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### Pedagogical Education: History, Present Time, Perspectives

# APPROACHES TO MONITORING AND DIAGNOSTICS OF EDUCATION SYSTEM

D. VI. Lukashenko (a)\*, A. VI. Vilkova (b), R. M. Sherayzina (c)

\*Corresponding author

(a) Research Institute of the Federal Penitentiary Service of Russia, Moscow, Russia, dim-mail-ru@mail.ru

(b) Research Institute of the Federal Penitentiary Service of Russia, Moscow, Russia, mavlad67@mail.ru

(c) Yaroslav-the-Wise Novgorod State University, Veliky Novgorod, Russia, Roza.Sherayzina@novsu.ru

### *Abstract*

Monitoring in the education system comes to the fore in connection with the need to assess the effectiveness of educational organizations. The monitoring system should ensure the observability of a whole vector of state parameters of the education management system. The article substantiates the minimum set of parameters guaranteeing complete observability of the state of the education management system. In turn, the observability of the parameters of the state of the education management system and the analysis of the spectrum of these parameters will improve the monitoring of the education system. The following parameters are distinguished: parameters related to educational activity, determined by state educational standards and qualification requirements, and state parameters characterizing the quality of training of students, products and services. The latter include the parameters of the current and final state of education of the student, staffing and the functional state of the governing bodies, the methodological content of the elements of the educational material base, the functional state of the personnel of the governing bodies. The effectiveness of the control system in any technological circuit, which can manifest itself only during the functioning of the system and in the direction of creating the following effects: manifestations of additional quality and quantity, cost savings, productivity, invariance to disturbances.

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**Keywords:** Education system, educational management, efficiency, indicator of efficiency, monitoring of the education system.



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## 1. Introduction

This article addresses a complex and controversial issue. This problem is related to monitoring the education system.

On the one hand, the process of student satisfaction with education as its main clients is determined, while personal development and student satisfaction with higher education is considered as an element of monitoring the quality of education (Podkovko, 2019; Razinkina et al., 2018), as well as the integration of the online account system of student educational organizations into the educational process (Sheludko, Minina, Kukaev, Makin, & Kuznetsov, 2017).

On the other hand, indicators related to the number of students, the percentage of faculty members with and without academic degrees are considered as invariant indicators in assessing the effectiveness of educational organizations (Karelina, Sobolev, & Sorokin, 2016). In addition, as a technology for studying the effectiveness of educational organizations, monitoring of the quality of scientific and pedagogical personnel of universities, the process of forming a system of indicators for assessing education, research methodology, and the organization of consulting services are considered (Galiahmetova, 2018; Leontev, Bondarenko, Shebzuhova, Butko, & Egorova, 2018).

The article considers an inclusive education system for people with special needs, one of the elements of which is monitoring the activities of educational organizations to support and increase the effectiveness of training for people with disabilities (Kashtanova, Medvedeva, Kudryavtsev, Olkhina, & Karpushkina, 2017; Yaraya & Rokotyanskaya, 2018).

It is supposed to carry out monitoring and taking into account distance technologies, the creation and implementation of online courses in the teaching system of educational organizations (Vaganova et al., 2018), the implementation of interconnection based on assessing the level of student involvement in ongoing research projects (Abramov & Evseev, 2018). Research on this complex issue reveals various facets of this phenomenon. They relate to various aspects of monitoring the education system, revealing the various elements of this process.

## 2. Problem Statement

A feature of the article is an attempt to justify the minimum set of parameters of the state of the education system that guarantee complete observability of the system, and the formation of methods for reliable assessment of these parameters.

## 3. Research Questions

- 3.1. How should a monitoring system ensure the observability of the full vector of state parameters of the education management system?
- 3.2. Which spectrum data will improve the monitoring of the education system?

#### **4. Purpose of the Study**

A radical solution to the problems of modern education, bringing it to a qualitatively new level is possible only on the basis of providing educational authorities with objective, comprehensive and timely information about the state of the education system. It is necessary to carry out comprehensive continuous monitoring of the state of the education system for these purposes.

#### **5. Research Methods**

Considering the objects of management in the education system, we can distinguish its main element - the student. Changing the state of the object is the main goal of management. In our case, we consider the preparedness (education) of the student and, accordingly, the change in this state (the evolution of the moral, cognitive and functional components of the student from his level as an applicant to a specialist who meets the qualification requirements) will be the main goal and main indicator that allows us to judge the education system and its effectiveness. If the level of the current state of education meets the requirements of the educational trajectory in accordance with the curriculum, then we can assume that the education system is functioning efficiently and does not require additional corrective organizational and methodological guidelines.

At the same time, the unsatisfactory level of education of the student, as a consequence of the manifestation of a number of factors during the implementation of the educational program, which influence the formation of the moral, cognitive and functional literacy of the student, needs to find the reasons (diagnostics) of the unsatisfactory state of education in order to develop targeted organizational and methodological directions. Therefore, monitoring is not an end in itself, but plays the role of a diagnostician of the quality of the education system. Information about the state of the educational process in educational institutions and the management system is the basis for the implementation of feedback, the essence of which is the development by educational authorities, in accordance with their competence, of organizational and methodological instructions in order to eliminate the mismatch of the parameters of the current (observed) state from the required values.

The development of targeted instructions requires an analysis of the status of all elements of the education management system based on the diagnosis of causes (weaknesses) in this management system.

So, the monitoring system is aimed at forming and ensuring observability of the full range of parameters characterizing the state of the education management system.

An unobservable state (for example, part of the state parameters cannot be evaluated) of any control system determines its uncontrollability, since the behavior of unobservable (underestimated directly or indirectly) parameters is not controlled, and they evolve by themselves. Of course, all the parameters of the educational process are interconnected and after some time through controlled parameters, in particular, through the state of education of graduates, the negative impact of unobservable factors will manifest itself. However, the moment for timely correction of the education process will be missed. In addition, the question "why did this happen?" remains open.

In this case, address correction is out of the question, and the only way remains - a total inventory of all system elements. This approach makes even those elements of the system that function efficiently and do not need to be corrected with overvoltage "work".

The main vector of the monitoring methodology under consideration should be aimed at the formation of parameters that, in their minimum aggregate, will make it possible to monitor the state of the education system, while guaranteeing complete observability of the system.

At the same time, it is necessary to indicate at what level the educational authorities are directly responsible for certain parameters of the state of the system, which will help to develop functional schemes of a multi-level education management system in the future and, from the perspective of a systematic approach, analyze its functioning in changing the state of education of the student in the desired direction.

It should be noted that monitoring should ensure control in accordance with the following parameters related to the state of the education management system:

- content parameters of the state educational standard;
- parameters of qualification requirements and content of the regulatory and legal framework of the educational process in the educational organization;
- quality parameters of training students, products and services, including parameters of the current and final state of student's education (parameters of the state of moral, cognitive and functional literacy and their compliance with the requirements of a professional educational program); the parameters of staffing and the functional state of the governing bodies of the educational organization, the teaching staff; the parameters of the methodological content of the elements of educational material base and the parameters of the volumes and substantive aspect of professional educational programs that directly affect the change in the state of education of the student and their compliance with the requirements of state educational standards and qualification requirements, as well as performance indicators and accreditation of educational organization, the parameters of the functional state of personnel administration.

### **5.1. State parameters characterizing the quality of training of students, products and services**

*The parameters of the student's current and final state of education* are measured in the traditional five-point grading system. Correspondence of the state of students' education to the requirements of a professional educational program is monitored by conducting the current (planned control activities of the curriculum per semester), attesting students throughout the entire period of study (semester exams and tests) and final certification of graduates, as well as periodically monitoring the state of education of students (monitoring the current and the final state of qualification).

Planning and organization of the final certification of graduates' education (monitoring the final state of education of graduates) is carried out by staff of state (federal) governing bodies (in terms of compliance with the requirements of state educational standards) and central management bodies of customers (in terms of compliance with qualification requirements).

The correspondence of the *functional parameters of the educational organization's governing bodies, personnel support parameters*, methodological content of the elements of the educational material base is controlled by comparing with the required values of these parameters in the guiding documents on licensing, certification and accreditation of educational institutions and have numerical expressions.

*The parameters of the functional state of the personnel* of the governing bodies are rating indicators characterizing the effectiveness of the contribution of the staff when implementing a professional educational program and ensuring the implementation process regarding those parameters for which this governing body personnel.

Currently, educational organizations have methods for assessing the activities of faculty based on rating indicators. In addition, by a similar scheme, methods for evaluating any officials can be developed.

The organization of monitoring and diagnosis of the educational process should be based on the target function of the education management system in the educational organization, which is a function of the desired (required) state of education (moral, cognitive and functional) of its graduates.

Therefore, it is desirable to have a comprehensive indicator of the effectiveness of the functioning of educational organizations when they implement professional educational programs, which would clearly show its effectiveness.

## **6. Findings**

The effectiveness of the control system in any technological circuit producing a service or product can be manifested only during the functioning of the system in the direction of creating the following effects.

*The effect of the manifestation of additional quality and quantity.* Produce a larger volume and higher quality of both the main product (service) and additional related products with equal funds spent and at the same time; the quality of products should not be lower than certain requirements, and the product itself and its volumes are in demand.

*The effect of cost savings.* Have lower costs for the production for the same set and sold volumes with the required (desired) quality of products produced at the same time.

*Performance effect.* To produce the same set volumes with the required product quality in less time with the planned costs of its production; another identical interpretation of this effect is the quantity of products produced with the required quality per time unit. It is assumed that products manufactured at an increased pace are in demand and sold. It should be noted that the effect of productivity in the educational organization is fundamentally absent, since it is not in the competence of the educational organization to change the terms for the training of specialists defined by professional educational programs.

*The effect of invariance to perturbations* of both external and internal nature. This effect, by definition, is the result of some action that makes an impression. If the production process is planned according to all parameters, then the output will be the expected (planned) result. However, for such functioning, manufacturers from executives to managers of all ranks (management personnel) are always encouraged: bonuses for fulfilling plans. The question is why as they performed only their official functions, for the implementation of which they received a salary? The concept of the effect of plannedness suggests itself. But in terms of content, the concepts of “effect” and “plannedness” are not logically combined: plannedness rejects any unplanned effect (unplanned result of an action), and the effect always implies a deviation from the planned one, with the positive effect (dividends) in the positive direction and the negative side in the negative effect (costs).

There is no contradiction here and manufacturers are encouraged not in vain. Here, the effectiveness of the functioning of manufacturers is manifested in the effect of compensation (suppression or smoothing) of unforeseen effects (when planning all the nuances are difficult to foresee) that have a negative impact on the production process. In practice, often these effects are manifested in various combinations. Therefore, it is necessary to evaluate the effectiveness of a comprehensive. As performance criteria, some judgments (evaluation rules), functionals and individual performance indicators can be used, with the help of which and from a position that can compare the effectiveness of the considered control systems.

*Efficiency functional* is a rule according to which the implementation of the production process (production function) from the beginning to the receipt of the finished product is associated with a number (measure), the physical meaning of which reflects the well-defined effect achieved in the production process.

*Efficiency indicator* is a parameter (characteristic) of production (activities of producers during the entire production cycle) in numerical terms, which unambiguously reflects any effect on production output.

The performance indicators should not be confused with the performance indicators of the system and the control object, since the former reflect the achieved effect (dividends or production costs), and the latter characterize the property to satisfy the requirements of the customer. At the same time, with all other conditions being equal and production parameters (the same production time, the same volume of production), quality indicators can act as performance indicators, since here there is the effect of the manifestation of additional (or decrease) quality.

The effectiveness of the educational organization in the implementation of educational programs must be assessed for each level of professional programs separately, since the main products (graduates) are different in quality and purpose.

In principle, you can use known performance indicators separately for each effect shown as a result of the activities of the educational organization for the implementation of educational programs.

Let us give some examples:

- the efficiency ratio of the fulfillment of the state order when fulfilling the quality requirements (the number of graduates referred to the number of the state order) reflects the effect on the volume of output, but does not say anything about the cost;
- economic efficiency indicator when fulfilling quality requirements (the real cost of preparing one graduate, related to the planned cost) reflects the effect of saving (the indicator is less than one), or waste of money (the indicator is more than one);
- the average score of the final certification, referred to a satisfactory score, when fulfilling a state order with planned costs, characterizes the average increment in the quality of training in relation to a satisfactory level;
- the volume and quality of additional (accompanying) products when fulfilling a state order with the required quality (the number of published textbooks and monographs, methodological recommendations and other scientific and methodological publications that are used in other educational organizations, scientists prepared for this educational organization for other educational institutions) characterize the additional effect the functioning of educational institutions from the main activity;

- adaptive performance indicators of educational institutions in conditions of disturbance. For example, the inverse of the percentage of staffing of educational institutions in fulfilling the state order and the requirements for the quality of training characterizes the internal reserves and resources that allowed educational institutions to compensate for the absence of some officials.

## 7. Conclusion

The fundamental principle of the formation of indicators of the state of the educational process of educational organizations defines the principle of orientation towards solving the main problem. This principle comes from the need for any educational institution to solve its main task - training.

The listed indicators reflect individual facets of effectiveness. Using them for a comprehensive assessment of effectiveness is difficult, since it is difficult to justify the "weight" of these indicators. Therefore, it is important to develop a criterion (indicator) for a comprehensive assessment of the effectiveness of the educational organization's implementation of professional educational programs, which would take into account both the effect of additional quality and quantity, the effect of cost savings, and the effect of invariance to disturbances of both external and internal nature.

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