

## THE MANAGEMENT OF EDUCATIONAL PROCESSES OF MATHEMATICS

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**Abstract.** The management of educational processes of mathematics in higher educational establishments could be divided into two parts – the formation of the educational program and the organization of the study processes. On the basis of the results of the questionnaire distributed to the students and the observations of the lecturers in the following article have been discussed three factors that influence the management of educational processes (the background knowledge of the students, the style of learning and the peculiarities of the age differences). The background knowledge of the students and the style of learning are relevant to the full time students because they perceive learning as something that goes without saying. In the following article there have been discussed the peculiarities of adult learning that are characteristic of part time students and the students of masters programs.

**Key words:** mathematics, the study of mathematics in higher educational establishments, the style of learning, adult education, educational processes.

### Introduction

Science (mathematics, chemistry and physics) is the basis of engineering; therefore the studies of mathematics are included in all the programs of higher academical (and professional) studies.

The management of educational processes of mathematics in higher educational establishments could be divided into two parts:

- the formation of the educational program (the curricula, the amount and the competences acquired);
- the organization of the study processes.

The study processes are influenced by several called internal factors:

- the relevant differences between students (knowledge, skills);
- different age groups (especially in part time and masters programs);
- different learning styles;
- the lack of motivation of students;
- the large groups of students that does not allow the use different methods of teaching;
- the limited amount of actual lectures in technical higher educational institutions of science.

The mentioned factors influence the study programs, and in order to achieve the aims and goals different methods of teaching should be used.

### Methods of research

The research was done in three ways:

- the assessment of the previous knowledge of mathematics (based on the level received in the state examinations when finishing the secondary school);
- the dominant learning styles;
- the age groups.

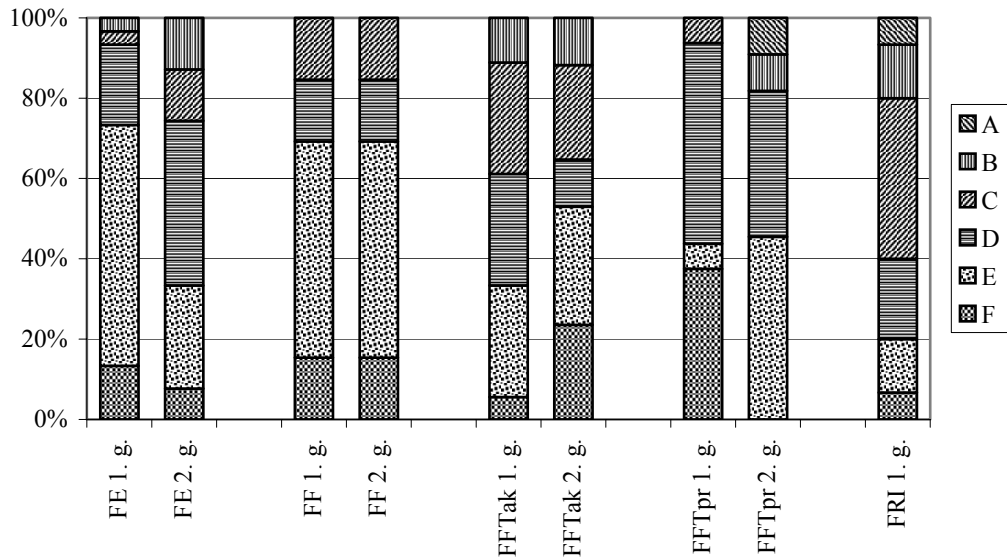
The previous knowledge in mathematics has been determined by spreading a questionnaire (two years) to the students (full time, first year) of the Latvia University of Agriculture faculties – Faculty of Food Technology (FFT), Forest Faculty (FF), Faculty of Rural Engineering (FRE) and Faculty of Engineering (FE).

In 2005/2006 the mentioned students (first year, second year, together 137 students) filled out the test created to discover their learning styles.

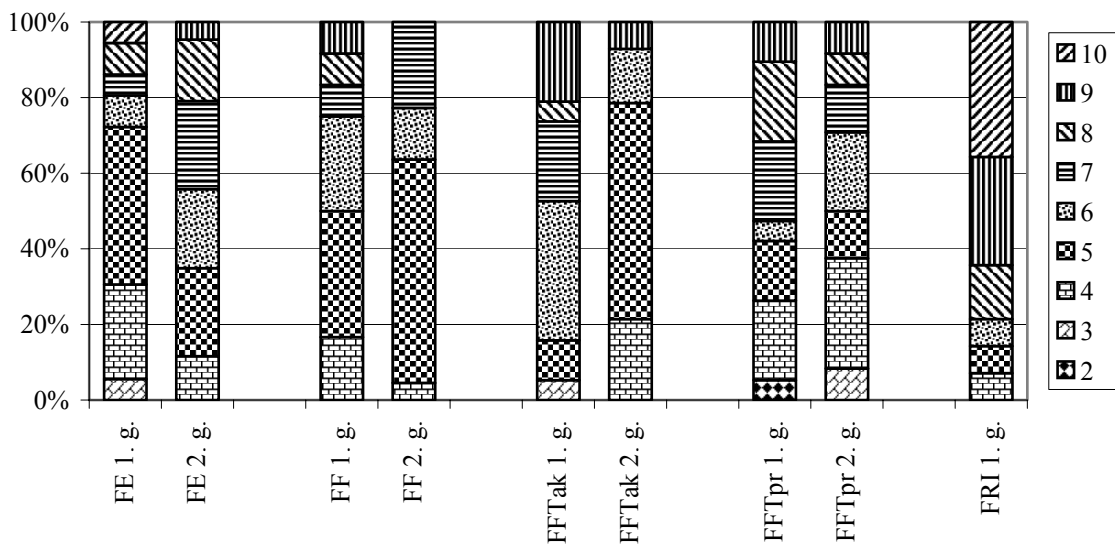
The statistical analysis of the results showed the dominant learning styles of the students. The groups of students have not been purposefully created therefore the results cannot be applied to all student groups.

**Assessment of the previous knowledge of mathematics**

The previous knowledge of mathematics of the students of the Latvia University of Agriculture characterizes the level of the State examinations (Figure 1) or the State tests (Figure 2) when finishing the secondary school.



**Fig. 1. Level in the State examination of mathematics**



**Fig. 2. Level in the test of mathematics**

Several students when finishing the secondary school took both the examination and the test. The findings of the research confirm the already known problem – the previous knowledge of mathematics is low.

After analyzing the results of last two years, it can be concluded that the overall competence in mathematics has not increased. For example, the level of mathematics of the first year students of Faculty of Engineering is higher than in the previous year however the level of the first year students of Food Technology is noticeably lower. The level of Forest Faculty students is almost the same as the previous year; however, we are delighted that the knowledge of the students of Food Technology is a little bit better.

A relatively low number of students in the secondary schools choose the science subjects because they are quite difficult. That is the reason why so many students of higher educational establishments possess unsatisfactory previous knowledge of science, mathematics, technical thinking, reasoning faculties and world knowledge. Therefore, there is necessity, when providing the students with new theoretical material not only stick to the provision of the important definitions, formulations of theorems and their application but also provide the explanations about the general conceptions that should have been learned in the secondary school. This is a very problematic area because of the lack of actual lectures. When organizing the practical sessions the lecturers have to choose the best and the most suitable methods. After analyzing the experience of lecturers it can be said that quite often they have to use the method of analogical reasoning faculty based on the process of fundamental thinking of human (in order to remember analogies and later on apply them in the solutions of problematic situations) (Zimmer, 2005).

The priority for the Ministry of Education and Science has been set – the subjects of science. The improvement can be expected already after three years because the ministry hopes that after that time when finishing the secondary school all the students will take the State examination in mathematics. At the same time, a new program of secondary education in mathematics is being prepared. The program aims are as follows: to use the knowledge of mathematics in understanding and learning other subjects (not just as the object of study). There is no certain answer, which style of learning of mathematics is the most beneficial and which allows getting the most out of studying (Kangro, 2005). The acquired theoretical knowledge helps the students to develop their cognitive skills – from the abstract to the specific, from the general to the particular. The interdisciplinary approach enables to see the coherence and relations between the objects.

### The dominant learning styles

The management of educational processes of mathematics is also influenced by the psychological factors of students (including the styles of learning: activist, thinker, theoretician and pragmatic).

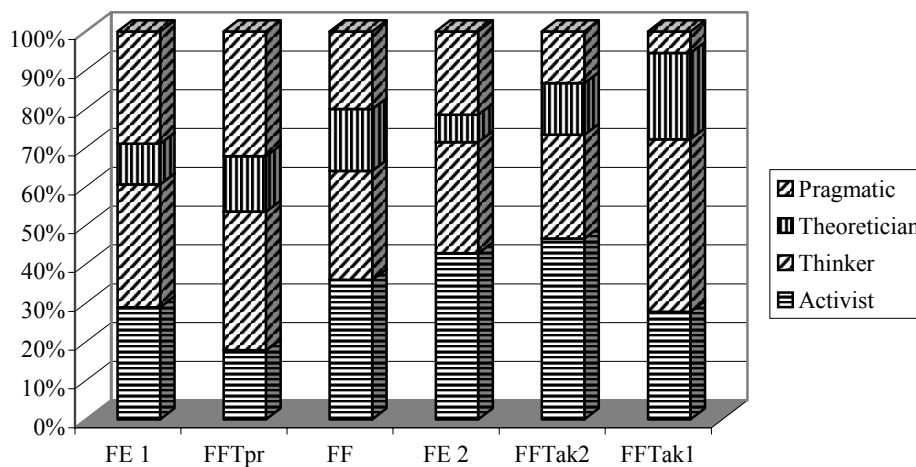


Fig. 3. The dominant learning styles

The results (Figure 3) show that there are students with different learning styles. The dominant learning styles in the groups are not equable. It is interesting that the pragmatic learning style (which characterizes good technical orientation) was found in only one student of Food Technology and at the same time it is present in 30% of Faculty of Engineering first year students. It has to be said that the second year students of FE are not so technically oriented (only 24%) but 43% of the students possess the active learning style.

The students of professional studies of Food Technology are mostly thinkers (36%) and unlike the students of academic studies (FFTak) are technically oriented (32%). The Forest Faculty students can be characterized as activists because 36% of them possess the active learning style. The first year students of FE are not only activists (30%) but also thinkers (33%) but only 11% of students possess the theoretical learning style.

After analyzing the relevant literature and the experience of lecturers in the work with the students it is possible to determine which the most effective methods are and which do not give the desired results. It can be seen in Table 1.

Table 1

### The style of learning

The style	The most effective if:	The least effective if:
Activist	The part of the work is new; there are involved other people; they can work by themselves; they can show themselves, there are discussions etc.; the task is difficult and it demands to search for the answer	There is no active participation and you just have to listen, read, observe and you have to work alone; have to prepare beforehand or analyze afterwards; the actions should be repeated; there are instructions and they cannot work by themselves
Thinker	There are no strict deadlines and you can work in your own rapidity; there is time to think and analyze; there is time for the lookup; careful analysis is needed; the preparation is not rushed	Have to be in the centre of attention; the work is started without planning and preparation; an immediate decision or resolution is demanded; there are strict instructions; there is not enough time to do the task
Theoretician	The experience is a part of entirety of systems or theories; there is intellectual performance; there are difficult situations demand participation and understanding; you can think over and make sure that it is logical; you can read or hear about the logical arguments	You are thrown into situations without systems or aims; they are expected to be emotional; the ideas are not based on facts and they are not realistic; if they feel different from others who are involved in the process; there are a lot of ideas without logical basis
Pragmatic	The action is inwrought with the situation or the problem; there is a result from the learning; there are practical actions; an expert or an authority explains how to do things; you acquire skills that can be used immediately	The result is not connected with the situation or the problem; the course is not realistic or practical; there are no clear instructions; the findings cannot be applied because of the external factors; there is no visible acquirement

After analyzing the strong and weak sides of the learning styles it is possible to determine their influence on the management of educational processes.

Because of the lack of time, the dominant method in the lectures of mathematics is *the lecture*. If we look at the anticipated results of the students (according to their learning style) for the theoretical material has to be found a practical application and only then the effectiveness will increase. The methods used in the practical sessions have to be different. As the experience shows, the most effective is the group work and it not only enables to learn mathematics but also helps in acquiring some other social competences. When dividing the students into groups the lecturer has to make sure that in a group there are students with different learning styles.

When organizing the practical sessions of mathematics the following situation can be made *student ↔ student* (keeping in mind two different principles):

- according to their previous knowledge – where the smarter students work together with those of unsatisfactory knowledge (Judrupa, Judrups, 2005);
- according to their style of learning – combining the students with different styles of learning (for example: theoreticians and pragmatics, theoreticians and thinkers).

The first way could be used in organizing consultations. The second way could be more effective when used in the situations where the lecturer is able to follow this collaboration.

If the project method is used (for practical homework assignments) then the following situations could be created *student ↔ student ↔ the study material*. To make the work more efficient it is advised to put together theoreticians or thinkers with activists and pragmatics.

### Factors that influence adult-learning

The efficiency of the work is also subject to the age groups of the students. In the groups of full time studies the age group of students is quite homogenous – 19 – 23 years old students. On the contrary in the part time and master study programs the age groups are quite heterogeneous – 19 – 50 years old students.

There are differences between the management of educational processes of mathematics in the groups of full time students and the part time and Masters students. The full time students perceive the studying as something that goes without saying but the part time and Masters students have already overcome some certain obstacles (psychological and social). Grownups quite often do not have enough self-confidence therefore grownups have different needs starting from the motivation till the curricula and the methods used. The lecturer has to be able to understand each student and their needs to achieve their specific goals. Of course, the lecturer has to help to notice and formulate these goals. The part time and masters students are similar to grownups and their education in general.

The Norwegian scientist G. Ose shows several principles of how to work with grownups and how to help them acquire the required knowledge. The basis of her principles is communication – the creation of welcoming atmosphere, sharing the experiences, emotions, and the help in self-assessment. The accent is put on potentialities and perspectives.

When working with grownups the lecturer has to observe the following phases: the clarification of the level of the students; the realization of problems which occur because of unsatisfactory knowledge; the clarification and formulation of the goals; the planning of work; the analysis of results and the selection of the most appropriate methods for all students. There are five differences between the education of grownups and children: self-vision, experience, the readiness to learn, the perspective of time, and the orientation in subjects thus the following assumptions should be understood:

- when maturing people change and start independently develop themselves;
- maturity is experience and it is used as a new source;
- the social roles play a significant part in their readiness to learn;
- when maturing the time perspective changes from the later usage of the acquired knowledge to the immediate usage of the acquired knowledge. The studying is directed towards the solution of the problems (and not towards the studying of the subject).

Generally speaking there is difference in attitude from the both parties (the student, lecturer). The attitude towards the content and the process of the studies has also changed.

There are several other important nuances in the education of grownups. For example for the successful commencement of study process: belonging, aspirations, safety, identity, progress; the conditions to reach the goals: concreteness, reality, with time management, stipulated, measurable and the positive form (Smith, 2000). If the final results are divided into several realistically fulfilled parts then the students not only acquire knowledge but also regain the confidence in the acquisition of the material. If welcoming, encouraging and competent attitude is combined with the particular work of studies then it becomes possible to educate grownups at any level. There are possible four models of the organization of work (also mathematics) – characterized by the attitude of the lecturer, the students and the study material:

- ‘Giver’ – the most applied;
- ‘Development’ – the accent is on the student and the lecturer becomes like a consultant to overcome obstacles;
- ‘Dialogue’ – shared responsibility, individual approach and the consideration of subjective needs;
- ‘Faultfinder’ – the aim of the lecturer is to foster the understanding of the society and showing the ways to change it.

After analyzing the literature on the education of grownups, it can be concluded that almost all authors say that in the organization of adult-learning every detail has to be taken into account – starting with the arrangement of the room, the ability to use the board, accurate communication and ending with the choice of methods and the curricula. Strogard J. R. offers more specific plan (Figure 4) and it includes all areas – from the content of the studies till the participants of the process.

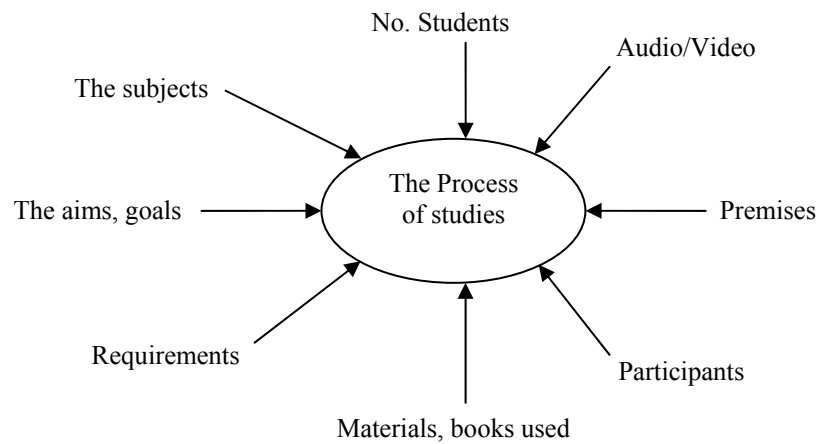


Fig. 4. Factors that influence adult-learning

### Conclusions

1. Taking into account the differences in the previous knowledge of the students, as well as their peculiarities different methods should be implemented and several courses should be differentiated.
2. In order to choose the most effective methods the goals of programs and the anticipated results should be precisely formulated. The peculiarities of the students as well as the age groups should be thoroughly analyzed.
3. In order to achieve the desired goals different methods and approaches should be used and there has to be a link with the practical usage of the material learned.

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