8/1 (2010), 41–59
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Teaching Mathematics and Computer Science

Some thoughts on a student survey

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Abstract. The paper analyzes a survey of college students and describes its major findings. The object of the survey, involving 154 students, was to discover and highlight the problems that arise in taking the course Economic Mathematics I. The paper, as the summary of the first phase of a research project, wishes to present these problems, ways that may lead out of them, and possible means of help that can be offered to those taking the course.

Key words and phrases: teaching calculus, studying Economic Mathematics, student survey, secondary school background of students, survey of motivation.

ZDM Subject Classification: C20, C30, C70, D70.

1. Introduction

After teaching for several years in a secondary school, I went on to work in higher education. Since September 2003, I have been working full-time at the Economics Faculty of Tessedik Sámuel College (between 1996 and 2001 I worked as a part-time lecturer at the Gyula branch of Gábor Dénes College, but that work situation was quite different). After this change, I soon personally experienced the truth of Mr Pálmay's words ("giving seminars in a college is very different from teaching in a secondary school"), and Mr Németh can also be cited here just as well ("one even touches the doorknob differently when teaching in a college"). In this paper I describe the more important insights that I have gained through teaching Economic Mathematics I seminars.

At the Economics Faculty of Tessedik Sámuel College there are four degree programmes:

- Andragogy
- Business and Management
- Finance and Accounting
- Technical Manager

In all of these programmes, except for the first, Economic Mathematics I (Analysis) is a compulsory core subject.

The mathematical knowledge of the students admitted to our faculty covers a very wide range. Although there are some who have an interest in mathematics, for the majority of them mathematics is a "necessary evil" that needs to somehow be overcome and the sooner the better. As regards the teaching of the subject, one has to take into account the joint negative effects of two factors. First, it is not favourable for the teaching of mathematics that in the higher education application process a student can get enough points with the "help" of humanities subjects to gain admission. Second, due to changes in law, course-unit methodological examinations have been abolished, and this has served to reinforce the "I only want to survive maths" attitude of the students.

While in secondary school I, like some other teachers, had the goal, if possible, of – instead of explaining everything repeatedly – giving the students the joy of discovery, even if it meant that we could cover less in a lesson. At the college – after seeing the Analysis examination results – I again and again faced a dilema in connection with the best way to teach a seminar. This dilemma comes from teaching experience, and not mainly from the findings of surveys.

The two sides of the dilema which emerged are:

1. Solve more exercises with less explanation and introduce more practical applications during the lesson. The advantage of this alternative is that the students will have more case studies and examples at hand and can browse several types of problem solving methods when they are preparing at home. The disadvantage is, however, that there is little explanation. It is possible that students will have less understanding of the subject, and in this case the large number of exercises will have no use, the speed might be too fast and they may have difficulties in digesting a large amount of data and information.
2. Solve fewer exercises with more detailed explanations during the seminar, and perhaps leave or assign more time for discovery and understanding. The advantages of this method are that students will better understand the studied

and solved exercises and applications, and the problem solving technique or applied method will last longer in their minds, or will be forever imprinted. However, a serious disadvantage is the small number of solved problems, or problem types. This can cause trouble later (for example, at their Analysis exam the students might come across a new application or type of exercise that they have not seen before).

The solution to the above dilemma (if there is any) may be to find a healthy and optimal proportion, that is, to combine the two methods in the right way. However, unfortunately in practice this is not so easy.

2. The objectives, targets and circumstances of the survey

In order to make an attempt to solve the problems mentioned above in February 2007 I drew up a questionnaire the stated aim of which was to find out about and spotlight the problems and difficulties arising during the study of the subject Analysis. The target group of the survey were the first-year full-time students in the three programmes of the Faculty of Economics at Tessedik Sámuel College who have to take mathematics.

I handed out a total of 182 questionnaires to the students, and 154 came back fully completed. Six questionnaires were returned partially completed and I did not use these in the assessment process. The 84.6% completion-submission ratio shows that the students felt the importance of the survey, took its completion seriously and understood that it was in their interest. Of course they did not have to identify themselves, and the questionnaires were distributed and collected by student group leaders, thus complete anonimity was guaranteed. The survey was carried out in February, because at this time the students can still remember their Analysis results, and they can also more easily recall the marks they received at their school-leaving examinations. I myself checked whether what they reported on the questionnaire in connection with their marks received at the college and at their school-leaving exams was accurate, and corresponded to reality. I was happy to see that, generally, it was.

Structurally the questionnaire consisted of three parts (Appendix 1):

I. Previous studies and first-term mark in mathematics.

II. Students' study habits.

III. Difficulties encountered, proposals for improvement, possible solutions.

With the first group of questions my intention was to get a picture of the students' “mathematical track record” and to somehow link this with the first-term Analysis results (to see if there was a significant correlation between these two).

The second group of questions tried to discover how the students study the subject, what the most common study habits are, and, basically, how seriously our students take the study of Analysis.

The third part of the questionnaire attempted to get information about what the students consider as their biggest difficulty in studying mathematics, what areas cause them the most troubles, and whether they have any ideas on how to make the teaching of the subject more effective.

3. Findings and conclusions

In Part I first of all I examined what types of schools the students had attended. From the 154 completed surveys, 50 (32.5%) had gone to a grammar school, while 104 (67.5%) had attended a secondary vocational school. In checking the pre-higher education background of students who had already completed their first year and were further along in their studies at the college, I found that the proportions are generally the same. So the one-third grammar school, two-thirds vocational school distribution practically applies to the whole of the college faculty. The majority of the students having a vocational school background come from schools that teach economics. However, since the launch of the Technical Manager programme in 2007, the number of our students who had technical training in secondary school has shown a rising tendency.

When we look at the distribution of school-leaving final exams in mathematics, we can see that an overwhelming majority of respondents, 144 (93.5%) took ordinary level final exams, while only 10 $(6,5\%)$ sat for a final exam in this subject at an advanced level.

Having the information regarding the school-leaving exam marks and the first-term Analysis marks, I checked to see if there was a connection between the two, and if there was, what kind of a connection (Table 1). I summed up the data in two categories:

– grammar school ordinary level,

– vocational school ordinary level.

Because of the small sample size, I did not assess data for students who passed an advanced level school-leaving exam

Table 1. Final exam and analysis marks of students taking ordinary level final exams in mathematics (Source: my own editing based on my questionnaire survey)

Grammar school ordinary level		Final exam mark in mathematics				
		2	3	4	5	$\sum$
Analysis exam mark	No signature	0	0	0	0	0
	1	0	4	4	2	10
	2	1	4	6	6	17
	3	0	3	3	6	12
	4	1	1	0	1	3
	5	0	0	0	1	1
	$\sum$	2	12	13	16	43

Vocational school ordinary level		Final exam mark in mathematics				
		2	3	4	5	$\sum$
Analysis exam mark	No signature	0	1	1	0	2
	1	3	6	10	2	21
	2	2	13	20	8	43
	3	1	3	13	7	24
	4	0	2	2	4	8
	5	0	2	0	1	3
	$\sum$	6	27	46	22	101

Analysing the data, it can be said that the mathematics results of the students in our faculty are rather satisfactory than good, so the teachers have a more difficult job than their colleagues working in universities. Coming from secondary school our students possess significantly less knowledge of mathematics than their peers going to university. In the language of numbers it means the following. In the case of former grammar school students the average school-learning mathematics final exam mark is 4.00 with a deviation of 0.92, and the average of the Analysis exam mark is 2.26 with a deviation of 0.97. For former vocational school students the average school-learning mathematics final exam mark is 3.83 with a deviation of 0.83, whereas their average Analysis exam mark is 2.24 with a deviation of 1.03.

Carrying out the correlation calculations the following results were found in these two categories:

1. Grammar school ordinary level final exams $R = 0.1052$
2. Vocational school ordinary level final exams $R = 0.2205$

It can be confidently stated that for all intents and pruposes there is hardly any connection between their maths school-leaving final marks and their Analysis marks. On the basis of this we can say, a little ironically, that it does not matter what the final exam school-leaving mark in mathematics was, because a student with a weaker mark can do well at the Analysis exam and vica versa. Leaving irony behind, however, there is much more at stake here. Mostly it is about the fact that in real life it appears there is not any, or hardly any, connection between the mathematics education provided in secondary schools and that provided in universities and colleges, and also that the latter does not build on the former. If my statement is correct this is a very serious problem that should without doubt be addressed.

Question six of Part I was about the length of time given to studying Analysis. In higher education the number of mathematics lessons is much lower than in secondary schools (and unfortunately this small number is still shrinking). Due to the curricular requirements alone the students meet the teacher in the framework of official classes less often than in secondary school. As a result of this it is extremly important how much time the students spend studying mathematics on their own. Thus, I examined the average amount of time per week the students spend studying mathematics. The findings were rather disturbing. Ninety-one students (59.1%) spend less than three hours per week studying mathematics, 51 (33.1%) between three and six hours, and only 12 respondents (7.8%) said that they spend more than six hours studying theory and solving problems. So the majority of the students (almost three-fifths) admittedly do not devote enough time to the study of the subject. One-third of them study for a satisfactory length of time, and only one student out of every 13 considers and studies mathematics in a way that is proportionate to the difficulty of the subject. In addition, I should note that these findings do not consider the regularity and efficiency of their studying which varies greatly from student to student.

It could be debated whether this expenditure of time necessairly and logically leads to the Analysis exam marks mentioned above, but I would rather now touch upon the question of motivation. Obviously there is no need to argue for the fact that in the process of learning motivation has a key role, because this is what drives students the most. It does matter whether a student views the study of a subject as a compulsory burden, necessary evil and outside obligation, and accordingly studies it half-heartedly (or in no way at all), or studies course material with commitment and interest. Therefore we have to do everything we can to keep the students' attention, raise their interest for a given subject and topic and to make them more motivated to study both in the classroom and at home. If these things are achieved, they will undoubtly in turn have an effect on the efficiency of learning.

The first section of Part II concerned the Analysis lecture and the problems arising in connection with it (Table 2).

Table 2. Data about lectures (%) (Source: my own editing based on my questionnaire survey)

	Regularly	Ususally	Sometimes	Hardly ever	Never
I go to the lectures, pay attention and understand the material	12,3	23,4	44,8	13,6	5,9
I go to the lectures, pay attention, but need the help of the coursebook	13,6	29,9	26,0	21,4	9,1
I go to the lectures, pay attention, but do not understand the material	3,9	13,6	33,8	30,5	18,2
I go to the lectures, but do not pay attention	1,3	1,9	14,3	39,3	44,2
I do not go to the lectures	5,9	8,4	20,8	22,1	42,8

Analysing the data it can be seen that slightly more than one-third of the students (35.7%) said that most of the time they understand new material without any help at all, while more than 43% need the help of different coursebooks and reference books. A relatively large proportion of the students (35.1%) irregularly or seldom attend clases. Thus it is clear why they need different sorts of external help, and why, in many cases, they do not understand the material. For, in the case of some topics that build on each other, initial absence kicks off, already at the start, a process that leads to the accumulation of problems later on. Also, it does not help matters that the number of lectures have been reduced (from 2 hours to 1 hour per week), while the syllabus has practically remained the same. So the lecturer is often forced to ask the students to study certain "easily understandable" parts of theory on their own from the coursebook.

Teaching experience shows that if the students cannot tie the different concepts to examples and experiences, then they are often unable to recall them, or they will be meaningless, swotted up knowledge (only some sort of mnemonic exercise). My experience at the college has proven the following statement many times:

> "Abstract thinking can only come from concrete things, and for one to think well abstractly, one needs to have a lot of concrete things. Mathematics is very abstract, so the most successful way to lead the students to this very abstract discipline is to give them an adequate number of sufficiently various concrete experiences." Tamás Varga

In Part II I also studied and processed their responses concerning the Analysis seminars (Table 3).

Table 3. Data about seminars (%) (Source: my own editing based on my questionnaire survey)

	Regularly	Ususally	Sometimes	Hardly ever	Never
I pay attention and understand the solutions to the problems and the applied methods	24,7	37,7	30,5	4,5	2,6
I pay attention, but need the solved exercises from the problem book	15,6	39,0	28,6	12,3	4,5
I pay attention, but do not understand the solutions to the problems or the applied methods	2,6	8,4	29,9	41,6	17,5
I go to seminars, but do not pay attention	0,6	1,9	2,6	21,4	73,5

Analysing the data it can be seen that the majority of the students understand (or at least they think they do) the problems and the applied methods by the time they take a seminar. This is definitely positive feedback. There is, however, a group of students that, depending on the material, needs the support, some a lot while some not so much, of different problem books and teaching references. In addition it is very disconcerting that almost 30% of the students understand the different exercises and methods in varying degrees (which is obviously essentially influenced by the material then currently being taught). All this has to prompt teachers (including myself) to pay even more attention to the differences in the students' mathematical skills when we plan seminars and compose problems to be solved.

While preserving the syllabus, one has to choose such exercises that are mathematical, yet one also has to try to connect them in one way or another to the given topic or a problem related to the students' perception of the world. We need problem books in higher education (too) that can serve as an example for both teachers and students. The proposed problems should be revised again and again, adjusting them to a given group of students. In the case of economics programmes, the economic applications of mathematics are important, some of these being, for example, the comparison of insurance options, securities, securities portfolios, investment return analyses, the comparison of the fees of different services, etc.

Table 4. Data about homework (%) (Source: my own editing based on my questionnaire survey)

	Regularly	Ususally	Sometimes	Hardly ever	Never
I do the homework and assigned practice problems on my own	31,2	39,6	20,1	7,2	1,9
To do the homework and assigned practice problems I get help from someone in the family, or from other students	2,6	16,2	37,0	31,8	12,4
I am unable to solve the homework and assigned practice problems on my own	1,3	5,9	34,4	35,7	22,7
I do not even try solve the homework and assigned practice problems on my own	0,6	2,6	5,2	25,3	66,3

Towards the end of Part II of the questionnaire, I looked at problems concerning homework assignments and practice exercises (Table 4). Examining the data about homework it can be seen that a large proportion of the students (70%) usually try to prepare the homework assignments, practice exercises and tests individually. They ask for and get help on an irregular basis, either from someone in the family, or from friends, or occasionally from other students. Their need for help, for the majority of them, again essentially depends largely on the current topic being studied. It is also a serious problem that a large part of the students do not take the solving of the practice homework assignments seriously. They are most willing to practice before mid-term tests and as the exam period approaches. It is a positive experience that the students who prepare and practice continuously can tackle the problems at the exam more easily and quickly.

One often hears the opinion that students in higher education, like many in high school, also need the help of a private teacher in order to understand the material. Because of this, those filling out the survey were asked if they took private lessons in mathematics. Contrary to this popular belief, I was surprised to see that 126 people (81.8%) get no such help or get hardly any such help. I did not examine what reasons may lie behind this (although this would make another interesting paper).

To the question of whether they received enough help for their study of Analysis, which was question 3 in Part III of the questionnaire, 82.5% of the students (127 people) answered yes. This high proportion, more than four-fifths, is reassuring for our staff at the Institute of Applied Natural Sciences in so far as the majority of our students feel that they have received help of adequate quantity and quality to succeed on the Analysis exam, but we cannot stop trying to raise this percentage to an even higher level. In the students' remarks the following were mentioned as shortcomings:

– little supporting material on the Internet,
– few appointments for consultation,
– more exercises should be solved together with the teacher's help.

I was curious about how well-founded these listed shortcomings were, so I examined them more closely. I wanted to discover how objective these opinions were and whether they were justified, or whether they should only be seen mainly as a sort of stereotypical popular feeling. I found that often the students do not even know about the existing study-aids (many do not even look for them), they are ignorant of the existence of most of the aids collected in different networks or on the Internet, and they do not know where and what to search for. This means then that although we have to take the students' remarks seriously and have to address them, we also have to bear in mind that their validity is limited. The request for more consultation appointments surfaced in several students' remarks. Not only we, the teachers, but the students themselves also feel that the number of seminar classes is not enough, and there is a demand for more occasions (direct teacher-student contact) that could improve their understanding of the material. But here also I would like to mention the fact, from my own experience again, that a lot of students do not even know the existing consultation times, or if they do, they “do not dare” come and ask questions. It is an old and typical habit of students to fear that the teacher will “remember” them if they do not know something or do not ask good (well-phrased) questions. Turn-out at the consultations is often campaign-like (either a legion of students come or none at all). It is usually when the exam period is approaching that the number of those wishing to take advantage of these appointments rises.

With the first question of Part III I wanted to find out the students’ opinions about whether the skills gained in secondary education are enough for their understanding, studying, and applying Analysis. The distribution of the answers was the following:

Yes	46 students (29.9%)
No	79 students (51.3%)
Partly	29 students (18.8%)

Looking at the responses it can be seen that about 70% of the students feel that their knowledge obtained in secondary school is not adequate enough, or is only partially adequate enough to enable them to study Analysis here. In our faculty the experiences of mathematics teachers coincide with this “feeling” of the sudents. As a result of this data and the high number of exam re-sitters and the high proportion of students who fail the Analysis exam, we have managed to succeed, following in the footsteps of several other universities and colleges, in launching a 2-hour-per-week so-called “catch-up” course in mathematics. The main objective of this course is to reiterate and revise the secondary school math material, amend the emerging shortcomings, and make up for what is lacking in secondary school-level mathematical knowledge.

In Part III question 5, I wanted to shed light on what areas of the syllabus cause the students problems or difficulties. I asked the students to mark the degree of difficulty for each topic on a 1-5 scale (with 1 being the easiest and 5 the most difficult) (Table 5).

From their averages it can be easily seen that once “higher” mathematics entered the scene, their troubles immediately started to grow and multiply. Ever more often and more forcefully we are faced with the reality that Analysis cannot be taught effectively in higher education in only a deductive manner. If we want to achieve success in passing on mathematical knowledge to a wide circle of students, then we have to combine deductive methods with inductive ideas and methods. The students’ abilities for abstraction are very different, so it is very difficult to present a uniform method to introduce particular concepts and new material.

One distinct possibility is to try to approach and build up a given problem or a given part of the syllabus, and to try to explain the solution to that problem in several ways. Research and experiments have demonstrated that a multifaceted approach is the best way to inscribe new knowledge into long-term memory and to apply learned skills in problem situations. With the help of modern diagnostic equipment (fMRI) it has also been shown that long-term memory imprint is only triggered by means of an emotional or motivational basis.

Table 5. Averages of degrees of difficulty for each topic (Source: my own editing based on my questionnaire survey)

Topic	Average
Logic and basics of set theory	1,61
Functions	2,28
Financial computations	2,60
Series and sequences	2,06
Limits and continuity of functions	2,69
Differential calculus	3,51
Applications of differential calculus	3,75
Integral calculus	4,15

The question of which was the most difficult: theory, understanding the problems, or application of the methods, resulted in the following breakdown:

– theory 93 students (60.4%),
– understanding the exercises 27 students (17.5%),
– application of the methods 34 students (22.1%).

More than 60% of the students consider theory as the source of their greatest troubles. The appearance of "higher" mathematics mentioned above obviously causes great difficulties in connection with both theory and practice. We teachers have to do everything possible so that the teaching of theory should be more than merely passing on information. Instead of presenting facts and formal knowledge, it is more effective if students form and extend their knowledge through an ever growing series of individual experiences. We cannot be satisfied with teaching mathematics to them, but rather we should aim to teach them how to mathematicize. In this respect I find these two thoughts very appropiate:

"It would be silly to put the blame on mathematics for being abstract: it comes from its nature. However it is justified criticism if we blame the

> teaching of mathematics for not clearly showing the way whereform and the road to abstract mathematics." André Revuz

> "Mathematics is a very abstract science, and that is precisely why it should be presented very concretely." György Pólya

We need to start from something concrete, that is tied to the presentation of a problem, and from there we have to reach the intangible, the abstract. This does not mean that we are not concerned about the gaining of knowledge. Quite the contrary! In fact we would like to raise that to a truly high level. Knowledge acquired in this way will, on the one hand, be lasting, and, on the other, it will prepare the ground for the reception of new information.

The penultimate question of the questionnaire was whether leading questions and logically sequenced partial exercises would offer any help in solving the problems. Reading the answers the findings are unambiguous. The vast majority of students, 129 (83.8%) answered yes, 9 (5.9%) said no, while 16 (10.3%) were undecided. It seems that we need partial exercises in higher education too. These can give significant help in breaking the ground for and opening the way to seemingly unsolvable problems, as well as toward initiating a thought process. Forming solutions to such partial exercises will probably not guarantee the complete solution of the original problems, but nevertheless they can be of help. Part of a solution or an entire solution can be used to solve an original problem, or ideas or conclusions from partially solved problems might provide useful crutches. If such partially-solved problems do not, perhaps, provide help for an actual problem, they can possibly help methodologically. Besides this, they might show the way to a solution, or help evoke a procedure, method or train of thought that would eventually lead to an important insight.

Partial exercises also help in making decisions. For if we have several options to solve a problem, partial exercises can serve as guidelines for measuring up these alternatives. Experience gained through previously solved "preparatory" exercises can help in finding a quicker or easier way. These exercises are also a good way to practise concepts featured in an original problem, but which are not known well enough yet because at a lack of sufficient practice. Of course we have to be careful in choosing and assigning adequate partial exercises, lest we, "falling down on the other side of the horse", waste too much time and energy on them, and lose our way in too much detail. We have to find and use exercises that can be truly helpful, and in which the solutions and results can be used in other problems too.

The last question invited the students to share their ideas related to making the teaching and study of Analysis easier and more understandable. Without claiming complete comprehensiveness, here are some of the most common ideas:

– more seminars,
– the solution of more problems,
– individual work in seminars, then check with the group,
– extra-curricular classes for those students who do not understand a topic.

The request for more seminars featured in almost 83% of the answers. The students therefore also feel that the time currently available for them is not adequate enough to understand the different methods and to practise the problems thoroughly. Additional opportunities would also be needed where the issues causing the most troubles could be reviewed and analysed in more detail.

4. Conclusions

Summing up the essential findings of the research carried out, the respondents are characterized by the following:

– they enter higher education with very different, usually intermediate or lower, levels of mathematical knowledge, and this acts as a serious obstacle.
– the correlation between the marks of secondary school final exams and those of Analysis is loose, which partly implies that the higher education mathematics curriculum hardly builds on the things taught in secondary school.
– the majority of the students consider Analysis a "necessary evil" that must be survived, so they attend the lectures irregularly or hardly at all, and spend too little time during the semester studying the subject.
– a minority of the students can grasp the lectures on their own, but the rest are not able to understand and digest the material without further help (learning aids, extra classes and consultations), their abstraction skills are weak, so it is advisable to go through a series problems of various levels of difficulty in seminar classes.
– the majority of the students do their homework on their own; however, a large part of them do not take it seriously enough.
– according to the students the number of study aids, consultation opportunities and seminar classes is insufficient.

– more than two-thirds of the students think that the mathematical knowledge they have gained in secondary school is not adequate enough, or is only partly adequate enough, to enable them to tackle Analysis, and the problematic areas for them are mainly theory and "higher" mathematics (differential and integral calculus).

– they think that more seminar classes, solving more problems and checking their solutions in class would help them the most in the study of the subject.

It must be emphasized that the above remarks, ideas and conclusions can obviously only apply to my own college and faculty. Because conditions are different in other colleges and universities, the issues researched here might be manifested in a different way somewhere else. I think it would be very useful if some of my colleagues working in these other institutions prepared similar surveys, or if they have already been conducted, would publish their findings so that we could compare and analyse them. It is perhaps not too bold an idea that, building on our common experience, we could create a "universal" questionnaire that we could all use in future surveys, and thus the findings of different institutions would be directly comparable with one another.

My plan is to repeat the questionnaire every year with the, then current, first-year students. Comparing these yearly findings with previous ones, we will be able to get a picture over a longer period of time of whether changes in course material and methods enacted at certain points of time have helped the students and contributed to their study of Analysis and enabled them to end up with better results, arrived at in a more efficient way. It is also my plan that for teaching one part of the syllabus I will compose helping and leading questions and exercises, and will set up a practical study agenda (guidelines). This obviously involves, to a certain degree, the rewriting and restructuring of the teaching methodology of this part of the syllabus.

I hope that the experiences described above and supported by a survey, are similar to those of colleagues working in other colleges and universities, and thus they are not the proverbial exceptions to the rule, but rather can be said to be typical. If this is the case, the insights formulated above can perhaps be part of those nation-wide steps that have to be taken in the difficult task of making the teaching of Analysis more effective. Until these steps are taken, what else can we teachers do for the students in addition to our efforts thus far? Perhaps it is most important to do everything possible to make the students interested, so that they will enjoy learning and acquiring new information, so that they will study not just because it is an obligation, and so that they will feel an urge to better themselves on their own.

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Appendix 1

Questionnaire for the efficiency of teaching and studying Analysis

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By filling in the questionnaire you can contribute to improving teaching, especially the teaching of mathematics.

Please read the questions carefully! Mark your answer or give your opinion! Do not write any names or other forms of identification on the sheet!

I.

1. What type of school did you attend?
   a) grammar school b) vocational school c) trade school
2. Type of school-leaving exam in mathematics?
   a) ordinary level b) advanced level
3. Your mark at the school-leaving exam: ....
4. Your first-term mark in Economic mathematics (Analysis): ....
5. On average, how much time do you spend a day studying outside the classes?
   a) less than 1 hour b) between 1 and 2 hours c) more than 2 hours
6. On average, how much time do you spend a week studying mathematics outside the classes?
   a) less than 3 hours b) between 3 and 6 hours c) more than 6 hours

II.

How well do the following statements describe your way of studying mathematics? Mark the appropriate box!

		Regularly	Ususally	Sometimes	Hardly ever	Never
1.	I go to the lectures, pay attention and understand the material.	1	2	3	4	5
2.	I go to the lectures, pay attention, but need the help of coursebook(s) to understand the material.	1	2	3	4	5
3.	I go to the lectures, pay attention, but do not understand the material.	1	2	3	4	5
4.	I go to the lectures, but do not pay attention.	1	2	3	4	5
5.	I do not go to the lectures.	1	2	3	4	5
6.	In the seminars I pay attention and understand the solutions to the problems and the applied methods.	1	2	3	4	5
7.	In the seminars I pay attention, but I need the solved exercises from the problem book.	1	2	3	4	5
8.	In the seminars I pay attention, but do not understand the solutions to the problems.	1	2	3	4	5
9.	In the seminars I do not pay attention.	1	2	3	4	5
10.	I do the homework and assigned practice problems on my own.	1	2	3	4	5
11.	To do the homework and assigned practice problems I get help from someone in the family or from other students.	1	2	3	4	5
12.	I am unable to solve the homework and assigned practice problems on my own.	1	2	3	4	5
13.	I do not even try to solve the homework and assigned practice problems on my own.	1	2	3	4	5
14.	I take private lessons in mathematics.	1	2	3	4	5

III.

For the following questions, in a few words please explain why you are giving your particular answer!

1. In your opinion are the basics acquired in secondary school enough to enable you to understand, study, learn, and use Analysis?
   ....
   ....
2. What caused you difficulties in Analysis? In your opinion, why did these difficulties arise?
   ....
   ....
3. Did you get adequate support (teacher, literature, Internet, consultation etc.)? If not, what kind of support was lacking?
   ....
   ....
4. Which was the most difficult for you, theory, understanding problems, or the application of methods?
   ....
   ....
5. Which topics caused you trouble in Analysis? (*The figures indicate the degree of difficulty, 1 means the least trouble, 5 indicates the most trouble*). *Please mark only one box for each topic!*

a)	Logic and basics of set theory	1	2	3	4	5
b)	Functions	1	2	3	4	5
c)	Financial computations	1	2	3	4	5
d)	Series and sequences	1	2	3	4	5
e)	Limits and continuity of functions	1	2	3	4	5
f)	Differential calculus	1	2	3	4	5
g)	Complex function analysis	1	2	3	4	5
h)	Integral calculus	1	2	3	4	5

6. Would the assignment and solution of helping, leading questions and partial problems help in solving the problems?
   ....
   ....

7. In your opinion what can be done so that students will be able to understand Analysis better and more easily?

   ....
   ....
   ....

   Thank you very much for your answers!

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(Received February, 2009)