

EVALUATION OF THE CURRENT STATE IN TEACHING INFORMATICS AT UPPER SECONDARY LEVEL OF EDUCATION (ISCED3) IN THE SLOVAK REPUBLIC: CONCEPTUAL AND METHODOLOGICAL STARTING POINTS

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Abstract

When considering the quality of education, one of the most important screening values is the information about students' attitude towards the particular subject that on the one hand is determined by the character of the subject and on the other hand by many other aspects. This paper is based on the widely conceived international research oriented on the comparative evaluation of current state of teaching Informatics from the point of view of specific factors at the upper secondary level of education (ISCED 3) in the Slovak and Czech republics. Based on the comparison of positive experience and diagnosis of strengths and weaknesses in teaching Informatics and Programming its aim from the long-time perspective is to design various possibilities of quality and attraction increase of their teaching in the Slovak Republic. The authors focus on the specification of some factors that significantly influence quality of teaching Informatics from the students' point of view. They also present an analysis of the questionnaire items reliability used to create a quality tool for obtaining reliable data within the completed international research.

Key words: *quality in education, Informatics, analysis of the questionnaire reliability, Cronbach's alpha coefficient.*

Introduction

Discussions connected with Informatics syllabi and curricula development and unsatisfactory results achieved by Slovak students at PISA monitoring led a team of researchers from Constantine the Philosopher University in Nitra to deal with issues of evaluation of the current state in teaching Informatics at upper secondary level of education (ISCED3) in the Slovak Republic. A decision was made to carry out a research aimed at evaluation of this state and to compare it with the situation in the Czech Republic.

The paper brings results of the first (preparatory) phase of this research which is currently in its second phase (collection and processing of research data). This means that the key topic of the paper is presentation of a methodology on which the research has been based. Following the methodology, in the next chapters, there is a detailed description of design, verification and mainly verification results of the questionnaire which has been used as a tool for the necessary research data collection.

Teaching Informatics at Upper Secondary Level of Education

Nowadays, fundamentals of Informatics are being taught in the level of secondary schools all over the world. Informatics in the system of education plays an important role in development of logical thinking of students, their ability to analyze and synthesize, even generalize (similarly as in Mathematics). It also helps students to find suitable problem solving strategies and verify them in practice. It leads to more exact way of expressing ideas and processes procedures and their formal recording with the emphasis on the development of algorithmic thinking. Education in the scientific field of informatics should help students to enter more easily the real life and provide them with skills needed practically in any profession.

Concrete study content of the subject Informatics is frequently being discussed not only in School Subject Committees, but also in special journals and numerous special events (conferences, workshops). Analysis of Informatics syllabi in the upper secondary level of education should result in a controversial discussion about the lack of lessons for teaching algorithmization and the fundamentals of programming. Unfortunately, the attention paid to the algorithmization is underestimated nowadays.

Algorithmic thinking and algorithmic process of problem solving are the most typical and highly specific features of the scientific field informatics which differentiate it from other sciences.

Students, upper secondary school graduates (mainly grammar school graduates) often do not realize that informatics is closely connected and dependent on mathematics. Their expectations about higher education study of informatics is then, in better case, frequently connected with assembling of hardware components or building computer networks; in a worse case, only with the work using application software. The notion the students, their parents and teachers have about informatics is often restricted in this sense and it does not reflect general specialization of informatics as a scientific discipline. Rather frequently students expect that the Informatics teaching time will be devoted to the “work on PC”, i.e. they expect the work where the Internet plays the main role. If students are asked what they expect to learn in Informatics, in some cases they are not able to give a clear answer. Then, we can also meet students with a high level of computer literacy, who evaluate their abilities (in the sense of user’s skills) as highly satisfactory and they do not consider it necessary to be further educated this area (Hašková, Záhorec, 2009).

As to teaching Informatics we prefer the opinion that syllabi of the subject Informatics should emphasize mainly principles and not concrete technologies, i.e. software products. Unfortunately, teaching Informatics in our upper secondary schools (especially secondary grammar schools) is more and more influenced by training activities with concrete software products to the detriment to basic principles of any algorithmization and programming, e.g. instead of principles of 2D computer graphics the work with a concrete software product is being taught. Very few of these software applications support algorithmic thinking of students (except of programming in database systems or macroinstructions if the subject is taught up to this depth). Then if basis of algorithmization and programming are taught, it often happens that students are confused and these topics are too difficult for them. If students learn how to work with a concrete software product, it may seem that they are given a big advantage, as they are able to find their place in society very quickly without further study. But this advantage does not last long as all these products are quickly replaced by newer, more recent technologies.

One of the possible solutions for teaching basics of algorithmization and programming within the subject Informatics in secondary grammar schools is to apply new approaches and tools for visual data interpretation. The aim of the use of these new approaches is to make teaching Informatics more relevant to current development trends in this scientific field and in the same time to make it much more visual for students. Every student who learns how

to transform presented issue into the form of algorithm (and thanks to this the students learn to make programs) needs to understand the topic and create correct and integrated concepts about the notions used. Without this knowledge s/he is not able to understand the ideas where these notions are used and as a result s/he is not able to apply them in practice. According to the research study results (Majherová, 2005; Ortaňčíková, 2005), in programming one cannot succeed only with the formal knowledge obtained by learning by heart (based on mechanical learning).

When applying visualization in education process, an important role plays its connection with creation and application of models for demonstration and exploration of various abstract objects and dynamic processes of the real world. Very important function of models in teaching Informatics is development of clear ideas in student's mind. When comparing the original with its model and finding how they differ from each other, also the abstract object becomes a visual one. In upper secondary schools, under the condition that students acquired the ability of abstract thinking, we can achieve that they can perceive as concrete and visual also abstract models and descriptions of real processes and facilities, as well as different sign models as schemes, graphs, etc. The use of visual and modelling tools (visualization of algorithm in the environment of a children's programming language, in a form of development diagram, animation or programme scheme) makes it possible to develop students' abilities for visual recognition and creative and logical thinking (Fulier, 2005).

Conceptual Starting Points for the Evaluation of Current State in Teaching Informatics in the Slovak System of Education

A key aspect of a school subject evaluation which is applied in the majority of EU countries is filling the school curricula with the content subject matter, the extent of their connection with practice and its needs and impulses, range of internalization, compatibility and comparability in the European education area. To evaluate quality and attractiveness of teaching, a teacher needs some feedback, i.e. interaction teacher – student. As a possible feedback we can also consider a set of student's competences obtained and demonstrated in a relevant form assessed by the teacher. This student assessment, however, does not provide relevant information about quality of the subject teaching. When assessing quality of teaching, information about students' attitudes to the teaching subject have very important screening value. Students' attitudes towards the subject are determined by the character of the subject but also by many other factors. In the research, we have carried out to evaluate the current state of teaching Informatics, we determined and analysed these factors. The research is based on the students' opinions expressed to evaluate different aspects of teaching Informatics.

Teaching Informatics is a part of "science literacy" acquisition. Within the international monitoring of science literacy (PISA (Programme for International Students Assessment) carried out by the OECD in 2006 year, the Slovak Republic attained quite unsatisfactory results. According to the National Report (PISA, 2007) the Slovak Republic was ranked with 488 points under the average level of science literacy OECD (498 points) and with 492 points at the average performance in mathematical literacy of OECD (500 points). The international monitoring showed that Slovak students have acquired big amount of science knowledge, but they have problems to think independently about science problems (create hypotheses, use various research methods and procedures, collect, process and interpret data, formulate and give evidence for conclusions, etc.). It also showed that the Czech Republic gained statistically better results than Slovakia did. According to the analysis (Palečková et al., 2007), Czech students belong to the group with above-average score both in science test (513 points) as well as in mathematics test (510 points). Achievements of the Czech students in international monitoring science tests are in the long-term above-average which showed not only the three cycles of

PISA research but also two cycles of international research TIMSS (Trends in International Mathematics and Science Study).

The question is to what extent we can judge about the quality of teaching Informatics and Programming in Slovak schools on the basis of the achievements reached by the Slovak students in the stated international monitorings. The quality of teaching is usually judged on the basis of subject matter analysis and the results achieved by students. We decided to evaluate current state of teaching Informatics in schools on the basis of students' evaluations of this state. Furthermore, taking into consideration common historical development of Slovak and Czech school system (within former Czechoslovakia) and evidently different results achieved in science subjects, we decided to focus our attention not only at the situation in Slovak schools but also at the state of teaching Informatics and Programming in the Czech Republic. The main aim of our research was then evaluation of current state of teaching Informatics and Programming in upper secondary schools in Slovakia. Besides that we decided to evaluate in the same way and on the basis of the same criteria also the current state of teaching Informatics and Programming in the Czech Republic and to diagnose strengths and weaknesses of teaching Informatics and Programming in Slovak and Czech system of education on the basis of comparative study.

Methodology of the Research

As the quality of teaching is determined by many factors, the level of education cannot be evaluated by only one indicator. That is why for our research, the main aim of which was an evaluation of the level of teaching Informatics and Programming, a number of factors which highly influence the quality of the teaching process was identified. Selection of these factors was based on the detailed research of both Slovak and international literary resources, on consultations with experts from the field and last but not least on discussions with experienced secondary school teachers of Informatics.

On the basis of the above-mentioned research activities there was determined a group of factors that indicate the state and level of quality in teaching Informatics or Programming in upper secondary schools including the factor of students' attitude towards these subjects. The methodology of evaluation of current state in teaching Informatics and Programming was based on the screening of students' opinions about the following thirteen factors (items):

1. popularity of the school subject
2. applicability of the obtained knowledge for students' future use
3. attractiveness of the subject matter content
4. difficulty of the subject content
5. comprehensibility of teacher's presentation of new study material(s)
6. attractiveness of teacher's presentation of new study material(s)
7. relevance of concrete ways of presentation of new study material(s)
8. attractiveness of the solved tasks
9. comprehensibility of the used textbook(s)
10. applicability of the obtained knowledge in practical tasks solution
11. attractiveness of the teaching aids used
12. relevance of the ways used for written notes
13. fear sources related to the school subject

The factors were designed so that the qualitative features of teaching the selected school subjects could have been transformed into quantitative ones what gives wider possibilities for final evaluation using wider range of quantitative oriented research methods.

To screen students' opinions a questionnaire was used. In the questionnaire the addressed students were asked to use an assessment scale in order to indicate their opinion about the extent each of the factors is important for teaching Informatics (or Programming), or they evaluated

to what extent each of these factors is, from their point of view, really respected in teaching Informatics (or Programming).

Hand in hand with the design of the questionnaire detailed realization and evaluation rules of the questionnaire survey were developed, too. As for the purpose of the prepared research it was necessary to design our own not standardized questionnaire, the research team considered to be important to pilot the designed questionnaire as to its reliability.

Judging the Quality of the Designed Research Tool

The process of measuring is based on data collection. If the measurement has to be of a good quality, the measurement procedure has to be objective, reliable and valid. In our case the process of research data collection was based on the administration of our questionnaire *Evaluation of the School Subject by Students from the Point of View of Selected Factors*. Reliability of this research tool was confirmed on the basis of judging its reliability and identification of suspicious items through analysis of items reliability.

From the overall amount 17 items of the designed research tool, we included into statistic measurement only 9 for the process of evaluation. In these items, there were students' opinions measured by the Likert 7 point scale. Absolute disagreement with the particular statement was expressed by value 1, the very opposite opinion by value 7.

In the questionnaire item 1 (P1), the respondents had a chance to evaluate Informatics in the following way: 1 – *extremely non-popular*, 2 – *non-popular*, 3 – *rather non-popular*, 4 – *neither non-popular nor popular*, 5 – *rather popular*, 6 – *popular*, 7 – *extremely popular*. In the item 2 (P2) they were asked to evaluate how important Informatics is for real life and as a part of general education (1 – *I will definitely not use the obtained knowledge*, 2 – *I will not use the obtained knowledge*, 3 – *I will possibly not use the obtained knowledge*, 4 – *it is difficult to judge whether I will use the obtained knowledge*, 5 – *I can use the obtained knowledge*, 6 – *I will use the obtained knowledge*, 7 – *I will definitely use the obtained knowledge*). In the item 3 (P3) the respondents expressed their opinion about the attractiveness of the subject Informatics (1 – *extremely uninteresting*, 2 – *uninteresting*, 3 – *rather uninteresting*, 4 – *neither interesting nor uninteresting*, 5 – *rather interesting*, 6 – *interesting*, 7 – *extremely interesting*). In the item 4 (P4) they were asked to express their opinion about difficulty of the Informatics subject matter (1 – *extremely difficult*, 2 – *difficult*, 3 – *rather difficult*, 4 – *neither difficult nor easy*, 5 – *rather easy*, 6 – *easy*, 7 – *extremely easy*). In the item 5 (P5) respondents evaluated comprehensibility of teacher's presentation of new study materials (1 – *I never understand*, 2 – *I mostly do not understand*, 3 – *I rather do not understand*, 4 – *sometimes I understand sometimes I do not*, 5 – *I rather understand*, 6 – *I mostly understand*, 7 – *I always understand*). In the item 6 (P6) students evaluated teacher's presentation of the new study materials from the point of view how interesting his/her ways of presentations are (1 – *very uninteresting*, 2 – *uninteresting*, 3 – *rather uninteresting*, 4 – *neither interesting nor uninteresting*, 5 – *rather interesting*, 6 – *interesting*, 7 – *very interesting*). In the item 8 (P8) students were asked to evaluate how interesting the tasks solved in Informatics lessons are (1 – *very uninteresting*, 2 – *uninteresting*, 3 – *rather uninteresting*, 4 – *neither interesting nor uninteresting*, 5 – *rather interesting*, 6 – *interesting*, 7 – *very interesting*). In the item 9 (P9) they were assessing attractiveness of the Informatics textbooks (1 – *definitely unsuitable*, 2 – *unsuitable*, 3 – *rather unsuitable*, 4 – *neither unsuitable nor suitable*, 5 – *rather suitable*, 6 – *suitable*, 7 – *definitely suitable*). Finally, in the item 10 (P10) students could express their opinions about the applicability of the obtained knowledge in solving practical tasks (1 – *extremely useless knowledge*, 2 – *useless knowledge*, 3 – *rather useless knowledge*, 4 – *neither useless nor useful knowledge*, 5 – *rather useful knowledge*, 6 – *useful knowledge*, 7 – *extremely useful knowledge*).

Analysis of the item reliability

Analysis of the items reliability belongs to multidimensional survey techniques and it serves for judging about the quality/reliability of the measurement procedure, e.g. questionnaire scale and identification suspicious questionnaire items. One of the ways of direct reliability estimation is the Cronbach's Alpha Coefficient

$$\hat{\alpha} = \frac{m}{m-1} \cdot \left(1 - \frac{\sum s_j^2}{s^2} \right) \quad (1)$$

where m is the number of items in the questionnaire, s^2 is the questionnaire scale variance, s_j^2 is the variance of the j item in the questionnaire.

Estimation of the reliability can be calculated also using the average correlative coefficient \bar{r} of the particular items. It is called standardized Cronbach's Alpha Coefficient

$$\bar{\alpha} = \frac{m\bar{r}}{1 + (m-1)\bar{r}} \quad (2)$$

where m is number of the items.

The standardized Cronbach's Alpha Coefficient can also be calculated using the previous formula (1), if all the measurements were standardized in advance, i.e. from each variable value is subtracted its average value and it is divided by its standard deviation.

If both estimations are too different, it means that different items do not have the same variability (Munk, Kapusta, 2005).

Conclusions of the reliability/items analysis of the designed research tool

Analysis of the reliability/questionnaire items was done on the basis of the data collected during a pilot testing of 24 students of the eighth grade at the 8-year secondary grammar school with extended teaching of Informatics and Programming in the school year 2009/2010 (Secondary Grammar School at Golianova street, Nitra, 18-19 years old students).

The questionnaire was administered in a printed form. As the group of the respondents was students in the last year of their studies and this was a class which had extended teaching of Informatics and Programming during the whole period of their studies, we can consider their evaluation as a representative, in other words a relevant one. The main aim of the pilot testing was to find out weaknesses of the questionnaire, so that all formal, technical, methodological or content defects could be avoided. The pilot group of the respondents was from the statistical point of view big enough and it enabled to judge about questionnaire reliability and identify its suspicious items. After this analysis the questionnaire was adapted into its final form.

Figure 1 summarizes students' evaluation of separate questionnaire factors P1 – P10 of teaching Informatics (without the item P7 which, as it was above mentioned, was not included into the statistic measurement). The box graph shows the average, standard error in the estimation of the average, standard deviation in evaluation of separate items.

Graphical presentation shows that the most heterogeneous answers were recorded in the item P6 (standard deviation 2.0) and P8 (standard deviation 1.9), i.e. in the items where the respondents expressed their opinion about how interesting can teachers explain new study materials and how interesting are the tasks given to students for solving in Informatics lessons. On the other hand, the smallest standard deviation, and it means the smallest variability of the students' answers, was recorded in the items P1, P9 and P10 (standard deviation for all of them was almost identical, 1.5). It is worth noticing that identical results were achieved also in

other two pairs of items - P2 and P4 (standard deviation 1.6) and P3 and P5 (standard deviation 1.7).

Visual layout in the graph 1 of separate items students expressed their evaluation clearly shows that among all the items included in statistical research the highest evaluation was achieved in the item P1 (the average scale value 5.6 out of 7 point scale) where the students assessed their opinions about popularity of the subject Informatics. The collected data show that students' attitude towards the subject Informatics is highly positive and that it is one of their favourable subjects.

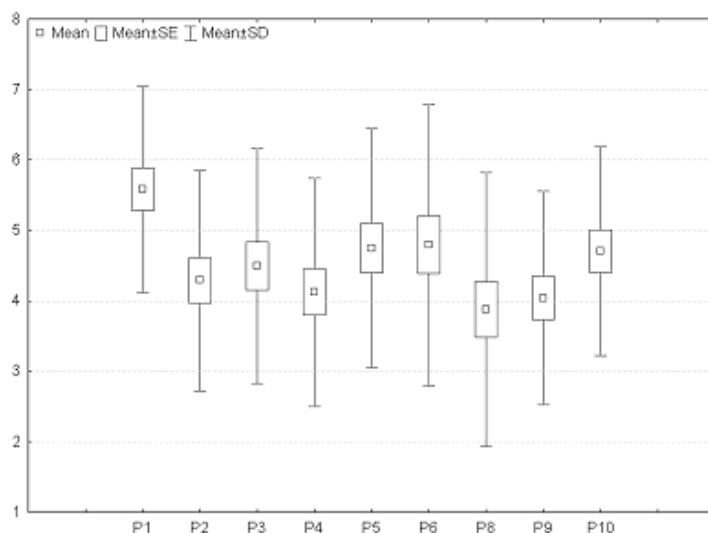


Figure 1: Box graph - Visualization of differences in evaluation of the questionnaire items P1 – P10.

After the analysis of the rest of the items in our questionnaire it was found out that the frequency of positive answers given by students was not as substantial as in the previous case; but despite of that positive answers prevailed over the negative ones. The lowest average score was recorded in the item P8 (average scale value 3.9) where students expressed their opinions about tasks they were solving in Informatics lessons. Majority of the students expressed either neutral or negative attitude to this factor. In this way the students declared that the tasks they were given for solving in Informatics lessons were not interesting enough and that teachers should choose more motivating tasks leading to connection of theoretical knowledge with practical real life tasks.

From the correlation matrix (table 1) we can identify suspicious items in the questionnaire. Highlighted Pearson correlation coefficients are statistically significant at the level of significance 0.05. It is evident that there is statistically significant correlation among the majority of the items what means that there is some degree of mutual dependence among them (the more the correlation coefficient approximates to 1 the higher linear dependency is). The only exception is the item P4 that does not correlate with other items what allows us to say that the values change independently. On the basis of these results, the item P4 was identified as a suspicious one.

Table 1. Correlation matrix of the questionnaire items.

	P1	P2	P3	P4	P5	P6	P8	P9	P10
P1	1,0000 p= ---	0,5240 p=0,009	0,4604 p=0,024	0,2593 p=0,221	0,7035 p=0,000	0,5897 p=0,002	0,4528 p=0,026	0,2417 p=0,255	0,4581 p=0,024
P2	0,5240	1,0000 p= ---	0,6045 p=0,002	-0,1340 p=0,532	0,4346 p=0,034	0,6143 p=0,001	0,5961 p=0,002	0,4681 p=0,021	0,7432 p=0,000
P3	0,4604	0,6045 p=0,002	1,0000 p= ---	0,1365 p=0,525	0,4905 p=0,015	0,3194 p=0,128	0,5842 p=0,003	0,4037 p=0,050	0,4815 p=0,017
P4	0,2593	-0,1340 p=0,532	0,1365 p=0,525	1,0000 p= ---	0,2481 p=0,243	0,1021 p=0,635	-0,0224 p=0,917	0,0154 p=0,943	-0,3261 p=0,120
P5	0,7035	0,4346 p=0,034	0,4905 p=0,015	0,2481 p=0,243	1,0000 p= ---	0,2909 p=0,168	0,3986 p=0,054	0,2233 p=0,294	0,6055 p=0,002
P6	0,5897	0,6143 p=0,001	0,3194 p=0,128	0,1021 p=0,635	0,2909 p=0,168	1,0000 p= ---	0,3739 p=0,072	0,0746 p=0,729	0,5338 p=0,007
P8	0,4528	0,5961 p=0,002	0,5842 p=0,003	-0,0224 p=0,917	0,3986 p=0,054	0,3739 p=0,072	1,0000 p= ---	0,6367 p=0,001	0,4685 p=0,021
P9	0,2417	0,4681 p=0,021	0,4037 p=0,050	0,0154 p=0,943	0,2233 p=0,294	0,0746 p=0,729	0,6367 p=0,001	1,0000 p= ---	0,2366 p=0,266
P10	0,4581	0,7432 p=0,000	0,4815 p=0,017	-0,3261 p=0,120	0,6055 p=0,002	0,5338 p=0,007	0,4685 p=0,021	0,2366 p=0,266	1,0000 p= ---

The correlation matrix of separate questionnaire items recorded in the table 1 is visualized in the figure 2. Each correlation coefficient is presented by a point/correlation graph (scatter plot) and the units on diagonal are substituted by the histogram that shows the shape of variables distribution. In the case of a linear dependence all the points in the correlation graph are expressed by increasing straight line, in the case of a non-linear dependence it is decreasing straight line. In the case of the independence the points form a constant straight line.

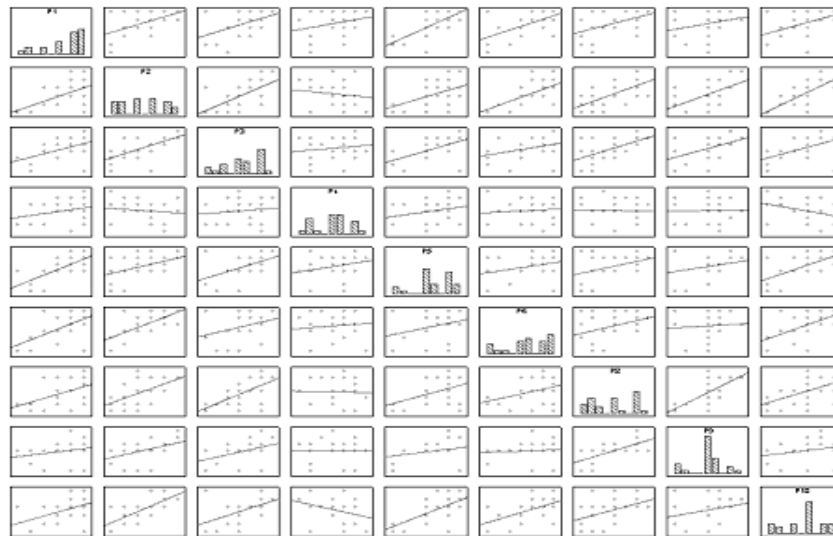


Figure 2: Matrix graph – visualization of the correlation matrix of the questionnaire items.

Reliability coefficient value 0.84 (84 %) expresses the quotient of the sum of scale items variability to the overall variability of the questionnaire. Both estimations (Cronbach's alpha and standardized alpha) are not very different, what means that separate items are of the same variability (table 2).

Table 2. Summarized statistics of the questionnaire.

No of questionnaire items		9	
No of valid questionnaires		24	
Average	40,666666667	Variance	99,014492754
Standard deviation	9,950602633	Cronbach's Alfa	0,838274846
Average correlation between the items	0,391254173	Standardiz. Alfa	0,840456333

The questionnaire can be considered to be reliable, but the low average correlation among its items indicates that after omission of some of the items we could increase its reliability.

Table 3 shows that all the items correlate with the overall score of the scale and if any of them is removed from the questionnaire, the reliability coefficient decreases whereas with the item P4 we can see the opposite tendency – if this suspicious item is removed, the reliability coefficient increases (Cronbach's alpha increases from 0.84 to 0.87). It means that the fourth item decreases overall reliability of the questionnaire and therefore it will be subject to further qualitative analysis.

Table 3. Questionnaire statistics after removing the separate item.

	Average after removal	Variance after removal	St.Deviation after removal	Items - Total correlation	Alpha after removal
P1	35,08333	74,99306	8,659853	0,714002	0,805948
P2	36,37500	72,90105	8,538211	0,745606	0,800934
P3	36,16667	73,72222	8,586164	0,659718	0,809291
P4	36,54167	90,74825	9,526188	0,053320	0,870103
P5	35,91667	74,07639	8,606764	0,629654	0,812492
P6	35,87500	73,19271	8,555274	0,533383	0,825067
P8	36,79167	70,33160	8,386394	0,657385	0,808528
P9	36,62500	81,31771	9,017633	0,424199	0,833982
P10	35,95833	77,12327	8,781985	0,611192	0,815948

Suspicious questionnaire item analysis

As evident from the previous part when analysing reliability/items of the designed research tool, it was found out that the item P4 decreased the overall questionnaire reliability. It was the item where students evaluated difficulty of the school subject Informatics.

Informatics belongs to a group of subjects that are:

- 1 - extremely difficult
- 2 - difficult
- 3 - rather difficult

- 4 - *neither difficult nor easy*
- 5 - *rather easy*
- 6 - *easy*
- 7 - *extremely easy*

Omission of this item resulted in a higher reliability of our questionnaire.

The reason why the item P4 decreased the overall reliability of the questionnaire was that even those students, who stated in their questionnaires that the subject Informatics belonged to their favourite and interesting school subjects and who said that they almost always or in most cases understood the explanation of the new study material by the teacher, declared in the item P4 that they found Informatics quite difficult. These data can be interpreted in such a way that though Informatics is an interesting and popular school subject for students, the requirements of teachers (as to the development of information competences, amount of knowledge acquired, expected performance standards - especially from the graduates of study programmes with extended teaching of Informatics) are very high and therefore the students think the subject is rather difficult.

Conclusions

Summary of the results of the preparatory phase of the research

In the preparatory phase for the research several factors related to the evaluation of current state of teaching Informatics or Programming in upper secondary school were determined. These factors served as the basis for questionnaire items design. The questionnaire (*Evaluation of the School Subject by Students from the Point of View of Selected Factors*) was to serve as a tool for collection of research data. The results of questionnaire piloting were used to test its reliability. To evaluate the questionnaire reliability we used reliability/items analysis. Results of reliability/items analysis showed that one of the questionnaire items was suspicious and decreased its overall reliability.

To count the overall reliability we used Cronbach's Alpha Coefficient. The value $\alpha=0.84$ indicates high internal consistency of the designed measurement tool. It means that application of the designed research tool enables to collect reliable data through which we can achieve the stated aim of our research which is to evaluate the level of teaching science subjects, in particular the subjects Informatics and Programming, in upper secondary schools on the basis of the determined factors.

Plannes for the following phases of the research

Because of the big variety of upper secondary school profiles and related to this fact wide range of different forms of teaching Informatics and Programming in them, for our research we decided to focus only on one type of the upper secondary schools (ISCED3) – secondary grammar schools (gymnazium). To find out about the current state of teaching Informatics in the selected schools – the secondary grammar schools, we will evaluate those factors which we specified as main factors determining quality of teaching the subjects.

As to the research sample of students, considering our limited possibilities of carrying out the research, accessible selection to the random one was preferred.

As the intention of the further on-coming research is to evaluate current state of teaching Informatics not only in Slovak but also in Czech schools, on the basis of accessibility two research samples were created: one group of students from Slovak secondary grammar schools (8 secondary grammar schools – 586 respondents) and one group of students from Czech secondary grammar schools (5 secondary grammar schools – 322 respondents). In both

cases the secondary grammar schools involved are from different regions and from differently populated cities. Collection of research data from these research samples and their processing have been in progress currently.

Limitations to generalize research results after elaboration of research data can be connected mainly with the research sample. The research sample consists of students of different grades and different study profiles. They include groups of respondents from classes without any specific profile but also groups of respondents attending classes with specific profiles or with extended Informatics teaching. However there are no groups with extended teaching of foreign languages. Partial problem can also be assessment of teaching Programming. The problem is that Programming is not taught in classes with a general profile and in classes with extended teaching of Informatics it varies a lot in different schools. In some schools (the secondary grammar schools – gymnasium) Programming is taught as a separate school subject but in other schools as a separate topic within teaching Informatics (this prevails).

More detailed statistic analysis of the administered questionnaire (*Evaluation of the School Subject by Students from the Point of View of Selected Factors*) with a deeper quantitative and qualitative analysis of the obtained research data will be published in one the following papers. On the basis of data collection – research data obtained in the selected Slovak and Czech schools, a scientific report (as the main aim of the research) will be written. It will show and discuss current state and quality of teaching Informatics in Slovak and Czech upper secondary schools. The report will compare strengths and weaknesses of teaching the subjects Informatics and Programming and it also will design some measures for improvement of quality of teaching the subjects in Slovakia.

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