The System of Monitoring the Success of Training in the Formation of Technical Competencies of Students of Technical Specialties

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Abstract
In connection with modern requirements for education in the undergraduate system, there is a need to ensure the adequacy of the requirements of life and the content of education, including educational technology. This is especially important now in the context of the need to form competencies aimed at bridging the gap between learning outcomes and modern practice requirements. In this regard, training technologies are required that are focused on the participation of individuals in the educational process and contribute to the integration of future specialists in society. In this study, our efforts were aimed at creating and implementing in the educational process of the technical university conditions for mutual adaptation of the student and the learning environment - the infosphere. Filling the learning environment with specific subject content is one of the most important tasks of educators. In this paper we analyze the quality aspects of educational process and methodological system, forming technical competences. We present the developed system of a midterm control as a part of pedagogical control. Our research shows that the midterm control is an effective tool for raising the quality of education especially in conditions when the amount of student’s independent work is increasing.

Keywords
Infosphere, Technical Competencies, Bachelor, Midterm Control, University Education.

Introduction
In connection with modern requirements for education in the undergraduate system, there is a need to ensure the adequacy of the requirements of life (target settings for education) and the content of education (including educational technologies). This is especially important now in the context of the need to form competencies aimed at bridging the gap between learning outcomes and modern practice requirements. In this regard, training technologies are required that are focused on the participation of individuals in the educational process and contribute to the integration of future specialists in society (Bilgin I., Šenocalk E., Sözbilir M., 2009:153; Koponen I., Nousiainen I., 2013:325).

In the work preceding the present study, the selection and structuring of the material in the unity of its substantive and procedural sides was carried out in accordance with the hierarchically arranged learning objectives (Mazhitova L.H., Nauryzbaeva G.K., 2010:74).

In this research, our efforts were aimed at creating and implementing in the educational process of the university conditions for the mutual adaptation of the student and the learning environment - the infosphere. Filling the learning environment with specific subject content is one of the most important tasks of educators. In terms of pedagogical reality, the content of education exists in various forms of educational activity and is included in this activity. In this case, the content of the training is in unity with its procedural side. In didactics, the development of the procedural side of training is associated, first of all, with the choice of appropriate forms, methods and teaching aids with an orientation towards the formation of technical competencies.

Under the new conditions of increasing the volume and strengthening the role of students' independent work in the educational process, only methodologically structured information can be accepted by students and acquired at the proper level and converted into competencies.

At the same time, it is important to use proper control methods. In this paper, we will analyze a midterm control (one particular type of the pedagogical control) as an important indicator of student rating and the quality of the entire educational process as a whole, and which is one of the important factors of the formation of technical competencies.

Currently, this topic has not only not exhausted itself, but has acquired even greater relevance in connection with the transition to training technology, designed to ensure the fundamental and practical preparation of future technical bachelors.

Materials and Research Methods
Three main aspects are identified in the quality of education problem: the quality of the conditions (information and educational environment) of the activity process (educational, research, management) and the result (the formation of the technical competencies of the students, the final preparation: knowledge, skills).
Theoretical Analysis
At the same time, technical competencies (TC) are of considerable interest as technical readiness and the ability of a student or specialist to carry out tasks and responsibilities not only in everyday activities, but also as a combination of certain personality qualities with a high level of technical readiness for professional work for effective interaction with teachers and future colleagues. Technical competencies (TC) must be determined not only through a certain amount of knowledge and skills, but also through the experience of pre-professional activity, since the preparation of students of technical specialties for future activities begins outside of interaction with the objects of professional activity, and therefore the determining role here circumstances and the content of the training play. The specificity of technical competencies is that they are formed through a set of specific actions of the teacher, which are deployed through the appropriate methodological system for managing students' educational activities. Such a system can be implemented at several levels (Figure 1):

- Methodological: the ultimate goals of teaching technical bachelors at the discipline level are defined, a system of factors determining the content of training with an orientation to the subject of professional activity through generalized professional tasks, requirements for the formation of technical competencies of a future specialist (training goals) is determined;
- Technological: the teaching material was structured as the basis and prerequisites for the development of technical competencies, the course programs were developed and syllabuses were created in the areas of training, the following were determined: 1) principles for constructing the educational and methodological support of the course, 2) criteria for the quality of knowledge, 3) criteria for assessing the results of educational activities students, 4) criteria for the formation of technical competencies, 5) specific ways of managing educational activities for the formation of technical competencies (activities training, activity teaching syllabus);
- Operational: a description of the learning process as a solution to didactic problems with an orientation toward teaching and learning activities. At this level, private methods are used for conducting various types of classes, methods and means of current and mid-term pedagogical control, a system of teaching aids and manuals for the discipline, graphic design tasks and other didactic materials using innovative teaching technologies (learning environment and description of the results training on the formation of technical competencies).

As in any educational technology, three main aspects are identified in the quality of education problem: the quality of the conditions (information and educational environment) of the activity process (educational, research, managerial) and the result (the formation of the technical competencies of the students, the final preparation: knowledge, skills). In this study, our efforts were aimed at creating and implementing in the educational process of the university conditions for the mutual adaptation of the student and the learning environment - the infosphere. Filling the learning environment with specific subject content is one of the most important tasks of educators. In
In this regard, the mandatory elements of the midterm control in physics were introduced:

- Midterm control should provide the optimal accumulation of each student’s grades based on current grades received by students in the classroom for all types of work;
- Midterm control should involve evaluation of the results of students’ learning activities based on the material of theoretical study and so on).

Under the new conditions of increasing the volume and strengthening the role of students’ independent work in the educational process, only methodologically structured information can be accepted by students and acquired at the proper level and converted into competencies. What is sometimes called the student’s independent work on the study of theoretical material is largely formalism: a student can read the text on his own, write down formulas, but hardly understand and learn how to work with this material, making it “his”. For a systematic assimilation of material, a student (even if there is a great desire) needs months of work, and only a qualified teacher who is familiar with the psychological characteristics of educational activities and knows the teaching methodology can help the student save time by helping him to form not only knowledge, skills, abilities and experience (KSQE) discipline, but also contribute to the formation of technical competencies in the process of independent work, so necessary for him in the further development of the profession.

Pedagogical control carries out three main interrelated functions: diagnostic, training and educational. The diagnostic function is associated with the identification of the level of knowledge, skills, abilities and experience assessment of student ratings. The learning function of control is manifested in the intensification of work on the assimilation of educational material. Educational - the presence of a control system disciplines, organizes and directs the activities of students, helps to identify gaps in knowledge and to eliminate these gaps (in subsequent work), the desire of students to develop their abilities. In the educational process, all three functions are closely interconnected and intertwined, but in various forms of control one of them can prevail over the others. So, in practical and laboratory classes, by the protection of computational and graphic works (CGW), the training function plays the main role: various opinions are expressed, leading questions are asked, errors are discussed, the wording of laws and concepts are clarified. At the same time, there are diagnostic (in each lesson, the student receives an appropriate assessment) and upbringing (oral speech develops, pedagogical communication is formed) functions. A written survey on selected topics of the course (mini tests) and colloquiums performs primarily a diagnostic function. They allow you to document the level of assimilation of the material, but require a lot of time from the teacher. A skillful combination of different types and forms of pedagogical control is an indicator of the quality of the educational process at the university and one of the important indicators of the teacher’s pedagogical qualifications.

In the training technology we are considering, we have identified three types of control: current, midterm and final. As said before, in this paper, we will discuss midterm control as an important indicator of student rating and the quality of the entire educational process as a whole, and which is one of the important indicators of the formation of the level of technical competencies.

The educational process is a very complex dynamic system, the indicators of which require multidimensional characteristics. In this regard, it is necessary to develop criteria that would make it possible to unambiguously evaluate learning outcomes.

When developing the border control structure, we proceeded from two main points:
- Midterm control should involve evaluation of the results of students' learning activities based on the material of the discipline based on current grades received by students in the classroom for all types of work;
- Midterm control should provide the optimal accumulation of each student's grades.

In this regard, the mandatory elements of the midterm control in physics were introduced:
A generalized assessment of the activity in the practical lesson (preparation for the lesson, activity in the lesson, the results of mini-tests (written survey));
- Timeliness of delivery and the result of the protection of CGW;
- Timely execution of laboratory work (on schedule) and the result of protection;
- The result of the colloquium (degree of development of theoretical material and practical skills).

In determining the student rating based on the results of the midterm control, the absence of at least one positive assessment of the four indicated means an unsatisfactory assessment (non-certification) of the midterm control. Unfortunately, practice shows that a significant percentage of students are not certified for this reason.

**Results and Discussion**

To monitor the quality of training at the discipline level (using the example of physics), we have created scientifically sound methods and technologies for conducting various types of classes and assessing the effectiveness of educational activities, control tasks for all types of control. So, at this stage of the work, we determined the content and structure of the complexity level of the combined tasks for the colloquium. At the same time, we proceeded from the requirements of comprehensiveness (coverage of all sides of significant content and the necessary levels of assimilation), validity (the suitability of the task, that is, the ability to qualitatively measure what it is intended for), bringing the curriculum requirements into account as training goals and control questions, objectivity (a criterion in which reliability, accuracy, uniformity in content and variability in the form of the presentation of questions are combined). Based on the developed criteria, information and methodological support for pedagogical control was created.

So, the tasks of midterm control (colloquium) include questions that identify KSAE:
- Knowledge of a specific material (terms, formulas, concepts of physical quantities);
- Skills (the ability to carry out the transfer of knowledge, to see the relationship between various phenomena and laws);
- Abilities in applying knowledge in practice when solving problems;
- Experience of activity (to see the relationship of physical laws with the practice of life and future professional activity).

The proposed structure of the task determines its form - combined type tasks in which there are questions of the test nature of closed and open types, simple tasks that do not require complex calculations, but have physical meaning (allow you to identify the depth of understanding of the material, its relationship with the phenomenon in the field of energy and telecommunications).

We carried out experimental and pedagogical work on the basis of the educational technology under consideration. In pedagogy of the concept, the success of training is not limited to assessing the mastery of KSAE, but also includes the degree of formation of personal qualities. As an individual criterion for the overall success of a particular student, we propose using a value equal to the ratio of the total rating of this student to its maximum possible value at the moment. The specified criterion, firstly, fully satisfies the above requirements, and secondly, although it does not exhaust all aspects of the student’s characteristics, it is quite informative, as it relies on objective diagnostic methods during all kinds of current, mid-term and final control, the results of which are somehow reflected in the examination assessment. This criterion can serve as a fairly reliable indicator of the success of an individual student. Dividing the range of possible values (from 0.4 to 1.0) into four equal intervals, we get four groups of students whose performance in the range from 0.40 to 0.53 corresponds to critical, from 0.54 to 0.68 - satisfactory, from 0.69 to 0.84 - good, and in the range from 0.85 to 1.00 - excellent levels of learning success.

Table 1 shows the distribution of students of the experimental group by the levels of TC and the success of training.

<table>
<thead>
<tr>
<th>Learning success levels</th>
<th>Technical competencies levels</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
<td>medium</td>
</tr>
<tr>
<td>Critical</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>7</td>
<td>26</td>
</tr>
<tr>
<td>Good</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>A great</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total:</td>
<td>17</td>
<td>40</td>
</tr>
</tbody>
</table>

The results obtained by measuring TC confirmed our assumption that a specially organized teaching methodology in junior courses reveals KSAE and personal qualities and affects the formation of students’ TC. Our analysis led us to the conclusion that a special purposeful work is necessary in the conditions of the university on the formation of TC.

An analysis of the results of passing the final control shows that the level of students’ knowledge has increased due to the use of the information-training environment to form the technical competencies of the future specialist.
Based on methodological principles, we believed that conducting a midterm control, successfully passing the final control and developing the technical competencies of a future specialist are closely interconnected and mutually affect each other.

**Conclusions**

The information sphere developed by us for the formation of technical competencies has shown not only positive dynamics in the quality of training, but also in the levels of formation of technical competencies. Thus, we are talking about some aspects of improving the technology of training future specialists in the natural sciences, which, most likely, do not exhaust the entire problem of the transition to teaching technologies in undergraduate and oriented to the formation of technical competencies.

The search in this direction will continue, in particular, it seems to us expedient to continue to develop complex individual tasks on the basis of interdisciplinary relations with the disciplines associated with the acquisition of a future profession.

**References**


