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***Original paper***

# Investigation of the state of education in computer science in study programs of economic and managerial orientation

**Marcela Hallová*, Ján Záhorec, Klára Hennyeyová, Vladimír Popelka**

Slovak University of Agriculture, Faculty of Economics and Management, Department of Informatics, Slovak Republic

**ABSTRACT**
The primary objective of allocating disciplines of informatics into economic and managerial study programs on ISCED 5 (The International Standard Classification of Education) is to develop those informatics competencies for students which have a broad transfer on the labor market. Therefore, it is necessary to focus in addition of the qualitative aspect of teaching disciplines of informatics also on the educational content of these disciplines in the relevant sector of study programs. We consider that within the statistical analysis of the data might be significant also comparison of interest of students reviews in teaching informatics from the perspective of evaluation (difficulty, attractions, popularity) other, non-informatics learning themes forming the basis of their study profiling, as well as decision-making and choosing future occupation. The authors in this paper present the methodological research background, area specification of aspects which determine optimization and innovation of education in informatics disciplines in the relevant area of study programs with the respect to ever-growing and changing requirements of practice and associated with them the current requirements of European Union labor market on the knowledge of the studied area.

**KEYWORDS**: informatics, innovation of education, informatics competencies

**JEL CLASSIFICATION:** A40, Q50, R30

## INTRODUCTION

ICT has evolved as one of the major tools for improving education in general and teaching-learning process in particular, at present. It, along with all its various dimensions, has proved to be indispensable for better teaching-learning approach from lowest level of learning to highest level of learning [2]. As far as higher education is concerned it has provided better opportunities for learners to construct, acquire, consolidate, share and expand their knowledge. Other reason why we are so interested in area of optimization the development of IT competencies of students is Lavy's and Or-Bach's [3] research with orientation on

* Corresponding author: Marcela Hallová, Slovak University of Agriculture, Faculty of Economics and Management, Department of Informatics, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic.
E-mail: marcela.hallova@uniag.sk

retrospective perception of students who have attended IT courses. Analysis of the research data revealed that the students believe the ICT-literacy course raised their self-confidence in their ability to cope with further learning. According a Study on the effects of information technologies on university students by Gökalp [1], information technologies positively affected the academic success of students. In keeping with the results obtained from his research it was observed that it was inevitable not to use the tools of information in an "age of information" and that information could not be provided or acquired without using information tools.

Job applicants with ICT skills are preferred even if it's not necessary for position. It's kind of benefit which can help them to solve a critical situation faster and make them earn money to survive. Adding a course that examines international perspectives about ICT for teaching and learning would benefit all students no matter their career trajectory, as the issues to be addressed can provide them with critical perspectives within a comparative framework [5]. Similar arguments can also be found in publications of Papic and Bester [4], Vanderline, Dexter and Van Braak [7] and Tantall [6]. On the basis of the comparative analysis and application of modern trends of education in this area we want to suggest the optimum development options of informatics competencies of future graduates in accordance with the requirements of the current practice and the labor market.

## MATERIAL AND METHODS

Based on the above, we built methodology of education in selected disciplines of informatics, management, accounting and finance/currency within the study programs of economic and managerial focus provided by the Faculty of Economics and Management, Slovak Agricultural University in Nitra (hereinafter sometimes referred to as FEM SUA) on the screening reviews of students through the evaluation of selected educational topics/issues. We consider that the above aspects of the investigation procedure could be involved in the relevant degree on the final image of research problem. For screening reviews of students was used questionnaire. The questionnaire, which contains a total of 153 items, is divided into the following six areas:

- *Introductory part* (identification of gender and age of the respondent and four other items regarding the study focus of the respondent);
- *What I want to learn.* To what extent is for the student interesting the study of the following topics;
- *My future profession*. To what extent are defined factors in selecting and deciding about the future choice of profession important for the student;
- *What I would like to learn*. To what extent are for the student interesting information from those areas;
- *My education in computer science*. To what extent the students agree respectively disagree with these statements about education in informatics disciplines they previously passed during university studies;
- *My professional capability in the context of study profilation.* Respondents were asked to choose one of seven alternative answers, with which most agree, or which best describes their opinion.

From the total number of 153 items in questionnaire, only 146 were included for the process of evaluation to the statistical measurements. Their rating to each ordinal item, respondents expressed through the five-point Likert scale, i.e. score between 1 to 5 with a median value on submission neutral, emotionally indifferent response assessment. A higher degree of

disagreement with the present argument is marked with a lower value; complete disagreement is marked with a degree 1. A higher degree of agreement with the present argument is marked with a higher value; full agreement is marked with a degree 5.

Analysis of reliability/item questionnaire was based on the results of pilot testing on a group of students of the 3rd year on a first stage of tertiary education in the study programs Business Economics, Business Management, Accounting, Business Enterprise provided by the FEM SUA in Nitra during the academic year 2013/2014.

The reliability of the items was analysed using multidimensional survey techniques to judge the quality/reliability of the measurement procedure (e.g. the questionnaire scale) and to identify suspicious questionnaire items. One of the ways to directly estimate reliability is the Cronbach's Alpha Coefficient

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

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

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

$$\overline{\alpha} = \frac{m\bar{r}}{1 + (m-1)\bar{r}},$$

where $m$ is number of the items.

## RESULTS AND DISCUSSION

In the questionnaire part titled *My education in computer science* (items labelled as E1 to E18) we asked students to what extent they agree respectively disagree with selected statements relating to education in those topics from the field of informatics, as well as their views on the implementation of education in those disciplines which they completed during higher education. Respondents have at their disposal 18 items (E1 to E 18) with the selecting position of the consent on the five grade Likert scale (5 – *strongly agree*, 4 – *agree*, 3 – *neither agree nor disagree*, 2 – *disagree*, 1 – *strongly disagree*). Table I contains selected descriptive characteristics of the resulting score of answers from the items E1 to E18 of questionnaire without differentiation of completing study respondents program. We indicated the rates of the mean and measures of variability (mean, median, standard deviation, standard error of the estimate average, lower and upper quartile) score of respondents' answers. Achieved values of standard error of estimated average are close to zero. These values are not published in Table I.

The average score has significantly highest value for item E9 (average scale 3.88 from 5 point scale), in which respondents spoke to the usability of computer knowledge gained during the study, in their future profession. Within the evaluation of the descriptive statistics data for the research sample of respondents we can conclude gratifying results (scale median 4 – *agree*) in the case of the items E2 – interesting content of the curriculum informatics disciplines, E3 – content complexity of IT disciplines, E7 – the importance of informatics as the part of the education of human, E8 – the usefulness of computer knowledge for the common human's life, E11 – significance of IT knowledge for the understanding of modern information technologies and E16 – if the teacher's way of presenting the content of subject is interesting.

For items E3 and E7 and a group of items E2, E8, E11 and E16 it was recorded the same scale of values of the students responses, whereas the middle 50% of the value assessment moves in the scale range from 5 to 3, respectively 4 to 3, from maximum value 5.

Table 1 From the results of descriptive statistics from part *My education in computer science* Source: Authors

| Item | Mean | Std. Dev. | Standard Error | Median | Quartile Range | |
|---|---|---|---|---|---|---|
| | | | | | Lower Quartile | Upper Quartile |
| Informatics subjects belong to my favorites. (E1) | 3.068 | 1.127 | 0.147 | 3.000 | 2.000 | 4.000 |
| Informatics subjects are interesting. (E2) | 3.458 | 1.039 | 0.135 | 4.000 | 3.000 | 4.000 |
| Informatics subjects have challenging content. (E3) | 3.746 | 1.108 | 0.144 | 4.000 | 3.000 | 5.000 |
| Informatics subjects are relatively easy to learn for me.(E4) | 2.966 | 1.144 | 0.149 | 3.000 | 2.000 | 4.000 |
| Informatics subjects opened my eyes to new and exciting activities. (E5) | 2.932 | 0.998 | 0.130 | 3.000 | 2.000 | 3.000 |
| I like informatics subjects more than the others. (E6) | 2.644 | 1.200 | 0.156 | 2.000 | 2.000 | 4.000 |
| I think that everybody should learn informatics subjects. (E7) | 3.542 | 1.222 | 0.159 | 4.000 | 3.000 | 5.000 |
| Knowledge, which I learned in informatics subjects, will help me in my everyday life. (E8) | 3.525 | 1.056 | 0.138 | 4.000 | 3.000 | 4.000 |
| Knowledge, which I gain in informatics subjects, will help me to increase my chances in future career. (E9) | 3.881 | 1.001 | 0.130 | 4.000 | 4.000 | 5.000 |
| Informatics subjects increased my curiosity about phenomena, which we still cannot explain. (E10) | 2.966 | 0.999 | 0.130 | 3.000 | 2.000 | 4.000 |
| Informatics subjects taught me to understand modern information technologies. (E11) | 3.448 | 0.902 | 0.118 | 4.000 | 3.000 | 4.000 |
| Informatics subjects showed me the importance of science for our life. (E12) | 3.293 | 1.060 | 0.139 | 3.000 | 3.000 | 4.000 |
| I would like to work in the area of applied informatics.(E13) | 2.483 | 1.143 | 0.150 | 2.000 | 2.000 | 3.000 |
| I would like to have in school more informatics subjects. (E14) | 2.379 | 1.254 | 0.165 | 2.000 | 1.000 | 3.000 |
| I would like to find a job in the IT field. (E15) | 2.475 | 1.264 | 0.165 | 2.000 | 1.000 | 4.000 |
| During the teaching of informatics subjects teacher realizes interesting interpretations of the new curriculum. (E16) | 3.254 | 1.123 | 0.146 | 4.000 | 3.000 | 4.000 |
| Within the teaching of informatics subjects we solve interesting tasks. (E17) | 3.339 | 1.010 | 0.132 | 3.000 | 3.000 | 4.000 |
| Within the teaching of informatics courses we use interesting tutorials, interactive simulation models. (E18) | 3.103 | 1.087 | 0.143 | 3.000 | 2.000 | 4.000 |

Resulting value (3) scale median documents that the group of items E1 –popularity of IT disciplines, E4 – complexity of IT disciplines, E5 – obtaining the horizon above new activities in common life, E10 – interested in exploration in the unexplained phenomena so far, E12 – the importance of informatics scientific specialization and modern technology in the functioning of society and E17 – whether solved tasks are interesting, respondents rated neutral (*neither agree nor disagree*).

Students state, that education in the field of IT subjects is in content interesting enough, but also relatively difficult. A finding in item E2 we give into context with the finding of items

B1 to B26 namely the teaching of selected topics of IT disciplines, the decisive number of respondents in items linked to this study subjects took rather positive (scale median 4 in 7 items) to neutral (scale median 2 in 1 item) attitude. Approximately on the same positive level students also evaluated the method of presentation of the new theme by teachers. Also proclaim the importance of informatics as part of the education of man and its significance for common life of man. But students do not have a clear view towards the inclusion of computer disciplines to the general part of study programs. The research results also point to certain reserves regarding the attractiveness of tasks that teachers use on the computer lessons. For this purpose it is possible to use, for example, learning tasks aimed at creating algorithms or interpretative tasks in solving which we apply heuristics as a methodology of creative problem solving. These tasks also have a motivating character, because they are very interesting, arouse curiosity and desire for searching solutions. It can be stated relatively less interested of respondents about topics related to previously unexplained phenomena, and the settlement of issues related to the social functioning with modern information technologies.

Within the results of statistical processing of responses for the queried group of respondents we consider as a worrisome evaluation of items E6 – preferring popularity of IT disciplines within the portfolio of educational subjects, E13 – erudition and professional participation in the field of applied informatics, E14 – need of the completion, if possible, the broadest range of IT disciplines and E15 – professional enforcement in the IT field. We detected that scale median in the case of items above represents the value 2 (*disagree*), which means that respondents rated them rather negatively. In item E15 (*I would like to be employed in IT field*), we had the largest quartile range and therefore the greatest diversity of student responses, the middle 50 % of those responses is in scale between 1 to 4, from the maximum scale value 5.The lowest value of variability indicator (0.90) was recorded in item E11 (middle 50% values in range between 4 to 3 from the maximum scale value 5), in which respondents spoke to the significance and importance of the knowledge gained in the studied informatics disciplines for the understanding the principles of modern information technologies.

Achieved wide-ranging diversity of responses opinion in item E15 is possible to relate with heterogeneous representation of our sample of respondents of our questionnaire in the context of completing a number of study programs provided by FEM SUA in Nitra.

Mentioned critical evaluation of items E6, E13, E14 and E15 we can give in the context with professional specialization of graduates of these study programs. By its statement students declare that their perspectives are not too tied with the enforcement in the field of information technology and they are relatively sceptical to the role of technological progress in society. If we look on this result through the lens of their study profiling, the finding can be considered in this context, more or less expected. But it's a completely different motivation for learning informatics subjects, modern technologies and motivation for career choice, about very different future orientation of their professional activity within society.

The same statistical technique that serves to the assessment of quality – reliability of the measurement procedure was also applied for testing of the all areas by created research tool. Statistical results for all four areas *What I want to learn* (with items B1 to B56), *My future profession* (with items C1 toC24), *What I would like to learn* (with items D1 to D48) and *My education in computer science*.(with items E1 to E18) were in the same intentions. Research tool in view of analysed items can be considered as reliable, but low average correlation between items in different areas of investigation indicates that after removing some items we could increase the reliability of the questionnaire.

## CONCLUSIONS

In the preparatory phase of research it was allocated a certain range of aspects on which the investigation of state of education will be realized in informatics area, accounting, management and finance/currency within the selected study programs of economic and managerial focus on tertiary level (ISCED 5). For these determinants there are targeted items that were incorporated into the questionnaire as a tool for collecting research data. The results of the pilot verification of the questionnaire were used to verify its reliability.

The overall reliability of the questionnaire was calculated by using Cronbach's Alpha. Calculated value for all four areas $\alpha_B = 0.9570$ (*What I want to learn*), $\alpha_C = 0.8405$ (*My future profession*), $\alpha_D = 0.9620$ (*What I would like to learn*) a $\alpha_E = 0.9293$ (*My education in computer science*) indicates high internal consistency of used measurement instrument. It means, that the application of created research tool allows to obtain reliable data through which can achieve the aim of our research.

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**Reviewed by**

1. Ing. Martina Hanová PhD. Department of Statistics and Operations Research, Faculty of Economics and Management, , Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic
2. Mgr. Radomíra Hornyák Gregáňová, PhD., Department of Mathematics, Faculty of Economics and Management, Slovak University of Agriculture, Tr. A. Hlinku 2, 94976 Nitra, Slovak Republic