Liet. matem. rink, **46***, spec. nr.*, 2006, 183–190

Mathematics for business and management studies

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Abstract. This work contains the material about study process of mathematics for business and management in colleges in higher education in Lithuania. It contains clear description of the problems of evaluation strategy and ensuring studies quality. It was made the research as well as the analysis of students' questionnaire data.

Keywords: study process, mathematics, students.

Introduction

The first colleges in Lithuania were found in 2000. Nowadays there are 40 state colleges and 11 private colleges in Lithuania. Approximately 38% of all Lithuanian students study in colleges [1]. Vilnius College in Higher Education is the biggest college in Lithuania. In this College there are studying 10.168 students (according data of 2005) [2]. After choosing the Vilnius College in Higher Education the students can choose among 40 study programmes [2].

Forms and duration of studies in colleges are: full-time studies – 3 years, part-time (extramural) and evening studies – 4 years. The final stage of studies is a preparation of Diploma Paper. Students defend his/her Diploma Paper publicly demonstrating acquired professional competences. Those, having successfully completed studies, gain higher non-university education diplomas. Colleges graduates have successfully employed and are rated trusty and qualified specialists in their fields by employees.

Within 5 years of colleges lifetime the teachers of the colleges have gained lots of teaching experience. There is the Association of Mathematics Teachers of Colleges of Lithuania operating in Lithuania. In the seminars of Association there are organized discussions about the problems of teaching of mathematics in the colleges, there are held workshops to share experience, there are trying to find the ways and methods to improve the quality of mathematics subject studies as well as to solve the problems arose.

Studying and teaching mathematics in colleges

The first year students are taught higher mathematics course and statistics course.

The most of the mathematics subjects are also analyzed in the secondary schools. However, in colleges these subjects are taught more deeply and wider therefore the success of these subjects studies strongly depends on the knowledge and abilities acquired in the secondary school. The level of this knowledge must be seen from the

school marks. The students that come to study in the higher school have to expect for up-to-date teaching methods, especially applying information technologies in a teaching process. And they have not to be disappointed in that. After choosing a college, a student hopes to acquire knowledge put into practice and to get practical experience therefore there must be found more time for teaching practice in the teaching programmes.

How to prepare suitable study programmes of mathematics for business and management studies in colleges? What kind of teaching methods are the most effective and what methods students prefer – that are the questions there are still searching for answers.

Being ready for learning in the higher school does not ensure its success. Teaching is undisputed attendant at learning.

Higher mathematics as a general higher education subject is lectured in all colleges. Statistics is lectured in all colleges as a special subject. In the programmes of specialty trained by the colleges there are indicated the abilities formation of which is influenced by mathematics subject. The most crucial ability is to be able to select process and analyze the data critically.

In this work there is investigated the mathematics course programmes of business management and business administration fields of studies, there is disputed the problems of teaching process. In this work there is also analyzed the results of students' answers of the questionnaire, is searching the possibilities to improve the studies process.

Analysis of research results

In 2000 in 1st of September in Lithuania (on the basis of further education schools that had come a long way of development for its practice) were founded the first higher education schools – colleges, including Vilnius College in Higher Education.

In the college it is prepared module programmes of career education. After timetabling a standard of module – 40 hours, they got close with the university module programmes. There is certainly indicated the number of hours for students individual work in the structure of one term subject module. In the programmes it is also described the strategy of evaluation.

Grading scale at colleges in Lithuania is based on the 10-point scale. The compare of national mark and ECTS mark is shown in Table 1 [3].

In the colleges the programme of subject of mathematics is prepared according to fields of studies. In the engineering sciences studies there is 6 credits calculated for mathematics subject and 2 credits for statistics subject. In the economics, management and business administration studies there is 4 credits calculated for mathematics subject and 2 credits for statistics subject. The programmes of mathematics and statistics differ not a little in these two main fields. In this work it is investigated mathematics and statistics subjects in the management and business administration studies.

In 2003–2006 there were made the analysis of Business Management Faculty's (Vilnius College in Higher Education) study programmes as well as the analysis of mathematics and statistics subjects programmes. The opinion of the students was also investigated. The teachers also participated in the surveys.

Table 1. Comparative national marks and ECTS marks table

Mark	**Mark defined in words**	**Percent of knowledge obtained**	**Approximate ECTS equivalent**	**Definition**
10	Excellent	100%	A	
9	Very good	90–99%	A or B	
8	Good	80–89%	B or C	
7	Highly satisfactory	70–79%	C	Passed
6	Satisfactory	60–69%	D	
5	Sufficient	50–59%	E	
4	Insufficient	40–49%	F	Not passed –
3	Highly insufficient	30–39%	F	re-take possible
2	Poor	20–29%	FX	Necessary to
1	Very poor	0–19%	FX	repeat the course

In the subject studies programmes there is certainly indicated contact hours number – for lectures and trainings (practical tasks) as well as the for students individual work.

This data is based on the analysis of study programmes of Vilnius College in Higher Education (Faculty of Business Management) [4]. There is given the distribution of mathematics hours in the Fig. 1 (Vilnius College in Higher Education, Faculty of Business Management [5]). After analysis of the data we can see that in the full-time studies it is about 40% of all hours for lectures, about 15% for the training, and about 45% for individual work. In the evening studies accordingly about 20%, 15% and 65% and in the part-time (extramural) studies – 10%, 5% and 85% of all hours [5].

In the programme of business management studies among others there are indicated the following professional qualifications and the aims of studies [4]:

- ability to apply the methods of data analysis;
- to understand methods of market researches;
- ability to plan and carry out market researches;
- ability to systemize data and to prepare the survey of market researches;
- ability to prepare statistic and other reports;
- ability to understand the classification of accounting data;
- ability to select information and organize its transmission.

To follow the programme of Business Management studies [4] it is stated the purpose of mathematics subject:

1. Formation of mathematics modeling abilities.
2. Training of mathematics literacy and logical mind.

The main chapters of mathematics programme are as following: mathematical analysis (42% of all hours), linear algebra (34% of all hours), finance mathematics (18% of all hours) and application of mathematical methods (6% of all hours).

To follow the programme of Business Management studies [4], it is stated the purpose of statistics subject: analyzing of data using methods of statistics and stochastic.

The main chapters of statistics programme are as following: essential of probability theory (28% of all hours), statistical models (72% of all hours).

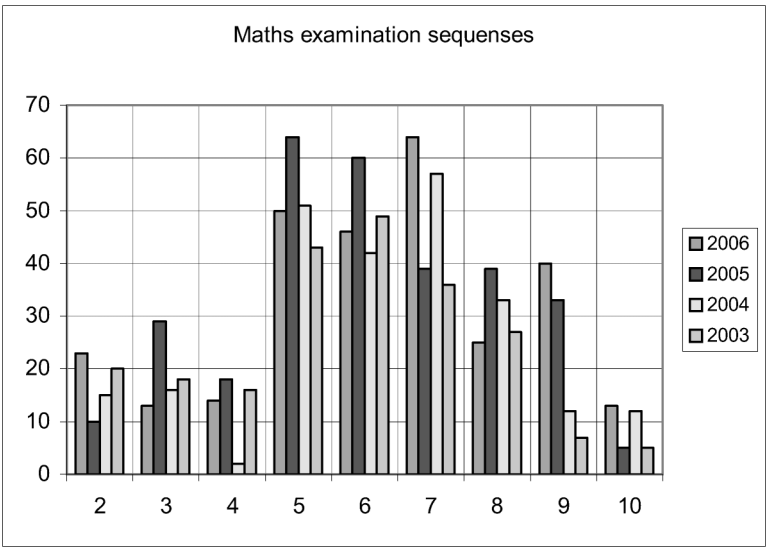

Fig. 1. Mathematics examination sequences (autumn term).

After analyzing the statistics programme one can maintain that in the full-time studies statistics subject consist of 40% of all hours for lectures, 15% for the training, and 45% for individual work [6].

Mathematics subject is studied in the first year in an autumn term, and statistics subject in the first year in a spring term. Study of mathematics subject end with examination and for the final evaluation is used accumulative mark [5]. Study of statistics subject end with credit course and for the final evaluation is used accumulative mark [6]. With reference to teaching experience one can maintain that accumulative mark benefits for weak students.

In pursuance of study quality of mathematics subject we analyzed the students' assessments of mathematics subject. Applying statistical methods in 2003–2006 it was made the analysis of mathematics subject's assessments of the 1st year autumn term students (accordingly 221, 240, 197 and 288 students) of Business Management Faculty.

The results of analysis of mathematics subject's assessments of autumn term of students of Vilnius College in Higher Education [7] are stated in the Fig. 1.

After analyzing the data one can maintain that the averages of assessments of 2003–2006 are approximately equable (~ 6.2), median does not change and equals 6 (satisfactory). It will be observed that the number of students with very good marks (excellent, very good, good) is on the increase: from 18% in 2003 to 27% in 2006. The number of students with sufficient marks is approximately the same: approx. 20%. It will be observed that the number of students with insufficient marks has a tendency to decrease: from 22% in 2003 to 17% in 2006.

After analyzing the programme of Business management studies [4] one can maintain that mathematics and statistics have coherence with other subjects of studies and the closest coherence is with the following subjects:

- microeconomics;
- macroeconomics;
- marketing researches;
- business economics;
- the essentials of finance accounting;
- sociology;
- applied computer systems.

After analyzing the data one can maintain that in Business management studies mathematics and statistics are applied in such aspects [8]:

1. Quantitative analysis (analytical approach to company's finance).
2. Models of optimization (optimum – the parameter of economic solution and operation).
3. Stochastic models.

After more detailed analysis including the students' Diploma works one can maintain that mathematical calculations, stochastic and statistics models are widely applied in Diploma works. After analyzing the Diploma works one can maintain that in all Diploma works were made financial calculations (percentages, price, expenditures, advertising budgeting and others) as well as was applied descriptive statistics (surveys, systematizing of statistical data, analysis of statistical data). Reliability calculations and sample calculations are presented in approx. 25% of Diploma works.

What ways are used in College with an eye to realize prepared programs? What kind of teaching methods use teachers and how students think about them? How teachers and students evaluate lectures, trainings (practical tasks), and individual works?

We can hypothesize that trainings, mathematical computer systems as well as individual works should be given the full marks both by teachers and by students.

On purpose to answer to all these and other questions there was carried out a research of Vilnius College in Higher Education [10].

What kind of teaching methods to your notice are the most useful to give the benefit of knowledge and what – to condition the skills? Teachers think that the most useful giving the benefit of knowledge by lecturing, working with teaching/learning package and working on computer systems. Meanwhile to perceive a subject, to condition the skills, by the teachers' opinion, the most useful are trainings or practical tasks as well as individual students' work and, undoubtedly, properly organized practically.

In following it will be analyzed results of research of students' opinion.

Students' opinion

236 students participated in the research.

First-year students finish autumn term by taking mathematics examinations. Therefore for the research were selected namely first-year students. By the first half-year students have already formed clear view how studies and teaching process are organized, how lectures and trainings go on, what is knowledge level and so on in the College.

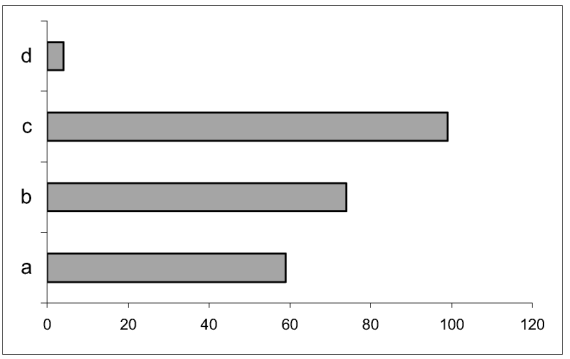

Fig. 2. Subjects that go best: a – mathematics 25%; b – arts subjects 31%; c – special subjects 42%; d – others 2%.

Making students inquiries about what subjects go best, the answers were the following (Fig. 2). The get answers prove the results of assessments of mathematics subject in 2003–2006.

It is true to think that studies of mathematics do not expose to problems for quarter of the inquired students, therefore the most part – even three-quarters – needs for additional motivation, interest or even positive attitude towards this subject learning to study mathematics. Therefore it is very important how attractive, informative and interesting are mathematics teaching methods and ways the teacher uses.

Analyzing students' answers of the questionnaire that are related to evaluation marks of teaching forms as well as methods, statistical data-processing methods were applied.

Based above stated data-processing methods, it was systematized students answers to the question *What kind of teaching forms You prefer the most (please evaluate each position by marks from 1 to 10).*

Data shows that students evaluate by full mark the work with computer systems and practices; practical task approaches, and the lectures are evaluated by mark of 7.12. Work with teaching/learning packages was only evaluated by mark of 6.29, and this gives thought about the preparation level of teaching/learning packages and does this accord with the needs of students, or maybe not sufficient readiness to use them [10].

By surprise the individual work has low evaluation knowing that according to College studies programmes hours for individual work totaled average 45% of hours for subject studies. It is obviously that teachers have to pay much more attention to students' individual work during the studies. I think it is expedient to prepare the individual work tasks and evaluation strategy.

A very low mark of seminars of 4.2 – it is not very surprising because first-year students practically have no seminars. The most of students have precisely indicated in their answers.

Furthermore the research results allow to maintain that application of computer systems during mathematics lectures as well as training gives new possibilities to engage,

attract and visualize, the rather that there are clear possibilities for individual as well as specialized teaching in such lectures and training. The research shows the same – approximately 84% of the students think that such kinds of lectures are interesting [9]. The most part of the students has enough working skills with the personal computers. So there are no problems applying computer systems for teaching mathematics and statistics.

To the question *What do You think whether the studies in the College will be useful in Your career?* students answered: 88% – "Yes", 2% – "No" and 10% specified partial complaint reasons.

To the question *What do You think whether the studies in the College will help You to get a job?* students answered: 95% – "Yes", 1% – "No" and 9% were not secure of success.

The gained results allow maintaining that the most of the students are satisfied with studies in the College and suppose that the professional acquirements successfully will help to get a job.

The survey of students' opinion carried out in 2005 [7] showed that the most of students are motivated to learn mathematics. 62% of them think that mathematics subject is necessary, 18% of students have no opinion and even 20% of students think that the mathematics subject is not necessary for their chosen occupation. 40% of students attend well the lectures, 55% of them attend average, and 5% of them quite lot cut the lectures. The methods of teaching of mathematics meet the requirements of 84% of students; do not meet of 10% of students. Organization of individual works meets the requirements of 67% of students; do not meet of 14% of students. Unsatisfied students think that individual works are too difficult and the amount of them was too much. They also think they are in need of more teachers' consultations, more mistakes explanations as well as the program is too extensive and a speed of lecturers is too intense.

The first-year students, which just started the studies, took part in the survey. It is scheduled to carry out a survey of College graduates. It will allow comparing the results and making more detailed conclusions.

Conclusions

With reference to literature resources, carried out analysis of studies programmes, and to survey of students' opinion there are made the following conclusions:

1. The chosen model for teaching mathematics in colleges in higher education is efficient.
2. The programmes of mathematics and statistics courses meet the requirements of competences and aims of the studies that are indicated in Business management study programmes.
3. It is necessary to cooperate with lecturers of economics subject and management subject as well as with tutors of Diploma work.
4. It is necessary to apply computer systems in the lectures of mathematics and statistics.
5. It is necessary to continue the researches, to gain further experience and keep working on the improvement of the teaching process.

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REZIUMĖ

J. Saldauskienė. Matematika verslo ir vadybos studijose

Straipsnyje nagrinėjamos matematikos ir statistikos dalykų dėstymo Lietuvos kolegijose problemos, dalykų programos, ugdomos profesinės kompetencijos. Atlikta analizė atskleidžia tolesnes studijų kokybės tobulinimo paieškos kryptis.