Prospects of Application of Technologies of Test Control of Students' Knowledge in the Direction of Preparation «Ecology and Environmental Management»

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ABSTRACT

Relevance of the considered problem is caused by broad application of test technologies in the course of realization of the main educational program 022000.62 (05.03.06) «Ecology and environmental management». The purpose of article consists in development of integrated approach to an assessment of properties of test tasks, to the principles of selection of their maintenance, development of approaches to creation of sets of test tasks which can be included in funds of estimated means of various disciplines. The empirical method and questioning were the leading methods of research in this work. In work examples of test tasks of various designs on the example of one of the all-professional competences formed at ecologists are given; the average percent of the solution of test tasks of different designs is analysed, by results of questioning of students it is revealed that it is quite enough time allowed for execution of the test to most of students, and test tasks consider more than a half of respondents as lungs in spite of the fact that the coefficient of the decision indicates that the majority of tasks had average difficulty. Results of researches have allowed to reveal high interest of students in use of technologies of test control of knowledge practically of all disciplines provided by the main educational program; students at poll point to objectivity of measurement of results of training by means of test technologies, speed of receiving results and to the favorable psychological atmosphere of educational process at estimation of knowledge.

Introduction

State of the problem

Now quality of educational process acts as the main characteristic of an education system, as the integrated indicator synthesizing all stages of formation of the personality and criterion of efficiency of activities of educational institution. In Russia, as well as around the world, problems of quality

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assurance of education are designated more and more sharply, there is a search of well-tried remedies, methods and technologies of estimation of its results correlated to international standards.

Transition to federal state educational standard of higher education sets for higher education institutions a complex challenge – forming in implementation process of the main educational program of all types of competences that is a capability to apply knowledge, abilities and personal qualities to successful performance in a certain area. These purposes require not only creation of modern educational technologies for forming of required competences at trained, but also creation of funds of estimative means which will allow to estimate objectively created competences.

For high school system the assessment of level of formation of competences is a new task which cannot be solved only by means of traditional control methods and tools of an assessment of results of development of educational programs. One of the most effective and objective forms of estimation of knowledge, skills, the tests allowing to reveal not only level of educational achievements, but to analyze structure of the knowledge which is trained are. Tendencies of strengthening of communication of control and training lead to reconsideration of a role of control and estimative system in education: control, an assessment and training are considered as the interconnected and interpenetrating components of single educational process (Kabanova & Novikov, 2009).

Now many higher education institutions of the Russian Federation realize the main educational program for the direction of preparation 022000.62 (05.03.06) «Ecology and environmental management». This new modern direction which has arisen due to the need of overcoming of ecological crisis, change of regulations and rules of managing, revolutionary changes in the international and national legal system aimed at providing an ecological safety, conservation, rational use of natural resources. The purposes of this main educational program include creation of conditions for the high-quality education based on a continuity of the developing educational environment; to realize the innovative programs and new technologies of training, ecological education guaranteeing competitiveness in the labor market; development of informative activity, scientific creativity, independence and creativity of bachelors in the sphere of environmental protection.

Results of development of the main educational program are determined by the common cultural and professional competences, including general scientific and all-professional competences purchased by the graduate (in the field of ecology, environmental management and geo-ecology). Development by university graduates of a data set of competences can be considered as the base of success in their future professional and civil activity. An important condition of successful development of future profession is forming of a capability effectively it is worth acting on the basis of practical experience, knowledge and abilities in case of the solution of the tasks connected with productive activity at the same time before the higher school a task of development of the interdisciplinary competence-based oriented estimative means (Davydova, 2012).

It is obvious that teachers of higher education institutions will need to transform the activity and to make certain efforts for development and

formation of common cultural and professional competences. However that these efforts had purposeful character, it is necessary to develop to adapt to measurement of level of formation of competences. For the teachers working in the sphere of professional education, the assessment of professional competences therefore our work is based on this aspect has prime value.

All traditional methods of control of knowledge of students – oral poll, examination, the combined control, the condensed poll in some cases are insufficiently objective. Methods of test control are considered as more effective (Zvonnikov & Chelyshkova, 2007). Despite availability of certain difficulties and disputed issues test control of knowledge in educational process is very perspective, especially thanks to development and use of modern information and communication means. The benefit of test control is indisputable in the conditions of implementation of modular and rating system of estimation of progress as factor of the student stimulating a regularity of self-preparation and gradual accumulating, and then by the time of completion of studying of discipline or other structural logically interconnected block of an educational program conscious ownership of knowledge and to abilities at higher level.

Materials and Methods

The experimental base of research – department of ecology of the Mari State University, here in case of an assessment of knowledge of students has traditionally developed a tendency of wide use of tasks in a test form for control of knowledge of students. Experience of their creation and use has been provided in the education guidance «Test Tasks on Ecology and Monitoring of Environment» (Voskresenskaya et al., 2013) and in the certificate on the state registration of the computer program № 2013613376 «An electronic educational resource on discipline «Theory of the biosphere»».

Process of creation of test tasks is an effective, evidence-based gage of educational achievements. On each discipline by a basis of an educational program of the direction of preparation 022000.62 (05.03.06) «Ecology and environmental management» at department of ecology of the Mari State University the fund of estimative means which part also the set of test tasks is developed.

The set of test tasks is created for the purpose of improvement of quality of training of students, achievement of objectivity in case of an assessment of level of the knowledge and abilities which are trained of competences of graduates. A necessary condition of effective application of test technologies in educational process is availability of a developed set of test tasks. In case of its effective use control and management of process of forming at students of the necessary competences determined federal state educational standard of higher education is exercised.

When developing tests are guided by basic properties of test tasks which sets have to possess certain properties. It is possible to distinguish the following from these properties:

1) a subject orientation – the developed tasks have to correspond to a subject of studying of a concrete subject matter;

2) a validity – the valid ability of the test to measure that characteristic for which diagnostics it is declared;

3) reliability – the characteristic of accuracy of the test as measuring tool;

4) contents – optimum display of maintenance of a subject matter in system of test tasks;

5) volume – quantitative structure of the test tasks entering the test or a set of tasks;

6) the quality of test tasks and a set in general providing objective and reliable results at monitoring procedure with various purposes.

For creation of a set of test tasks the testing purpose, his contents, approaches to his creation originally is determined by each discipline. Then carry out the analysis of maintenance of a subject matter and select key positions for control of knowledge, skills of students at this course. These requirements are defined in the corresponding federal state educational standard and in standard training programs therefore the analysis of these documents – the most important part of development of test tasks.

Further carry out determination of elements of content and direct creation of test tasks which can be included further in the test. There are principles of selection of content of test tasks:

1. Contents of the test shall correspond to content of a subject matter, and separate tasks shall in the correct proportion cover all important partitions of the area of content.

2. It is necessary to include in tests the most important, basic knowledge reflecting essence, content, laws and regularities of the considered phenomena, and all disputable points of view should be excluded from test tasks.

3. Each educational element shall have some average measure of difficulty which needs to be considered in the course of control of the created competences.

By means of correctly constituted test tasks perhaps successful solution of a number of pedagogical tasks. First of all it is possible to determine compliance of quality of training trained (the characteristic expressing extent of achievement of the planned results of an educational program by means of a quality evaluation of development of an educational program trained) to requirements of federal state educational standard. In addition receipt of a comparative assessment of level of the created competences at various groups of trainees can become an important aspect.

In a set of test tasks various forms of test tasks are usually used, namely: the choice of one answer option from the offered set, the choice of several right answer options from the offered set, tasks for establishment of compliance, a task for establishment of the correct sequence, a task for filling of the passed keyword (an open form of a task), a case task. In testing tasks in the closed form are most often used. These tasks are characteristic the fact that they comprise also a basis (a question, statement) and answers (elements of answers) from which the examinee shall choose or constitute the right answer.

All tasks in a test form not only shall be created and used according to certain requirements (Avanesov, 2005, Cline, 2006) but also it is necessary to consider a number of circumstances. So, it is important to take compliance of tasks to sources of information which students use into account. So, constituting or accepting ready selective tests to use, it is necessary to check carefully compliance of the formulations appearing in them, terms, quantitative data,

images to those education guidances which students when studying this information used. It must be kept in mind that the task shall require the solution only of one question from the student, this requirement of simplicity of the test interferes with unnecessary complication of control procedure. The formulation of a test task shall explain comprehensively set before trained the task. And language and terms, methods and indexation of designations, illustrations shall be equally clear to all. One more requirement – tasks shall be detailed, and answers – are laconic, this requirement is offered not only from the point of view of convenience of registration of a task and reducing its printing amount, but also in order that the student, checking the subsequent answers, could keep previous in memory. In case of development of test tasks identity of all answers in a form and amount is considered, this requirement comes true experience: in the presence of answers, different in amount, trained instead of the choice to the point chooses that answer which is more on amount.

Sets of test tasks are included into funds of estimative means practically of all disciplines, in 2014-2015 academic year at students of 1 rate of the direction of preparation "Ecology and environmental management" test technologies were applied in case of estimation of knowledge, skills at students when studying disciplines "Geography", "Biology", "General ecology", "The doctrine about the hydrosphere", "Introduction in professional activity", "Bioethics". In addition to such standard indicator as average percent of the solution of test tasks of different designs calculated coefficient of the solution of tasks (as a share of the examinees of this selection who have performed a task it is correct). The coefficient of the solution of a task is associated with a measure of its difficulty. Optimum value of a measure of difficulty for a task – 0,5, but at the test there shall be both easy and difficult tasks.

According to requirements of federal state educational standard the higher education institution is obliged to provide trained a real opportunity to participate in forming of the training program and a possibility of estimation of content, the organization and quality of educational process in general, and also works of certain teachers. Taking into account these conditions among students for the purpose of an efficiency evaluation of application of test technologies in educational process at 25 first-year students of the direction of preparation "The ecology and environmental management" periodically made questioning of students. For this purpose after test control of knowledge learned from students whether time allowed for execution of the test as they estimate test questions on difficulty suffices and whether it is necessary to apply test technologies of an assessment of the knowledge which is trained in all objects to specify benefits and shortcomings of test control of knowledge.

Results

With entering of federal state educational standards of the third generation the development problem in high school system of monitoring of quality of education is especially actual. Creation of such system corresponds to requirements of the standard legal documents regulating activities of educational institutions. Obligatory availability of such system in higher education institution is essentially new requirement of the legislation. Entering of monitoring of quality of training of students shall promote forming in high school controling mechanisms and a quality evaluation of education at all stages of educational process: from acceptance before release. Tasks in a test form allow to realize this

system in higher education institutions. Pedagogical tasks in a test form are considered as very technological means of intellectual development, education and training promoting activization of the doctrine, improvement of quality of knowledge, and also increase of efficiency of pedagogical work (Avanesov, 2013).

Traditional forms and control methods of knowledge often are exposed to serious criticism, many consider that they do not allow to establish objectively either quantitative, nor quality characteristics of readiness of trainees, and participants of pedagogical process, as a result, have no information necessary for effective interaction. Use of opportunities of test control of the knowledge which is trained now is a little limited, mainly because of poorly developed technology of designing and handling of tests, tasks, consisting from various in a form, including multiple test tasks (which significantly reduce probability of the accidental choice of all correct answers, allow to reduce number of test tasks in case of diagnostics of the same amount of controlled knowledge, to carry out diagnostics at the same time of several types of knowledge) (Mayorov, 2010).

Entering of technologies of mass testing removes trained in open educational and control and estimative space. Testing promotes objectivity of an assessment of results of training, allows to determine the most poorly acquired sections, subjects, single questions and to timely correct training process. Testing creates conditions for more flexible training which is equitable to interests of each personality, and at the same time it is capable to set the single level of the requirement for all trained. Thus, testing becomes now not only part of modern educational process, but also the most important means of establishment of feedback thanks to which training turns into the differentiated, personally oriented process providing individual rate of training, elimination of subjectivity in an assessment of level of educational achievements of pupils, means of objectification of a quality evaluation of educational process and its individualization (Efremova, 2007).

The test form of tasks represents a specific method of communication of content of a task with the form, most suitable for this content. Specifics of a method are determined by features of the main forms: tasks with the choice of one or several correct answers, tasks of an open form and tasks for establishment of the correct sequence.

The greatest distribution in practice of pedagogical measurements was gained by test tasks of the closed form. Alternative tasks most correspond to a task of identification of in what degree the examinee understands data. They may contain check of abilities to work with schedules, drawings. Any other form of representation of tasks will be much more bulky and less convenient. The task with the choice of one correct answer option from four possible (or 2 of 5, 3 of 6) is the main type of tasks applied in achievement tests. Tasks with the multiple choice assume availability of variability in the choice.

Tasks for establishment of compliance between elements of two lists, an order of a row are less widespread, it tasks of the increased complexity level. The main benefits of tasks of this type are the possibility of a fast assessment of knowledge, skills in specific field of knowledge, and profitability of placement of tasks in the test.

Tasks for establishment of sequence are the very high-quality form of test tasks having considerable advantages: brevity, simplicity of check, and high objectivity of an assessment of the achievements which are trained.

So, one and the created all-professional competences (professional competence – 5) «The nobility of a basis of the doctrine about the atmosphere, about the hydrosphere, about the biosphere and about a science about landscapes» is created when studying several disciplines (General ecology, the Doctrine about the hydrosphere, Theory of the biosphere, etc.), but at the first year key discipline is «The general ecology». The fund of estimative means of this discipline contains tasks of various designs.

For example, *alternative tasks*:

1. The term «ecology» has been offered by V. I. Vernadsky (1938).

– yes

– no

2. Sinecology – the section of ecology studying communities of organisms (biocenoses, ecosystems).

– yes

– no

Tasks with the choice of one correct version of the answer from four possible:

1. The term «noosphere» has entered …

a) E. Lerua

b) K. Ber

c) V. Dokuchayev

d) V. Sukachyov

2. Coal, limestones, oil is examples _____ substances.

a) biogenous

b) bioinert

c) inert

d) live

Tasks with the choice of two correct versions of the answer from five possible:

1. Driving forces of a biogeochemical cycle of substances are …

a) energy of the Sun

b) radioactive energy of Earth

c) wind power

d) energy of water

e) the deposited power sources

2. In a biogeochemical cycle allocate _____ and _____ funds.

a) reserve

b) exchange

c) land

d) reserved

e) power

Tasks for compliance establishment:

1. Establish compliance between geospheres of Earth and borders of distribution of life.

1. Atmosphere

2. Hydrosphere

3. Lithosphere

a) the ozone screen at the height of 22-25 km

b) full settling by live organisms

c) an isotherm with a temperature of +100 ˚C

2. Establish compliance between mineral resources and biogenous elements which sources they are.

1. Apatity

2. Nitrites

3. Sulfides

a) phosphorus

b) nitrogen

c) sulfur

Tasks for establishment of sequence:

1. Distribute circulations of substances in the biosphere in the direction of increase in speed of their course.

A. Biogeochemical cycle of nitrogen

B. Turnover of carbon dioxide

C. Oxygen circulation

D. Hydrological cycle

2. Establish sequence of course of the main events in the course of evolution of the biosphere.

A. synthesis of the elementary organic compounds

B. emergence of prokaryotic organisms

C. emergence of eukaryotic organisms

D. emergence of the sort Homo

Test tasks of various designs are directed to identification of various level of the knowledge, skills which are trained that, undoubtedly, has to be considered also by drawing up tasks, and at their use.

So, alternative tasks and tasks with the multiple choice (most often one of four) are directed to identification of the basic knowledge which is trained to a large extent. These tasks, perhaps, are the most widespread and the most habitual for examinees. The decision at such tasks is usually 1,4-1,9 times higher, than at other types of tasks (fig. 1), however alternative tasks have essential minus - it is high probability of guessing (50 %) because the question contains only two possible versions of the answer (yes or no).
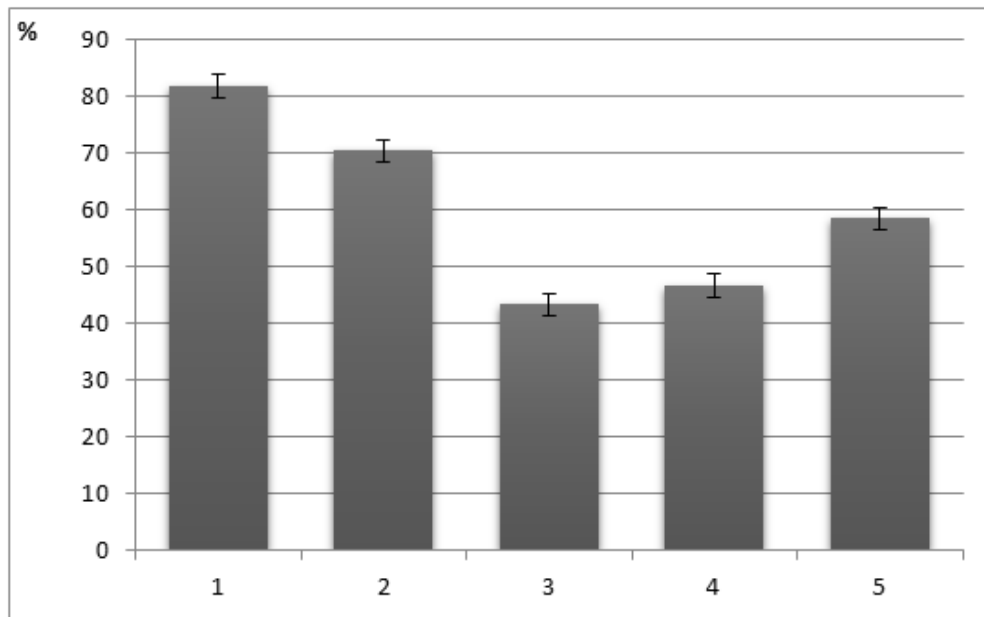
Figure 1. Average percent of the solution of test tasks of different designs.

Note: 1 – alternative tasks (yes – no); 2 – a task with the choice of one correct version of the answer from four; 3 – tasks for compliance establishment; 4 – tasks for establishment of sequence; 5 – an open form (to squeeze the word)

Tasks for establishment of compliance and task for establishment of sequence had considerably smaller decisions (43,2–46,5 %) that allows to consider these tasks as tasks of the increased complexity level which are more expedient for applying at total control of knowledge.

When questioning students whose knowledge was estimated by means of test tasks of various designs was also established whether time allowed for execution of the test and as trained estimate test questions on difficulty (fig. 2) suffices.

Certain time which depends on a design of a test task is allowed for the solution of each question. So, each alternative task has to be performed within 1 minute; on the solution of a task with the choice of one correct version of the answer from four offered 2 minutes are allotted. Each of tasks for establishment of compliance and on establishment of sequence, and also tasks of an open form are solved within 4 minutes. As a result of this questioning it has been established that the vast majority of respondents (73,2 %) consider that it is quite enough time allowed for the solution of test tasks.

At estimation of a test question on difficulty opinions of students were shared almost equally between the fact that tasks difficult and average difficulty (42,7 and 51,8 % respectively), only about 5 % of respondents considered that the tasks provided for the decision are lungs. The received results allow to assume that test tasks of a different design can be used at various forms of intermediate and total control of knowledge of students.

Analyzing coefficient of the solution of tasks of various designs it was revealed that tasks of the increased difficulty and easy tasks about 10-15 % from all selection were used, other tasks had values of coefficient of the decision, near

optimal (0.4–0.7), despite it, the share of the students considering tasks as averages on difficulty isn't high – only 5.5 % that demonstrates that trained not always objectively estimate complexity of the tasks presented in the test.

A
1 – insufficient 2 – too much, 3 – sufficient

B
1 – light, 2 – tough, 3 – average difficulty
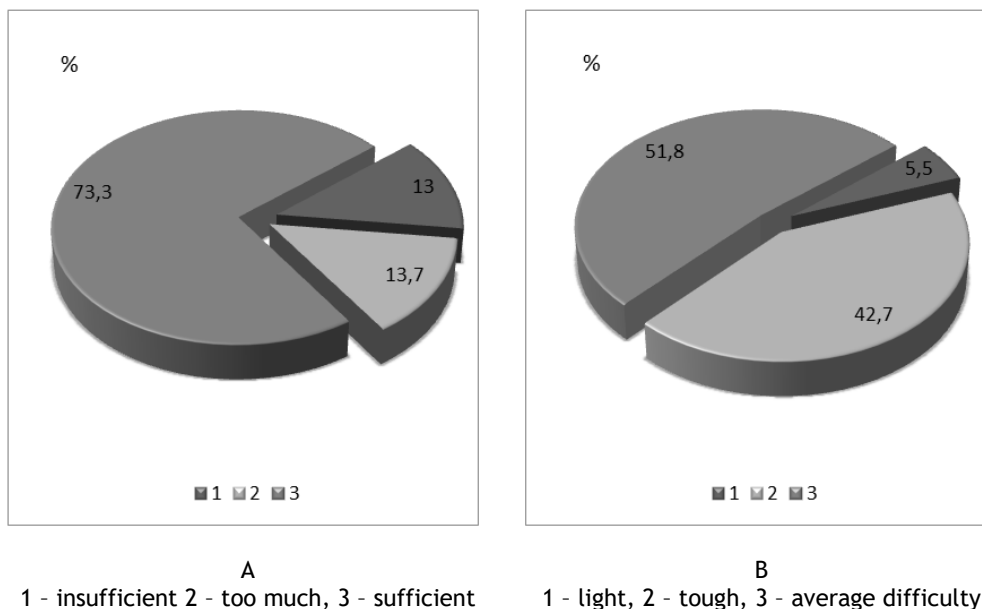
Figure 2. The results of the survey of students
A – Is there enough time available for the test?
B – How do you assess the tests are in difficulty?

Test quality control of knowledge of students increases performance of educational process, eliminates influence of elements of subjectivity in an assessment of knowledge of students, increases the level of self-organization of students and responsibility of teachers for quality of the organization of educational process. Test tasks can be used for check of residual knowledge of students of a certain discipline, the current control or for carrying out final assessment of knowledge, also they allow to speed up work of students at lecture and to solve a problem of attendance of lecture occupations if the beginning of each practical occupation to hold short testing on lecture materials. As a result of questioning of students also it has been established that more than 80 % of respondents consider that use of test technologies for control of the gained knowledge, skills, it is necessary to apply on all disciplines of the curriculum. Among the main advantages of test control of knowledge by students justice, availability equal the conditions for all which are trained, lack of subjectivity of the teacher, a scope of all studied sections in case of a small amount of tasks, an insignificant amount of time spent for control actions, objectivity of estimation of results are specified.

Discussions

Studying of various aspects of test control of knowledge traditionally is considered one of the most topical issues in case of the characteristic of modern means of estimation of results of training. The majority of works in this direction

are devoted to theoretical and practical questions of designing of pedagogical yews, applications of testing in determination of structure of knowledge of students (Borisov, 2003; Avanesov, 2005; 2013; Cline, 2006; Efremova, 2007; Mayorov, 2010, etc.). Number of researchers (Kiselyova & Navodnov, 2012) consider the matter in the context of internal system of monitoring as controling mechanism quality of education in higher education institution. Also there are researches directed to creation of recommendations about designing of estimative means for implementation of multi-level educational programs of higher education in case of competence-based approach.

The modern works devoted to various aspects of application of technologies of test control of knowledge of students are reduced, undoubtedly, to the fact that in case of quality requirements of training of specialists increase more and more, university graduates shall not only own professional knowledge and abilities, but also to be ready to fixed advanced training and to show interest in the field of professional activity it is shown as in development of its acceptances and methods, enhancement of technology, enrichment of methodological tools and expansion of area of its application and expressed in development of his personality, identity of the student, forming of its professionalism. Our work is directed to identification of the most perspective directions of use of test tasks of various designs at students of the direction of preparation «Ecology and environmental management», in works of other researchers this aspect was not considered.

Conclusion

Use of test technologies in case of control of knowledge has no alternative now. It allows to exercise effective control over training at all levels – from studying of a subject of each discipline before final state assessment of graduates as possesses such properties as objectivity, mass character, technological effectiveness, mathematical accuracy of measurement, a scope of all content of a training material, speed of monitoring procedure. Considering features of implementation of the main educational program of the direction of preparation 022000.62 (05.03.06) "Ecology and environmental management" it is impossible to underestimate a role which is played in it by pedagogical testing exactly thanks to these benefits before traditional types of control of knowledge. Testing can be used on each practical occupation as a method of the current control, to become its main function the motivation of students to systematic preparation for occupation, also the training function can be implemented (if analysis of individual results of testing with students is carried out); corrective function will be executed by the final control on a subject which is carried out at the end of occupation for determination of success of goal achievement of studying of a subject. Inclusion of test tasks in funds of estimative means of various disciplines allows to realize effectively all benefits of testing and all functions of pedagogical control.

Results of researches have allowed to reveal high interest of students in use of technologies of test control of knowledge practically of all disciplines provided by the main educational program. It is caused first of all by usability of tasks in

a test form, the minimum quantity of time spent for testing in comparison with other forms of control of knowledge and a habitual form of tasks with which trained begin to work with a school bench by preparation for uniform state exam. Besides, interview with students has shown that the majority of them consider that test tasks are estimated by the teacher more objectively, the prejudiced opinion which can be created in training process disappears, the psychological atmosphere in group in case of estimation of knowledge improves. Thus, results of our research studies allow to reveal obvious prospects of application of technologies of test control of knowledge of students in the direction of preparation 022000.62 (05.03.06) «Ecology and environmental management».

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References

Avanesov, V. S. (2005) The form of test tasks. Moscow: Test Center. 240p.

Avanesov, V. S. (2013) Application of test forms in e-learning with carrying out the distraktorny analysis. *Educational technology*, *7*, 125–135.

Borisov, V. V. (2003) Method of dynamic testing in definition of structure of knowledge of students. abstract of the thesis candidate of pedagogical sciences, Moscow: AST, 85p.

Davydova, O. V. (2012) Create meters to assess the competencies of students. *Moscow: University Bulletin*, *12*, 77 – 82.

Efremova, N. F. (2007) Test control in education. Moscow: Logos, 386p.

Kabanova, T. A. & Novikov V. A. (2009) Prospects for the development of test technologiestool for assessing the quality of education in the transition to the federal state educational standard of higher education. *Russian Peoples' Friendship University Bulletin series.«Informatization of Education», 2,* 78-83.

Kiselyova, V. P. & Navodnov, V. G. (2012) The internal monitoring system as a quality control mechanism for the formation in high school. *Education Quality Problems: Proceedings XII All-Russian scientific-method Conference.* Moscow, 62–66.

Cline, P. (2006) Reference design test. Kiev, Sokol, 238p.

Mayorov, A. N. (2010) Theory and practice of creating tests for the education system. Moscow: national education. 351p.

Vernadsky, V. I. (1938) Scientific Thought as a Planetary Phenomenon. Dubna: Phoenix.

Voskresenskaya, O. L., Alyabysheva, E. A., Sarbayeva, E. V. & Voskvesenskij,V. S. (2013) Tests for Ecology and Environmental Monitoring. Yoshkar-Ola: MarSU Publishing House. 128p.

Zvonnikov, V. I. & Chelyshkova, M. B. (2007) Modern means of assessment of learning outcomes. Moscow: Academy. 306p.