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## Differentiated approach to learning in higher education

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### Abstract

The relevance of this work is determined by the fact that due to the increasing demands for professional development of specialists it is necessary to apply such approaches to teaching so that students of all learning levels could fully understand the material. In order to create optimal learning conditions for students the use of a differentiated approach to the educational process is presented in the paper. For its realization the introduction of level differentiation and differentiated module-rating system was suggested.

In this paper we define the conditions for the implementation of level differentiation, describe the developed training complex containing multilevel tasks, variants of control tests with a choice of difficulty levels. To assist the students to choose the difficulty level a web application was designed. Differentiated module-rating system is a modification of the rating system. It is distinguished by the method of counting ranking: at the end of the semester the student has a range of individual private ratings considered in the exam. Differentiated module-rating system allows them to get an idea of the level of learning the material under study and make the necessary adjustments.

The introduction of a differentiated approach into the educational process helps to individualize the learning process of students, contributes to a more lasting and deeper acquiring of knowledge, the formation of positive motivation to learning, creation of a comfortable learning environment, building students' self-esteem and making them more autonomous.

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### 1. Introduction

In modern society the requirements to professional development increase, which leads to the increase in the volume and complexity of the studied material content of programs in various disciplines. The development of educational standards is mandatory for all students, but according to their abilities, level of training, the pace of work they are very different from each other. Particularly noticeable are the differences in teaching non-core subjects, such

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as Mathematics given to the humanitarian students. For some of them it is difficult to master even basic level, others can learn Mathematics deeply, which provides great opportunities for professional growth.

Hence the need for such an organization of the educational process, which would take into account the differences between the students and create optimal conditions for their effective learning activities (Tomlinson, 1999). One way out of this problem is to construct the learning process based on a differentiated approach. For effective implementation of this approach we proposed two directions: the use of level differentiation in the learning process and the introduction of differentiated module-rating system.

## 2. Level differentiation

In school didactics we distinguish between two types of differentiation: level and profile. In higher education only level differentiation may be used, since the students have already chosen their specialty.

The factor determining the level of differentiation in university didactics is the degree of preparation of the student. On that basis they master the material of greater complexity. In higher school didactics there is a problem in level differentiation. It is due to the fact that for each specialty requirements for learning are different, as determined by the specifics of the future profession.

At the Department of Mathematics of the Siberian State Medical University we attempted to implement the level differentiation for the specialty "Clinical Psychology" and created a training complex, based on a differentiated approach. For the effective implementation of the level differentiation it is necessary to meet a series of important conditions:

- the training complex should contain a system of multi-level tasks;
- Students should be able to choose the level of complexity of the tasks;
- levels of complexity of tasks and criteria for the learning results should be explained to students.

A system of multi-level tasks is an important didactic requirement, since it provides an opportunity to implement a level differentiation. We've created a bank of 1500 tasks, composed of resources of different difficulty level on all topics of the course.

The objects of the resource bank are graphic files containing mathematical tasks for the specialty "Clinical psychology". The tasks gathered in the resource bank cover a wide range of topics for the course "Mathematics". This allows you to use it for teaching mathematics not only to the psychology students, but also students of other Humanities.

Within each topic, the tasks were differentiated by difficulty level, which we determined by the number of mathematical operations or phases of solutions required. Difficulty level was considered as an objective characteristic, reflecting the probability of a task solution by the student. It was determined by the number and type of the mental operations necessary for its solution (Naymushina, 2010).

During practical classes students are offered tasks of various difficulty levels (from simple to complex). Doing the tasks as well as at home and independent work students have the opportunity to get acquainted with the tasks of different complexity.

A further condition of the level differentiation is the student's ability to select the level of difficulty of the tasks of the various types. To ensure this any variant of work must include multilevel tasks. This can be accomplished in several ways:

- *Without a fixed difficulty level* – the variant is composed of tasks of varying complexity without level indication, the total score is determined by summing. In this way, the difficulty of the task influences the maximum number of points that a student can get. This method was used in homework, individual works and a number of independent works.
- *With a fixed difficulty level*- the variant consists of three parts of different levels of difficulty. Before doing the task the student should adequately assess their knowledge, choose the difficulty level (basic, advanced, or high) and perform tasks only at this level. This method was used in the compilation of individual works.
- *Mixed model* – for each topic the student is offered the tasks of three difficulty levels. The students can choose the level of difficulty of each of the tasks given depending on how well they mastered the topic. This method of differentiation was used in all of the control tests.

In all cases, the student knows in advance the number of points he receives for successful completion of a specific task.

The use of different methods of differentiation in a course of Mathematics we consider justified. The majority of students (especially freshmen) have problems with the choice of the difficulty level of the task. Some of them do not believe in themselves and choose simpler tasks. Other more self confident students on the contrary choose more complex tasks of incredibly high level. So during independent work it is reasonable at first not to fix the level of difficulty and then to offer the option with the fixed difficulty level or mixed in order to develop student's adequate self-esteem.

From our point of view, the most promising is a mixed method. It allows each student to show his abilities as much as possible, to try to solve more complex tasks if any section is learnt at a good level. The survey showed that mixed method of differentiation was preferred by the majority of students (71%), the least convenient was a fixed difficulty level. According to the students the test papers with a choice of difficulty levels for each task better take into account the "peculiarities of mindset and the amount of knowledge."

The disadvantage noted by the survey was the problem of choosing the difficulty level of the task. So, students tried to solve several tasks during the test in order to understand what level was appropriate for them.

To assist students in choosing the difficulty level of the task we created web-application simulator "Getting ready for the control test," downloaded on the website of SSMU. This application is designed to generate variants of control tests, credit assignments and the practical part of the examination cards. Presented variants are as close as possible to the content and difficulty level to those that the student will have to solve on the control test, credit or exam.

When working with the simulator, students have the opportunity to choose from the list of tests, the level of complexity of the entire work or each task separately. After that, the application generates an exemplary control work. Students can view the job, try to do it, consult with the answers or check the solution (Earl, 2003).

According to the results of the survey 80% of students used the simulator to prepare for both the control test and the exam. According to the students, the simulator helps them in exploring missed topics and makes it possible to assess the level of their knowledge, to carry out reflection, to establish an adequate self-esteem.

### **3. Differentiated module-rating system**

Differentiated module-rating system is a modification of the rating system of knowledge control. The peculiarity of this system is that as a result the student gets not the only unit but the range of units per semester. The semester is divided into thematic modules corresponding to the main topics studied. Each module consists of blocks containing 1-3 classes.

For each block the following activities are estimated: homework; independent work in the classroom; individual work and control tests. Control work and individual work is carried out at the end of the study of the module and contain tasks belonging to different blocks. Points for these tasks are taken into account when calculating the individual rating for each block. By the end of the semester each student knew his assessment for all the studied topics.

When conducting the examination one must consider the following:

- If during the semester some topics have not been learned at a sufficient level they should be worked out in preparation for the exam;
- The student must have the choice of the evaluation which he claims considering his level of training and individual rating;
- Examination cards should take into account the individual rating of the student and the requested assessment.

To do this, you need to change the procedure of the examination. Students should be able to choose the evaluation claimed. Depending on the match between the requested evaluation and an individual rating of each student the practical part of the examination of the card is formed and therefore - individual cards which is a very time consuming process.

For its optimization a computer program "Examiner Assistant" was developed which contains a large bank of tasks for each topic differentiated by difficulty level. This allows you to create exam cards so that even two students sitting

next will not get the similar tasks. The application is built on the basis of the book Microsoft Excel and produces html-files with ready-made tasks.

Thus, during the exam the elements of traditional control are combined with information technology. The computer is used only for creating individual cards and the exam procedure goes in the traditional form as a student and teacher talk.

The "assistant examiner" can also be used during the credit. The difference is that as credit is not differentiated there is no necessity to consider the assessment. Formative assessment during the semester is conducted the same way. The student is not getting the task on any unit if his rating is 75% or higher. If the rating of the student is less than 75% he is assigned a mandatory difficulty level. The introduction of differentiated module-rating system is complicated by a heavy workload for teachers in creating bank of tasks and the need to assess the difficulty level of the tasks because the differentiation of basic tasks is the personal experience of the teacher.

After the exam the students were asked about the content of the program and the feasibility of using such programs to carry out tests and examinations in mathematics and other subjects. All the students rated the content as excellent or good, as one of the advantages of the program was the opportunity to choose the difficulty level of the tasks. The usage of this program at the examinations and tests in Mathematics, as well as other Science subjects, but not Humanities was found appropriate by 71% of students, 10% of respondents did not answer.

Against the use of such a program were 19% of the students. According to one of them, "the examination lost the element of fortune and waiting for a miracle." But the exam should not be a lottery; it is the result of long work of students in the semester. It is no secret that for some of the students Math has been difficult. Throughout the semester, they receive low scores for different types of work, repeatedly rewrite the control tests, but in the end, manage to understand the studied subjects ("quantity turns into quality"). If the student by the exam time does not understand the studied subjects, for most of the topics gets "satisfactory" and claims to be "excellent" this procedure of not giving him a chance to get the requested assessment.

Another advantage of the proposed module-rating system is that it allows you to fulfill the function of the process management. Constant monitoring enables students and teachers to assess the level of achievement of modules and blocks hence providing feedback. This allows you to make the necessary adjustments in educational process, to take into account the nature of the errors and eliminate them. It gives students the opportunity to better prepare for the exam and to raise awareness on topics not sufficiently studied during the semester. Teachers obtain the ability to identify problem issues and improve the methodology for their presentation.

#### 4. Summary

The application of level differentiation and module-rating system allows one to fully realize the individual approach to learning. Throughout the semester students have the opportunities to be trained according to individual educational trajectory: doing the independent work and control tests depending on their training and the level of mastering a particular topic they can choose the appropriate difficulty level of tasks.

The usage of a differentiated approach to learning in higher education:

- allows to create a psychologically comfortable learning environment for students - they learn the material according to their difficulty level;
- contributes to the formation of positive motivation to learn Mathematics as students gain greater freedom of action;
- gives an opportunity to assess their own strength and to choose for themselves the level that corresponds to the needs and abilities of students at the moment, and eventually move to a higher level;
- contributes to the development of independence and responsibility for their results, the formation of self-esteem.

Thus, the introduction of a differentiated approach into the educational process contributes not only to a more lasting and deeper assimilation of knowledge, but also the development of a number of personal qualities of the students.

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