

# Individualisation and Differentiation through Individual Work in Teaching Mathematical Disciplines in Higher Education

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**Abstract:** The article discusses some options for applying a differentiated approach in teaching university students. It contains models of tasks for individual work, which take into account students' level of mathematical knowledge.

**Keywords:** *differentiated approach, teaching in higher education, individual work*

**Introduction.** Over the last two millennia society has constantly been challenging education with some new problems to be solved. Today's technological society is no exception in this respect. It poses new issues and problems to education, including higher education as well, on both national and world scale. Some of these issues concern promoting students' active involvement in the process of education, helping them acquire new knowledge and skills to put this knowledge to practice, as well as developing habits for self-study and individual work in implementing the newest and more effective methods, means and forms of education.

Some of the main values of the new information society are individuality, creativity and independent thinking. These qualities could be formed in young generation by improving the organization of study process, more specifically its methodological aspect, in higher education institutions.

Therefore we think that the need to create educational environment which stimulates students to reach their personal potential is of crucial importance nowadays.

The present study aims to share my experience in managing university students' individual work, which lends itself to using differentiated approach in teaching mathematical disciplines to students of different areas of study (specialities).

**Discussion.** At present, tuition in higher education institutions is provided to students who are divided into groups depending on their speciality. However, these groups of students are not homogenous in terms of their:

- level of mathematical knowledge and skills developed in the secondary school (the amount and depth of knowledge, and the ability to use this knowledge);
- level of cognitive and practical independence and activeness;
- motivation to study;
- age;
- determination and will to succeed, etc.

In addition, psychological studies show that different people display enormous individual differences in the way they acquire, process, store and reproduce knowledge [1, c.90-91]. Therefore in pedagogy it is of vital importance to take into account these differences, rather than ignoring them, which in turn necessitates adapting the teaching to students' abilities and needs, i.d. individualisation of teaching. Individualisation should not be understood as simplifying teaching to the level of students' abilities (especially when students have learning

difficulties or lag behind their peers); it should rather be seen as creating opportunities for improving the quality of learning.

Students' individual work is a means for personal stimulation of each student to develop their capacity and reach their potential in terms of mathematical development.

Differentiated teaching presupposes taking into account each student's individual traits and study potential. The term *differentiation* derives from the Latin word *differēntia* (difference) and the verb *differe* (to differ) which means differentiating, a different attitude or behaviour towards some object.

In Bulgarian higher education there are three main types of instruction in mathematical disciplines: lecture, seminar and individual work. The latter has two sub-types: individual work under the lecturer's supervision, and students' individual work.

The pace and the level of difficulty in seminars are usually orientated towards the average student. The students who find it difficult to grasp and understand the study material as well as the students who have above the average knowledge and skills in Mathematics should be supported through individual work in its two sub-types.

For the purposes of this differentiated instruction it is necessary to devise personalised tasks for individual work which take into account students' level of mathematical knowledge and skills. These tasks fall into two groups:

- Tasks for individual work which aim at filling gaps in students' knowledge and skills;
- Tasks for individual work aimed at building on students' knowledge and honing their skills and habits, and as a result, provoking their interest in learning more.

Another way of grouping tasks for individual work is to organise them according to different indicators, such as: length, difficulty, degree to which students can solve them on their own, or a combination of indicators. One example of such grouping of tasks is presented in my article [2], where a system of tasks are arranged according to their difficulty in studying the topic of *Sets and operations with sets*.

In order to guarantee the success of individual work assigned to students it is necessary for the tutor to identify students' learning styles, as well as his or her own interaction style in working with students.

A good way to implement an individual approach in teaching university students is to take into consideration

students' personal preferences, abilities and determination to achieve their goals.

Depending on the level of students' knowledge, skills and will the tutor can choose the right approach which will guarantee the effectiveness of the assigned individual work in the following way:

- When students' knowledge, skills and will are at a low level, the tutor takes the leading role in education;
- When students' knowledge and skills are at a low level, but they have strong will, the tutor can provide constant assistance and support;
- When students' knowledge and skills are at a high level, but they don't have strong will, the tutor has to constantly motivate the students in an appropriate way;
- When students' knowledge and skills are at a high level and they have strong will, the tutor has to provide appropriate environment for self-education and to stimulate students' motivation and sense of achievement.

Such tasks for individual work are effective if they are used in combination with consistent continuous assessment or with the students' portfolio. Over the last 5 years I have been using the students' portfolio in my work with students [3], [4]. The results of the pedagogical experiment I have conducted are discussed in my publication [3]. Two of the conclusions will be mentioned here:

- Students' portfolio is an effective instrument for improving quality in the process of teaching Mathematics;
- The results of the survey show that the students are convinced that the efforts they make in doing the tasks assigned for individual work are beneficial to their education and are taken into consideration in their continuous assessment evaluation.

Differentiation in teaching mathematical disciplines can be applied to teaching in other specialities in higher education.

In teaching students who major in Economics the discipline of Mathematical analysis, the tutor can assign academic papers to be written by students as individual work - the so-called students' individual work, which involves tasks illustrating the application of mathematical tools in economics. In teaching mathematical disciplines to students from the Natural sciences faculty the academic paper assignments can include tasks which emphasize the skills for modeling natural processes by means of appropriate mathematical tools.

It has to be mentioned that there are a number of problems arising when using differentiation in education. Some of these problems are:

- ✓ Diagnostic - in order for differentiation to be effective, the tutor has to have diagnostic competence. The limited time for contact tuition in seminars does not allow for determining students' personal traits on the basis of observations alone (which are the easiest way to study individual differences);
- ✓ Didactic - the vast amount of study material in each discipline thwarts its didactic processing;
- ✓ Organisational - the preparation, realisation and management of differentiated tuition makes is particularly time-consuming for the tutor;
- ✓ Motivational - a lot of students lack motivation for achieving results.

### 3. Conclusion

An appropriate combination of tutor's expertise and students' enthusiasm can lead to positive results in applying a differentiated approach in teaching mathematical disciplines. This approach greatly contributes to developing students' creativity and cognitive autonomy.

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**Индивидуализация и дифференциация обучения в математических дисциплин в высшей школе посредством самостоятельной работе**

**L. M. Karakasheva**

**Аннотация.** В этой статье я обсудила некоторые возможности для применения дифференцированного подхода в обучении студентов.

**Ключевые слова:** дифференцированный подход, обучение в высшей школе, самостоятельная работа