allowing to render the process of their evaluation automatic.

A very important – even though not obvious – step of our research is an essential postulation of existence of noncognitive skills as an independent metric which may be used separately from traditional performance indexes.

Assume that the skills (both cognitive and noncognitive) are the ‘phenotype’ of work of basic consciousness mechanism. Enhancement of a certain skill may only be implemented based on comparison of behaviour and the results of the behaviour of different individuals. Any skill is a variation from the point of view of basic

cognitive functions of a person – like an ear for music is a variation of basic ability of a homo sapiens to perceive sonic waves.

From this point of view we may name following the main factors allowing to postulate absence or presence of a skill:

- differences in behaviour;
- differences in the results of behaviour (success/failure).

Let us illustrate our approach using the example of a reading self-check skill. The result of reading is leaning of the information which was read. Learning can be checked with traditional methods like exposition or a question to the text. During reading we may observe following variations of behaviour leading to successful result:

1. Having excellent memory, a reader goes from one paragraph to the next one with no changes in the speed of reading.
2. Having average memory, a reader silently ‘retells’ each paragraph he reads.
3. A reader goes through all the paragraphs and then gets back to the places he has troubles memorising or understanding.

We would like to note that in the first variation we do not observe any signs of control of reading process. In two other variations a reader applies certain effort in order to control the reading process. All three variations can lead to a successful result – a learner can retell the text and answer the questions to it. It is the differences in behaviour in variations (1), (2), (3) that let us assume that within this case there may be different variants of implementation of the cognitive process, which relatively for variations (2) and (3) may be called ‘a skill of reading control’. We would like to underline the fact that a success of behaviour is a very important condition of postulating of skill presence. We can easily imagine a situation when a reader has read all the text, reread some parts of it but still cannot do the task. In this case we may suggest that regardless on the variant of a deep cognitive process – even if it was very close to the successful one by the behavioural manifestation – it cannot be regarded as a skill.

Within our research we intentionally stick to somewhat simplified models which may be regarded as overly sketchy to a professional in the sphere of educational psychology. However, we consider such approach to be quite efficient according to solution of problems of automation of complex skills evaluation. Traditionally behaviour is defined as a set of actions and their peculiarities by a human, animal, system of an artificial object, which are the reaction to external irritants directed at oneself or at the environment [0]. For the purposes of our research we need to simplify this definition and make it more specific.

In the first place we are interested in the behaviour within educational process or the process of evaluation of knowledge and skills (KaS). The quota of behaviour is actions in a certain sequence, characterised by certain parameters. At this, the

sequence of actions is equally important as their parameters. As within the task of identification of skills the variation of behaviour is crucial, the importance of equivalence of behaviour arises. Let us specify criteria for declaring of two or more cases of behavioural manifestation the same variation.

Cognitive apparatus of a human (as, probably, of any other living creature) brilliantly does a task of identification of equivalent behavioural variations. At the level of everyday consciousness 'identification' of a certain behavioural variation is manifested as an ability to identify some set of actions done by one person as a *repetition* of other person's actions. The factor of identification is crucial as it allows to approach to understanding of abstraction mechanism used by the consciousness to identify not only objects but even the processes. From this point of view the mechanism of action nomination (naming) in the language presents interest. The whole complexes of actions and processes may be named with a single word. At this, often these complexes may include numerous actions without clear definition and independent name in a language.

All the above mentioned lets us conclude that a possibility of certain successions of parameterized actions be named with the same lexical unit or – in a broader context – be described with a rather short utterance (sentence) is an important evidence that this succession may be regarded as a behavioural variation. The fact of naming in this case is a sure indicator of repeatability of action succession.

In order to empirically identify a certain succession of actions a behavioural variation, we need to pick up examples demonstrating existence of alternative successions leading to similar or *equal* results.

Along with identification of behavioural variations it is also important to suggest an operational definition of *behavioural invariant*. Behavioural invariant is an abstract idea of general parameters combining a set of variations. Probably, it is impossible to avoid engagement of the result of behaviour within searching of invariant. However, we think that whenever possible we should search the invariant manifestation with no or limited participation of result. According to our experience, this approach allows for the most clear description of noncognitive skills, which later may be used for search of corresponding behavioural patterns. This approach also well conforms to the objective of our research – to find methods of automation of complex skill evaluation through analysis of behavioural patterns.

Table 1 presents several examples of good definitions of behavioural invariants with corresponding variations.

Table 1 - Examples of behavioural invariants with corresponding variations

<i>Invariant</i>	<i>Variation</i>
Critical analysis of the fact	<ol style="list-style-type: none"> <li>1. Expression of doubt in fact reliability</li> <li>2. Statement of hypothetic alternative version of the fact</li> <li>3. Search of information about hypothetic version of the fact on the Internet</li> <li>4. Analysis of information found</li> <li>5. Step 2 and 3 – repeat</li> </ol>
	<ol style="list-style-type: none"> <li>1. Expression of doubt in fact reliability</li> <li>2. Search of alternative versions of the fact on the Internet</li> <li>3. Analysis of information found</li> </ol>
	<ol style="list-style-type: none"> <li>1. Expression of doubt in fact reliability</li> <li>2. Engage the knowledge a learner already has in order to belie/prove the fact</li> </ol>
Creation of models for objects under study and processes through presentation of information in a sign-symbolic way	<ol style="list-style-type: none"> <li>1. Decomposition of the object or process under study</li> <li>2. Assigning of symbols to parts singled out upon decomposition</li> <li>3. Drawing an overall scheme of the object or process consisting of symbols denoting its parts</li> </ol>
	<ol style="list-style-type: none"> <li>1. Creation of a simplified representation of the object or process as a scheme</li> <li>2. Detection of repeating fragments in the scheme</li> <li>3. Introduction of symbols for repeating fragments</li> <li>4. Creation of a final version of a model with symbols</li> </ol>
Argumentation of own point of view as a reaction to presentation of interlocutor's point of view	<ol style="list-style-type: none"> <li>1. Exposition of the interlocutor's point of view which had been just hears</li> <li>2. Demand to prove the correctness of interpretation of his point of view by an interlocutor</li> <li>3. Presentation of own point of view</li> <li>4. Presentation of proof for correctness of own point of view</li> <li>5. Presentation of example supporting correctness of own point of view</li> </ol>

<i>Invariant</i>	<i>Variation</i>
	4. Determination of differences between own point of view and that of an interlocutor 5. Conclusion
	1. Advancement of counter-examples contradicting the interlocutor's point of view 2. Formulation of own point of view based on counter-examples 3. Determination of differences between own point of view and that of an interlocutor 4. Conclusion

## **Conclusion**

An approach to formulation of behavioural invariant which we have presented above is, surely, disputable and maybe somewhat simplified. However, we consider it efficient for the purposes of our research. It is one of the tools for search of connection between a certain skill and its manifestation in patterns of a user fixed within electronic educational environments.

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