

Comparison of the ICT literacy level of the Slovakian and Hungarian students in the higher education

Gabor Kiss^{1a}, and Zuzana Arki²

¹Obuda University, Becsi ut 96/b, Budapest H-1034, HungarySciences, Production Department

²J. Selye University, Bratislavská cesta 3322, 945 01, Komárno, Slovakia

Abstract. Communication and technology have an important role in life and especially in education. Nowadays, students generally use technology for communication. When using technology in education, there may be some communication barriers. In this research, it is studied about communication barriers that prevent teachers' candidates to use technology. The aim of this research is to find the communication barriers which teachers' candidates face when they utilize technology. First of all we have to see the ICT knowledge level of the students to make decision about the application and retraining methods. It is important to know can we find any difference in ICT literacy between the Hungarian and the Slovakian students. We measured the ICT literacy level with a tool consisting of 15 items (Likert scaled). We worked with 663 students. The data analysis was performed with SPSS software using descriptive statistics and Mann-Whitney test. ICT literacy comparison has showed significant differences by countries, the Hungarian students ICT literacy was on higher level (self-report) except by using learning platforms.

1 Introduction

The aim of this research is to find the communication barriers which teachers' candidates face when they utilize technology. First of all we have to see the ICT knowledge level of the students to make decision about the application and retraining methods. It is important to know can we find any difference in ICT literacy between the Hungarian and the Slovakian students to see how long is the way to finish the ICT revolution in these countries. On the other hand is it important to see which topic need more attention from the teachers in the high school to give a good knowledge for the student before they go in the higher education.

^a Corresponding author: kiss.gabor@bgk.uni-obuda.hu

Some earlier research analyzed the ICT literacy of the students in Hungary on different levels [4;5;6;7]. The current research analyses the ICT literacy level of the Slovakian and Hungarian students in Higher Education.

2 Information technology education in Hungary

IT education is based on a national curriculum in Hungary (Ministry, E. H, 2003).

Hungary the use of IT is to be 2003 (e.g. search on the Internet, painting with computers etc.) and is taught in 1 class weekly. According to the Information Technology curriculum the following subjects are taught from the 5th grade to the 12th grade at the schools of Hungary in 2 classes weekly: Word processing; spreadsheet calculation; presentation; algorithm and programming; database management.

Generally the Microsoft Office packet is taught and it can be seen that teaching Word processing takes 4 years in Hungary (Table 1). Basic algorithms or rather programming appears in Information Technology sooner, but recursion, list and tree data structures are only selectable part of the curriculum. Database management begins in the 9th grade. In grades 11-12 CS is just selectable. At basic level it is taught 2 hours weekly, on a higher level 3 hours weekly and a final exam can be taken.

Table 1. The subject of IT by grades in Hungary.

Subject	Grade									
	5.	6.	7.	8.	9.	10.	11.	12.		
Word processing		✓	✓	✓	✓					
Spreadsheet calculation				✓	✓					
Presentation							✓			
Algorithm and programming			✓	✓	✓					
Database management					✓					

3 Information technology educations in Slovakia

The education of Informatics from the 2nd grade has been compulsory since the school year of 2008/2009, since the introduction of the school reform but it also appears in the 1st grade as well as in the nursery school curriculum though not as a compulsory subject. It is compulsory to have 1 Informatics lesson a week in the junior section and 0.5 lesson a week in the senior section that can be raised by the schools' own programme. Some schools took the opportunity and increased it to 1 lesson a week. The National Educational Programme does not assign precisely what teachers have to teach in the various grades but announces the school leaving standards to reach at the end of the senior section. So it does not matter if programming is taught in the 6th grade in one school and in the 8th grade in another school; the aim is to reach the school leaving standards. It is part of the educational programme of the school how its students should reach these standards, how many lessons they have a week and at what pace they learn the material; this programme is accepted by the management of the school and its teachers together .

The National Educational Programme divides Informatics into 5 topics (it does not specify the number of lessons):

1. Information around us
2. Communication with the help of the means of the ICT
3. Problem solving, thinking with the help of algorithms

- 4. Basic principles of the operation of the ICT tools
- 5. IS society

These 5 topics are then to be divided into the school leaving standards [10].

4 Analyzing students' ICT literacy level

The purpose of this study is to compare the ICT literacy level of students from Slovakian
nts: The sample consisted of 663

Table 2. The number of participants by gender and country

	Male	Female	Total
Slovakian	66	83	149
Hungarian	427	87	514
Total	493	170	663

The students filled out a self-reported questionnaire with 15 items (Table 3). We have used Likert-type rating scales to measure the ICT literacy level of students [11].

Table 3. ICT literacy level items

Number of item	Item
1	Handling Operating System (OS)
2	Word processor
3	Spreadsheet
4	Database Management
5	Multimedia
6	Software specific to my degree
7	Using documentary bases (Such as EBSCO)
8	Web Browsing
9	Internet Communication
10	Internet Safety
11	Website design
12	Using learning platforms
13	Image Editing
14	Video Editing
15	Creating simulations and animations

Likert scales are commonly used by self-reported questionnaire, providing a range of responses to a given question or statement [3]. There were 4 categories of response :1 = basic level; 2 = medium; 3 = advanced, 4 = „master”. The reliability of the questionnaire obtained by the technique of Cronbach- α was 0.914 it means the reliability of the questionnaire is very good.

4.1 The results of Independent Samples Mann-Whitney U test

The Likert scale is ordinary scale, and as such we can calculate mean, min, max, median, modus, std. dev. etc. We can use the nonparametric tests where we need ordinary variables. We have two independent samples so we could use the Mann-Whitney-Wilcoxon test for 2 samples [1]. The Mann-Whitney-Wilcoxon test seems better choice versus t test by Likert-type data [2], because it is testing the medians of the samples. We used the Mann-Whitney independent sample U test of SPSS to compare the means of scores taken by the

students. Monitoring was held on $p=5\%$ significance level in the whole analyzing process. We used 3 different ways of comparison: by countries, by gender and by gender in Hungary or in Slovakia.

Table 4. The results of Independent Samples Mann-Whitney U test by countries

Number of item	Item	Slovakian (Mean score)	Hungarian (Mean score)	P
	Handling Operating System (OS)	2,36	2,23	0,103
2	Word processor	1,93	2,37	0,000
3	Spreadsheet	1,54	1,93	0,000
4	Database Management	2,03	1,68	0,000
5	Multimedia	1,73	1,96	0,006
6	Software specific to my degree	1,58	1,59	0,888
7	Using documentary bases (Such as EBSCO)	2,81	1,77	0,000
8	Web Browsing	2,81	2,82	0,994
9	Internet Communication	2,05	2,57	0,002
10	Internet Safety	1,32	1,86	0,000
11	Website design	1,28	1,56	0,000
12	Using learning platforms	2,01	2,14	0,060
13	Image Editing	1,56	1,96	0,000
14	Video Editing	1,36	1,53	0,024
15	Creating simulations and animations	2,46	1,29	0,000

4.1.1 The results of Independent Samples Mann-Whitney U test by countries

If we summarize the scores of all items and make the comparison we can see the ICT literacy lever of students by countries. The result of Mann-Whitney U test on the total scores has shown significant difference between the 2 group of students by ICT literacy, $p=0.000$. We calculated the mean scores by items and also calculated the difference between them grouped by countries. Then we can made analysis process with Mann-Whitney U test (Table 4.). According to the table we can find lot of significant differences just by few items can we recognize same result (“Handling Operating Systems”, “Software Specific to my degree”, “Web browsing” and “Using learning platforms.”) in other cases the subjective ICT literacy level of Slovakian and Hungarian students is different. Same examples show the frequency of the scores by different items (Fig. 1., Fig. 2, Fig.3.).

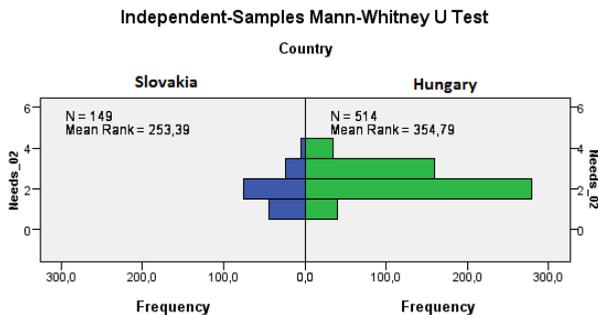


Fig. 1. Word processor

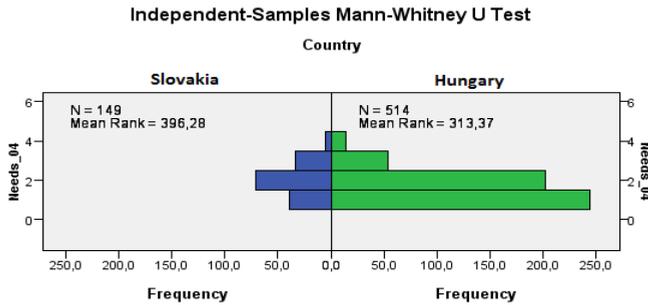


Fig. 2. Database management

According to the figures we can see the scores of the students from different countries; we can see that the subjective ICT literacy level of Slovakian students is higher than the Hungarian students by database management, using documentary bases and creating simulations and animations. On other hand the subjective ICT literacy level of Hungarian students is higher than the Slovakian students by word processing, spreadsheet calculations, multimedia handling, internet communication internet safety, website design, image and video editing.

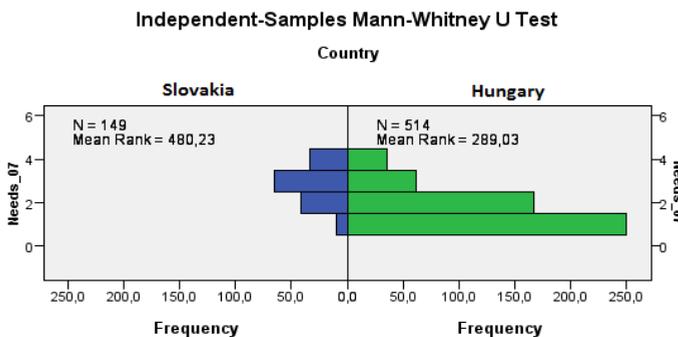


Fig. 3. Using documentary bases

4.1.2 The results of Independent Samples Mann-Whitney U test by genders

We calculated the mean scores by items and also calculated the difference between them grouped by genders. Then we can made analysis process with Mann-Whitney U test by boys (Table 5.) and girls (Table 6.).

According to the table (Table 5.) we can find significant differences by the big part of items just by five items can we recognize same result (“Multimedia”, “Software specific to my degree”, “Web browsing”, “Using learning platforms.” and “Video Editing”). The subjective ICT literacy level of Slovakian boys is higher as the Hungarian boys by handling operating systems, database management, using documentary bases and creating simulations and animations in the higher education. On other hand the subjective ICT literacy level of Hungarianboys is higher as the Slovakian boys by word processing, spreadsheet calculation internet communication and safety, web design and image editing.

According to the table (Table 6.) we can find significant differences by the big part of items just by five items can we recognize same result (“Handling operating systems”, “Database management”, “Multimedia”, “Web browsing” and “Video Editing.”). The subjective ICT literacy level of Slovakian girls is higher than the Hungarian girls by software specific in my degree, using documentary bases and creating simulations and animations in the higher education. On other hand the subjective ICT literacy level of Hungarian girls is higher than the Slovakian girls by word processing, spreadsheet calculations, Internet communication and safety, website design, using learning platforms and image editing.

Table 5. The results of Independent Samples Mann-Whitney U test by boys

Number of item	Item	Slovakian boys (Mean score)	Hungarian boys (Mean score)	p
1	Handling Operating System (OS)	2,50	2,27	0,029
2	Word processor	2,06	2,36	0,002
3	Spreadsheet	1,58	1,93	0,000
4	Database Management	2,24	1,68	0,000
	Multimedia	1,77	1,99	0,084
	Software specific to my degree	1,50	1,64	0,207
7	Using documentary bases (Such as EBSCO)	3,02	1,80	0,000
8	Web Browsing	2,95	2,82	0,169
9	Internet Communication	2,26	2,55	0,009
10	Internet Safety	1,44	1,85	0,000
11	Website design	1,29	1,55	0,001
12	Using learning platforms	2,09	2,10	0,718
13	Image Editing	1,67	1,91	0,019
14	Video Editing	1,36	1,52	0,150
15	Creating simulations and animations	2,32	1,28	0,000

Table 6. The results of Independent Samples Mann-Whitney U test by girls

Number of item	Item	Slovakian girls (Mean score)	Hungarian girls (Mean score)	p
1	Handling Operating System (OS)	2,24	2,02	0,060
2	Word processor	1,83	2,41	0,000
3	Spreadsheet	1,51	1,93	0,000
4	Database Management	1,87	1,70	0,091
5	Multimedia	1,70	1,83	0,405
6	Software specific to my degree	1,64	1,36	0,014
7	Using documentary bases (Such as EBSCO)	2,65	1,66	0,000
8	Web Browsing	2,70	2,80	0,395
9	Internet Communication	1,89	2,66	0,000
10	Internet Safety	1,22	1,91	0,000
11	Website design	1,28	1,60	0,001
12	Using learning platforms	1,95	2,34	0,005
13	Image Editing	1,47	2,18	0,000
14	Video Editing	1,35	1,56	0,106
15	Creating simulations and animations	2,57	1,37	0,000

4.1.3 The results of Independent Samples Mann-Whitney U test by gender in Slovakia

We calculated the mean scores by items and also calculated the difference between the students grouped by genders in Slovakia. Then we can made analysis process with Mann-Whitney U test by gender (Table 7.). According to the table (Table 7.) we can find any significant differences in the subjective ICT literacy level of Slovakian girls and boys. It means the Slovakian girls and boys do not have same subjective ICT literacy level in the higher education. On other hand the subjective ICT literacy level of Slovakian boys higher than Slovakian girls by handling operating systems, word processing, database management, using documentary bases, web browsing and internet communication.

The situation is a little bit different in Hungary. According to the table (Table 8.) we can see that the subjective ICT literacy level of Hungarian girls is higher by Item 12th :“Using learning platforms” and Item 13th: “Image editing” in the higher education.

Table 7. The results of Independent Samples Mann-Whitney U test by gender in Slovakia

Number of item	Item	Slovakian girls (Mean score)	Slovakian boys (Mean score)	p
1	Handling Operating System (OS)	2,24	2,50	0,017
2	Word processor	1,83	2,06	0,048
3	Spreadsheet	1,51	1,58	0,779
4	Database Management	1,87	2,24	0,003
5	Multimedia	1,70	1,77	0,372
6	Software specific to my degree	1,64	1,50	0,308
7	Using documentary bases (Such as EBSCO)	2,65	3,02	0,008
8	Web Browsing	2,70	2,95	0,049
9	Internet Communication	1,89	2,26	0,002
10	Internet Safety	1,22	1,44	0,065
11	Website design	1,28	1,29	0,935
12	Using learning platforms	2,95	2,09	0,327
13	Image Editing	1,47	1,67	0,076
14	Video Editing	1,35	1,36	0,869
15	Creating simulations and animations	2,57	2,32	0,144

On other hand the subjective ICT literacy level of Hungarian boys is higher by Item 1st: “Handling Operating System (OS)” and Item 6th: “Software specific to my degree”. It means the girls have found the way to use the ICT by learning to be more successful by exams at universities [6] and they are more creative by image editing. The boys enjoy same advantage in higher education like in the secondary grammar schools in Hungary [7]. They are more successful by find the deeper secret of operating systems, using different multimedia tools and software connection with the learning strategy in the higher education.

Table 8. The results of Independent Samples Mann-Whitney U test by gender in Hungary

Number of item	Item	Hungarian girls (Mean score)	Hungarian boys (Mean score)	p
1	Handling Operating System (OS)	2,02	2,27	0,009
2	Word processor	2,41	2,36	0,673
3	Spreadsheet	1,93	1,93	0,716
4	Database Management	1,70	1,68	0,831
5	Multimedia	1,83	1,99	0,098
6	Software specific to my degree	1,36	1,64	0,002
7	Using documentary bases (Such as EBSCO)	1,66	1,80	0,207
8	Web Browsing	2,80	2,82	0,981
9	Internet Communication	2,66	2,55	0,335
10	Internet Safety	1,91	1,85	0,653
11	Website design	1,60	1,55	0,615
12	Using learning platforms	2,34	2,10	0,028
13	Image Editing	2,18	1,91	0,016
14	Video Editing	1,56	1,52	0,780
15	Creating simulations and animations	1,37	1,28	0,397

5 Conclusion

In this research we have tried to analyze the subjective ICT literacy level of the Slovakian and Hungarian students in the higher education. We have used a self-reported questionnaire with 15 items (Table 3) and Likert-type rating.

After the analyzing process we can say the subjective ICT literacy level of Slovakian students by database management, using documentary bases and creating simulations and her hand the subjective ICT literacy akian students by word processing, spreadsheet calculations, multimedia handling, internet communication internet safety, website design, image and video editing

We have made more analysis by gender by countries. In the following we share the important information connection with it.

We have found significant differences by boys by 10 items except five items (“Multimedia”, “Software specific to my degree”, “Web browsing”, “Using learning platforms.” and “Video Editing”). It means the the subjective ICT literacy level of Slovakian boys is higher as the Hungarian boys by handling operating systems, database management, using documentary bases and creating simulations and animations in the higher education. On other hand the subjective ICT literacy level of Hungarian boys is higher as the Slovakian boys by word processing, spreadsheet calculation internet communication and safety, web design and image editing.

The results by girls are almost same. We could find significant differences by the items except five result (“Handling operating systems”, “Database management”, “Multimedia”, “Web browsing” and “Video Editing.”). It shows the subjective ICT literacy level of Slovakian girls is higher than the Hungarian girls by software specific in my degree, using documentary bases and creating simulations and animations in the higher education. On other hand the subjective ICT literacy level of Hungarian girls is higher than the Slovakian girls by word processing, spreadsheet calculations, Internet communication and safety, website design, using learning platforms and image editing.

We made the analysis by gender in countries too and we have found not so many significant differences in the subjective ICT literacy level between the same countries. The subjective ICT literacy level of Slovakian boys higher than Slovakian girls by handling operating systems, word processing, database management, using documentary bases, web browsing and internet communication. By other items the subjective ICT literacy level is same, the Slovakian girls do not have higher subjective ICT literacy level than boy.

The situation was a little bit different in Hungary. The Hungarian girls have higher subjective knowledge level by using ICT tools until the learning process. It means the girls have found the way to use the ICT by learning to be more successful by exams at universities and they are more creative by image editing.

On other hand the subjective ICT literacy level of Hungarian boys is higher by Item 1st: “Handling Operating System (OS)” and Item 6th: “Software specific to my degree”. In Hungary we can find two items where the subjective ICT literacy level of the girls is higher than boy. The Slovakian girls did not have higher subjective ICT literacy level than boys by any items it means in Slovakia would be more important to think over the by gender separated ICT education like it works in Germany where it was recognized the girls can catch same result in ITC but they need other teaching methods.

References

1. Boonyasit W., Appropriate statistical analysis for two independent groups of Likert-type data, Dissertation, American University Washington, (2011)

2. De Winter J. C. F. and Dodou D., Five-Point Likert Items: t test versus Mann-Whitney-Wilcoxon, Practical Assessment, Research & Evaluation, Vol.: 15, No.: 11, ISSN: 1531-7714, (2010)
3. Jamieson, S., Likert scales: how to (ab)use them, MEDICAL EDUCATION 2004; Vol.: 38, pp 1217–1218, (2004)
4. Kiss G. (2009). The survey measuring the informatics skills of the entering Students at Budapest Tech, BánkiDonát Faculty of Mechanical and Safety Engineering, 7th IEEE Informatics, Subotica, Serbia, gital library Digital Object Identifier: 10.1109/SISY.2009.5291125
5. Kiss G. (2010a). A comparison of informatics skills by genders of Hungarian grammar school students, 8th International Conference on Applied Informatics, Eger, ISBN 978 9894 72 3, Vol. 2., pp. 17-27
6. Kiss G. (2010b) A Comparison of Informatics Skills by Genders when entering Higher Education in Hungary, 8th IEEE International Symposium on Intelligent System and Informatics, Subotica, Serbia, ISBN: 978-1-4244-7395-3, pp. 179-182, IEEE Catalog Number: CFP1084C-CDR, IEEE Xplore digital library Digital Object Identifier: 10.1109/SISY.2010.5647280
7. Kiss G. (2010c) A Comparison of Programming Skills by Genders of Hungarian Grammar School Students, Symposia and Workshops on Ubiquitous, Autonomic and Trusted Computing, Xi'An, China, ISBN: 978-0-7695-4272-0, pp. 24-30, IEEE Catalog Number: CFP1075H-CDR, IEEE Xplore digital library Digital Object Identifier: 10.1109/UIC-ATC.2010.83
8. Kiss G. (2011a) A Comparison of Informatics Skills by schooltypes in the 9-10th grades in Hungary, International Journal of Advanced Research in Computer Science, Vol.: 2, No. 2, ISSN: 0976-5697, pp. 417-428
9. Kiss G. (2011b). Measuring Student's Computer Science Knowledge at the End of the primary stage in Hungary, 9th IEEE International Symposium on Applied Machine Intelligence and Informatics, Smolenice, Slovakia, ISBN: 978-1-4244-7428-8, pp. 19-22, IEEE Catalog Number: CFP1108E-CDR, IEEE Xplore digital library Digital Object Identifier: 10.1109/SAMI.2011.5738880
10. Kiss G. (2012). Measuring Hungarian and Slovakian Students' IT Skills and Programming Knowledge, Acta Polytechnica Hungarica, Vol. 9., No. 6, 2012, ISSN: 1785-8860, pp. 195-210.
11. Likert, R.(1932). A technique for the measurement of attitudes, Archives of Psychology, Vol.: 27, No.: 140, pp 44–55