

# The attitudes of Slovakian and Turkish high school students to the ICT used in biology according to gender and age differences

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## Abstract

The impact of information and communication technologies on our daily lives has been constantly increasing. This fact influences the modification of attitudes towards information and communication technologies. This study is focused on finding the gender differences in computer attitudes. A questionnaire with 33 Likert's type items was used in our research. The questionnaire was called Information and Communication Technologies' Attitude Questionnaire (ICTAQ). The sample consists of 518 students from 9 high schools. Data was evaluated with the factor analysis with Varimax rotation, ANOVA, Pearson's chi-square test, Pearson's product moment and Cronbach's alpha which was calculated to find out the reliability of the questionnaire. The items of the questionnaire were divided into five dimensions: 1) The positive influence of ICT; 2) The negative influence of ICT; 3) Advantages of ICT; 4) ICT used in biology lesson; 5) Disadvantages of ICT. In our research students' positive attitudes towards the computer have been confirmed and students consider using ICT in biology lessons to be very useful. They prefer a mixed-mode learning environment, i.e. a combination of face-to-face interaction and online activities. Furthermore, boys have more positive attitudes than girls do.

*Keywords:* Attitudes; Biology; Information and communication technologies, Questionnaire; Students  
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## 1. Introduction

The current time is influenced by the intensive usage of information and communication technologies. Providing new opportunities to deliver information and helping clarify communication and resource sharing, the Information and Communication Technologies (ICT) are also challenging educational institutions to integrate the ICTs into their curricula and to utilize them in some way. Their influence is obvious in the educational process. For example students can pose questions to the teacher via the web, but they also use the internet to interact with each other.

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Biology teaching traditionally takes place in one or more of three different kinds of environments; the lecture theatre or classroom, the laboratory and the field (outdoors). However, with the arrival of access to multimedia technologies the experiments are being done to translate features of each of these three learning environments to the biology student's computer desktop [1, 2]. Biological educators may see the possibilities and opportunities for opening up whole new and exciting ways of learning and teaching using this new technology. When teachers teach biology, they frequently use external representations taken from textual and pictorial descriptions of biological phenomena to symbolic and graphical representations of biology concepts and principles. Computers offer teachers the additional opportunity to take advantage of representations in order to present biological phenomena as well as biology concepts that change in time and space. While biology teachers employ external representations to improve the students' understanding, such representations also place specific demands on students [3]. For instance, students need to understand (1) how information is encoded in each single representation, (2) how each representation is related to the physical world, and (3) how information in one representation can be related to or transformed into information in another representation [4, 5].

Information and computer technologies could be used as a replacement for real dissection. When students were asked what is more favorable for them, whether the real dissection or the computer-based dissection, a majority of students chose the second alternative [6, 7]. The mere provision of interactivity does not guarantee its effective usage. Successful learning with interactive representations demands that students carefully prepare, execute, and evaluate their interactions [8].

As we may notice, students are influenced by ICT to a large degree and the successful integration of computers in an educational environment depends to a great extent on the students' attitudes towards them. Among investigators who belong to this research area, the term of the computer attitude is used. The computer attitude, according to several investigators, is defined as a person's general evaluation or feeling of favor or antipathy towards computer technologies and specific computer-related activities [9]. The computer attitude evaluation usually encompasses statements that examine the users' interaction with the computer hardware, computer software and other persons relating to computers, as well as activities that involve the use of the computer [10]. Various computer/ICT scales have been developed for the measuring of attitudes towards computers [11, 12]. The important factors of the computer attitudes are (a) computer importance (the perceived usefulness of the computer), (b) computer enjoyment (the liking for the computer), and (c) computer anxiety (the student's confidence in using the computer) [13].

Numerous studies point out a positive correlation between positive attitudes towards computers and the learners' success in both the subject matter learnt and the use of communication technologies [14, 15]. Similarly, Sagin Simsek [16] found that the students' attitude towards the ICT was positive. Frequent positive usage of the computer fosters positive attitudes towards it [17, 18]. Using computers more frequently leads one to develop a variety of computer-related skills and techniques, thus increasing one's knowledge of the computer as a whole. This, in turn, widens one's learning possibilities and potentials that, in turn, promotes a positive feeling towards the computer [19, 18].

Many explorations are focused on finding gender differences in attitudes and using ICTs. Dorup [20] found that male students had more access to computers at home and, therefore, held more favorable attitudes towards the use of computers in their medical studies than female students did. A small proportion of students reported that they would prefer not to use computers in their studies. Male teachers or instructors were also significantly more inclined

to replace traditional teaching activities with better ICT resources. Kaplan [21] reported that while female users of office personal computers (PCs) believe computers are fun, men buy them as machines. Men, on the other hand, are reportedly more interested in mastering computer commands and they want to own computers with voice recognition and features that extend their senses. While women want to be able to use the machines, men want to command the machines. This difference in attitude about computer technology based on gender has been explained by some individuals as an outcome of the socialization process. Society views computers as highly technical and part of the male domain [22]. The current study of Palaigeorgiou, Siozos, Konstantakis, and Tsoukalas [23] also confirms that both men and women have similar engagement with computers and holds concerns for the future effects of continuous computer use. However, women are more anxious about the use of hardware and, thus, judge the consequences of computers in personal and social life less positively. The investigations of attitudes towards using ICT in biology have not been so extensive. Haunsel and Hill [24] have found that pupils using computers have more positive attitudes towards biology and natural sciences than pupils who have been educated by traditional styles. The majority of studies have been focused on finding the various attitudes to ICT.

In most countries, the participation of females in ICT professional careers and pathways is not only low, but also continues to fall. Females have less positive attitudes toward ICT and show less confidence in using ICT in comparison with males [25, 26]. Although not supported by convincing empirical evidence, girls' less positive attitude to ICT in primary and secondary schools is often regarded as a predictor or an explanation for the low participation of women in ICT training and ICT related professions [27].

Men have more positive attitudes toward computers than women [28]. Moore [29] found in her study involving South African students a positive correlation between computer experiences and attitude. Schumacher and Morahan-Martin [30] researched the relationship between the use of the Internet and computer experiences, skills and attitudes. Mumtaz [31] found that primary school boys spent more time playing computer games whereas girls spent more time on the Internet e-mailing friends.

Finally, a lot of research has shown that females and males differ in their preferences for specific computer activities. According to Van Eck and Volman [32], boys use a computer for a broader variety of activities than girls. Janssen Reinen and Plomp [33] also demonstrated that male students were engaged in a greater number of different computer activities in school compared to female students. Their study showed that female students indicated a higher engagement in word-processing in comparison with male students.

Durndell et al. [34] found that female students in Romania perceived more male hostility to females with computing abilities than males did and also females thought that it would be more difficult for them to get a job in computing than males would.

In contrast, Comber et al. [35] found no gender differences in the use of the computer for word-processing and playing games. Internet usage seemed to be more attractive to girls than it was for boys. It is possible to notice similar findings in the study of Teo [36]. Martin [37] showed that girls were more enthusiastic than boys in doing tasks with the Internet. In Slovakia there is a lack of studies focused on students' attitudes to ICTs. Fančovičová and Prokop [38] found students' attitudes towards computers to be positive.

The main aim of our study was to find gender differences in attitudes toward the use of information and communication technologies in biology. The hypothesis which ensued from this aim was that the male attitudes towards the use of ICT in biology were more positive than the female attitudes were.

## 2. Methodology

### 2. 1. An instrument

The measurement tool used in our research was a self constructed scaled questionnaire of Likert type [39], which was called Information and Communication Technologies' Attitude Questionnaire (ICTAQ). In general, written questionnaires have limitations with regards to the kind of information that can be collected. They do not provide the possibility to obtain such in-depth information about how respondents perceive ICT in comparison with observations. However, observations are limited to a small number of respondents, while written questionnaires collect data from many respondents. The questionnaire was anonymous and it was divided into two sections. In the first section there was an introductory text, followed by the demographic variables: gender, age and the year of study. The second section consisted of 33 items which focused on the students' perception of ICT in the biology lesson. We were also interested in how students perceive the influence of ICT on the human body and in the environment. Some items were concerned with the influence of e-mails and internet for obtaining knowledge. The assignment was to express one's own opinion and to use the scale from "strongly agree" to "strongly disagree" with given statements. The scoring of students' responses was as follows: "strongly agree" (5 points), "slightly agree" (4 points), "neutral" (3 points), "slightly disagree" (2 points), "strongly disagree" (1 point). Seventeen items were negatively formulated, and were taken into consideration by being recorded during the evaluation. Whitley [40] emphasizes that it is important to balance negative and positive statements because attitudes towards computers have a tendency to differentiate less if most items are formulated positively. Total scores provided a composite index of attitudes towards ICT. Low scores reflected relatively negative attitudes and high scores reflected positive attitudes towards ICT. A questionnaire was assembled and presented to a group of students for comments and suggestions and then it was revised and used in research. The questionnaire was initially constructed in the Slovak language and then translated for the needs of the authors into English.

### 2. 2. Sample

The questionnaire was filled in by 518 Slovak high schools students and 445 Turkish high school students. The schools were chosen according to the classic style of teaching. We chose schools, where, according to the government, computers as learning and teaching components were being used. The conventional length of study is four years. We obtained results from every year of study. The age of the Slovak students was from 15 to 19 ( $x = 16.97$ ,  $SD = 1.00$ ) years old. The sample consisted of 37.84 % ( $n = 196$ ) of boys and 62.16 % of ( $n = 322$ ) girls. Respondents filled the questionnaire in during their lessons. Initially, the questionnaires were sent to teachers, who distributed instruments among the students. The time of filling the measurement tool was not longer than 20 minutes. The age of Turkish students was from 15 to 18 ( $x = 16.41$ ,  $SD = 1.15$ ). The number of boys was 236 (53.03 %) and the rest was created by girls ( $n = 209$ ; 46.97 %). There is small difference between school systems in Turkey and in Slovakia. In our study the Slovakian students are the students of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year of study, which is identical with 9<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup> and 12<sup>th</sup> grades of Turkish students.

### 2. 3. Statistical procedure

For the statistical evaluation we used Factor analysis with Varimax rotation, which divided items in the questionnaire into the five dimensions: 1) The positive influence of ICT; 2) The negative influence of the ICT; 3) Advantages of the ICT; 4) The ICTs used in the biology

lesson; 5) Disadvantages of the ICT. Five items with the factor score smaller than 0.3 [41] were deleted. Next we calculated Cronbach's alpha ( $\alpha = 0.82$ ), which indicated a high value of the questionnaire's reliability. Cronbach's alpha was calculated for each dimension. Values are shown in the Table 1. The following tests were used: ANOVA test, Pearson's chi-square test ( $\chi^2$ ) and Pearson's product moment on finding gender differences.

### 3 Results

#### 3.1. Dimensions

It was mentioned in the methodology that the factor analysis with Varimax rotation was used, and it divided items into the 5 categories. We deleted five items because of the score being smaller than 0.30 (Table 1).

We used the Pearson correlation (Pearson's product moment) to see if there was a relationship between the dimensions. The values of the correlation for Slovak students are shown in the Table 2. The statistical significant differences between the pupils' attitudes mentioned above were not found out in the comparison between the two dimensions called "positive" and "negative" influence of ICT. It is possible to conclude that the items were not defined as ordered pairs which might express the same reality. We focused on different aspects of positive or negative influence of ICT. When comparing the dimensions "advantages" and "disadvantages" of the ICT a small correlation between the results was found. This showed a similar result, namely that the claims were neither duplicated, nor defined in the positive or the negative way. Our aim was to think about and to expose different aspects of the ICT influence on the learning and teaching of high school students. The questionnaires were anonymous and the students expressed their own points of view and attitudes which were not allowed to be sanctioned. That was why we didn't investigate the students' trustworthiness. The highest value of the correlation was between the factor 3 (Advantages of ICT) and factor 4 (ICT usage in biology lesson). These two dimensions correlated on the medium level.

The values of correlation for Turkish students are shown in the Table 3. The values of correlation were higher in comparison with Slovak students, but some of them were negative. For example, the strongest negative relationship was found out between factor 2 and factor 3 and the strongest positive relationship was between "positive influence of ICT" and "advantages of ICT". The values of correlations are showed in the Table 3

We found a statistically significant gender difference ( $F(1, 516) = 4.48; p < 0.05$ ). Girls achieved the score 3.61 ( $n = 322, SD = 0.60$ ) on average and boys achieved the score 3.68 ( $n = 196; SD = 0.54$ ) on average. From this we may deduce that boys have more positive attitudes to ICT than girls do.

In the next evaluation, we focused on whether there was a statistically significant gender difference among class. In this evaluation we used the two-way analysis of variance, where the gender and class were independent variables and the average score was a dependent variable. There was no statistically significant difference in the result of Slovak students ( $F(3, 510) = 0.20; p = 0.89$ ). The girls achieved higher score in all grades in comparison with boys. The highest difference was in the 2<sup>nd</sup> grade and the smallest one was in the 4<sup>th</sup> grade. The attitude toward ICT used in biology is nearly consistent. The interest of boys is decreasing and the interest of girl is from 2<sup>nd</sup> grade decreasing. The oldest students do not see the importance of ICT in biology in comparison with the youngest ones (Fig. 1).

In the Turkish sample we found a statistically significant gender difference ( $F(1, 444) = 6.64; p < 0.05$ ). Girls achieved the score 2.97 ( $n = 322, SD = 0.01$ ) on average and boys achieved the score 2.93 ( $n = 196; SD = 0.01$ ) on average. There is the situation different in

**Table 1. The factor analysis score of ICTAQ.**

	$\alpha$	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
<b>I. The positive influence of ICT</b>	<b>0.76</b>					
1. ICT are important in the teaching of biology.	0.67	-0.11	0.03	0.02	0.00	
2. ICT make the lesson more interesting.	0.73	-0.06	-0.03	0.02	0.03	
3. The ICT usage causes a higher interest in biology.	0.79	0.03	0.08	0.01	0.04	
4. I understand the biology curriculum more when the ICT are used.	0.76	-0.04	0.11	0.07	0.09	
5. I have got ideas when the ICT are used.	0.59	0.17	0.05	0.17	-0.06	
7. ICT cause me to be exhausted.	0.47	0.21	-0.07	0.21	0.24	
9. The work with an educational disc makes a cognitive process better.	0.48	-0.13	0.27	0.22	-0.06	
19. I am bored in biology lessons when ICT are used.	0.44	0.10	0.17	0.18	0.28	
20. I do my homework more quickly when I use ICT.	0.40	0.02	0.20	0.22	0.19	
<b>II. The negative influence of ICT</b>	<b>0.67</b>					
22. The ownership of a PC is useless, because the PC makes learning impossible.	0.10	0.32	0.23	0.10	-0.11	
23. The use of computers causes eye disease.	-0.09	0.74	0.01	-0.04	0.12	
24. It is impossible to use ICT meaningfully because the majority of information is in another language to Slovak.	0.07	0.41	0.00	-0.08	0.15	
25. The use of ICT causes a spine disease.	-0.01	0.77	-0.04	0.18	0.11	
28. ICT do not save energy.	0.00	0.59	0.11	-0.12	0.03	
29. The computer is not a suitable tool for teaching because it needs a lot of space.	0.20	0.35	0.19	0.06	0.16	
<b>III. Advantages of ICT</b>	<b>0.64</b>					
26. E-mails help me to find out information.	0.09	0.04	0.48	0.20	-0.19	
30. The advantage of ICT is that classes are less dusty in comparison with the use of chalk on the blackboard.	0.04	-0.07	0.57	0.15	0.12	
31. ICT save a space because the teacher does not need teaching aids.	0.12	0.08	0.78	-0.12	0.19	
33. I obtain more information from the internet than I do from textbooks.	0.10	0.10	0.55	0.14	0.05	
<b>IV. ICT usage in the biology lesson</b>	<b>0.41</b>					
6. I give priority to the use of a computer rather than the use of an overhead projector.	0.00	0.15	0.25	0.36	0.29	
10. I consider the work on the internet to be unimportant during the teaching process.	0.12	0.03	-0.03	0.62	0.17	
13. We obtain new information by using the web pages because some information in the textbooks has become outdated.	0.21	-0.04	0.21	0.63	0.03	
14. I have got an opportunity to cooperate with other schools with the assistance of ICT.	0.13	-0.04	0.14	0.61	-0.06	
<b>V. Disadvantages of ICT</b>	<b>0.40</b>					
8. I am not able to concentrate on the teaching process when the computer is turned on.	0.16	0.20	0.09	0.10	0.34	
11. Biology teachers should only examine by using the assistance of the ICT.	0.10	0.21	0.26	0.24	0.38	
12. I think that I achieve worse evaluations in the written examinations with the assistance of the ICT.	0.07	0.06	-0.05	0.11	0.30	
15. I am not able to concentrate on the teaching process when the camera is being used during the teaching process.	-0.05	0.07	0.02	0.05	0.70	
16. My communication with teachers is worse when the ICT are used during the teaching process.	0.19	0.14	0.15	-0.05	0.68	
Own values	5.58	2.69	1.91	1.53	1.41	
Deleted items						
17. I am not satisfied with the use of the ICT in the biology lessons at our school.	0.07	-0.03	0.07	0.02	0.08	
18. The ICT equipment of our school is very poor.	-0.06	0.01	-0.09	0.01	-0.12	
21. I use ICT for the preparation of the paper.	0.10	-0.05	0.03	0.06	0.03	
27. Teachers should be better trained in the used of ICT.	-0.02	0.04	0.24	0.12	-0.01	
32. I am afraid when I use a computer.	-0.01	-0.05	0.23	0.11	0.02	

$\alpha$  – Cronbachs' alpha; The numbers of items are identical with the numbers in the questionnaire.

**Table 2. Values of correlation between dimensions from the Slovak students.**

	factor 2	factor 3	factor 4	factor 5
factor 1	0.01	0.22	0.28	0.21
factor 2		0.11	0.13	0.35
factor 3			0.40	0.30
factor 4				0.31

**Table 3. Values of correlation between dimensions from the Turkish students.**

	factor 2	factor 3	factor 4	factor 5
factor 1	-0.59	0.47	0.30	-0.50
factor 2		-0.75	-0.44	0.49
factor 3			0.34	-0.46
factor 4				-0.32

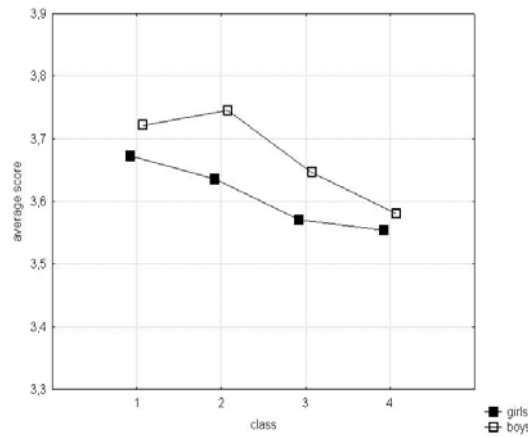


Fig. 1. An average score of Slovak students with the respect to gender and class.

comparison with Slovak students, the Turkish girls have got more positive attitudes toward ICT used in biology in comparison with boys. Other significant point is, in the both group of Turkish gender was score lower than 3.00. It means, the both groups (boys and girls) have got relative negative attitudes toward ICT used in biology.

The two-way analysis of variance does not show statistically significant difference in the results of Turkish students ( $F(3, 437) = 2.26; p = 0.08$ ). The Turkish girls achieved more positive attitudes toward ICT used in biology except of 10<sup>th</sup> grade. The results were not so consistent as in Slovak students. The girls achieved similar score in all classes, but boys were more different. The highest score achieved the 10<sup>th</sup> grade students and the lowest one achieved the oldest one. In the 12<sup>th</sup> grade was the highest difference in the score (Fig. 2).

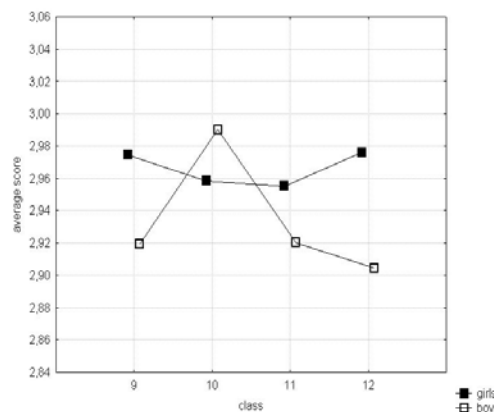


Fig. 2. An average score of Turkish students with the respect to gender and class.

### 3. 2. Items

During the questionnaire evaluation we found that there was no item where the respondents unanimously chose the strictly “yes (I completely agree)” or “no (I completely disagree)” (the average would be 1.0 or 5.0) (Table 4). They were close to these extremes in

item No. 32 “I was afraid to use a computer”, where the predominant attitude was that the students had no fear of using the computer and there were no statistically significant differences between the attitudes of boys and girls. A similar stand was taken in statement No. 10 “I consider the work with the internet to be unimportant in the teaching process”, where many students didn’t agree with the statement and considered the use of the internet during the teaching process to be important (4.49).

The items 22 and 29 belonged to the same dimension (Negative influence of the ICT) and the students expressed their disagreement with the uselessness of owning the PC, with making the learning process harder (or impossible) by using the PC (4.35), and with the unsuitable usage of the PC in the midst of their learning environment because of the space requirement (4.26).

The values score for items from Turkish students were different from Slovak students. Some were similar, for example item no. 2 or item no. 10. There are some differences in the items. For example one of the highest differences is in the item 32. “I am afraid when I use a computer”. The score of Turkish students was very low (1.41), it means, the Turkish students are afraid to use computers more than Slovak students. The lowest score achieved Turkish students in the item 16 (1.12) “My communication with teachers is worse when the ICT are used during the teaching process”. So the Turkish students considered the ICT as the tool, which is disturbing during communication with their teacher. Also the low score was in the item no. 18 (1.33) “The ICT equipment of our school is very poor”. The values of all items are showed in the Table 4.

**Table 4. Values of Likerts’ scales of Slovak and Turkish students.**

item No.	1	2	3	4	5	6	7	8	9	10	11
<i>Svk</i>	3.74	4.22	3.39	3.49	2.89	3.65	3.78	4.36	3.97	4.49	2.48
<i>Tur</i>	4.34	4.19	3.71	3.77	3.23	3.8	2.43	2.09	4.40	4.29	3.50
item No.	12	13	14	15	16	17	18	19	20	21	22
<i>Svk</i>	3.24	4.03	3.49	3.49	3.49	3.06	2.23	3.78	3.45	3.96	4.35
<i>Tur</i>	2.38	4.04	4.00	2.10	1.12	1.66	1.33	1.55	3.67	3.45	1.51
item No.	23	24	25	26	27	28	29	30	31	32	33
<i>Svk</i>	2.83	3.82	3.34	3.58	3.95	2.88	4.26	3.99	3.55	4.69	4.01
<i>Tur</i>	1.40	1.66	1.97	4.03	3.57	1.97	2.37	3.42	4.47	1.41	4.38

*Svk* – Slovak students; *Tur* – Turkish students.

#### 4. Discussion

Slovakia and Turkey are countries where the use of ICT in education is still at a very low level. Nevertheless, there are only a few studies which are connected to the differences among the attitudes towards the use of ICT in Turkey and Slovakia. The one study is from Fančovičová and Prokop [38], which examined the effects of the variations in the ICT facilities in Slovak elementary schools on students’ attitudes towards the use of the ICT.

In our research we focused on the students’ attitudes towards the ICT. The general view showed that the students had positive attitudes towards the computers/ICT. The average score was higher than 3.50. This means that the students see the advantages of the use of the ICT in the biology lesson. They are able to use ICT in their biology lessons. Sagin Simsek [16] wrote that the majority of students accepted the use of ICT for learning purposes and they had positive attitudes towards the use of ICT. The results in our research show that our respondents like to use computers and they would like to use ICT more often in teaching. ICT make the lessons more interesting, easier, more fun for them and their pupils, more diverse, and more motivating for the pupils and more enjoyable among others.

We maintain that in Slovakia and Turkey, there are positive attitudes towards ICT, but they could be higher and there are differences between boys and girls. Here is some advice:



the use of ICT is generally helpful during the class suspension but most students preferred a mixed-mode learning environment, i.e. a combination of face-to-face interaction and online activities. Teachers would have to find ways of stimulating a more face-to-face situation without being in the same physical surroundings. One such imperfect solution is the provision of resources such as teachers being able to do real-time, live, video-broadcasts of their lectures [42].

In our research we tried to verify that the following hypothesis: “Boys have a more positive attitude towards the use of ICT in biology lessons than girls do”. This statement is confirmed by the use of statistical procedure. For this finding ANOVA was used. For the statistical evaluation we used a factor analysis, Pearson chi-square test ( $\chi^2$ ) and a Pearson’s correlation except an analysis of variance, and for findings of the reliability we used Cronbach’s alpha. We found five dimensions or categories: 1) The positive influence of ICT; 2) The negative influence of ICT; 3) The advantages of ICT; 4) ICT usage in the biology lesson; 5) The disadvantages of ICT.

We found that the boys had a more positive attitude towards ICT than the girls had. This hypothesis was not confirmed for Turkish students, where the girls achieved significantly higher score in comparison with boys. Our finding is supported by other research for Slovak case. Males have a more favorable attitude towards computers and the use of computers than females do. Both males and females consider computer activities to be stereotypically male activities. Females are less attracted to computer courses and computer-related careers than males are [43, 44]. Durndell and Haag [45] found higher computer self-efficacy, more positive Internet attitudes, longer Internet use and lower computer anxiety among male rather than female students.

Volman et al. [46] found the gender difference in attitudes to ICT in secondary education. Girls use the computers less at home than boys do and programming and games in particular are unpopular. Boys achieved higher scores in the dimensions of interest in the computers and self-confidence in the computer. Whitley [40] did a meta-analysis of gender differences in computer-related attitudes and found that boys and men, when compared with girls and women, saw computers as more appropriate to themselves and saw themselves as more competent on computer-related tasks and, consequently, reported that they were more positively affected by computers. Schumacher and Morahan-Martin [30] found in their research that girls had a negative attitude towards new technology and that this negative attitude also played a role in females being less comfortable and competent with computers than males are.

In this context the following information focuses on the explanation of why computers are typical for boys and males. Computer attitudes and computer skills are related to gender in favor of men, that is, men have a better attitude towards computers and, thus, have more computer skills and experience than women have [40, 47]. There are many hypothetical reasons why, males/boys acquired a positive attitude towards ICT. It could be that when the computer is used for purposes other than studies, male students spend more time working with the computer than female students do. Male students do more word processing in the form of e-mails and they play games more often [48]. Research of Schumacher and Morahan-Martin [30] showed that females possessed fewer competencies and felt less comfortable with computers and Internet than males did.

Public views consider that boys and males are far more technically competent than girls are. Cooper [49] has a similar affirmation and wrote that the general public believes that men and boys are more interested in using computers, and are more competent in the usage of computers. The negative attitudes of the girls adversely make an impact on their computer performance. Knowing that girls have a negative attitude towards computers and are reluctant

to use them only reinforces the stereotype that computers are for boys and not for girls. Females may have socialized differently in today's computer generation to become more comfortable with computers hence removing barriers to opportunities for training. This could be due to the increased use of computers for teaching and learning at schools that might have worked against the cultivation of gender differences as reported in previous research [50]. So there is an important piece of information that students prefer the use of computers. Dorup [20] found that between 3% and 7% of the students (significantly more females than males indicated that they would prefer not to have to use computers in their studies.

Researchers on gender differences and ICT have expectations of school and teachers to make ICT more attractive for girls. Teachers are expected to select and use educational software attractive to both girls and boys. However, there are high expectations for female teachers who are confident with ICT: they are seen as the role models for female students [51].

Students indicated that knowledge is important for their future life and, also, were satisfied with the learning material, with the presentation and the graphical layout [9]. There is much software available which can be provided to the students to allow them to engross in the biology concepts, thus making learning more meaningful. The impact of ICT on the students' learning outcome will ultimately depend on the biology teachers. They are the ones who will decide how to convey the knowledge in the best way. The use of ICT will undoubtedly bring new educational experiences to both the learners and the teachers.

Students' attitudes toward ICTs have been found by many studies to be influential in their learning and achievements. These people (teachers, lecturers, etc.) play an active role in the students' changing attitudes towards ICT.

## 5. Conclusion

The results of attitudes towards the use of ICT in the subject of biology among the high school students from Slovakia and Turkey were based on statistical evaluation – a factor analysis, an analysis of variance, a Pearson's product moment, Pearson's chi-square test, and Cronbach's alpha.

Using the factor analysis we found five dimensions/categories. By using the Analysis of Variance we found some statistically significant differences between boys and girls. Boys perceive ICT in biology in a more positive way than girls do and younger students reached a higher score in their attitudes towards ICT.

Practical applications, which can increase girls' attitudes to computers, would be to strengthen the practical computer knowledge of women or to strengthen the self-confidence of girls in the computer domain, by teaching them functional and self-protective attribution patterns. Teachers, parents and peers should support and encourage women's participation in digital developments that are useful for their professional lives and help to prevent dysfunctional attribution patterns in computer-related tasks [52-66].

The students, who were the respondents of our investigation, showed an interest in using ICT in the biology classes; this was obvious from their answers. It is important to realize that ICT can enhance the students' learning in science/biology from an early age. However there may be a problem, if there is much pressure put upon the use of ICT in science/biology lessons. In addition, teachers are not always confident about the benefits of ICT.

The major reason for using ICT in lessons, is that it allows teachers to do things better than can be done without them. The use of ICT should allow the teacher or the pupil to achieve something which could not be achieved without it or to allow the teacher to teach or the pupil to learn something more effectively [53].

Successful science lessons that employed ICT were associated with the following pedagogical skills:

- The lesson objectives were clearly identified and the tasks were clearly defined.
- The time bonus was used creatively and often involved interventions to encourage discussion and investigate approaches.
- ICT activities were explicitly linked to other activities before, during and after the ICT lessons.
- Teachers planned a greater emphasis on the interpretation of the results and thinking about science.
- Teachers recognised and built upon the technical skills already acquired by the students [54].
- Computer assisted instructions are an effective teaching method which could be applied to improve the teaching quality.
- Computer assisted instructions may be used effectively in teaching subjects in which simulation models can help to improve cognitive abilities.

Knowing the situation when and when not to use ICT can be just as important as knowing when and how it should be used.

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