Criterion of identification of test steps in training and educational systems

Serdiuk Olga

Ph.D. student,
Computer networks and installations Department
Kryvyi Rih National University,
Ukraine
E-mail: olgajs28@gmail.com

Abstract
There fulfilled analysis of modern means of identification of test operations in training and educational systems. Main generally excepted cybernetic factors of investigated operations, which characterize certain directions of investigated process, are evaluated. Their main restrictions that reduce certainty of identification are specified. Checkout methodology for identification indexes is developed.
Analytic expression for quantitative determination of relative index of identification of objective estimating operation is obtained.
Key words: IDENTIFICATION CRITERION OF EVALUATION OPERATION, CYBERNETIC INDEXES, RELATIVE INDEX OF IDENTIFICATION OF OBJECTIVE EVALUATION OPERATION, PRINCIPLES OF CREATION OF MEASURING TECHNIQUE OF SKILLS AND EXPERTISE, OBJECTIVE PERFORMANCE RATING

In the present time, the importance of reliable identification of test operations in training and educational systems promptly increases.

Existing methods of evaluation do not provide objectivity and uniqueness of obtained result. All of this exists despite a set of suggested forms and methods of identification. Therefore, development of criterion of estimation of test operations is an open question today.

Objectively there is a system of the basic indexes providing possibility of unique identification of efficiency of evaluating operation. The problem lies in the fact that the researchers start the development of criterion of estimation, without establishing these basic indicators. The opposite problem consists in the use of indicators, which are not basic.

Analysis of modern researches in the field of estimation of test operations showed that the main tendencies of modern approach to the question of identification is the support on such tendencies as the use of coefficient of complexity, decrease in influence of effect of "guessing" as the accounting of the actual time of test performance, possibility of the accounting of resource intensity of a task.

Thus, the peculiarity of modern developments in the field of identification of evaluating operations is that:

- lack of revealed basic indicators on the basis of which, it is possible to identify evaluating operation unambiguously;
- development and use of the criteria of identification distorting the results of estimation;
- lack of techniques for check of adequacy of the developed criteria of estimation.

Work objective is the development of an indicator (criterion) of identification of objective evaluating operation.

It is known that the economic operated systems, yielding and realizing various production, along with their specific features, pursue the only aim to obtaine additional cost.

Using generalized approach, it is possible to notice that our life consists of a set of system operations. Any of these operations is designed to increase of value of output products of operation in relation to input products [1].

In problems of identification of test operations an input products are initial data (unresolved task) and an output product – is the result of processing of initial data (solved task). It is obvious that the value of the solved task is estimated higher by society than an unresolved task.

Identification process may be fulfilled both in relation to sequence of operations (process), and in relation to certain evaluation operation.

Developing the criterion of identification of test operations, it is important to define for which type of test operations this indicator will be applied. One test operation may consist of several stages.

However, test operation for estimation of which, there made only one action in the form of separate process of calculation of value of evaluating parameter may be reduced to simple operations. Analytical expression of relative indicator of identification will be further developed for the simple test operations.

If the expert evaluation of set objective can be determined by α indicator displaying its level of complexity, and expert evaluation of the solved task by indicator ($k\alpha > \alpha$), than, according to the theory of estimation, the absolute effect of operation of identification can be defined by expression $M = \alpha(k-1)$. If the task is solved, but the result is not exact, the value of the solved task decreases on the value (fol) equal to discrepancy of a standard. In the final form the determination of size of an absolute assessment can be presented in the form $M = \alpha(k-1) - fol$.

This absolute index displays the size of added value of solved task.

How does this absolute measure differ from the traditional absolute measure of educational system existed for centuries?

First, this index indicates what a significant the task was solved by testee. The value of complexity degree index α speaks about this fact. Secondly, the coefficient k shows how the value of the solved task increases. The indicator fol specifies how the result differs from reference value. If $fol > (k\alpha - \alpha)$, the task is considered unsolved.

Such indicator of absolute estimation of test operations will be well coordinated with the conventional system of estimation. But such way of estimation is not the only one and is not the basic one. Relative indicators were always considered as more perfect system indicators. For example, such indicator can answer a question: "How expenses correspond to the received results?"

In relation to test operations, the relative indicator can be presented in the form: $R = \frac{(\alpha[k-1] - fol)}{\alpha}$. Fundamental defect of such relative indicator is the absence of reference to time of the solution of a test task. So, the task that has identical basic indicators (α, k, fol), will not differ for test operations, where the time for solution differs significantly.

Developments of efficiency theory obtained recently allowed to lift this limit [2]. The solution of a problem of identification of test operations with the use of basic provisions of efficiency theory allowed to receive the following expression: $Q = \frac{(k - fol - 1)^2}{kT^2}$.

To create the most suitable and systemically reasonable criterion of identification of test operations in the training and educational systems, it is necessary that each composing index of the obtained expression was independent and objective. Therefore, it is necessary in practice to show the adequacy of reaction of relative estimated criterion for change of the factors forming an assessment of simple operation of testing.

The technique of testing of estimated indicators has to be available, clear and universal.

Unambiguity of the results obtained during change of the size of separate element of cybernetic expression may be observed under the condition of a constant state of other components of this expression.

Nature of interrelation of results of relative indicator of an assessment of test operations Q from coefficient of complexity of a task k at $fol = const$, $T = const$, is presented in table 1, figure 1.

Table 1. Results of calculation data of the value of estimated figure Q during the change of task complexity factor k

k	Fol	T	Q
1.5	0	10	0.001667
1.6	0	10	0.00225
1.7	0	10	0.002882
1.8	0	10	0.003556
1.9	0	10	0.004263
2	0	10	0.005
2.1	0	10	0.005762
2.2	0	10	0.006545
2.3	0	10	0.007348
2.4	0	10	0.008167
2.5	0	10	0.009

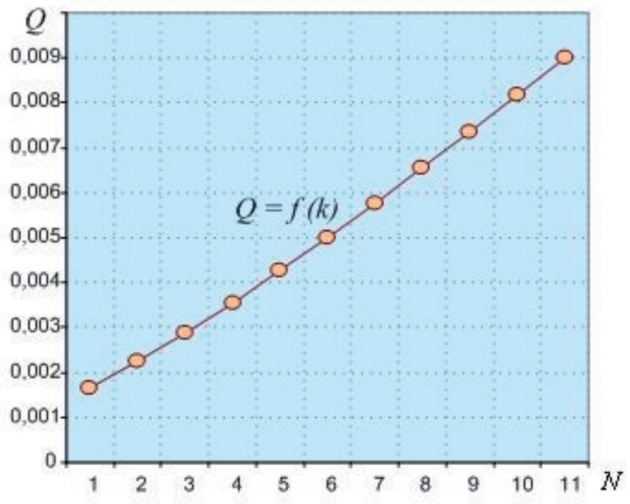

Figure 1. Diagram of calculation of value of relative indicator of identification of test operations models during change of the value of complexity coefficient of task k, *fol = const, T = const*

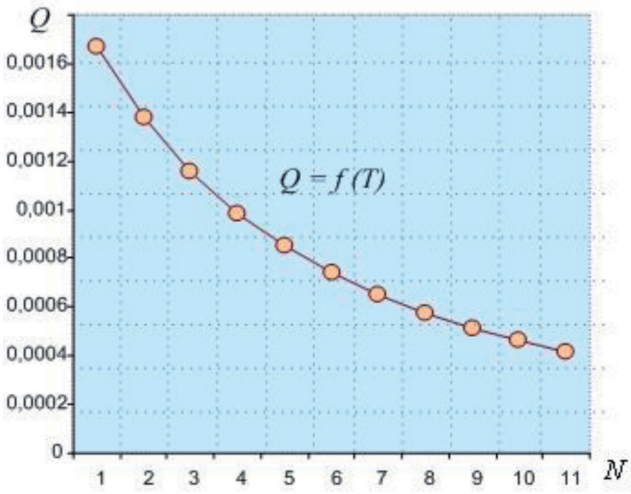

Figure 2. Diagram of calculation of value of relative identification indicator of models of test operations Q during change of actual time of performance of a task T, *fol = const, k = const*

The more complicated the task of test operation, the higher the level of intellectual abilities, knowledge and skills necessary for their performance. Therefore, with the increase of resource intensity of task k, the value of estimated criterion Q will similarly grow. In fig. 1 the expected unambiguity of reaction of value of indicators to change of complexity level is accurately shown.

Trend dependence of size of an estimated indicator on the size of time of performance of test operation is shown in the table 2, figure 2.

The subject spent less time for performance of an objective, works with greater efficiency, than the subject, which needed more time for the solution of a similar task. Therefore, abilities of the first subject have to be estimated higher, than of the second one. And the indicator of identification should also display it.

Table 2. Calculation results of the value of estimated figure Q during change of real time of task performance T, *fol = const, k = const.*

K	*fol*	*T*	*Q*
1.5	0	10	0.001667
1.5	0	11	0.001377
1.5	0	12	0.001157
1.5	0	13	0.000986
1.5	0	14	0.00085
1.5	0	15	0.000741
1.5	0	16	0.000651
1.5	0	17	0.000577
1.5	0	18	0.000514
1.5	0	19	0.000462
1.5	0	20	0.000417

From diagram it is possible to draw conclusions that with increase in time of performance of the same task the size of rating Q decreases. Similarly the indicator Q should react in case of increase in a deviation of the solved task from reference value (*fol* indicator), as well as it is shown in calculations results in table 3, figure 3.

Table 3. Results of calculations of relative indicator in connection with the change of deviation rate of solved task from the reference value

k	*fol*	*T*	*Q*
2.5	0.1	10	0.00784
2.5	0.2	10	0.00676
2.5	0.3	10	0.00576
2.5	0.4	10	0.00484
2.5	0.5	10	0.004
2.5	0.6	10	0.00324
2.5	0.7	10	0.00256
2.5	0.8	10	0.00196
2.5	0.9	10	0.00144
2.5	1	10	0.001
2.5	1.1	10	0.00064

Simplicity and universality of use of *fol* component in the obtained expression makes it unique as compared with other methods of identification of test operations.

If the indicator k has indirect influence on formation of an assessment of the subject of identification, the value of indicators T and *fol* are defined directly from the level of latent characters of each individual. Possibility of indicator Q to react on the introduced mistakes of the subject of estimation without individ-

ual pedagogical intervention testifies to its objectivity.

Edgy dependence of values *Q* and *fol* is shown in the figure 3.

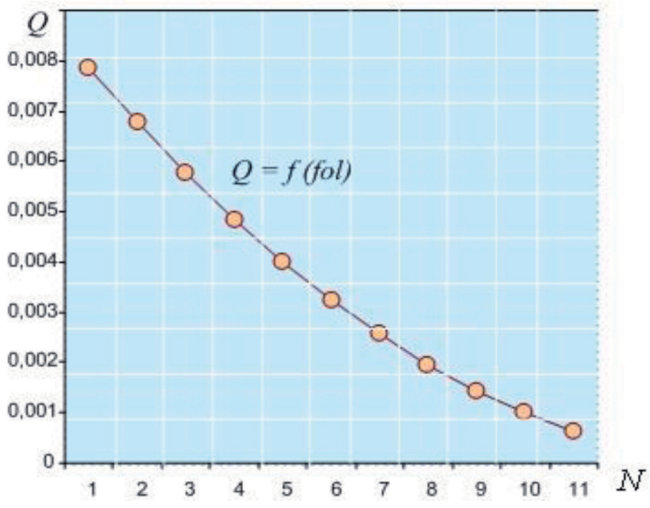

Figure 3. Diagram of change of the value of relative identification indicator of models of test operations *Q* with the change of indicator *fol, T = const, k= const*

In this diagram adequate response of change of values of a relative indicator *Q* to trend change of one of the its compound cybernetic expression at constant value of the others is shown.

Expression of a relative indicator of identification *Q* gives the chance objectively and adequately to estimate both typical tasks of an education system, and specific test tasks of trainings, where the speed and accuracy of their performance is important for increase or confirmation of the level of professionalism of the subject of estimation (including in computer simulators).

Conclusions

Nowadays full-scale usage of technologies of estimation is restrained due to the absence of criterion of estimation, which allows to identify test operations unambiguously.

For test operations, which can be reduced to simple operations, analytical expression for criterion of estimation is obtained.

It is found that any test operation can be completely described with the use of three basic indicators: coefficient of complexity, a result deviation from reference value and time of operation.

The indicator of identification of test operations, which provides their unambiguous identification with a support on the three basic indicators is developed.

It is established that the criterion of identification is in number equal to the difference square relation (k – fol – 1) to the product of coefficient k on the square of operation time T.

The technique of check of adequacy of criterion of estimation based on trend change of one of the basic indicators in relation to the fixed level of the others is developed.

References

1. Lutsenko I. (2014).Deployed model of extremal system operation for solving optimal management problems. *Eastern-European Journal of Enterprise Technologies.* Vol. 5/2(71), p.p. 61-66 DOI: 10.15587/1729-4061.2014.28592.
2. Lutsenko I. (2015). Identification of target system operations. Development of global efficiency criterion of target operations. *Eastern-European Journal of Enterprise Technologies.* Vol. 2, Issue 2 (74), p.p. 35–40. DOI: 10.15587/1729-4061.2015.38963.
3. Serdiuk O.Yu. (2014). Complex evaluation of computer testing. *Tehnologichesky audit i rezervy proizvodstva.* [Technology audit and production reserves]. No 6/4 (20), p.p. 21-22 DOI: 10.15587/2312-8372.2014.29599
4. Drozhdin V. V., Pavkina E. A., Jaremko O. E. (2011). Specification of test tasks estimations. *Bulletin of Penza state pedagogical university named after V.G. Belinsky.* No 26, p.p. 386–391.
5. Telnov G.V. (2014). Mathematical reasoning of evaluation criteria of competence-based levels of absorption of educational material on the base of binary logic of dummy variables of topical tests. *Bulletin of Adyghe State University,* No 2 (137), p.p. 128-134.
6. Rizun N.O. (2009). Usage of fuzzy sets theory for identification of the degree of complexity of the topic in the system of computer-based knowledge testing. *Eastern European journal of high technology*. No 6/2 (42), p.p. 32-37.
7. Serdyukov V. I., Serdyukova N. A. (2014). Improvement of automated control system of knowledge. *Pedagogicheskoe obrazovanie v Rossii* [Pedagogic education in Russia]. No 8, p.p. 75–80.