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QUALITY ASSURANCE OF INFORMATICS EDUCATION WITHIN TERTIARY ECONOMY AND MANAGERIAL STUDY FIELDS

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Abstract

One of the key issues of the EU educational policy is quality assurance. The presented research represents a contribution to solving the issue of quality assurance of informatics education on the tertiary level of education in economy and managerial study fields. Within the research current state of informatics education in selected economy and managerial study programmes was analysed based on students` views and opinions. Necessary research data were collected through questionnaire survey respondents, who were students of the relevant study programmes in the Slovak and Czech Republics. The paper presents in more detail results of the questionnaire part which was focused on finding out how the students evaluate informatics education incorporated in their pre-graduate education considering its relevance to their study and career profiles. Another task of the research was to find out whether the students` evaluations depend on their gender and study specializations, and also whether there are some differences in the evaluations done by the students of the same or at least similar study programmes studying either in Slovakia or in the Czech Republic. As the results showed, students of the economy and managerial study programmes do not connect their future career with the information technologies and they do not have ambitions to be employed in the IT area. But at the same time, they are aware of the fact that the knowledge and skills obtained within their informatics preparation are important for their everyday life and future career. On the other hand, they are not satisfied with the quality of the informatics subjects they are taught. So, to assure the quality of their pre-gradual preparation does not mean only to innovate curricula of the informatics preparation but also to deal with the issues of an efficient transfer of these curricula content to students.
Keywords: *tertiary education, informatics education, curricula innovation, evaluation of the education, quality assurance, career profiles.*

Introduction

Nowadays in Slovakia informatics is integrated in different forms in the study programmes of almost all study fields carried out at the tertiary level of education. An important reason, why informatics topics are included into the study programmes of the economy and management study fields on the tertiary level of education (The International Standard Classification of

Education – ISCED 6, ISCED 7), is a need to develop students` computer literacy in general (http://www.akredkom.sk/index.pl? tmpl=odbory) and at the same time enhance mainly those their informatics competences which have a broad transferability from the point of practice and labour market view (http://www.alianciapas.sk). Acquirement and development of informatics competences significantly support one`s professional adaptability and his/her employment opportunities in the labour market in general, but at the same time it also enhances one`s adaptability in personal out-of-service life (Burgerová & Beisetzer, 2002; Chauchat & Zolotaryova, 2011; Kozík & Sitáš, 2009; Pešaković, Flogie & Aberšek, 2014). These aspects are very close to the issue of quality assurance of education provided by higher education institutions, which has been one of the key points of the educational policy of the EU countries since the beginning of the Bologna process (Crosier & Ruffio, 2009; EHEA, 1999; ENQA, 2009; Gadušová, 2012; Pisoňová & Nagyová, 2014; Wiliams, 2010).

However difficult, taking account of the different purposes of tertiary education and the perspectives of different to it relevant stakeholders, it may be to define quality as such, quality is a broadly common and shared concern. The purpose of the quality assurance policy is to establish a common set of core values for quality assurance within the field of education across the different academic levels and areas. In this meaning quality assurance is defined as the total of all activities and methods aimed at the systematic and purposeful development of the higher education institutions` effort in the field of education. The key aim of the whole process, based on the constant development of teaching practices and forms, is to maximize student learning outcomes.

In an modification based on the analysis of the areas included in the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ENQA, 2009) quality assurance of higher education institutions can be followed in five sections: recruitment and admission, structure and process, development of education, teaching and learning environment (related to the microlevel of the education system, i.e. performance of the particular lessons included in the study programme curricula), study environment (related to the macrolevel of the education system, i.e. services and facilities provided by the institution to support students acting at the university, college etc.) and the relation between degree programmes and the labour market. Internal quality assurance systems of higher education institutions try mainly to improve the quality of the offered study programmes. The quality of a study programme lies in its ability to provide appropriate solutions for the expectations of anyone who is interested in the educational services available, equally students as well as the world of work. To achieve and keep this ability of the offered study programmes, internal quality assurance systems of higher education institutions regularly gather and analyse important information – such as e.g. numbers of students who graduate in line with the regular programme or employment situation of the graduates – and based on the results of the relevant analyses the institutions plan particular improvement actions.

The generally proclaimed overall unsatisfactory level of informatics education confirm not only results of different national and local surveys and research studies (Domanja, 2015; Šnajder & Guniš, 2016) but also results of international comparisons. One of them was a survey funded by the European Commission and carried out by the University of Liège in 2012 (European Schoolnet, 2013). Among other things this survey confirmed that at EU level around 50 % of students at grades 8 and 11 in vocational education are part of the low ICT access and use at school. In Slovakia the problems stated in the report from this survey should solve e.g. the national project *Conception of informatization and digitization in education sector with a view to 2020* (so-called *Digipedia 2020* project, MŠVVaŠ SR, 2013). As to the tertiary education, a greater reflection to the stated problems has been in the Czech Republic rather than in Slovakia. In particular one can mention a project carried out at University of Economics in Prague *Innovation of the subject Managerial informatics – database applications* (VŠE, 2013) a goal of which was to modify curricula of the subject to the up-to-date labour market requirements. With a goal to adapt the already accredited study programmes to increase the

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relevant graduates` employability in the labour market a broader-conceived project *Innovation of education in informatics subjects in study programmes of the University of Ostrava* (OU, 2012).

Within the economy and managerial study programmes a criticism is aimed mainly at insufficient attention paid e.g. to integrating the issues of teaching database, information systems and internet technologies into the study programme curricula. Partially it is also a consequence of a low lesson allocation devoted to subjects taught within the informatics education in the concerned study programmes (Carlsson, Hedman & Steen, 2010; Lareki, Morentin & Amenabar, 2010). Goal-directed development of students` knowledge and skills in the area of database systems and database technologies (systematic creation of databases, work with data in different basis) supports also one`s logical and analytical thinking, his/her invention and creativity. Last but not least, teaching database systems and technologies introduce broad possibilities to apply already acquired knowledge and skills at solving tasks and problems relevant to the particular study profilizations (Helfert & Duncan, 2006).

The stated weaknesses of informatics preparation of the economy and managerial study programme graduates do not only decrease their employability in labour market, but they can have also other social impact as they present also a risk to business growth and societal development. This is reflected in a general need for actions to be taken to upgrade these workforces continuously to ensure and maximise the competitive potential of the graduates in their professional environment which significantly uses rapidly developing applications of digital technologies.

Particular approaches, experiences and achievements regarding the issues of informatics education curriculum within the economic and managerial study fields at the tertiary level of education (ISCED 6, ISCED 7) in developed West European countries, USA and also in the Central European countries are described in many professional publications and studies (Ekstrom & Renshaw, 2003; Fan, Yang & Zhang, 2015; Robbert, Wang, Guimaraes & Myers, 2000; Springsteel, Robbert & Ricardo, 2000; Tumbas, Sedlak & Matkovic, 2009; Urban & Dietrich 2001). Their authors point out that the practice demand on the higher education graduates specialized in economy or management is to dispose – except of the economical, managerial or marketing erudition – also of the adequate knowledge and skills in the area of database systems and information technologies which the graduates need to analyse and design complex economic and social causal relations and to elaborate probabilistic-statistical and prognostic models in different economy sectors. This knowledge and skills are very often crucial criteria of the enterprise bodies at recruiting graduates of the mentioned specializations, as just the graduates acquainted with the work with database systems and database technologies or with data mining at the quantitative statistical method applications are usually more productive and successful in their professional careers (Jakuš & Páleníková, 2009).

Research Focus and Purpose

Different research results show that informatics education currently provided within the tertiary economy and managerial study programmes does not respond significantly to current needs of practice neither to current requirements of employers on the professional competences of the graduates (this regards graduates´ abilities to use relevant software products at solving statistical and socio-economic analyses and processing statistical prognosis or abilities to define exactly requirements on the structure of the database systems to be created, etc.). So, a question arises – how informatics education included in the economy and managerial study programmes should be modified (in all aspects – as to its scope, content, arrangement) to be in accordance with the current needs of the practice and constantly increasing informatization in/of all life areas. The purpose of the carried research was to give at least some partial answers to this question. With this intention the current state of the informatics education in the selected economy and managerial study programmes was analysed to create a sophisticated platform

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for innovation and optimization of the informatics education carried out at higher education institutions (in frame of the economy and managerial study programmes). So, the key research question within the described broader context of the research was how the students of the selected economy and managerial study programmes evaluate informatics preparation included in their tertiary study programmes from the point of view of the professional profilization for their future job career. The term informatics preparation is usually used for study courses and subjects related to informatics which are included in the study programmes. Additionally to this definition of the term informatics preparation, within the above-stated key research question we were interested also in how the students evaluate not only the content of the informatics preparation they undergo during their tertiary studies but also how they evaluate ways in which the relevant courses and subjects are taught.

Problem of Research

There were stated two research tasks:

- to map and analyse informatics education, based on the students` views and opinions, in the context of the selected economy and managerial study programmes carried out at some relevant faculties in the Slovak and Czech Republics,
- to find out whether the students´ evaluations depend on their gender and study specializations, and also whether there are some differences in the evaluations done by the students of the same or at least similar study programmes studying in "different but very similar" countries.

It is expected that the research results will serve for optimization of informatics subjects (courses) instruction within the analysed study programmes in accordance with the current requirements of the observed study programmes graduates` knowledge and skills (profile).

Research Methodology

Research Sample

Considering the relationship between the systems of education in the Slovak and Czech Republic (their previous common development), the Czech Republic was chosen as a comparative country to the situation in Slovakia. The research samples in both these countries, groups of the questionnaire respondents, were created primarily on the basis of the availability of students enrolled in the observed study programmes, and secondarily on the basis of the selected study programmes relevance as regards the programme specialization, profiles of their graduates, number of students as well as their reputation.

In Slovakia the research sample consisted of the students of the Faculty of Economics and Management (FEM), Slovak University of Agriculture (SUA) in Nitra, enrolled in one of the following study programmes: *Business Management* (BMA), *Quantitative Methods in Economics* (QME), *Accounting* (AC), *Agrarian Trade and Marketing* (ATM) or *Business Economics* (BEC), and students of the Faculty of European Studies and Regional Development (FESRD), Slovak University of Agriculture (SUA) in Nitra, enrolled in the study programme *European Development Programmes* (EDP). Due to limited possibilities the research sample in the Czech Republic consisted only of the students attending the Faculty of Business and Economics (FBE), Mendel University (MU) in Brno, enrolled in study programmes *Economic Policy and Administration* (EPA) and *Accounting and Taxes* (ACT). In general both research samples (the Slovak and Czech one) consisted of students from 3rd to 10th term of their tertiary study (age category from 19 to 24 years) enrolled in selected study programmes from the study fields economy or management either at the Slovak University of Agriculture (SUA) in Nitra (Slovak Republic) or Mendel University (MU) in Brno (Czech Republic). All the above-mentioned faculties offer education in nearly identical study programmes of economy and

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managerial study specializations. Composition of the research sample in dependence on the factors (in the meaning of the variables related to the respondents' characteristics) COUNTRY, GENDER and FIELD OF STUDY (study specialization) is presented in Table 1.

Table 1. Composition of the research sample according the respondents' characteristics.

	Factor	N
COUNTRY	Slovakia (SR)	493
	Czech Republic (CZ)	42
GENDER	Female (F)	373
	Male (M)	162
FIELD OF STUDY	Business Economics (BEC)	319
	Agrarian Trade and Marketing (ATM)	62
	Quantitative Methods in Economics (QME)	28
	Accounting (AC)	37
	Business Management (BMA)	20
	European Development Programmes (EDP)	27
	Accounting and Taxes (ACT)	18
	Economic Policy and Administration (EPA)	24
Total		535

Instruments and Procedure

To gain research data on students` views and opinions, a questionnaire was to be developed. But to know how formulate particular questionnaire items, what focus them on, it was necessary to analyse study programmes of the groups of students grouped into the research sample. The analysis followed only the aspects of informatics education, its incorporation within the concerned study programmes, i.e. which subjects from the field of informatics are taught, what is the status of these subjects, to what extent they are taught, which topics are included in their curricula, in which year of the study they are taught, etc. Main results of the analysis are presented in the chapter *Results of the Study Programmes Analysis*.

The fact that the research was based on collection of the students` views and opinions on the observed issues can be evaluated as an original feature of the carried-out research (but on the other hand, this fact puts some limitations on generalization of the research results and findings, as well as from their derived conclusions).

The necessary research data were collected through a questionnaire survey in frame of which the respondents expressed their assessments or possible requirements on incorporation of different relevant topics, related to informatics education, into their study programmes taking into consideration their professional profilization. The used questionnaire consisted of 104 items which were structured in six areas (questionnaire parts A – F):

- Part A: *Introduction* (7 items)
  Identification of the respondent's gender, age, study specialization

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- Part B: *What I want to learn* (26 items)
  Identification of the informatics topics/subjects which the students want to learn from those included in the current curricula of their study programmes, estimation of the level of attractiveness of these subjects for students (how interesting they are for students in the context of their further career specialization)
- Part C: *My future profession* (24 items)
  Estimation of the level to which some given factors are important for students in their decisions made at their future job selection
- Part D: *What I would like to learn* (22 items)
  Identification of the informatics topics/subjects which the students would like to learn and which are not included in the current curricula of their study programmes, estimation of the level of attractiveness of these subjects for students (how interesting they are for students in the context of their further career specialization)
- Part E: *My education in the field of informatics* (18 items)
  Assessment of some statements regarding the informatics education the students have already passed during their tertiary education (estimation of the level to which the students agree or do not agree with the given statements)
- Part F: *My professional competences in the context of the study specialization* (7 items)
  Screening of the students` opinions on the development of their study specialization: how they assess their professional competence and how they assess their possibilities of labour market success in the context of their study specialization

In the questionnaire parts B – E the respondents expressed their opinions and assessments to the particular questionnaire items through 5-point Likert scale, i.e. through assessments from 1 to 5 points with a mean value to express neutral, emotionally indifferent evaluative answer. A higher level of the negative assessment or disagreement was expressed by a lower point value, markedly negative assessment or a total disagreement was expressed by the point value 1. A higher level of the positive assessment or agreement was expressed by a higher point value, the maximum positive assessment or a total agreement was expressed by the point (scale) value 5. At each respondent his/her responses to the particular items were recorded, i.e. one recorded the scale values by which the respondent assessed the particular informatics topic areas from the point of view of their interest and attractiveness for his/her study specialization (profilization), and the scale values corresponding to the degree of the respondent's agreement or disagreement with the particular given statements.

In the questionnaire part F named *My professional competences in the context of the study specialization* the respondents chose out of seven alternative answers the one which they identified mostly with, or which represented their viewpoint mostly. Formulation of the particular statements was in an agreement with our research intentions and was based on the following two aspects:

- to find out students' views and opinions to subjects and topics related to the field of informatics, which are an integral part of their education curricula,
- to find out students' opinions on particular aspects of teaching informatics subjects included in their study programme (teaching those subjects the students have already passed during their tertiary study).

In the results processing the attention is primarily paid to those questionnaire items which reflect mostly the current state of the realisation of the informatics education in frame of the observed study programmes (taking into account the profilization of these programmes graduates).

Structure of the created questionnaire resulted from previous experiences (Hašková, 2003; Záhorec, Hašková & Munk, 2012), from an extensive search work of available sources describing relevant research done in Slovakia and abroad, too (Adomavičius, Bareiša, Keršiene & Sekliuckis, 2004; Ellis, Hughes, Weyers & Riding, 2009; Entwistle, 2007; Ginns, Kitay

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& Prosser, 2008; Helfert, 2011; Lapidot & Hazzan, 2003; Markauskaite, 2003; Ribeiro & de Gusmão, 2010; Richardson, 2009; Ross & Genevois, 2006; Srivastava, 2012), as well as from consultations with experts dealing with these or similar issues and not least from personal discussions led in community of experts having extensive professional and educational experiences in teaching subjects related to informatics and informatics competences.

Reliability of the Questionnaire

To verify reliability of the prepared questionnaire, a pilot research was carried out to obtain data necessary for the analysis of its reliability/item questionnaire. As a research sample of the pilot research group of tertiary students enrolled in the 3rd year of the bachelor study programmes *Business Economics*, *Business Management*, *Accounting*, *Business Enterprise* was used (Záhorec, Hašková & Munk, 2014). The main purpose of the questionnaire verification was to identify problem points of the questionnaire from the respondents´ point of view and to prevent any possible troubles and difficulties which could occur, whether formal, technical, contentual or methodological. From the statistical point of view the selected group of respondents was sufficient enough, so it was possible to use statistical techniques and methods to assess the reliability of the questionnaire and identify its suspicious items. Following the comments of the respondents and the results of the analysis of reliability/items the questionnaire was modified to its final form.

Reliability of the created questionnaire was approved on the basis of its item reliability evaluation and suspicious questionnaire items identification by means of reliability/item analysis. The total reliability of the questionnaire was calculated through the Cronbach alpha coefficient. The Cronbach alpha values stated separately for all four questionnaire areas B – E (B – *What I want to learn* $\alpha_B = 0.9570$; C – *My future profession* $\alpha_C = 0.8405$; D – *What I would like to learn* $\alpha_D = 0.9620$; E – *My education in the field of informatics* $\alpha_E = 0.9293$) indicated a high level of the internal consistency of the used measurement tool.

Administration of the Questionnaire

Administration of the questionnaire survey was carried out in co-operation with teachers of the concerned faculties who ensured the administration of the questionnaires in the print version among the selected respondents. The administration was done during the face-to-face lessons of the relevant subjects. This way of the administration ensured the highest possible response rate of the questionnaires and eliminated also respondents` misunderstanding of the item (what are they asked about and how to answer). As the administrators assisted the students with necessary explanations in case of some doubts, from the total number of 550 administrated questionnaires only 15 was returned not fully completed and these were consequently excluded from the final data processing. So, the achieved final response rate was 97.3 %.

Data Processing

To find out whether the differences among the statistics values of the respondents` answers to the particular questionnaire items are random or they are statistically significant, to the data obtained by the selective finding repeated measures analysis of variance ANOVA was applied, i.e. a null hypothesis

H0: *There is no statistically significant difference between the assessments of the items* was tested.

Assumption of the analysis of variance for repeated measures is equality of the variances and covariances in the covariant matrix for repeated measures, so-called assumption of the covariant matrix sphericity. Although the research samples were big enough, assumption of normality for the given factors was tested through the Normal probability plot (Munk, 2011).

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Additionally, also the dependence of the students` responses to the particular questionnaire items on the factors COUNTRY, GENDER and FIELD OF STUDY was tested.

Thereinafter there are presented results of the relevant study programmes analysis at first and then main results and findings obtained from the analysis of the questionnaire items included in the questionnaire part E *My education in the field of informatics* (questionnaire items E1 – E18) which we consider to be the most relevant to quality evaluation of the current state of informatics education carried out in frame of the economy and managerial study programmes.

Results of the Study Programmes Analysis

At the Faculty of Economics and Management (FEM), Slovak University of Agriculture (SUA) in Nitra, the study programmes involve beside others also subjects related to informatics education. In the first term of the first (bachelor) level of the study students have the subject *Informatics* which is followed by the subject *Managerial informatics* in the second term. Within these subjects students acquire knowledge and skills related to the use of database tools and advanced techniques of work with Microsoft Excel in processing and analysis of large-scale tabulated data, knowledge related to basic concepts regarding relational database technology, and skills in the application use of Microsoft Access databases, as well as knowledge and skills related to structured documents creation and formatting through the use of Microsoft Word application tools. At the Faculty of European Studies and Regional Development (FESRD), Slovak University of Agriculture (SUA) in Nitra, the mentioned scope of the teaching topics is taught within a frame of the subject (course) named *Computer processing of information* incorporated in the first and second term of the first level of the tertiary study. Curricula of the subjects *Informatics*, *Managerial informatics* and *Computer processing of information* are designed in such a way that the students would be able to successfully pass a set of standardized certification exams at an advanced level of the ECDL system (*European Computer Driving Licence*) and to obtain the *Expert version* of the ECDL certificate. This means they should be able to obtain an internationally accepted document (certificate) on an advanced level of their computer literacy or digital expertness (http://www.ecdl.sk/testy-ecdl/sylaby-ecdl-advanced). Knowledge of the database systems is further developed within the study specialization *Quantitative Methods in Economics* (QME) in the first term of the second (master) level of the study within the subject *Database systems*. This subject represents an important component part of the study core of the tertiary level of education in both full- and part-time study forms at the Faculty of European Studies and Regional Development (SUA Nitra), specifically of the study programme *European Development Programmes* (EDP). The main aim of this subject is to make students familiar at both theoretical and practical levels with the key principles of database design and creation, which enables them in their future career performance to correctly formulate requirements on the establishment and consequent modifications of the (company or institutional) information systems. Students are acquainted in a practical way with segments (particular levels) of information systems, relational data models, relational algebra, query language principles, DML, DDL and DCL statements of SQL language. Further they are acquainted with conceptual, database and physical data models, data normalisation, methodology of data model creation, data protection and data integrity limitations. Passing the subject, the students acquire broad knowledge on the use of different data models, algorithmization methods and standardization. Topics of programming and database systems development do not occur within the informatics education curricula neither at the Faculty of Economics and Management (FEM) nor Faculty of European Studies and Regional Development (FESRD). Some information close to these issues, which students can be acquainted with, is information and skills developed in frame of the subject *Programming in applications* taught at the FEM in the last term of the master level of study.

Some subjects related to informatics education create a component part of the study programmes also at the Faculty of Business and Economics (FBE), Mendel University (MU) in

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Brno. One of them is a subject named *Informatics for economists* taught in the first two terms of the bachelor level of the study. Its aim is to teach students how to use basic internet technologies effectively, how to describe principles of basic data types storage in computer memory and to learn the principles of database and information systems. Another subject incorporated into the informatics education curricula at the bachelor level of the study at FBE MU is the subject *Database systems I*. Topics included into its curriculum are aimed at designing database models for particular applications, description and explanation advanced SQL queries and their parts and understanding SQL query logic. Passing this subject, students carry out also the database model implementation into the most common database systems. A continual extension of the subject *Database systems I* is incorporated into the master level of the study as *Database systems II*. Graduates of this subject are able to define and explain results of the data analysis at the reporting level, to design data warehouse model on the application level together with its consequent optimization, as well as to describe and carry out the ETL process of data loading into the data warehouse. In general, the graduates of this subject can be taken as knowledgeable to create database queries on an advanced user level, including the optimizing strategies.

Research Results

Data Processing Abstractedly from the Particular Factors

In the questionnaire part E entitled *My education in the field of informatics* the respondents were asked by means of the 5-point Likert scale (5 – *I agree,* 4 – *I rather agree*, 3 – *I neither agree nor disagree*, 2 – *I rather disagree*, 1 – *I disagree*) to state to what extent they agree or disagree with the given 18 statements (items E1 – E18, see in Table 2) relating to the education they reached in the area of informatics.

Table 2 summarizes descriptive characteristics of the final scores obtained for all items E1 –E18 processed without differentiation of the respondents according the factors COUNTRY, GENDER or FIELD OF STUDY (mean, standard deviation, standard error of the estimated average score and 95% confidence interval for the scale value).

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Table 2. Descriptive statistics of the items from the questionnaire part E – *My education in the field of informatics*.

Questionnaire part E / Item	Mean	Stand. deviation	Stand. error	Confidence interval of the mean	
				-95 %	+95 %
My education in the field of informatics					
E1 – Informatics subjects belong to my favourite	2.91	1.16	0.05	2.81	3.00
E2 – Informatics subjects are interesting	3.27	1.12	0.05	3.18	3.37
E3 – Informatics subjects are difficult as to their content	3.78	0.95	0.04	3.69	3.86
E4 – To learn informatics subjects is rather easy for me	2.92	1.03	0.04	2.83	3.00
E5 – Informatics subjects open me space for new and exciting activities	2.85	1.04	0.04	2.76	2.93
E6 – I like informatics subjects more than the other non-informatics ones	2.47	1.12	0.05	2.37	2.56
E7 – I think that everybody should learn informatics subjects	3.62	1.12	0.05	3.53	3.72
E8 – Knowledge acquired within the informatics subjects will help me in my everyday life	3.74	1.01	0.04	3.66	3.83
E9 – Knowledge acquired within the informatics subjects will increase my chances in my future professional career	3.98	0.90	0.04	3.91	4.06
E10 – Informatics subjects raised my curiosity about phenomena which we still cannot explain	3.00	1.08	0.05	2.91	3.09
E11 – Informatics subjects taught me to understand modern information technologies	3.38	1.03	0.04	3.29	3.47
E12 – Informatics subjects showed me how important is the science for our life	3.10	1.06	0.05	3.01	3.19
E13 – I would like to work in the area of applied informatics	2.20	1.12	0.05	2.10	2.30
E14 – I would like to have at school the most informatics subjects	2.40	1.21	0.05	2.30	2.51
E15 – I would like to work in the IT area	2.16	1.15	0.05	2.06	2.26
E16 – The way in which the teachers of informatics subjects use to explain/present the new subject matter is an interesting one	2.75	1.06	0.05	2.66	2.84
E17 – The tasks solved within informatics subjects teaching are interesting	2.82	1.04	0.05	2.74	2.91
E18 – Within informatics subjects teaching we use interesting teaching programmes, interactive simulation models	2.73	1.02	0.04	2.65	2.82

$N = 535$

On the basis of the presented results of the description statistics the null hypothesis H0: *There is no statistically significant difference between the assessments of the items*

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E1 –E18.
was tested at the 5% significance level:

Visualisation of the obtained data and expected normal values shows no significant normality deviations. In Figure 1 there is presented a graphical comparison of the distribution of the item variable E18 (*Within informatics subjects teaching we use interesting teaching programmes, interactive simulation models*) with the normal probability distribution. The closer the points are to the straight line, the better the variable coincides with the normal probability distribution. Similar results were obtained also for the items E1 – E17.

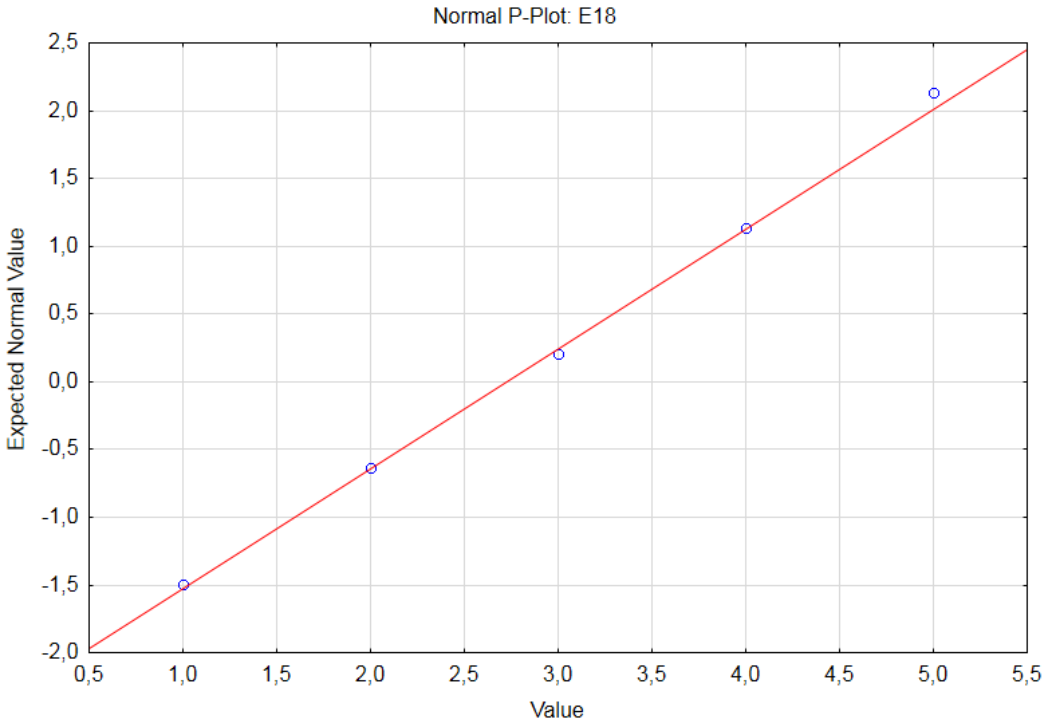

Figure 1: Normal probability plot for the item E18 – *Within informatics subjects teaching we use interesting teaching programmes, interactive simulation models.*

To test the equality of the variances and covariances in the covariant matrix Mauchly's sphericity test was used (Table 3).

Table 3. Mauchly's sphericity test.

Questionnaire Part / Item	W	Chi-Sqr.	df	p
My education in the field of informatics / Item (E1 – E18)	0.012	2339.356	152	p<.001

In case of the items E1 – E18 the test is statistically significant (p<.05) so the assumption of the variance equality failed, i.e. there is a failure of the assumption and so it is refused (Table 3).

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If the assumption of the covariance matrix sphericity is not fulfilled, value of the type I error increases. That is why in such cases degrees of freedom for the used F-test are revised by corrections to achieve the declared significance level. Because of the failure of the assumption of the variance analysis validity there was used Greenhouse-Geisser and Huynh-Feldt correction for analysis of variance repeated measures.

The results of Greenhouse-Geisser and Huynh-Feldt correction for analysis of variance repeated measures to test the respondents` answers to the items E1 – E18 (Table 4) proved the statistical significance of the differences between the respondents` assessments of the particular items within the studied area (p<.01).

Table 4. Greenhouse-Geisser and Huynh-Feldt correction (Lower Bound) for repeated measures of variance analysis.

	df	F	p	G-G	G-G	G-G	G-G	H-F	H-F	H-F	H-F
				Epsilon	Adj. df1	Adj. df2	Adj. p	Epsilon	Adj. df1	Adj. df2	Adj. p
Item	17	221.978	p<.001	0.595	10.116	5402.072	p<.001	0.607	10.327	5514.659	p<.001
Error	9078										

Following the obtained results for the repeated measures variance analysis the stated null hypothesis H0

H0: *There is no statistically significant difference between the assessments of the items E1 – E18.*

was disapproved at the 1% significance level.

Within the tests also Friedman test and Kendall's coefficient of concordance were applied. Results of Friedman's test (ANOVA Chi Sqr. (N = 535, df = 17) = 2655.679; p<.001) and achieved values of Kendall's coefficient of concordance (Coeff. of Concordance = 0.292) have proved Greenhouse-Geisser and Huynh-Feldt correction results (p<.01). The results are consistent, so they can be taken as robust.

After the approval of the statistically significant differences among the respondents` answers to the items E1 – E18 of the questionnaire part *My education in the field of informatics* the differences in the assessment were tested to find those items between responses to which the differences are statistically significant. The identification of the homogeneous groups in the concerned part was done by means of the repeated comparison of the particular couples. Overview of the repeated comparison is presented in Table 5.

Within the identified ten homogeneous groups the respondents (without their differentiation according the factors COUNTRY, GENDER and FIELD OF STUDY) answered to the particular questionnaire items almost all the same.

Average values of the scores obtained at the respondents´ answers to the particular questionnaire items E1 – E18, following the interval estimate of the mean, ranged from 2.16 up to 3.98, what in the frame of the used scale means evaluations from *I rather disagree* (2) up to *I rather agree* (4) with the given statement. Majority of the items was evaluated by the respondents neutrally (scale value 3 – *I neither agree nor disagree*). Students do not perceive informatics subjects as their favourite ones among those incorporated in the general part of their study programmes (E6 – *I like informatics subjects more than the other non-informatics ones*). The research results pointed out also some limitations regarding to the tasks solved during the lessons as to their attractiveness (E17 – *The tasks solved within informatics subjects teaching are interesting*). Based on the research results it can be further stated that the respondents are less interested in topics connected with phenomena which are still unexplained (E10 – *Informatics subjects raised my curiosity about phenomena which we still cannot explain*) as well as in questions connected with modern information and communication technologies and their role in society operation (E11 – *Informatics subjects taught me to understand modern information technologies*).

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Table 5. Identification of the homogenous groups.

Item	Mean	1	2	3	4	5	6	7	8	9	10
E15	2.160748	****									
E13	2.200000	****									
E14	2.403738		****								
E6	2.467290		****								
E18	2.732710			****							
E16	2.749533			****	****						
E17	2.824299			****	****	****					
E5	2.846729			****	****	****					
E1	2.906542			****	****	****					
E4	2.915888				****	****					
E10	3.000000					****	****				
E12	3.097196						****	****			
E2	3.271028							****	****		
E11	3.381308								****		
E7	3.622430									****	
E8	3.743925									****	
E3	3.775701									****	
E9	3.983178										****

Despite the fact, that the score values at the respondents´ answers to the questionnaire items E13 (*I would like to work in the area of applied informatics*), E14 (*I would like to have at school the most informatics subjects*) and E15 (*I would like to work in the IT area*) express their approach *I rather disagree* (scale value 2), we do not consider these results to be alarming. It is necessary to understand this situation within the frame of the respondents´ career profilization. By their statements the students declare that their future perspectives and ambitions are not in being employed in the IT area, and so they are relatively sceptical as to the role of the technology progress in the society. So, this result is essentially quite logical and could be expected. The purpose of incorporating these items into the questionnaire structure was to validate that the respondents are taken their study programmes because of the interest in the field of economy or management and not as an alternative or even substitution to their interest in computer sciences (informatics).

Data presented in Table 5 show a noticeable shift in the positive evaluation of the item E9 as to the tenth homogenous group and of the items E3, E8 and E7 as to the ninth homogenous group compared with the other tested items, mainly items of the first (E15, E13) and the second (E14, E6) homogenous group. Except that at the items of these two groups there were achieved the highest average values of the responses´ scores (scale value 4 – *I rather agree*). The difference among the respondents´ answers to these items compared with all other tested items is statistically significant. By these results the students declared importance and meaningfulness of informatics curricula teaching for their common everyday life (E8 = 3.74) as well as for their future career self-realisation (E9 = 3.98) despite the fact that to acquire knowledge from informatics branch is quite difficult (E3 = 3.78). Students consider informatics to be a significant component part of general education of people and to be very important for their everyday life (E7 = 3.62).

Table 5 shows that in frame of the tested items, there are 5 two-item homogenous groups, 3 five-item homogenous groups, 1 three- and 1 one-item homogenous group. The

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most numerous identified homogenous groups (3rd – 5th) overlap for items E17, E5 and E1. A statistically significant difference between the respondents´ responses was recorded e.g. between the popularity assessments of subjects related to informatics area (E1 = 2.91) and their content demandingness and difficulty (E3 = 3.78) or between the assessment of the informatics subjects popularity compared to the popularity of non-informatics subjects included in the curricula of the concerned study programmes (E6 = 2.46) and assessment of the importance and meaningfulness of the education in the field of informatics (E7 = 3.62). Statistically significant differences among the respondents´ opinions were recorded also between slightly related statements, as e.g. between evaluation of the attractiveness of the tasks solved within informatics subjects teaching (E17) and evaluation of the importance and meaningfulness of informatics curricula teaching for common everyday life (E8) or between the item E2 evaluation (*Informatics subjects are interesting*) and E9 evaluation (*Knowledge acquired within the informatics subjects will increase my chances in my future professional career*) but also between some other evaluated statements regarding informatics education and the level of informatics subject teaching carried out within the concerned study programmes. More or less the above-mentioned are quite alarming results, as they, also in the context of some other results (evaluations of the items E16 = 2.74; E17 = 2.82; E18 = 2.73), confirm the fact that students of the economy and managerial study programmes do not evaluate study of the relevant informatics topics as interesting enough (E2 = 3.27). But here we are only at a hypothetic level. Exactness into these matters could be brought through testing correlations between the presented results and results obtained at some of the questionnaire items included in the questionnaire part D *What I would like to learn* (D1 – D22). Another question is to which level the education content of the informatics subjects incorporated into the study programmes is fulfilled in the students´ opinion.

Results following Data Processing with their Dependence on the Particular Factors

Following the above-mentioned obtained results, a further subject of the research was to find out the divergence of the means of the average values of the respondents´ responses to the particular items of the questionnaire part *My education in the field of informatics* (E1 – E18) in dependence on the factors COUNTRY (labelled A0), GENDER (labelled A2) and FIELD OF STUDY (labelled A6). From the whole statistics evaluation we present results regarding only the items E1, E2, E3, E6, E8, E9, E11, E16, E17 and E18. Results of the data processing for these items are summarised in Table 6. The table consists of descriptive statistics of the total scores of these items in general (for the whole groups of the respondents without their differentiation according the particular factors) and in dependence on the particular factors COUNTRY (SK, CZ), GENDER (F, M) and FIELD OF STUDY (BEC, ATM, QME, AC, BMA, EDP, ACT, EPA) (descriptive statistics of the total scores of the concerned questionnaire items for the sub-samples differentiated in dependence on the above-mentioned factors). There are presented values of the means, standard deviations, standard errors of the mean estimation and 95% confidence intervals of the means of the scale value. It is evident that the total values of the standard deviation for the score of the respondents´ responses to the particular items do not differentiate too much.

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Table 6. Descriptive statistics for selected items from the questionnaire part E – *My education in the field of informatics.*

Item Level of Factor	E1 – *Informatics subjects belong to my favourite*			Confidence Interval of Average		E2 – *Informatics subjects are interesting*			Confidence Interval of Average	
	Mean	Std.Dev.	Std.Err.	- 95%	+95%	Mean	Std.Dev.	Std.Err.	- 95%	+95%
Total	2.91	1.16	0.05	2.81	3.00	3.27	1.12	0.05	3.18	3.37
SR	2.97	1.13	0.05	2.87	3.07	3.32	1.10	0.05	3.23	3.42
CZ	2.14	1.20	0.19	1.77	2.52	2.64	1.14	0.18	2.29	3.00
F	2.74	1.13	0.06	2.63	2.85	3.15	1.11	0.06	3.03	3.26
M	3.29	1.13	0.09	3.11	3.47	3.56	1.08	0.08	3.39	3.72
BEC	2.97	1.09	0.06	2.85	3.10	3.40	1.05	0.06	3.28	3.51
ATM	2.82	1.08	0.14	2.55	3.10	3.08	1.14	0.14	2.79	3.37
QME	3.71	1.15	0.22	3.27	4.16	3.96	1.04	0.20	3.56	4.37
AC	2.92	1.28	0.21	2.49	3.34	3.03	1.21	0.20	2.62	3.43
BMA	3.10	1.07	0.24	2.60	3.60	3.40	0.99	0.22	2.93	3.87
EDP	2.48	1.19	0.23	2.01	2.95	2.70	1.17	0.23	2.24	3.17
ACT	2.17	1.38	0.33	1.48	2.85	2.39	1.24	0.29	1.77	3.01
EPA	2.13	1.08	0.22	1.67	2.58	2.83	1.05	0.21	2.39	3.28

Item Level of Factor	E3 – *Informatics subjects are difficult as to their content*			Confidence Interval of Average		E6 – *I like informatics subjects more than the other non-informatics ones*			Confidence Interval of Average	
	Mean	Std.Dev.	Std.Err.	- 95%	+95%	Mean	Std.Dev.	Std. Err.	- 95%	+95%
Total	3.78	0.95	0.04	3.69	3.86	2.47	1.12	0.05	2.37	2.56
SR	3.78	0.95	0.04	3.70	3.87	2.52	1.10	0.05	2.42	2.62
CZ	3.69	0.95	0.15	3.39	3.99	1.83	1.08	0.17	1.50	2.17
F	3.85	0.93	0.05	3.76	3.94	2.33	1.08	0.06	2.22	2.44
M	3.60	0.99	0.08	3.45	3.76	2.78	1.15	0.09	2.61	2.96
BEC	3.80	0.90	0.05	3.70	3.90	2.52	1.07	0.06	2.40	2.63
ATM	4.00	0.99	0.13	3.75	4.25	2.48	1.14	0.14	2.19	2.77
QME	3.61	0.88	0.17	3.27	3.95	3.21	1.20	0.23	2.75	3.68
AC	3.59	1.07	0.18	3.24	3.95	2.43	1.07	0.18	2.08	2.79
BMA	3.60	0.99	0.22	3.13	4.07	2.40	1.23	0.28	1.82	2.98
EDP	3.70	1.30	0.25	3.19	4.22	2.15	1.10	0.21	1.71	2.58
ACT	3.67	0.97	0.23	3.18	4.15	2.00	1.33	0.31	1.34	2.66
EPA	3.71	0.95	0.19	3.31	4.11	1.71	0.86	0.18	1.35	2.07

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Item / Level of Factor	E8 – *Knowledge acquired within the informatics subjects will help me in my everyday life*			Confidence Interval of Average		E9 – *Knowledge acquired within the informatics subjects will increase my chances in my future professional career*			Confidence Interval of Average	
	Mean	Std.Dev.	Std.Err.	- 95%	+95%	Mean	Std.Dev.	Std.Err.	- 95%	+95%
Total	3.74	1.01	0.04	3.66	3.83	3.98	0.90	0.04	3.91	4.06
SR	3.78	0.99	0.04	3.69	3.86	4.02	0.88	0.04	3.94	4.09
CZ	3.36	1.10	0.17	3.01	3.70	3.60	1.04	0.16	3.27	3.92
F	3.75	1.02	0.05	3.65	3.86	4.00	0.91	0.05	3.91	4.09
M	3.72	0.99	0.08	3.57	3.88	3.95	0.89	0.07	3.81	4.09
BEC	3.86	0.96	0.05	3.76	3.97	4.08	0.81	0.05	3.99	4.17
ATM	3.56	1.07	0.14	3.29	3.84	3.71	1.05	0.13	3.44	3.98
QME	3.93	0.90	0.17	3.58	4.28	4.18	0.77	0.15	3.88	4.48
AC	3.49	1.04	0.17	3.14	3.83	3.84	1.07	0.18	3.48	4.19
BMA	3.70	1.03	0.23	3.22	4.18	4.35	0.67	0.15	4.04	4.66
EDP	3.56	1.09	0.21	3.13	3.99	3.78	1.05	0.20	3.36	4.19
ACT	3.39	1.24	0.29	2.77	4.01	3.28	1.23	0.29	2.67	3.89
EPA	3.33	1.01	0.21	2.91	3.76	3.83	0.82	0.17	3.49	4.18

Item / Level of Factor	E11 – *Informatics subjects taught me to understand modern information technologies*			Confidence Interval of Average		E16 – *The way in which the teachers of informatics subjects use to explain/present the new subject matter is an interesting one*			Confidence Interval of Average	
	Mean	Std.Dev.	Std. Err.	- 95%	+95%	Mean	Std.Dev.	Std.Err.	- 95%	+95%
Total	3.38	1.03	0.04	3.29	3.47	2.75	1.06	0.05	2.66	2.84
SR	3.45	1.00	0.04	3.36	3.53	2.79	1.03	0.05	2.70	2.88
CZ	2.62	1.17	0.18	2.26	2.98	2.24	1.16	0.18	1.88	2.60
F	3.35	1.03	0.05	3.25	3.46	2.73	1.08	0.06	2.62	2.84
M	3.45	1.05	0.08	3.29	3.61	2.80	0.99	0.08	2.65	2.96
BEC	3.51	0.96	0.05	3.40	3.62	2.85	0.98	0.05	2.74	2.96
ATM	3.27	1.06	0.13	3.01	3.54	2.40	1.11	0.14	2.12	2.68
QME	3.86	0.80	0.15	3.55	4.17	3.68	0.94	0.18	3.31	4.04
AC	3.16	1.09	0.18	2.80	3.53	2.49	0.87	0.14	2.20	2.78
BMA	3.40	0.94	0.21	2.96	3.84	3.10	0.97	0.22	2.65	3.55
EDP	3.07	1.11	0.21	2.64	3.51	2.30	1.14	0.22	1.85	2.75
ACT	2.72	1.23	0.29	2.11	3.33	2.11	1.28	0.30	1.48	2.75
EPA	2.54	1.14	0.23	2.06	3.02	2.33	1.09	0.22	1.87	2.79

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Item / Level of Factor	E17 – *The tasks solved within informatics subjects teaching are interesting*			Confidence Interval of Average		E18 – *Within informatics subjects teaching we use interesting teaching programmes, interactive simulation models*			Confidence Interval of Average	
	Mean	Std.Dev.	Std. Err.	- 95%	+95%	Mean	Std.Dev.	Std.Err.	- 95%	+95%
Total	2.82	1.04	0.05	2.74	2.91	2.73	1.02	0.04	2.65	2.82
SR	2.87	1.02	0.05	2.78	2.96	2.77	1.01	0.05	2.68	2.86
CZ	2.31	1.16	0.18	1.95	2.67	2.33	1.12	0.17	1.98	2.68
F	2.78	1.07	0.06	2.67	2.89	2.69	1.04	0.05	2.59	2.80
M	2.93	0.98	0.08	2.77	3.08	2.82	0.98	0.08	2.67	2.97
BEC	2.87	0.97	0.05	2.76	2.97	2.76	0.96	0.05	2.66	2.87
ATM	2.71	1.14	0.14	2.42	3.00	2.55	1.10	0.14	2.27	2.83
QME	3.82	0.98	0.19	3.44	4.20	3.64	0.95	0.18	3.27	4.01
AC	2.70	1.00	0.16	2.37	3.03	2.68	0.91	0.15	2.37	2.98
BMA	2.70	0.98	0.22	2.24	3.16	2.70	1.08	0.24	2.19	3.21
EDP	2.59	1.01	0.19	2.19	2.99	2.59	1.01	0.19	2.19	2.99
ACT	2.11	1.32	0.31	1.45	2.77	2.17	1.29	0.31	1.52	2.81
EPA	2.46	1.02	0.21	2.03	2.89	2.46	0.98	0.20	2.05	2.87

As it results from the interval estimate of the mean, values of the particular responses were within the range from 4.04 to 4.66 what with respect to the used scale means evaluations from *I rather agree* with the given statement (4) to *I agree* with the given statement (5). Next low values of the variability index were recorded at the group of the respondents – QME study programme students (0.77 – interval estimate of the mean in the scope from 3.88 up to 4.48), group of the respondents – BEC study programme students (0.81 – interval estimate of the mean in the scope from 3.99 up to 4.17) and at the group of the respondents – EPA study programme students (0.82 – interval estimate of the mean in the scope from 3.49 up to 4.18). Also, in case of these three groups it regarded the item E9. Similar result – one of the lowest divergences of the respondents´ responses (0.86) can be found in the group or the respondents – EPA study programme students at the item E6, in which the respondents expressed the level of their positive approach to informatics subjects, i.e. how favourite these subjects are for them compared with other non-informatics subjects included in their study programmes. Further very low divergence occurs in case of the group of the AC study programme students at the item E16 aimed at the way in which the informatics subject teachers carry out their presentations of the new subject matter (0.87). In both these groups the responses just to the mentioned items show the lowest heterogeneity with the achieved values of the interval estimate of the mean (E6: 1.35 – 2.07; E16: 2.20 – 2.78). Based on the means of the particular items evaluations achieved at the respondents' differentiation according the factor FIELD OF STUDY, it can be stated that the highest value of the mean was recorded in the group of the BMA study programme students at the item E9 (4.35). It means that these respondents gave very different answers to the question on the importance and meaningfulness of informatics education for their future career.

Following the point estimation of the mean of the assessment of the given items from the questionnaire part E, it can be stated that in comparison with the Czech respondents the Slovak respondents gave more positive evaluations at seven (E1, E6, E8, E11, E16, E17 and E18) of the ten concerned tested items (E1, E2, E3, E6, E8, E9, E11, E16, E17 and E18). The evaluations of the Slovak respondents are more positive compared with the evaluations of the Czech respondents although even at five of the items (E1, E6, E16, E17 and E18) the average scores of the assessments are at the level of the scale value 3 which means *I neither agree nor disagree.* At the items E2, E3 and E9 responses of the Slovak respondents were almost the same with those given by the Czech respondents. At processing the research data in dependence on the factor COUNTRY the average score reaches significantly the highest value in case of the Slovak respondents at the questionnaire item E9 (4.02 – *Knowledge acquired within the*

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informatics subjects will increase my chances in my future professional career) and in case of the Czech respondents at the questionnaire item E3 (3.69 – *Informatics subjects are difficult as to their content*) and as well at the item E9 (3.60), as it is in case of the Slovak respondents. In case of the group of the Czech respondents the final assessments of the questionnaire item E6 (*I like informatics subjects more than the other non-informatics ones*; 1.83 at the scale value 2 – *I rather disagree*) and E1 (*Informatics subjects belong to my favourite*; 2.14) show more or less a negative attitude of the students towards informatics subjects. However, in relation to the questionnaire item E6 the obtained result can be understood as a positive one, because the respondents were asked to evaluate their attitude to informatics subjects in comparison to their attitude to the other subjects included in their study profilization curricula (and the results show that just these are their favourite). Contrary to the mentioned the same result achieved at the item E1, at which the respondents were asked to evaluate their attitude to informatics subjects in general, can be understood as a negative one, because currently computer and informatics skills are considered by the employers as an integral part of the professional profile of the economy and managerial study programme graduates.

At the same time in case of the Czech respondents at the questionnaire item E1 there was recorded the highest value of the standard deviation (1.20), what means the highest variability (interval estimate of the mean from 1.77 up to 2.52 from the maximum scale value 5) in the respondents´ responses in frame of the tested items processed according to the respondents' differentiation in dependence on the factor COUNTRY.

At processing the research data according to the respondents' dependence on the factor GENDER males equally to females show the highest score at the item E9 (males – 3.95; females – 4.00). Responses of the both respondents' groups – males as well as females, belonged at this item to the most positive. In case of both these groups of respondents just at this item the lowest value of the standard deviation was recorded (males – 0.89; females – 0.91), what means the lowest variability (males from 3.81 up to 4.09; females from 3.91 up to 4.09) in the respondents´ responses to the question on the importance and meaningfulness of the informatics curricula teaching for the respondents´ professional self-realisation. The highest value of the standard deviation and so also the highest heterogeneity of the respondents´ responses to the questions was recorded in case of the group of the male respondents particularly at the item E6 (1.15). Interval estimate of the mean is of the range from 2.61 to 2.96, what means neutral expressions of the evaluating answers (scale value 3 – *I neither agree nor disagree*).

Relatively high heterogeneity (1.13) of the expressions related to the popularity of the informatics subjects – those which the respondents already passed during their tertiary study – was recorded also in the group of the female respondents at the item E1 (*Informatics subjects belong to my favourite*). Interval estimate of the mean for this group is of the range from 2.63 to 2.85 at the maximum scale value 5.

Before the valid use of the analysis of variance to test the differences of more means, there was applied Hartley, Cochran and Bartlett test (univariate tests on variance) to prove that in case of all tested items the presumption of equality of variances, which the tested data have to fulfil, was not broken ($p>.05$).

Dependence of the respondent`s answers on the factors COUNTRY, GENDER and FIELD OF STUDY was tested for all items of the questionnaire part *My education in the field of informatics* E1 – E18, not only for the above mentioned discussed E1, E2, E3, E6, E8, E9, E11, E16, E17 and E18. It means that validity of the following three null hypotheses, from which each one represents de facto 18 partial null hypotheses, was verified:

H_0: *Answers to the items E1 – E18 do not depend on the factor COUNTRY.*

H_0: *Answers to the items E1 – E18 do not depend on the factor GENDER.*

H_0: *Answers to the items E1 – E18 do not depend on the factor FIELD OF STUDY.*

Dependence and independence on the particular factors, stated in the above-mentioned hypotheses, was tested by means of parametric tests. In case of the items E1, E2, E3, E6, E8, E9, E11, E16, E17 and E18 the dependence on all three factors (COUNTRY, GERNDER, FIELD OF STUDY) was proved only in case of the items E1, E2 and E6.

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Following the statistical analysis of the results obtained from the research data to the tested items E1, E2, E3, E6, E8, E9, E11, E16, E17 and E18 processed on the bases of their dependence on the factor COUNTRY, p-value is higher than the selected level of significance (5 % =.05) in case of two items. Particularly these are the items E3 and E11, i.e. in case of these two items no statistically significant difference between the evaluations of the given items at the differentiation of the respondents according the factor COUNTRY was proved. In case of the other eight items (E1, E2, E6, E8, E9, E16, E17 and E18) the statistically significant difference between the evaluations given by the Slovak and Czech respondents was proved (p<.05).

Similar situation can be found at the assessments of the given items in dependence on the factor GENDER. In dependence on this factor males and females` responses to the items do not differ significantly. This is proved by the results of the analysis of variance (at none of the tested items the p value was lower than 0.05), what means that the differences between the corresponding values of means calculated for the relevant groups are a consequence only of the random selection of the research samples.

The results of the statistical analysis proved the null hypothesis according to which responses of the respondents to the items E8, E9, E11, E16, E17 and E18 do not depend on the factor GENDER.

As to the tested items E1, E2, E3 and E6, on the basis of the obtained p-value ($p < 0.05$) in case of them it we can proclaim that the differences between the males and females´ responses are statistically significant. Following that we reject the null hypothesis, what means that the answers to the tested items do depend on the gender of the respondents.

As it follows from the results of the analysis of variance summarised in Table 7, at testing the dependence of the responses on the factor FIELD OF STUDY the p value was lower than 0.05 at all the tested items with the exception of the item E3 ($p = 0.432056$), based on what the null hypothesis was rejected and it was stated that the respondent study specialization has a significant influence on how they evaluate the items E1, E2, E6, E8, E9, E11, E16, E17 and E18.

Table 7. Analysis of variance for the factor FIELD OF STUDY.

Item	**E1 –** *Informatics subjects belong to my favourite*				**E2 –** *Informatics subjects are interesting*			
	SS	MS	F	p	SS	MS	F	p
Intercept	1868.301	1868.301	1485.094	p<.001	2309.140	2309.140	1972.269	p<.001
St. Field	50.343	7.192	5.717	**0.000002**	50.687	7.241	6.185	**0.000001**
Error	662.985	1.258			617.014	1.171		
Total	713.327				667.701			

Item	**E3 –** *Informatics subjects are difficult as to their content*				**E6 –** *I like informatics subjects more than the other non-informatics ones*			
	SS	MS	F	p	SS	MS	F	p
Intercept	3307.634	3307.634	3641.058	p<.001	1342.173	1342.173	1126.135	p<.001
St. Field	6.343	0.906	0.998	0.432056	37.077	5.297	4.444	**0.000081**
Error	478.741	0.908			628.100	1.192		
Total	485.084				665.178			

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Item	**E8 –** *Knowledge acquired within the informatics subjects will help me in my everyday life*				**E9 –** *Knowledge acquired within the informatics subjects will increase my chances in my future professional career*			
	SS	MS	F	p	SS	MS	F	p
Intercept	3119.302	3119.302	3132.670	p<.001	3620.026	3620.026	4653.621	p<.001
St. Field	17.167	2.452	2.463	**0.017112**	22.898	3.271	4.205	**0.000159**
Error	524.751	0.996			409.950	0.778		
Total	541.918				432.849			

Item	**E11 –** *Informatics subjects taught me to understand modern information technologies*				**E16 –** *The way in which the teachers of informatics subjects use to explain/present the new subject matter is an interesting one*			
	SS	MS	F	p	SS	MS	F	p
Intercept	2450.256	2450.256	2442.252	p<.001	1697.283	1697.283	1663.855	p<.001
St. Field	41.486	5.927	5.907	**0.000001**	56.849	8.121	7.961	**p<.001**
Error	528.727	1.003			537.588	1.020		
Total	570.213				594.437			

Item	**E17 –** *The tasks solved within informatics subjects teaching are interesting*				**E18 –** *Within informatics subjects teaching we use interesting teaching programmes, interactive simulation models*			
	SS	MS	F	p	SS	MS	F	p
Intercept	1811.828	1811.828	1782.950	p<.001	1743.536	1743.536	1757.000	p<.001
St. Field	43.948	6.278	6.178	**0.000001**	33.816	4.831	4.868	**0.000025**
Error	535.536	1.016			522.962	0.992		
Total	579.484				556.778			

To the graphical visualisation of the respondents` assessments to the given items in dependence on the factor FIELD OF STUDY (study profilization) there were used dot and interval diagrams of their interval estimate of the mean (Figure 2). The graphical interpretation of the achieved results shows a slight shift of the opinions in the given item assessments between the group of the QME study programme students (in case of the item E9 this fact is stated for the group of the BMA study programme students) and the groups of the other study programme students.

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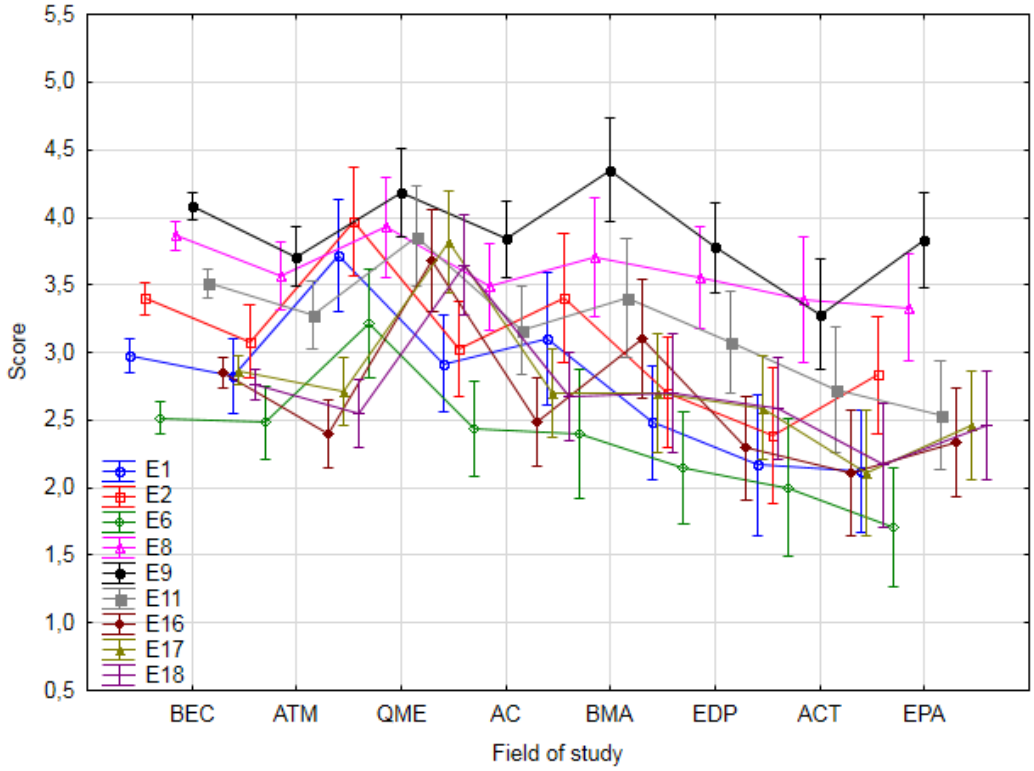

Figure 2: Dot and interval estimate of the mean to the selected items in dependence on the factor FIELD OF STUDY.

After the approval of the statistically significant differences between the respondents` answers in dependence on the factor FIELD OF STUDY, there was a search for the study groups between which in the context of their various study specializations this occurs. The identification of the homogeneous groups in dependence on the factor FIELD OF STUDY was done by means of the multiple comparison of the particular couples of the groups. Overview of the relevant results is presented in Table 8.

Table 8. Identification of the homogeneous groups at the respondent differentiation according to the factor FIELD OF STUDY.

Item St. Field	**E1** Mean	1	2
EPA	2.125000	****	
ACT	2.166667	****	
EDP	2.481481	****	
ATM	2.822581	****	****
AC	2.918919	****	****
BEC	2.974922	****	****
BMA	3.100000	****	****
QME	3.714286		****

Table is continued on the next page

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Item St. Field	**E2** Mean	1	2
ACT	2.388889	****	
EDP	2.703704	****	
EPA	2.833333	****	
AC	3.027027	****	
ATM	3.080645	****	
BEC	3.398119	****	****
BMA	3.400000	****	****
QME	3.964286		****

Item St. Field	**E6** Mean	1	2
EPA	1.708333	****	
ACT	2.000000	****	
EDP	2.148148	****	
BMA	2.400000	****	****
AC	2.432432	****	****
ATM	2.483871	****	****
BEC	2.517241	****	****
QME	3.214286		****

Item St. Field	**E8** Mean	1
EPA	3.333333	****
ACT	3.388889	****
AC	3.486486	****
EDP	3.555556	****
ATM	3.564516	****
BMA	3.700000	****
BEC	3.862069	****
QME	3.928571	****

Item St. Field	**E9** Mean	1	2
ACT	3.277778		****
ATM	3.709677	****	****
EDP	3.777778	****	****
EPA	3.833333	****	****
AC	3.837838	****	****
BEC	4.081505	****	****
QME	4.178571	****	
BMA	4.350000	****	

Table is continued on the next page

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Item St. Field	**E11** Mean	1	2	3
EPA	2.541667	****		
ACT	2.722222	****	****	
EDP	3.074074	****	****	****
AC	3.162162	****	****	****
ATM	3.274194	****	****	****
BMA	3.400000	****	****	****
BEC	3.510972		****	****
QME	3.857143			****

Item St. Field	**E16** Mean	1	2
ACT	2.111111	****	
EDP	2.296296	****	
EPA	2.333333	****	
ATM	2.403226	****	
AC	2.486486	****	
BEC	2.849530	****	
BMA	3.100000	****	****
QME	3.678571		****

Item St. Field	**E17** Mean	1	2
ACT	2.111111	****	
EPA	2.458333	****	
EDP	2.592593	****	
BMA	2.700000	****	
AC	2.702703	****	
ATM	2.709677	****	
BEC	2.868339	****	
QME	3.821429		****

Item St. Field	**E18** Mean	1	2
ACT	2.166667	****	
EPA	2.458333	****	
ATM	2.548387	****	
EDP	2.592593	****	
AC	2.675676	****	
BMA	2.700000	****	****
BEC	2.761755	****	
QME	3.642857		****

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In dependence on the category of the factor FIELD OF STUDY the average score of the responses to the items E1, E2, E6, E8, E9, E11, E16, E17 and E18 varies between the scale value 2 (*I rather disagree*) till 4 (*I rather agree*) at the maximum scale value 5 (Table 8). Analysis of the results of the answers shows that among the final responses given by the students of the concerned study profilizations to the given statements there is no one which would reach the average score at the scale value 5 (*I agree*).

For all tested items the lowest average score of the responses (1.70) was recorded at the item E6 in case of the EPA study programme students (*Economic Policy and Administration*). Respondents representing this study profilization expressed their rather disagreement with the statement on a greater popularity of informatics subjects compared with the other, non-informatics subjects included in their education curricula, i.e. they evaluated the informatics subjects in the given context rather negatively. The highest average score (4.35) in processing the research data for the particular sub-groups of the respondents created according the particular categories of the factor FIELD OF STUDY was recorded at the group of the BMA study programme students (*Business Management*) and the second one (4.19) by the QME study programme students (*Quantitative Methods in Economics*) identically in case of the item E9 (*knowledge acquired within the informatics subjects will increase my chances in my future professional career*). Both these achieved average scores reflect rather a higher level of the agreement with the given statement. A positive finding is that the students of almost all study profilizations more or less agree with the statement *knowledge acquired within the informatics subjects will help me in my everyday life* (E8) as well as with the statement *knowledge acquired within the informatics subjects will increase my chances in my future professional career* (E9). Exceptions are students of the EPA and ACT study programmes, who expressed more or less neutral approach to this issue. The others are aware of the fact that acquiring of the computer skills and development of the computer competence support one´s general professional adaptability and increases his/her employment opportunities in the labour market, and moreover it also contributes to the enhancement of his/her general adaptability in the extra-work life.

As weaknesses of the current state of the informatics education within the concerned economy and managerial study programmes were identified two factors. One of them is uninteresting and unattractive ways of teachers´ presentation of the new subject matter to students and the second one is unattraction also of the tasks solved within the informatics subjects teaching process. Elimination of these two weaknesses could help to increase also the attractiveness of the educational content of the informatics subjects (E2) as well as the general popularity of the informatics subjects (E1) among the students of the concerned economy and managerial study programmes (the values of the average score at the items E1 and E2 vary predominately within the scale range from 2 to 3).

In case of the assessment of the items E1, E2, E6, E9, E16, E17 and E18 there were identified two homogeneous groups, in case of the assessment of the item E11 three homogeneous groups were identified. The repeated comparison for the item E8 did not prove statistical significance of the differences between the responses. That is also why in case of this item there was identified only one homogeneous group.

From the data presented in Table 8 it is clear that in case of the assessment of the items E1, E2, E6, E11, E16 and E18 the homogeneous groups overlap at the BMA study programme (*Business Management*). The items E1 and E6 overlap at identical study programmes, particularly these are study programmes *Agrarian Trade and Marketing* (ATM), *Accounting* (AC), *Business Economics* (BEC) and already mentioned study programme *Business Management* (BMA). The items E9 and E11 overlap in case of three study programmes, particularly in case of the study programmes *Agrarian Trade and Marketing* (ATM), *European Development Programmes* (EDP) and *Accounting* (AC). At the item E9 the homogeneous groups overlap moreover in case of the study programme *Economic Policy and Administration* (EPA). At the item E11 in case of the study programme *Accounting and Taxes* (ACT) only the first two homogeneous groups overlap, and in case of the study programme *Business Economics* (BEC) the last two homogeneous groups overlap.

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Testing the significance of the differences among the means of all 8 items E1, E2, E6, E9, E11, E16, E17 and E18 the difference between the group of the respondents – the QME study programme students (*Quantitative Methods in Economics*) and at least another one study programme group was proved to be statistically significant. At the item E16 it was between the group of the QME study programme students and all others except the BMA study programme group, and at the item E17 it was between the QME study programme group and all other groups.

The above-mentioned finding could be more or less expected, as it can be connected by the fact that the students of the study programme *Quantitative Methods in Economics* (QME), following the structure of their study programme curricula, are led to use the software products at solving statistical and socio-economic analyses more intensive than the students of the other study programmes are. On the basis of the homogeneous groups identified at the respondent differentiation in dependence on the factor FIELD OF STUDY it can be stated that in frame of the given tested items even in seven cases of nine there was identified a homogeneous group consisting at least of the study groups of *Quantitative Methods in Economics* (QME) and *Business Management* (BMA), *Quantitative Methods in Economics* (QME) and *Business Economics* (BEC), or *Quantitative Methods in Economics* (QME), *Business Management* (BMA) and *Business Economics* (BEC) at the same time, which are filled up by the variations with other study profilizations. So, on the basis of the given statistical analysis it can be stated that among these three study profilizations of the students (QME, BMA, BEC) there is no statistical dependence in their responses to the concerned statements. The required erudition in the work with specific computer applications and information systems is utilized very often by the graduates of the economy and managerial study programmes (mainly of the QME, BMA and BEC study profilizations) mainly at solving different research tasks related to the application fields of economy, at analyses of the socio-economical information, at development and creation of economy strategies dedicated to different management levels, at analyses and designing complex economy and social causal relations, and designing probabilistic-statistical and forecasting models for decision making processes and business practice management.

The results of the variance analysis (Table 8) prove the statistical significance of the differences also among the responses of the respondent groups – students of the ACT (*Accounting*) and BMA (*Business Management*) study programmes, in particular at the item E9 (*knowledge acquired within the informatics subjects will increase my chances in my future professional career*). In case of the assessment of the item E11 (*informatics subjects taught me to understand modern information technologies*), where three homogeneous groups were identified, statistically significant differences between the answers of the particular groups of the respondents were proved at the respondents with the study specialization BEC (*Business Economics*) and EPA (*Economic Policy and Administration*), in particular between the first and second or the first and third homogeneous group, and between the respondents representing the study profilization BEC (*Business economics*) and ACT (*Accounting and Taxes*), in their case between the first and third homogeneous group.

Conclusions

With regard to the employment opportunities of the graduates of the economy and managerial study branches in the labour market in the context of its current requirements on their competence profiles, it is indisputable that informatics education has to be a part of their study programmes at higher education institutions. Within the carried-out research the statements about planning to work in the area of information technologies or applied informatics achieved the mean scores very close to the scale value 2 (E13 – 2.20, E15 – 2.16) which expresses rather disagreement of the respondents with the given statements. This means, that students of the economy and managerial study programmes do not connect their future professional career with the information technologies and they do not have ambitions to be employed in the IT

area. On the other hand, their attitude towards informatics subjects is not a negative one (E1 – 2.91, E6 – 2.47). As the profilization of these students is crucially aimed at economy and management, this finding can be understood as a positive one, based on the presupposition that the students` main favourite are the profile subjects of their study programmes, at least just these, not any complementary, should be. Moreover, a really very positive result is the finding that the students are aware of the fact that the knowledge and skills obtained within their informatics preparation (teaching the informatics subjects) are important and meaningful for both their everyday life as well as for their future career development. The highest mean values were recorded at the items with the statements regarding importance and advisability of the informatics education either for everybody or just for the respondents and their future to their study programme related professional career (items E7 – E12, mean values mostly considerably above the scale value 3, close to the value 4, *I rather agree*). Additionally, just the highest level of agreement was recorded at the statement regarding the importance of informatics subjects for the respondents` future career (E9 – *Knowledge acquired within the informatics subjects will increase my chances in my future professional career*, mean 3.98).

On the other hand, as the results show, students are not satisfied with the quality of the informatics subjects teaching. They consider the presentations of the new subject matter done by the teachers, as well as the tasks solved during the lessons and the used teaching aids and supportive materials to be uninteresting and unattractive for them (items E16 – E18, means bellow the scale value 3). So, to assure the quality of the tertiary economy and managerial study programmes does not mean to deal only with designing curricula of the informatics preparation relevant to the up-to-date requirements of the labour market on these study programmes graduate students but also to deal with the issues of an efficient transfer of these curricula content to students.

Identification of the informatics topics/subjects which should be included in the curricula of informatics preparation incorporated in the economy and managerial study programmes was done through questionnaire parts B and D. The data gained from these parts of the questionnaire are not presented here but we would like to mention here at least the most important findings resulting from them.

From the topics which are currently taught the respondents stated the topics *use of tools and advanced techniques of work with MS PowerPoint to create interactive presentations, use of tools and advanced techniques of work with MS PowerPoint to create interactive presentations and possibilities of conditional cell formatting in MS Excel* (questionnaire part B *What I want to learn*) as the most significant for them from the point of their professional profilization view. From the alternative topics, which could be but have not been taught yet, the respondents stated the topics *programming and web site design, programming of the web applications* (chat, discussion forums, e-business) and *harmful software* (questionnaire part D *What I would like to learn*) as the most significant for them from the point of their professional profilization view. However, here it can be polemized whether this is really a consequence of the specific requirements of the professional profilization or rather a consequence of the need to develop the common key competences of each information society member.

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