ACTA DIDACTICA NAPOCENSIA
Volume 2, Number 2, 2009

EXAMINATION OF THE FACTORS INFLUENCING THE EXAM RESULTS

Cecília Sitku-Görömbei

Abstract: The defectiveness of the effectiveness of the Hungarian general education revealed in the PISA survey appears in the higher education as well. The "Introduction to Informatics" subject has one of the lowest exam results among the students of the College of Nyíregyháza majoring in Computer Program Designer and Teacher of Computer Science. This subject is the mediator one for the elements of informatics for the students. By analysing the results of supplementary surveys I tried to find answers for the following questions: What are the relations between the exam results of the students and the secondary final examinations that should measure their previous knowledge? Can the weak results be explained by the thinking ability or rather the defectiveness of the special mathematics skills? What are the students' attributions towards the exam results? The results of the investigations and surveys, which have been done, show that most of the students come to higher education with a weak fundamental knowledge. In order to improve the results of the exams the individual improvement of those students who perform badly in the given fields is required.

Zusammenfassung: Die in den PISA-Erhebungen aufgedeckten Schwächen der ungarischen Schulwesen-Effektivität (Wirksamkeit) zeigen sich auch im Hochschulwesen. Für die Schüler bei Programmplaner-Informatiker und bei den Informationstechnologie-Lehrer ist das eine schwächste mit den Prüfungsergebnissen schließende informatisch-begründende Lehrfach „Einführung in die Informatik". Auf die nächsten Fragen suche ich die Antworten durch die Analysierung der Prüfungsergebnisse des erwähnten Lehrfaches und der Ergebnisse der ergänzenden Untersuchungen: Wie ist der Zusammenhang zwischen den Prüfungsergebnissen der Schüler und den vorherige Kenntnisse messenden Abitur-Noten? Ob die schwachen Ergebnisse durch die Denkvermögen oder lieber durch die Schwäche der speziell-mathematischen Fähigkeiten induziert werden? Wie sind die Attributionen in Verbindung mit den Prüfungsergebnissen der Schüler? Die aufgedeckten Ergebnisse werden durch die beendeten Untersuchungen gezeigt, dass ein bedeutender Teil der Schüler/Studenten im Hochschulwesen mit schwächen Gründen ankommen. In Interesse der Verbesserung der Prüfungsergebnisse wäre es notwendig, die schwache Leistung zeigenden Schüler in den gegebenen Bereichen durch die individuelle Entwicklung zu organisieren.

Keywords: informatics, education

1. Introduction

The defectiveness of the effectiveness of the Hungarian general education revealed in the PISA survey appears in higher education as well. Unfortunately the exam results of the students majoring in Teaching Computer Science and Computer Programmer Mathematician (from the academic year 2006/2007 Computer Program Designer) of the College of Nyíregyháza confirm the results of the survey.

We may often experience that the exam results of some subjects are well below than it was expected; moreover they can be treated as weak. In the case of the Computer Programmer Mathematician/ Computer Program Designer (hereafter CPM/CPD) and Teacher of Computer Science (hereafter TCS) one of basic informatics subject producing the weakest exam results is the Introduction to Informatics (from the academic year 2006/2007 it is called Informatics and Electronics). In the following I would like to introduce the experience gathered relating the teaching of this subject and the results of the survey exploring the reasons of the weak exam results.

Received 27 April 2009, accepted 20 May 2009, published 24 June 2009

2. Description of the investigation

2.1. Precedents of the investigation

The survey was launched in order to explore the reasons of the weak exam results of the above-mentioned subject. The average was 1,85 in the academic year 2004/2005. The details can be found below:

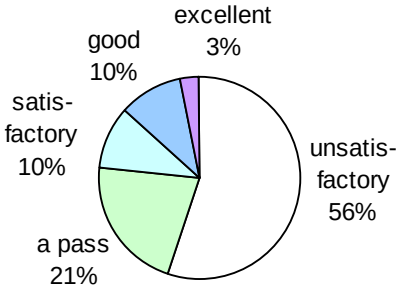

Figure 1 *Exam results*
(Introduction to informatics I. CPM, I. TCS 2004/2005)

The Introduction to Informatics subject in the above mentioned majors does not convey the usual, basic user-level knowledge but its aim is to offer the students comprehensive knowledge related to computer science mathematics, the bases of information theories, to become familiar with the technical terms and basic notions. Among others the subject deals with structure of the computers, algorithms, information and their forms of representation, data, representations of data structures and their operations.

It is a compulsory subject both for the students majoring in Teaching Computer Science with one lecture per week and for the CPM/CPD students with two lectures and two seminars per week. The themes of the lectures and the seminars are different. The content of the subject was processed partly during the lectures and partly during the seminars. During the lectures we put emphasis on the exact interpretation of the knowledge and algorithms similar to the exam tasks and the introduction of different methods for the solutions. During the solutions we presume and build on secondary school level mathematical knowledge.

The parallel subjects that also deal with some topics of the subject examined are: Computer Architectures, Programming Languages I; the CPM/CPD students also study Discrete Mathematics and Mathematical Logic.

Due to the high number of participants written examinations are organised. The students have to solve a test with ten exercises within 30 minutes without calculator. In the test there are tasks that require the ability of confident performing of mathematical operations, exact knowledge and adoption of the algorithms, namely converting from and to the decimal system, converting between numerical systems, converting from and to binary complement, converting from and to floating point form, logical operations, calculating information content and transforming the infix term to postfix.

The final result of each task is evaluated with 0; 0,5 or 1 point. The bottom limit of a pass is 6,5 points.

On the whole we can draw the conclusion that results are very weak in the case of the points and the marks as well so they mean a failure both for the teachers and the students as well.

2.2 The aim of the investigation

In the following semester we wanted to find the reasons of the outstandingly low exam results and what changes may result in improving the exam results.

2.3. The methods and schedule of the investigation

By using the test used in the academic year of 2005/2006 and 2006/2007 we made the surveying among the TCS and the CPM/CPD students. In the academic year of 2007/2008 and 2008/2009

supplementary surveys (inductive thinking test, basic counting skills measurement, motivation and attribution questionnaires) were made among the TCS students.

The characteristics of the sample examined are summarized in the Table 1.

Table 1 *The sample examined*

Academic year	**Number of students** (person) (I. year students + students who enrolled again = total)	
	Computer Programmer Mathematician| Computer Program Designer	Teacher of Computer Science
2005/2006	38 + 16 = 54	146 + 102 = 248
2006/2007	66 + 0 = 66	0
2007/2008	0	87
2008/2009	0	44

– Details of the academic year 2005/2006

Subject: Introduction to Informatics

The groups examined: students majoring in Teachers of Computer Science (TCS): 248 students, among them 102 who enrolled again; Computer Programmer Mathematician (CPM): 54 students, among them 16 who enrolled again, altogether: 302 students, among them 118, who enrolled again, number of exams: 481.

We run the measurement during the exam period by using the tests from the previous year. We completed the test with a questionnaire where the following data were asked: grades of the secondary school-leaving exam from mathematics and informatics, time and type of the secondary school-leaving exam, when he/she started the studies in the college

– Details of the academic year 2006/2007

Subject: Informatics and Electronics (with the themes of Introduction to Informatics subject)

The groups examined: students majoring in Computer Program Designer (CPD) 66 students (Teaching major was not launched, the Computer Programmer Mathematician major gave place to the Computer Program Designer major).

The method of the measurement was changed as it follows: the students were requested to write two mid-term tests with 8 exercises. The exercises were taken from the previous years' tests. The first mid-term test was about the decimal systems and so-called leading exercises could also be found in the test. The second test contained the other types of exercises: logical operations, number representations, information quantity, infix-postfix forms.

During the processing we took into consideration only those tasks that could be found in the previous years' tests.

– Details of the academic year 2007/2008

The group examined: Students majoring in Teaching of Computer Science (III. year TCS), altogether 87 students, in the academic year 2005/2006 those students took part in the survey who enrolled to the Methodology of Teaching Computer Science in the academic year 2007/2008.

The following supplementary measurement took place:

In the first semester of 2007/2008 we surveyed the state of inductive thinking by using the measurement sheet of the Pedagogy Department of the Attila József University (at present University of Szeged) (Csapó, 1998). "Number analogy", "word analogy" and "number line" tasks form the inductive thinking test.

In the second semester we surveyed the state of basic counting skills of the students. We used the test made by Dr. József Nagy et al (Nagy, 1971). The test of basic counting skills measures the state of using the four basic operations and the substitution skill.

– Details of the academic year 2008/2009

The group examined: Students majoring in Teaching of Computer Science (IV. year TCS), altogether 44 students. Among the students who were surveyed in the academic year 2005/2006 those students took part in the survey who enrolled to the Complex Methodology of Teaching course in the academic year 2008/2009.

During the supplementary measurement self-filling questionnaires were used. The questionnaire contained the attribution questionnaire used by Ms. Endréné Réthy et al (Réthyné, 2003). This questionnaire was completed with questions regarding the attitude towards informatics and learning motivation.

The attribution questionnaire enumerates 14 reasons that may affect the exam results. The students are required to evaluate the reasons from 1 to 9 whereas 9 marks the "very strong", 5 marks the "neutral" and 1 marks the "less" affecting reason. The rest of the number represents the transition.

3. The results of the investigation

We processed the data by forming two big circles of problems. In the first field the analysis of the results of the Computer Program Designer students can be found meanwhile in the other one the results of those Teacher of Computer Science students who took part in the supplementary measurements can be found.

3.1. The results of the students majoring in computer program designing

We compared the results of the Computer Program Designer students with the Computer Programmer Mathematician students.

By taking into consideration the average of the marks of the school-leaving exam it can be said that the average is good, the CPD students were weaker with 0,18 in mathematics but had better results from informatics, namely with 0,3 than the CPM students. But the mean of the exam results is much weaker than the mean of the marks of the school-leaving exam in both groups. The exam result of the CPD students is better with 0,37 than the CPM students' results. (Table 2)

Table 2 *Means of the marks of the school-leaving exam and the exam*

	School-leaving mathematics exam	*School-leaving informatics exam*	*exam*
I. CPM 2005/2006	4,03	4,00	2,18
I. CPD 2006/2007	3,85	4,30	2,45
I. TCS 2005/2006	3,40	4,00	2,05

The diagram in Figure 2 makes it possible to compare the results achieved in different fields.

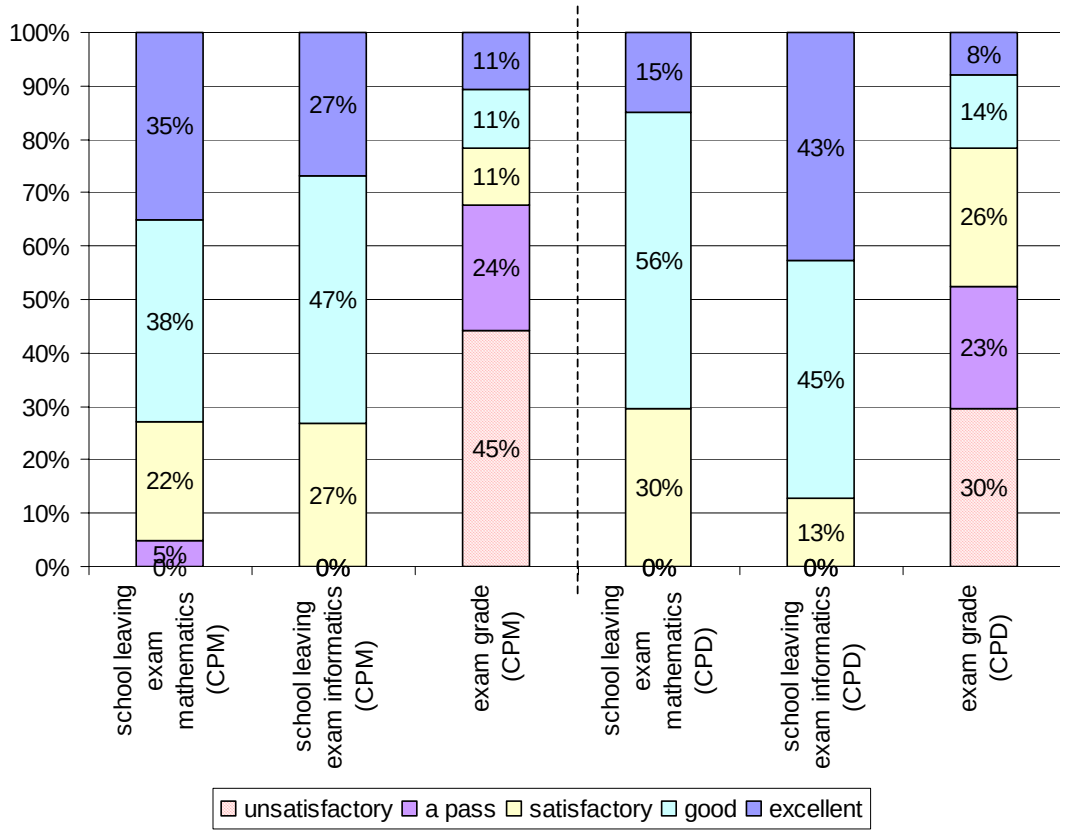

Figure 2 *School-leaving exam and the exam results*
(I. CPM 2005/2006; I. CPD 2006/2007)

It can be said that the CPD students have weaker marks from mathematics but better in informatics than the CPM students. The distribution of their exam results is more constant but their mean is not much better.

By using the Pearson correlation co-efficient when examining the relations among the exam results and the results of the school-leaving mathematics and informatics exams we can draw the following conclusions:

In the case of the CPM students the correlation co-efficient in the relation of the exam results and the school-leaving mathematics exam is $r_{(PM;v,m)}=0,283$, $p=0,040$; in the relation of the exam results and the school-leaving informatics exam is $r_{(PM;v,i)}=0,367$, $p=0,016$, where v is the exam result, m is the mathematics, i is the informatics exam result. Both schoolleaving marks influence the results in this group. The relation is relatively weak but the probability is high (96%, and 98,4%) that this relation is not accidental.

By taking into consideration correlation co-efficient of the results of the CPD students it can be said that the exam results do not show even a weak correlation with none of the school-leaving exams ($r_{(PTI;v,m)}=0,188$, $p=0,148$; $r_{(PTI;v,i)}=0,056$, $p=0,680$).

It may be possible that the changes in the methodology caused a certain improvement but the results do not give occasion for satisfaction.

3.2. The results of the students majoring in teaching computer science

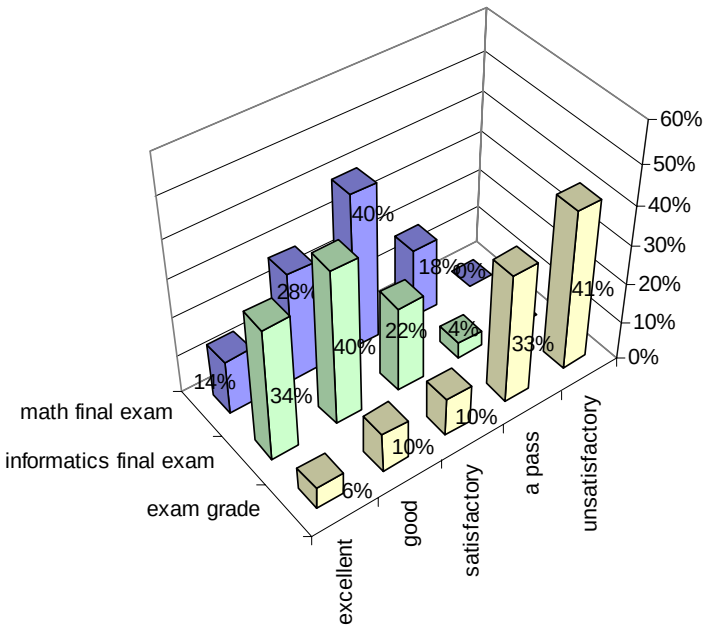

Figure 3 *School-leaving exam and the exam results (TCS 2005/2006)*

It is worth considering that even with a pass from mathematics or informatics was enough to get into the Teacher of Computer Science major. In case of the exam results the mean is better with 0,18 (2,07) than in the academic year 2004/2005 but the results are still weak and the rate of the unsuccessful exams is still too high.

3.3. The results of the supplementary surveys

– Inductive thinking test

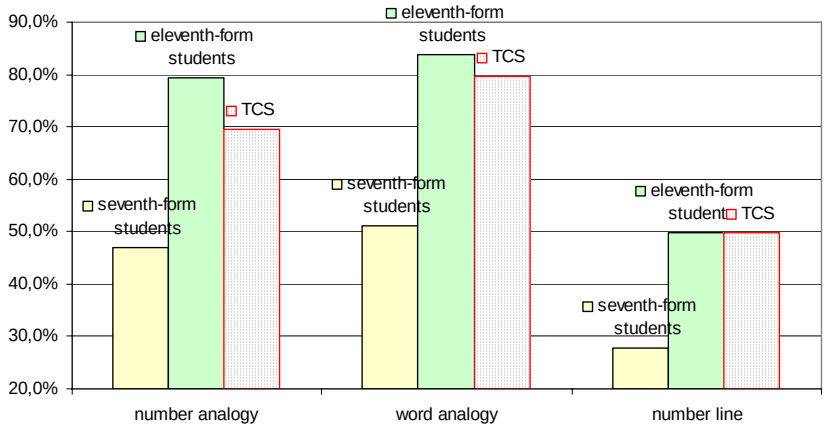

Figure 4 *Result of the inductive thinking test (TCS 2007/2008)*

The result of the inductive thinking test was compared with the results of the measurements done by Benő Csapó et al in 1993-1994. (Csapó, 1998 pp. 264) The students showed weaker results than the

second-form students in the field of word analogy and number analogy (number analogy: 69,4/79,3; word analogy: 79,7/83,9), and had a little better results in the number line test (49,9/49,7). Altogether it can be said that the students performed almost on the same level like the first-form students of secondary school.

– Basic counting skill test

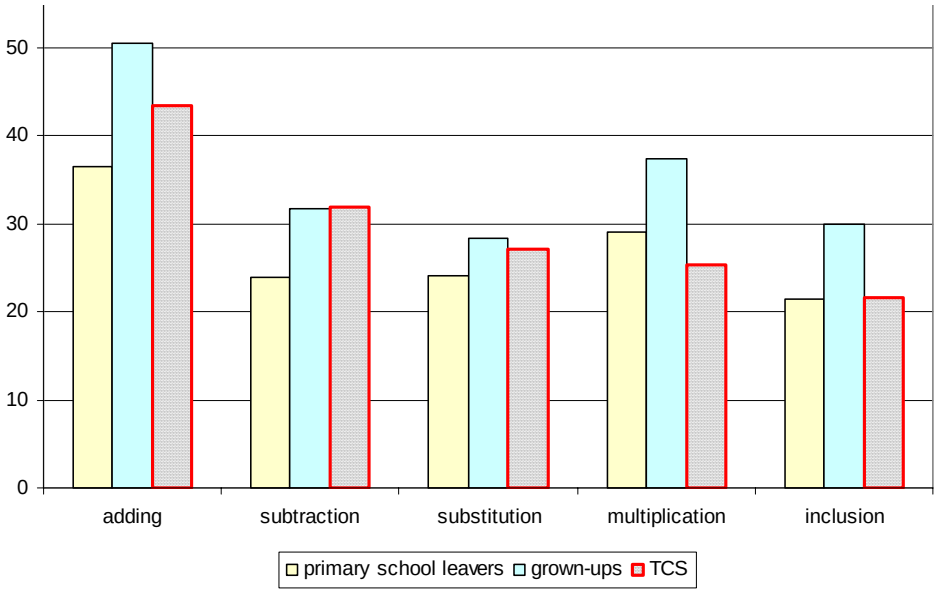

Figure 5 *Result of the basic counting skill test (TCS 2007/2008)*

We compared the results of the basic counting skill test with the nation wide survey results done by Dr. József Nagy et al in 1971. (Nagy, 1971 pp. 71-80) The students reached the grown-ups level only in the subtraction subtest and in the multiplication subtest they had worse results than the primary school-leaver students.

The results of the correlation calculation shows that there is a weak relation between the exam results and the grades of the school-leaving exam but there is no relation regarding the other variables (Table 3).

Table 3 *The result of the correlation survey (TCS)*

correlation co-efficient and significance levels	***(v,m)***		*(v,i)*		*(v,ind)*		*(v,szk)*	
	r	***p***	*r*	*p*	*r*	*p*	*r*	*p*
	0,255*	**0,018***	-0,21	0,865	0,133	0,244	0,140	0,271

(Abbreviation: v-exam grade, m-school-leaving exam grade, mathematics, i-school-leaving exam grade, informatics, ind-inductive thinking test, szk-basic counting skill test.)

– Attributions questionnaire

It is a common human feature that results of our or others' activity are attributed to some reasons and our attitude towards the results are based on the reasons supposed. With the attribution questionnaire we wanted to explore if the students attribute their own exam results inner or outer reasons.

On the Table 4 we collected the reasoned background of the exam results. All the reasons reached above 5,00 value that shows that the students treat all the reasons as significant. The first two ranks

– the interest in the exam subject 7,41; Intelligence 7,34– explain the results with inner attributes, they are depending on the personality. On the third place with almost the same strength they mentioned an outer reason that cannot be controlled by them: the presenting style of the teacher (7,24). This means that though they recognise the primary importance of the reasons depending on them but mention an outer reason with relatively great emphasis. If we examine separately the inner and outer reasons (Table 5), we can draw the conclusion that the inner reasons with 6,83 mean has stronger factor than the outer reasons with 6,72 mean.

Table 4 *The total ranks of the attributes on the sample examined*

Attribution	inner/outer	TCS. 2008/2009.	
		rank	value
Interest in the exam subject	i	1	7,41
Intelligence	i	2	7,34
The presenting style of the teacher	o	3	7,25
Creativity	i	4	7,18
Professional suitability	i	5	7,07
Diligence	i	6	6,93
The difficulty level of the subject	o	7	6,91
Desire for good performance	i	7	6,91
The difficulty of the exams	o	9	6,64
Certain skills	i	10	6,48
The learning methodology	i	11	6,30
Luck/Hard luck	o	12	6,02
Attitude towards the examiner	i	13	5,84
Others' help in the preparation	o	14	5,66
mean			6,71

Table 5 *The places of the attributes based on inner/outer features*

Attribution	inner/outer	TCS. 2008/2009.	
		rank	value
Interest in the exam subject	i	1	7,41
Intelligence	i	2	7,34
Creativity	i	4	7,18
Professional suitability	i	5	7,07
Diligence	i	6	6,93
Desire for good performance	i	7	6,91
Certain skills	i	10	6,48
The learning methodology	i	11	6,30
Attitude towards the examiner	i	13	5,84
inner attributes			**6,83**
The presenting style of the teacher	o	3	7,25
The difficulty level of the subject	o	7	6,91
The difficulty of the exams	o	9	6,64
Luck/Hard luck	o	12	6,02
Others' help in the preparation	o	14	5,66
outer attributes			**6,72**

We compared the results with the results published by Ms Endréné Réthy (Table 6: R. 1990/1992 and R. 1998/1999):

Table 6 *Total compared rank of the samples*

		R. 1990/1992		R. 1998/1999		TCS. 2008/2009	
		rank	value	rank	value	rank	value
Interest in the exam subject	i	1	6,98	1	7,32	1	7,41
Intelligence	i	4	6,58	5	6,92	2	7,34
The presenting style of the teacher	o	11	5,48	8	6,15	3	7,25
Creativity	i	12	5,38	10	6,04	4	7,18
Professional suitability	o	13	5,28	12	5,89	5	7,07
Diligence	i	5	6,17	2	7,14	6	6,93
The difficulty level of the subject	o	10	5,71	6	6,47	7	6,91
Desire for good performance	i	3	6,63	4	6,93	7	6,91
The difficulty of the exams	o	8	6,02	9	6,05	9	6,64
Certain skills	i	7	6,04	7	6,32	10	6,48
The learning methodology	i	9	6,00	3	7,05	11	6,30
Luck/Hard luck	o	2	6,82	13	5,66	12	6,02
Attitude towards the examiner	i	6	6,13	10	6,04	13	5,84
Others' help in the preparation	o	14	3,26	14	3,67	14	5,66
mean			5,89		6,26		6,71

We can draw the conclusion that the bigger parts of the attributes can be found with higher values among the students majoring teaching computer science. It is worth considering that which attributes have become stronger –for example intelligence, creativity, style of the teacher–, and which have less importance –diligence, learning method, desire for good performance (!)–. These values probably reflect the recent value changes within the society.

It is remarkable that in all the three samples examined the same attributes can be found in the first and in the last position: interest in the exam subject and others' help in the preparation. But it is a significant difference that while the others' help attribute had negative sign, it treated as hindering factor in the academic year 1990/92 and 1998/99 it appeared as a positive factor in our survey. The reason may be that the attitude changes in the teaching methodology has changed and the emphasis that used to be on the competitive way of thinking now is on the cooperative attitude that gives preference on working together.

4. Summary

The school-leaving grades show that some of the students come to higher education with weak background.

The state of inductive thinking plays an important role in the studying and in cognition. The performance of the students is relatively weak in this field as well.

The basic counting skill also shows a significant backwardness though it is required for the solution of the tests of the subject examined.

Based on the attribute questionnaire it can be said that the students recognises their own responsibility in the forming of the exam results but their opinion towards the values is greatly affected by the value changes can be experienced nowadays.

In order to improve the exam results methodology changes are required (usage of cooperative techniques, competence based teaching in the secondary and higher education, too) but it would be necessary to organise the individual development for the students who have weaker results in some fields. Special courses and mentor system would be necessary since within the mentor system personal support can be established.

Literature

[1] Csapó Benő (1998): *Az iskolai tudás.* Osiris Kiadó, Budapest

[2] Falucskai János (2002): *Introduction to informatics.* URL: http://zeus.nyf.hu/~falu/bevinfo/jegyzet.doc (2008.06.30.)

[3] Falus Iván (2000): *Bevezetés a pedagógiai kutatás módszereibe.* Műszaki könyvkiadó, Budapest

[4] Falus Iván – Ollé János (2008): *Az empirikus kutatások gyakorlata – Adatfeldolgozás és statisztikai elemzés* Nemzeti Tankönyvkiadó, Budapest

[5] Dr. Nagy József (1971): *Az elemi számolási készségek mérése és fejlettségének országos színvonala.* Tankönyvkiadó, Budapest

[6] Réthy Endréné (1993): Bölcsészhallgatók vizsgateljesítményekkel kapcsolatos attribuciói. *Magyar Pedagógia*, 93(3-4), 117-134.

[7] Réthy Endréné (2003): *Motiváció, tanulás, tanítás. Miért tanulunk jól vagy rosszul?* Nemzeti Tankönyvkiadó, Budapest.

[8] Sitkuné Görömbei Cecília (2005): How to teach the fundamentals of information science coding, decoding and number systems? International Multidisciplinary Conference, Baia Mare Vol 2 701-706.

[9] Sitkuné Görömbei Cecília, Falucskai János (2005): Az informatikai alapismeretek oktatásának tapasztalatai a Nyíregyházi Főiskolán, Informatika a Felsőoktatásban Konferencia, Debrecen URL: http://agrinf.agr.unideb.hu/if2005/kiadvany/index.htm (2009.03.11.)

Author

Cecília Sitku-Görömbei, College of Nyíregyháza, Nyíregyháza, Hungary, e-mail: sitkune@nyf.hu