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Self-Evaluation of Colleges Students and Professors Computer Knowledge and Skills in the Context of Their Communicational Development – Example Case Study in Serbia

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Abstract

The aim of this empirical research was to explore the perception of computer knowledge and skills of student's colleges and professors in the context of their development. The research was carried out during the 2012th in colleges of Belgrade, Serbia. It included 650 students and 130 professors. High levels of objectivity of self-evaluation of informants' own computer knowledge and skills have be confirmed by recent empirical research, which is why the same procedure was used in this research as well. The most significant contexts and/or ways of developing computer knowledge and skills were identifying by informants' picking out a context/way they personally believed to have been the most important for them. Analyses of results have shown that student's responses differ from professor's responses with regard to the self-evaluated levels of computer knowledge and skills. The two groups of informants also identify different contexts as most significant for the development of their knowledge and skills.

Keywords: college, students and professors, self-evaluation of computer knowledge and skills, Serbia

1. INTRODUCTION

Continually reinforces concerns about the digital divide, which is reflecting in the information exclusion of individuals, social groups or even of entire societies (Martinez, 2010). That division on the social level was causing uneven expansion and use of modern technology among nations and different regions, and growing fears about its further rapid deepening (Bell and Ramirez, 1997; Richardson, 2006). According to the forecasts of the future will be most manifest differences among the companies that will be in a position to produce content, and the companies, which will content and receive information only. Digital distribution is also evident among different social groups (Gunter, 2007; Surdin, 2009). For example, the division between rural and urban areas and communities, among wealthy people and those who live in relative poverty among members of different gender and so on. Education level is a significant indicator of the digital divide. With the increase in the level of education increases the level and quality of computing and the Internet (Bransford et al 1999; Holum and Gahala, 2001; O'Brien et al, 2005; Eickelmann, 2011). In addition, the use of modern computer technologies, especially for the older generation is a problem (Dryden and Vos, 2001; Prensky, 2004; Demunter, 2006; Buvat, and Mehra &

Braunschvig, 2007). Education level and age affect the inclusion in computer training. Educated people usually participate in computer training (due to their placement, and generally greater willingness to participate in various training programs) as well as between 16:24 young age (usually within formal education programs) (NCES, 2003, NCS Learn, 2001, Wastian-Schlüter, 2005). In many countries, women reported a reduced ability to access information and communication technologies as well as the lower level of development of computer skills than men for the same company (Plenković and Krstulovich, 2003; Vander Ark, et al, 2011). On a personal level, the biggest difference is reflecting in the division between individuals who know how to use modern computer technology and its many tools for those who do not possess sufficient knowledge and skills. It puts the education of a new challenge (Hunley et al, 2005; Demunter, 2006; Jenkins et al, 2007; Catts and Lau, 2008). On educational systems is the responsibility of everyone involved in the system (students, but also professors staff professional and administrative services, administration, etc.) enable to cope with the rapid spread of information and information and communication technology (Jenkins et al, 2007; Catts and Lau, 2008; Capobianco, 2007; Mishra and Koehler, 2006). It should be keep in mind that only allows access to computers is not enough. Thus, the digital divide is more than the division caused by unequal opportunities of individuals with access to modern information and communication technologies. If a man does not have developed the skills to use technology appears more division. Education systems of are the foundation of the development of information literate societies (Byrom, 1998, McCrory, 2008). Becker (1998) points out the problem of unequal opportunities of working with computer technology for professors and students at the school. In the schools of computer technology as different ages, due to the constant acceleration of technological change, necessarily leads to unequal opportunities to work (Brand, 1997). Digital distribution is reflecting in the social and educational issues. Unequal access to personal computers and the Internet can be though as a social issue. People who are already feeling the social and economic disadvantage in the future will feel even greater problem (Bolick et al, 2003, Branch et al, 1999). These problems have intensified their exclusion from the computer revolution, which partly redefine their social and economic life (Asia Society, 2007). Uneven access to a computer at home and at school has a direct impact on learning opportunities and quality of education of children and youth (Attewell et al, 2003; Demunter, 2006; Catts and Lau, 2008, Holum and Gahala, 2001). The problem occurs if the professors are not skilled enough in the use of computers (Trucano and Michael, 2005; Dilworth et al, 2012). Digital distribution of the different forms touches every society, social groups and individuals and makes a variety of effects, particularly in the social and educational level. Serbia has 71 college of which 51 state and 20 in private hands. Students are educated in the field of information technology on only four colleges. The rapid development of information technology cannot be ignored and the education of professors and students must be adapted to the fact that (Brancato, 2003, Hur et al., 2010, Stiggins, 1994). A large number of students to pike their knowledge of information technology through the Internet and a variety of multimedia content as is the case in Serbia (Jacobson and Archodidou, 2000; Texas Collaborative for Teaching Excellence, 2007; Robert et al, 2004; Santagata and Guarino, 2011; Lambert and Cuper, 2008). The research will show that a large percentage of professors in Serbia acquire or improved your knowledge of computer and internet is through different courses.

2. PROBLEM AND RESEARCH HYPOTHESIS

2.1. The research problem

Due to interaction with modern social and technological milieu in which today's young people live from birth changed their way of life than previous generations have evolved into technologically far poorer environment. The differences are especially apparent from the context of education and socialization. The changes, among other things touching ways young people learn to use computer technology to collect information and operate them as they are transformed, adopting and beyond. Computer inevitably affects their development because of their lives plays an important role. Their professors also live surrounded by modern technology; however, in their lives it is relative short present. Computers have entered into the lives of students and teachers who serve with them in various places in and out of school, develop and improve their computer knowledge and skills and use them in different ways and for different purposes (International Society for Technology in Education, 2008).

In order to contribute clarifying these issues, this study tries to answer the following problems:

1. To examine the levels of computer knowledge and skills of students colleges and their professors,

2. Identify and analyze the most important contexts / ways of acquiring their computer knowledge and skills,

3. Identify and analyze the relationship between the characteristics of colleges students and their professors (gender, type of school, academic achievement, a university degree, socioeconomic status, owning a home computer and Internet connection, attending different forms of training to work with the computer), and their estimates of the level and ways of acquiring computer knowledge and skills.

2.2. Hypotheses

H_1: The research is basing on the assumption that college students, compared to their professors, have developed computer skills, and the extent of their knowledge and skills to use computers in significantly higher estimates.

Other hypotheses regarding the different variables i.e. students and teachers have been placed in the null hypothesis H_1.

<u>Hypotheses concerning the students are as follows:</u>

H2: Distribution of self-assessment of knowledge and skills of young men and women are similar, but the young men in compared to young women significantly higher value on their knowledge and computer skills.

H3: Students from colleges that have multiple teaching subjects from the field computer science, their computational knowledge and skills assessed significantly higher than the students those colleges have less teaching subjects from the field computing.

H4: Their knowledge and computer skills in students whose average rating of studies higher of 9.50 estimated a highly while students who had worse at a low studies.

H5: Students with higher levels of socio-economic status of their knowledge and computer skills in a highly estimated, and students with lower levels of socio-economic status low.

H6: Students who have a home computer knowledge and computer skills in a highly estimated, and students who do not own a home computer low.

H7: Students, who had attended courses in computer knowledge and computer skills in a highly estimated, while students who did not attend computer courses low.

<u>Hypotheses concerning the professors are as follows:</u>

H8: Distribution of self-assessment of knowledge and skills of professor's different gender are similar and statistically completely insignificant.

H9: The difference in self-assessment of knowledge and skills among professor's different age groups was not statistically significant.

H10: The difference in self-assessment of knowledge and skills among professors of different levels of socio-economic status was not statistically significant.

H11: Their knowledge and skills in computer IT professors of the highest estimated, which confirms that there is insufficient technological training for computer professors whose academic subject area does not belong to information technology and that there is a statistical correlation between the assessment of their knowledge and skills on the computer and the areas academic subject that professors teaching.

H12: Is considering statistically significant difference in the self-assessment of knowledge and skills among professors who have a home computer and those who do not possess.

H13: Professors, who had attended courses of computer knowledge and computer skills in a highly estimated, while teachers who have not attended computer courses low.

3. RESEARCH METHODOLOGY

3.1. Research instrument

The research questionnaire designed for student's colleges and their professors, which consisted of two parts. The first part of the questionnaire was related to characteristics of students and professors (gender, year of study, type of school, success, university degree, socio-economic status, owning a home computer and Internet connection, attending various forms of training to work with the computer), and the other at the level of self-esteem and context of acquisition of computer knowledge and skills. In recent empirical studies, self-assessment has shown credible process for determining the development of computer knowledge and skills. When comparing the data collected by the objective indicators collected through systematic observation and testing knowledge of computer terminology and functions related to the computer, they do not differ significantly with each other (Conley, 2007). Respondent assertions to have been offered which could more or less agree, or they could be more or less eliminated (the scale is going out of 5, meaning strongly agree, to 1, meaning complete disagreement). The assessment offered five categories (identical for students and professors) that showed different levels of computer knowledge and skills, and they chose the one you thought that best reflects their knowledge and skills. The most contexts, and/or ways to develop computer literacy skills were investigating by the respondents chose one of the following contexts / ways for you personally find that it is most significant. Offered context of developing computer knowledge and skills are somewhat different for the students (school, course / seminar, parental teaching, learning with friends, studying, no computer knowledge and skills) and professors (school education, college, course / seminar, learning in the company of fellow students, learning with friends, studying, no computer knowledge and skills).

3.2. Respondents

The population that was examining in this study was students of the colleges and their professors. The research was carrying with students and their professors in ten colleges in Belgrade. Those are Higher education Institution for applied studies for Entrepreneurship, College of Business Economics and Entrepreneurship, Elite College, ICT College of Vocational Studies, The College of textile-design, technology and management, Modern Business School, School of Electrical Engineering and Computer Science Applied Studies, College of Information and Communication Technology, Medical College of Professional Studies and High Vocational School of Coaching. The study included 650 college's students and 130 professors. Samples of students and professors were formed at random respondents trying to colleges include the acquisition of different types of professions. In doing so we tried the proportion of students inside the sample relating to the type of college, gender and year of study, as much as possible to fit these measures "within populations" inside the student population. The survey was conducting during 2012.

4. RESULTS AND DISCUSSION

4.1. Self-assessment of computer knowledge and skills of students and professors

They do not have the necessary knowledge and skills to work on the computer consider 2.66% students and 6.98% professors. Most of the students (52.75%) and professors (60.47%) present data to have basic knowledge of computer skills. 28.12% students and 23.26% professors assess advanced knowledge and skills. With very good knowledge and skills are about 13.64% students and 9.30% professors. Only 2.83% of the student and no professor are considering ″hackers″.

Table 1: Self-assessment of knowledge and skills necessary for computer students and professors

Self-assessment	**Students**		Professors	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	17	2,66	9	6,98
I have the basic knowledge and skills of computer	343	52,75	79	60,47
I have advanced knowledge and skills computer skills	183	28,12	30	23,26
I have a very good knowledge and I am very proficient in using computers	89	13,64	12	9,30
For me to say that I "hacker"	18	2,83	0	-
TOTAL	650	100	130	100
X^2=13,6; df=4; p= 0,08687 for α =0,05				

Distribution of self-assessment of knowledge and skills of students and professors are similar, but students compared to professors significantly higher value on their knowledge and computer skills. For df = 4, threshold variable X^2 is 9.488 for α = 0.05 in our case X^2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills between students and professors statistically significant. The results confirm the hypothesis that students than their professors have significantly developed computer skills. The study verification and influence of the independent variables on the level of computer knowledge and skills of students and professors. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *ƒ*

***ƒ* = 2.7328**

Table 2: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*ƒ*
Treatments	1	27040	27040	2.7328
Error	8	79158	9894.75	
Total	9	106198		

Obtain critical value: From F critical value table, we get our critical value of 5.3177

Draw Conclusion: Since our test statistic *ƒ* = 2.7328 do not exceed our critical value of 5.3177, **we accept the hypothesis H_1**

4.1.1. Students

Students in the self-assessment of knowledge and skills necessary to work on the computer differ significantly among themselves with respect to (some features) independent variables.

Gender

Significant independent variable proved to be gender the student. Man on their knowledge and computer skills assessed significantly higher compared to women.

Table 3: Self-assessment of knowledge and skills necessary for computer students in relation to gender

Self-assessment	Man		Women	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	2	0,58	15	4,95
I have the basic knowledge and skills of computer	173	49,85	170	56,11
I have advanced knowledge and skills computer skills	100	28,82	83	27,39
I have a very good knowledge and I am very proficient in using computers	60	17,29	29	9,57
For me to say that I "hacker"	12	3,46	6	1,98
TOTAL	347	100	303	100
X^2=21,5; df=4; p= 0,0002561 for α =0,05				

Distribution of self-assessment of knowledge and skills of man and women are similar, but man than women significantly higher value on their knowledge and computer skills. For df = 4, limit value variable X^2 is 9.488 for α = 0.05 in our case X^2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills between man and women is statistically significant. The results have confirm the hypothesis the distribution of self-knowledge and skills man and women similar, but the man in compared to women significantly higher valued their knowledge and computer skills. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *f*

***f* = 0.0406**

Table 4: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	1	193.6	193.6	0.0406
Error	8	38124.4	4765.55	
Total	9	38318		

Obtain critical value: From F critical value table, we get our critical value of 5.3177 **Draw Conclusion:** Since our test statistic *f* = 0.0406 does not exceed our critical value of 5.3177, **we accept the hypothesis H_2**

Type of colleges

Considering the type of colleges found that students colleges who have multiple of teaching subjects in the field of computer science their computer knowledge and skills assessed significantly higher compared to students at colleges who have less of teaching subjects in the field of computer science. Most of them are evaluating as "basic" (41.53%) and as "advanced (33.92%), 5.26% even say they are hackers and there is no any student who does not have to corresponding the knowledge and skills necessary to use a computer. While on the other hand, 5.52% student colleges who do not have multiple of teaching subjects in the field of computer science declares that there is no knowledge and computer skills, and no one student who claims it a "hacker."

Table 5: Self-assessment of knowledge and skills necessary to work on computer students from different colleges

Self-assessment	Students from colleges that have multiple of teaching subjects in the field of computer science		Students from colleges that do not have multiple of teaching subjects in the field of computer science	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	0	0,00	17	5,52
I have the basic knowledge and skills of computer	142	41,53	201	65,26
I have advanced knowledge and skills computer skills	116	33,92	67	21,75
I have a very good knowledge and I am very proficient in using computers	66	19,29	23	7,47
For me to say that I "hacker"	18	5,26	0	0,00
TOTAL	342	100	308	100
X^2=77,5; df=4; p= 0 for α =0,05				

Distribution of self-knowledge and skills for college students who have multiple of teaching subjects in the field of computer science and those that do not have are similar. Students from colleges who have multiple of teaching subjects in the field of computer science were comparing to students in colleges that to do not have, significantly more evaluate their computer knowledge and skills. For df = 4, limit value variable X^2 is 9.488 for α = 0.05 in our case X^2 is dramatically higher than the limit value, and the difference in the self-assessment of knowledge and skills between the two groups of students statistically significant. The results confirm the hypothesis that students colleges that have multiple of teaching subjects in the field of computer science compared to students who do not have them have significantly developed computer knowledge and skills. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *f*

***f*=0.0222**

Table 6: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	1	115.6	115.6	0.0222
Error	8	41642.4	5205.3	
Total	9	41758		

Obtain critical value: From F critical value table, we get our critical value of 5.3177 **Draw Conclusion:** Since our test statistic ***f*=0.0222** does not exceed our critical value of 5.3177, **we accept the hypothesis H_3**

The success of the studies

Exploration of confirms the relationship between the success of the student's studies and self-assessment of computer knowledge and skills. Students whose averages scores larger than 9.50 their knowledge and skills work on the computer estimate higher levels, students who achieve a worse success a low.

Table 7: Self-assessment knowledge and skills necessary to work on computer students in relation to success on studies

Self-assessment	Students whose average scores of studies od 6,00 do 6,50		Students whose average scores of studies from 6,51 to 7,50		Students whose average scores of studies from 7,51 to 8,50		Students whose average scores of studies from 8,51 to 9,50		Students whose average scores of studies larger than 9,50	
	Number	%	Number	%	Number	%	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	15	8,87	2	1,38	0	0,00	0	0,00	0,00	0,00
I have the basic knowledge and skills of computer	143	84,62	100	68,49	100	58,82	0	0,00	0,00	0,00
I have advanced knowledge and skills computer skills	10	5,92	40	27,39	50	29,42	50	64,10	33	37,93
I have a very good	1	0,59	4	2,74	20	11,76	25	32,05	39	44,

knowledge and I am very proficient in using computers										83
For me to say that I "hacker"	0	0,00	0	0,00	0	0,00	3	3,85	15	17,24
TOTAL	**169**	100	**146**	100	**170**	100	**78**	100	**87**	100
X^2=225,3; df=16; p= 0 for α =0,05										

Distribution of self-assessment of knowledge and skills of students with different average scores of studies are similar, but students whose average scores of studies higher than 9.50 significantly higher evaluate their knowledge and skills work on the computer. For df = 16, limit value variable X2 is 26.296 for α = 0.05 in our case X2 is much higher than the limit value, so the difference in the self-assessment of knowledge and skills among students with different average scores of studies statistically significant. The results confirm the hypothesis that students whose average scores of studies higher than 9.50 their knowledge and skills work on the computer estimate higher levels, the students who had worse a low. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *f*

***f* = 0.1155**

Table 8: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	4	540.4	135.1	0.1155
Error	20	23399.6	1169.98	
Total	24	23940		

Obtain critical value: From F critical value table, we get our critical value of 2.8661
Draw Conclusion: Since our test statistic *f* = 0.1155 does not exceed our critical value of 2.8661, **we accept the hypothesis H_4**

Socio-economic status

Statistically significant differences between student colleges were establishing considering the socioeconomic status.

Table 9: Self-assessment knowledge and skills necessary to work on computer students in relation to socioeconomic status

Self-assessment	Students with higher levels of socioeconomic status		Students with lower levels of socioeconomic status	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	0	0,00	17	5,42
I have the basic knowledge and skills of computer	162	48,22	181	57,64
I have advanced knowledge and skills computer skills	100	29,76	83	26,43
I have a very good knowledge and I am very proficient in using computers	56	16,66	33	10,51
For me to say that I "hacker"	18	5,36	0	0,00
TOTAL	336	100	314	100
X^2=42,8; df=4; p=1e^{-8} for α =0,05				

Distribution of self-assessment of knowledge and skills of students with higher and lower levels of socioeconomic status were similar, but students with a higher level of socioeconomic status significantly higher value its knowledge and computer skills. For df = 4, limit value variable X^2 is 9.488 for $\alpha = 0.05$ in our case X^2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills among students with different levels of socioeconomic status statistically significant. The results confirm the hypothesis that students with higher levels of socioeconomic status on their knowledge and computer skills in estimate higher levels, and students with lower levels of a low socioeconomic status. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of $\alpha = 0.05$

Calculate our test statistic for treatments f

***f* = 0.0101**

Table 10: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	f
Treatments	1	48.4	48.4	0.0101
Error	8	38433.6	4804.2	
Total	9	38482		

Obtain critical value: From F critical value table, we get our critical value of 5.3177 **Draw Conclusion:** Since our test statistic f = 0.0101 does not exceed our critical value of 5.3177, **we accept the hypothesis H_5**

Owning a home computer

Statistically significant difference between the assessment of student knowledge and skill identified are considering owning a home computer. Students in households with higher socioeconomic status, and the percentage is growing and owning a computer is a logical connection between these variables and the level of development of self-knowledge and skills to work with your computer. With owning a home computer (especially networked) students are significantly more likely their computer knowledge and skills estimate higher, while students who do not have a home computer estimate them a low. Since that computer knowledge and skills developed largely through the practice of dealing with computer no significant, difference is self-explanatory.

Table 11: Self-assessment of knowledge and skills necessary to work on computer students by owning a home computer

Self-assessment	Students who have a home computer		Students who do not have a home computer	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	0	0,00	17	6,20
I have the basic knowledge and skills of computer	162	43,08	181	66,07
I have advanced knowledge and skills computer skills	120	31,92	63	22,99
I have a very good knowledge and I am very proficient in using computers	76	20,21	13	4,74
For me to say that I "hacker"	18	4,79	0	0,00
TOTAL	376	100	274	100
X^2=84,5; df=4; p=0 for α =0,05				

Distribution of self-assessment of knowledge and skills that students have or do not have a home computer are similar, but students who have a home computer higher value its knowledge and computer skills. For df = 4, limit value variable X2 is 9.488 for α = 0.05 in our case X2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills between students who own a home computer, and students who do not have statistically significant. The results confirm the hypothesis that students who have a home computer their knowledge and computer skills in estimate higher levels and students who do not have a home computer is a low. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *ƒ*

***ƒ* = 0.2048**

Table 12: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	ƒ
Treatments	1	1040.4	1040.4	0.2048
Error	8	40641.6	5080.2	
Total	9	41682		

Obtain critical value: From F critical value table, we get our critical value of 5.3177

Draw Conclusion: Since our test statistic *ƒ* = 0.2048 does not exceed our critical value of 5.3177, **we accept the hypothesis H_6**

Extracurricular computer course

It was also founding those students who attended computer courses colleges outside their knowledge and computer skills in estimate higher levels compared to students who have not attended such a course, which was expected.

Table 13: Self-assessment of knowledge and skills necessary to work on computer students in relation to the attending computer courses

Self-assessment	Students who attended computer courses		Students who have not attended computer courses	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	2	0,59	15	4,76
I have the basic knowledge and skills of computer	162	48,36	181	57,46
I have advanced knowledge and skills computer skills	97	28,95	86	27,30
I have a very good knowledge and I am very proficient in using computers	56	16,73	33	10,48
For me to say that I "hacker"	18	5,37	0	0,00
TOTAL	335	100	315	100
X^2=35,1; df=4; p=4,6e^{-7} for α =0,05				

Distribution of self-assessment of knowledge and skills of students who attended computer courses or those who have not attended a similar, but students who attended computer courses higher valued their knowledge and skills work on the computer. For df = 4, limit value variable X2 is 9.488 for α = 0.05 in our case X2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills between students who attended computer courses and students who have not attended a statistically significant . The results confirm the hypothesis that students who attended courses of computer knowledge and computer skills in estimate higher levels, and students who did not attend computer courses a low. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *f*

***f*= 0.0084**

Table 14: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	1	40	40	0.0084
Error	8	38298	4787.25	
Total	9	38338		

Obtain critical value: From F critical value table, we get our critical value of 5.3177 **Draw Conclusion:** Since our test statistic *f* = 0.0084 does not exceed our critical value of 5.3177, **we accept the hypothesis H_7**

4.2.2. Professors

For professors, it was determined that the self-assessment of knowledge and skills necessary to work with computers also differ significantly considering the some observed independent variables.

Gender, age and socioeconomic status

Statistically significant, and did not show variables gender, age and socioeconomic status self-assessment of knowledge and skills necessary to work on the computer.

Table 15: Self-assessment of knowledge and skills necessary for work on the computer professor in relation to gender

Self-assessment	Gender - Male		Gender - women	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	4	6,35	5	7,57
I have the basic knowledge and skills of computer	39	60,72	40	60,61
I have advanced knowledge and skills computer skills	15	23,45	15	22,73
I have a very good knowledge and I am very proficient in using computers	6	9,48	6	9,09
For me to say that I "hacker"	0	0,00	0	0,00
TOTAL	64	100	66	100
X^2=0,093; df=3; p= 0,9926 for α =0,05				

Distribution of self-assessment of knowledge and skills of professors of different gender are similar. For df = 3, limit value variable X2 is 7.815 for α = 0.05 in our case X2 is lower than the limit value, and the difference in the self-assessment of knowledge and skills among professors of different gender entirely statistically insignificant. The results confirm the hypothesis that the distribution of self-knowledge and skills of professors of different gender are similar and statistically completely insignificant. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *f*

***f* = 0.0016**

Table 16: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	f
Treatments	1	0.4	0.4	0.0016
Error	8	1993.6	249.2	
Total	9	1994		

Obtain critical value: From F critical value table, we get our critical value of 5.3177 **Draw Conclusion:** Since our test statistic f = 0.0016 does not exceed our critical value of 5.3177, **we accept the hypothesis H_8**

Table 17: Self-assessment of knowledge and skills necessary for work on the computer professor in relation to the age

Self-assessment	<30 year		31 – 40 year		41– 50 year		51 - 60 year		>61 year	
	Number	%	Number	%	Number	%	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	0	0,00	1	3,13	2	8,00	2	10,53	4	19,05
I have the basic knowledge and skills of computer	24	72,72	20	62,50	15	60,00	10	52,63	10	47,63
I have advanced knowledge and skills computer skills	7	21,21	7	21,87	6	24,00	5	26,31	5	23,80
I have a very good knowledge and I am very proficient in using computers	2	6,07	4	12,50	2	8,00	2	10,53	2	9,52
For me to say that I "hacker"	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
TOTAL	**33**		**32**		**25**		**19**		**21**	
X^2=10,386; df=12; p= 0,5821 for α =0,05										

For df = 12, limit value variable X2 is 21.026 for α = 0.05 in our case X2 is lower than the limit value, and the difference in the self-assessment of knowledge and skills among professors of different ages was not statistically significant thus confirming the initial hypothesis H9. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments f

f= 0.1713

Table 18: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	4	32	8	0.1713
Error	20	934	46.7	
Total	24	966		

<u>Obtain critical value:</u> From F critical value table, we get our critical value of 2.8661
<u>Draw Conclusion:</u> Since our test statistic *f* = 0.1713 does not exceed our critical value of 2.8661, **we accept the hypothesis H_9**

Table 19: Self-assessment of knowledge and skills necessary for work on the computer professor in relation to socioeconomic status

Self-assessment	Professors with higher levels of socioeconomic status		Professors with lower levels of socioeconomic status	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	4	5,55	5	8,62
I have the basic knowledge and skills of computer	45	62,50	34	58,62
I have advanced knowledge and skills computer skills	16	22,22	14	24,13
I have a very good knowledge and I am very proficient in using computers	7	9,73	5	8,63
For me to say that I "hacker"	0	0,00	0	0,00
TOTAL	**72**		**58**	
X^2=0,609; df=3; p= 0.8943 for α =0,05				

For df = 3, limit value variable X2 is 7.815 for α = 0.05 in our case X2 is less than the limit value, and the difference in the self-assessment of knowledge and skills among professors of different levels of socioeconomic status were not statistically significant thus confirming the initial hypothesis H10 . In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

<u>Calculate our test statistic for treatments *f*</u>

***f*= 0.0769**

Table 20: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	1	19.6	19.6	0.0769
Error	8	2038.4	254.8	
Total	9	2058		

<u>Obtain critical value:</u> From F critical value table, we get our critical value of 5.3177
<u>Draw Conclusion:</u> Since our test statistic *f* = 0.0769 does not exceed our critical value of 5.3177, **we accept the hypothesis H_{10}**

Area teaching subject

Significant independent variables showed that teaching subject area professors teach (**X^2= 97,847; df=9; p=0**). Their knowledge and skills work on the computer highest estimate IT professors, a slightly lower compared to them professors of vocational subjects, followed by the professors of natural sciences and mathematics subjects. Lowest knowledge and skills work on the computer estimate professors of social and humanistic group of subjects (of which 11.7% corresponding to general do not have knowledge and skills necessary for work on the computer) which supports the hypothesis of inadequately technological training of future professors. For df = 9, limit value variable X2 is 16.919 for α = 0.05 in our case X2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills among professors of different of teaching subjects statistically significant thus confirming the initial hypothesis H11. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

<u>Calculate our test statistic for treatments *f*</u>

***f*= 0.2308**

Table 21: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	3	92.2	30.7333333333	0.2308
Error	16	2130.8	133.175	
Total	19	2223		

<u>**Obtain critical value:**</u> From F critical value table, we get our critical value of 3.2389 <u>**Draw Conclusion:**</u> Since our test statistic *f* = 0.2308 does not exceed our critical value of 3.2389, **we accept the hypothesis H_{11}**

Owning a home computer

As in the case of students, it was found that professors who have a home computer more often than professors who do not have their computer knowledge and skills estimate higher and conversely (**X^2** = 17,244**;** df = 3; p=0,00063). For df = 3, limit value variable X2 is 7.815 for α = 0.05 in our case X2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills among professors who have a home computer and those who do not have a statistically significant, which confirmed the initial hypothesis H12. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

<u>Calculate our test statistic for treatments *f*</u>

***f* = 0.3206**

Table 22: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*f*
Treatments	1	90	90	0.3206
Error	8	2246	280.75	
Total	9	2336		

<u>**Obtain critical value:**</u> From F critical value table, we get our critical value of 5.3177 <u>**Draw Conclusion:**</u> Since our test statistic *f* = 0.3206 does not exceed our critical value of 5.3177, **we accept the hypothesis H_{12}**

Computer course

As expected there was a significant correlation between attending computer courses and higher levels of own estimates of computer knowledge and skills, the research and confirmed.

It was also founding that the professors who attended computer courses (e.g., ECDL computer programs or computer training courses reach a wider public) and those who did not show any statistically significant difference in their self-assessment of knowledge and skills development work on the computer.

Table 23: Self-assessment of knowledge and skills necessary for work on the computer professor in relation to attend computer courses

Self-assessment	Professors who attended computer courses		Professors who have not attended computer courses	
	Number	%	Number	%
I do not have the knowledge and skills needed to work on the computer	0	0,00	9	17,65
I have the basic knowledge and skills of computer	50	63,29	29	56,86
I have advanced knowledge and skills computer skills	20	25,32	10	19,61
I have a very good knowledge and I am very proficient in using computers	9	11,39	3	5,88
For me to say that I "hacker"	0	0,00	0	0,00
TOTAL	79	100	51	100
X^2=15,6; df=3; p=0,0013 for α =0,05				

Distribution of self-assessment of knowledge and skills of professors who attended computer courses or those who have not attended a similar, but professors who attended computer courses higher values its knowledge and skills work on the computer. For df = 4, limit value variable X2 is 7.815 for α = 0.05 in our case X2 is greater than the limit value, and the difference in the self-assessment of knowledge and skills among professors who attended computer courses and professors who have not attended a statistically significant. The results confirm the hypothesis that professors who attended courses of computer knowledge and skills work on the computer estimate higher levels, and professors who did not attend computer courses a low. In order to obtain more convincing data that we used ANOVA analysis for the same level of α. Perform 1 way ANOVA (Analysis of Variance) on the data set that you entered at a significance level of α = 0.05

Calculate our test statistic for treatments *ƒ*

***ƒ*= 0.2796**

Table 24: ANOVA Table Values:

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	*ƒ*
Treatments	1	78.4	78.4	0.2796
Error	8	2243.6	280.45	
Total	9	2322		

Obtain critical value: From F critical value table, we get our critical value of 5.3177 **Draw Conclusion:** Since our test statistic *ƒ* = 0.2796 does not exceed our critical value of 5.3177, **we accept the hypothesis H_{13}**.

The most important ways/contexts to develop computer skills and knowledge professors and students

Next thing we were interested in the ways/contexts to develop the knowledge and skills necessary to work on the computer, i.e. which forms the above of training students and professors attach most importance. Since the individual response categories differ for students and professors, there was no opportunity to determine the significance of differences between the two samples, but significant differences were founding within each sample.

4.2.1. Students

Table 25: Ways/contexts of acquisition most knowledge and skills for work the computer students

Rang	Ways/contexts of acquisition most knowledge and skills	Total number of students	%
1	Independent learning	271	41,69
2	Learning with friends	178	27,38
3	At College	155	23,84
4	The parental teaching	24	3,69
5	I do not have the knowledge and skills needed to work on the computer	17	2,62
6	The course / seminar	5	0,78

Much of the student declares (41.69%) is the most computer knowledge and skills gained independent learning, that are self-taught. 27.38% students have the most knowledge and learning skills come with friends, while 23.84% students indicated knowledge acquired in college. A smaller number of students (3.69%) taught parents, while 0.78% students the same knowledge acquire in the course. The above results are consistent with the results of previously conducted studies, for example Wastian-Schlüter (2005) and Demunter (2006). Regardless of the results of previous research worrying fact that this research is only about 23.84%, its highest student computer knowledge and skills acquire and developed in the process of formal education. Students are the most important in assessing methods of acquiring knowledge and skills of computer differ significantly among themselves considering the all independent variables monitored.

Gender

Gender is a students showed a significant independent variable when it comes to the ways of gaining the most knowledge and skills in working with computer (**X^2=50.7; df=5; p= 0 for α =0.05**). A self-study of most computer knowledge and skills acquired 52.17% man and 29.70% women. Equal number of mans (27.09%) and women's (27.73%) declare that they have computer knowledge and skills developed along with his friends. Approximately 5.94% women are comparing to man about 1.73% most knowledge and skills acquired computer skills with the help of parents. A significant difference appearing in formal learning contexts, about 30,69% women's compared to mans 17.87% most computer knowledge and skills developed in college, i.e. women's are more likely than man to learning in college and man prefer self-study. These differences in the contexts of acquisition of computer knowledge and skills, and confirm the results of earlier studies (Vastian-Schluter, 2005). We could say that women's in developing computer literacy skills prefer a well established, i.e. "more secure" ways of learning, as mans turn to more standalone "experimentation" and trying out some kind of computer, and their possibilities and limits.

Types of college

Ways of gaining the most knowledge and skills in working with the computer showed a significant difference with respect to the types of colleges which are attended by students (**X^2=37.1; df=5; p= 5.6e^{-7} for α =0.05**). College students with more of teaching subjects in the field of computer science significantly more than of the other ones that are most computer knowledge and skills acquired in college and independently (71.92%) and that there are no students who do not have the necessary knowledge and skills for working a computer. For college students who have more of teaching subjects in the field of computer science most skills for working with a computer acquired independent learning (40.91%), learning with friends (29.22%) and then follows the learning in college (17.53%). It also showed a significant variable and the success of students on studies (**X^2=122.1; df=20; p=0 for α =0.05**). What is student success a lower students often say they are the most computer knowledge and skills acquired with friends (50.00% for average between 6.00 do 7.50) and independently (37.64% for average between 6.00 do 7.50). Observing is growing the frequency of student responses to the self-trained in working with computer (25.09% among students with an average score of more than 9.50).

Owning a home computer

In this case, the significant independent variables showed the existence of a student's computers in the household (**X^2=265.5; df=5; p=0 for α =0.05**). Students who do not own a home computer more often than other colleagues do how they the most appropriate computer knowledge and skills acquired in college (44.89%), a little over of 6.20% declares that they do not have the necessary knowledge and skills to work with the computer. Unlike them, almost 67% student's networked home computers say they are self-taught, and this gives the answer 6.93% student's without a home computer. Approximately 2.13% of students with home computers and 5.83% students without a home computer correspond to the use of computers mastered with the help of parents.

Context of developing computer skills and knowledge in relation to self-assessment

Self-assessment variable was analyzing as a separate variable for the most important ways/contexts of developing computer knowledge and skills, and proved statistically significant as proved previous research. Thus, students who transfer their knowledge and skills are evaluated as advanced, very good or even consider themselves to be "hackers" usually say they are self-taught and, less often, that the knowledge and skills developed in the company of friends. It is interesting that those students who in the first place put the college as the most important context of their knowledge and skills are valued and they are mostly a low estimated as basic computer knowledge and skills. It remains an open question of quality informatics program, which seems to allow development only basic computer knowledge and skills, and fail to meet the interests of its student's computer knowledge and skills assessed higher ones. The same problem noted O'Brien et al. The vast majority of a student's stands out informal learning contexts (alone and with friends) as the most significant in spite of the existence of different possibilities for developing computer knowledge and skills in the formal college context (mandatory, optional or additional teaching informatics) as well as within of various computer courses that are organized outside college. This is because the mandatory teaching informatics realized only at the level of secondary education, while at the same time young people usually begin to use computers in elementary schools. Although college partially reduce differences among a student's when it comes to about their computer experience and the context of developing computer skills and knowledge appear to however, it no fails to completely remove the observed differences. This is especially true for students which their knowledge and skills work the computer estimated above average, to students achieve better success in studies, students who have more of teaching subjects in the study (which point out that most often are self-taught in working with computer). The results of the study showed that Wastian-Schlüter (2005) show similar tendencies in a number of EU member states. Students who attend computer courses significantly different estimate most important ways of developing their computer knowledge and skills (**X^2=35.1; df=4; p=4.3e^{-7} for α =0.05**). They often stand out attendance course as the most important form of overcome working with a computer, but give priority parental teaching and independent learning, as opposed of students who did not attend computer courses, which give priority to teaching and learning with friends in college.

4.2.2. Professors

Table 26: Contexts/ways of acquiring most knowledge and skills for work the computer professors

Rang	Context/ways of acquiring of knowledge and skills	Number professors	%
1	Independent learning	42	32,31
2	The course/seminar	38	29,23
3	Learning with friends	16	12,31
4	In college	11	8,46
5	Learning with college colleagues	9	6,92
6	I do not have the knowledge and skills needed to work with computers	9	6,92
7	In his school education	5	3,85
UKUPNO		130	100

Similar to the students, the largest number professors (32.31%) the most knowledge and skills to work with a computer has acquired independently. However, the professors in the sample, as opposed to the student's sample, significantly represented and category learning course/seminar (29.23%). Informal learning with friends 12.31% professors evaluates the most important, and only 6.92% in the company of their learning colleagues from college. The 8.46% professors indicated that the knowledge and skills developed mostly at university (probably professors computer science), and 3.85% of the professors in his school education (can assume that are younger professors). Teachers are the most important in the self-assessment ways acquiring knowledge and skills work significantly different on the computer considering a number of independent variables monitored.

Gender

Gender did not show statistically significant for self-assessment computer knowledge and skills.

Area of the teaching subject

Considering to the area of the teaching subject who teach in statistically significant differences among professors (**X^2=43.5; df=18; p=0.00067 for α =0.05**). IT professors valued the most significant formal learning contexts (college, university). Almost 31.57% of the professors in fields of Science and Mathematics in the first place by the significance of the allegations learning courses, and about 15.78% of them said university. Other professors from the social and humanistic area and professors of vocational subjects, significantly less often allegations university as the most important context of developing computer knowledge and skills (4-6%) and highly valued courses (25-35%). A significant percentage of all professors alleges that the self-taught, and of them is 43.18% of professors of vocational subjects. Professors from the social and humanistic area (14.28%), significantly more than the other of professors (6.8%), say they do not have a developed the knowledge and skills needed to work on the computer.

Age

Age of professors were also has shown a significant variable (**X^2=45.2; df=24; p=0.005 for α =0.05**). What professors are younger more frequently as the most important development contexts computer knowledge and skills stand out school and university (43.84%) and learning with friends (26.92%). Senior professors evaluate significant learning courses (32.30%). The results are logical considering that older professors during their school, and university education, have not been able to develop their computer knowledge and skills, as previously such teaching programs did not exist.

Socioeconomic status

The way of developing computer skills and knowledge professors differ substantially with regard to socioeconomic status (**X^2=44.8; df=6; p=5e^{-8} for α =0.05**). Professors average or below average socioeconomic status in relation to others with higher socioeconomic status, more commonly referred to as a self-taught (55.17%), to have computer knowledge and skills developed in organized courses for professors (32.75%) or even does not demonstrate these skills and knowledge (8.62%).

Owning a home computer

Professors differ with considering owning a home computer (**X^2=39.1; df=6; p=6.7e^{-7} for α =0.05**). This particularly refers to self-study, 15% of professors with networked home computer and 60% without a home computer that stand out self-taught while professors without a home computer far more often stated that they have no a developed computer knowledge and skills (10.00%).

Context of developing computer skills and knowledge in relation to self-assessment

Variable self-assessment of knowledge and skills necessary to work with the computer was analyzing as a separate variable for the most important ways / contexts of developing computer knowledge and skills have shown to be statistically significant. Although the on average all professors most often declare that are self-taught (except professors without computer knowledge and skills), the professors who transfer their knowledge and skills work on the computer extremely well evaluated significantly more often than other state formal learning contexts such as school and university (IT teachers and younger teachers). Professors with advanced and basic knowledge and skills are valued more significant learning courses and learning with friends. Professors in general very rarely allegations to as the most developed knowledge and skills with other colleagues teachers. Professors are in the acquisition of various forms of development of computer knowledge and skills differ. They differ with regard to the fact that did have attended computer courses or not, no matter whether the case of a specially organized courses for professors (**X^2**=19.2, df = 6, **p** = 0.0037 for α = 0.05) or courses to the general public (**X^2=10.9; df = 6; p=0.088 for α =0.05**). In both cases, the professors who have attended computer courses just those, significantly more often from other method, referred to as the most significant contexts.

5. CONCLUSION

Analysis of the results of the study on the levels of computer knowledge and skills of students and of professors confirmed the assumption that the student colleges their computer knowledge and skills assessed significantly higher than their professors. In addition, significantly smaller number students than the professors did not have developed the knowledge and skills necessary to work on the computer. Independent variables that were pointed out as important to show their knowledge and computer skills in estimate man developed, students who attend college with more of teaching subjects who achieved better student success who attended computer courses, students with higher socioeconomic status and those who have a home computer. Professors who have a home computer their computer knowledge and skills estimate higher, as well as those who attended computer courses. Worrying is the fact that it is professors who attended the professorial university (humanistic or social and the natural mathematical) their computer knowledge and skills estimate to significantly lower than other professors (computer science professors and professors of specific subjects in college). Except that the students and professors differ among themselves with regard to the estimated levels of computer knowledge and skills, and they stand out as the most different contexts during their development. Although the in both cases we find the answer to most often students and professors work independently mastered the computer, however, the answer significantly more often stand out students. This information is expected. In accordance with are results of previously conducted studies. It is highly conditioned by the technological environment in which today's students are developing from birth. Students compared to professors are far cozier to develop computer skills and knowledge with friends. Students stand out as third context learning in college. Professors, from understandable reasons, the context of putting the last place, because most of them developing computer skills and knowledge were not available during their education (in part it relates to higher education). Professors as a formal context of developing computer knowledge and skills, as opposed to students stand out IT training courses. Students significantly more often than professors as key ways of developing computer skills and knowledge stand out informal forms of learning that can show a very effective and today represent an increasingly important form of learning. Analysis of independent variables shows that the self-study as the most important context / way of developing computer knowledge and skills stand out man and students who attend the college with more teacher subject. Then there are the still and students who achieved a better student success, those who their computer knowledge and skills are evaluating as above average, and advanced as well as students who have a home computer, especially networked. On the other hand, significantly more often as a college the most important stand out women's, students who attend college with less of teacher subjects, those who their computer knowledge and skills are evaluated as primary and students in your household do not have a computer. Although the college has a significant role in reducing the participatory cleavages, yet he does not succeed to fully responding to the needs of all students, which particularly refers to students with higher levels of teacher knowledge and skills. When it comes to professors, as well as students, most often declare that are self-trained in working with the computer, is evident that professors rarely away from a student stand out the importance of informal learning (with friends or classmates) as well as among other contexts of developing computer knowledge and skills, high value computer courses. As most of the interviewed professors were not available during the secondary school and university education to develop skills and knowledge of computer, it is logical that attending computer courses for them is a very important way of developing computer knowledge and skills. Such type of computer training would be further implementing and intensify into it and in addition included professors and other teaching staff. In addition, this is study has proven in the introductory section work indicated that the digital divide is reflected in the social educational level. As the differences cannot be completely removing, it can be concluding that moderate, addressed to effective use of computer technology and information, from the children, youth and adult, a positive effect on its downsizing. Thus, it requires a systemic approach to educational within the formal and non-formal education aiming at developing computer knowledge and skills and build critical information access.

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