CZECH UNIVERSITY STUDENTS' ATTITUDES TOWARDS ICT USED IN SCIENCE EDUCATION

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Abstract: *This paper focuses on differences of attitudes related to information and communication technologies among Czech university students. Students' attitudes were evaluated summatively and with respect to gender, grade, and residence. The sample consisted of a total of 316 university students. The data analysis included factor analysis, ANCOVA, ANOVA, and t-test. The factor analysis yielded five dimensions: 1) Influence of ICT on teaching process, 2) Influence of ICT on human body and environment, 3) Using of ICT in teaching, 4) School and ICT, 5) ICT as didactic equipment. As a result, male students, sophomores, and students living in town showed more positive attitudes in comparison to other respective groups.*

Key words: *attitudes, information and communication technologies, questionnaire, science teaching, university students.*

POSTOJE ČESKÝCH VYSOKOŠKOLSKÝCH STUDENTŮ K POUŽÍVANÍ ICT V PŘÍRODOVĚDNÝCH PŘEDMĚTECH

Resumé: *Příspěvek je zaměřen na postoje studentů českých vysokých škol k informačním a komunikačním technologiím. Postoje byly vyhodnocovány jako celek a také s ohledem na pohlaví, ročník studia a bydliště respondentů. Výzkumný vzorek tvořilo 316 studentů vysokých škol. Faktorová analýza, ANCOVA, ANOVA a t-test byly použity jako statistické metody. Použitím faktorové analýzy bylo zjištěno 5 dimenzí: 1) Vliv ICT na vyučovací proces, 2) Vliv ICT na lidský organismus a prostředí, 3) Použití ICT ve vyučování, 4) Škola a ICT, 4) ICT jako didaktická pomůcka. Studenti (muži), studenti druhého ročníku a studenti žijící ve městě prokázali pozitivnější postoj k ICT v porovnání s ostatními skupinami.*

Klíčová slova: *postoje, informační a komunikační technologie, dotazník, přírodovědné předměty, vysokoškolští studenti.*

1 Introduction

The history of electronic educational materials does not go far back but for several decades now there is an increasing attempt to create more such resources (Arnold, Padilla & Tunhikorn, 2009). The educational value of the information and communications technologies (ICT) was confirmed by a variety of experiments (Fančovičová & Prokop, 2008). When used appropriately, ICT can support students' collaboration and knowledge building. Further, in the context of science education, it offers possibilities for interaction with the nature and tools for real-time data logging (Juuti, Lavonen, Aksela & Meisalo, 2009). The interactive nature of ICT materials is believed to provide the opportunity for students to analyze the process, assimilate and work independently (Kaino, 2008). Many teachers have realized the potential of ICT to increase quality of teaching and learning in recent years. The ICT has pervaded all sectors of education prompting the need to prepare teachers to take advantage of these tools. Although ICT allows students to work more productively than in the past, the teacher's role in classroom, where the ICT are presented, is more demanding than ever (Keengwe, Onchwari & Wachira 2008).

2 Theoretical background

Zhao, Tan and Mishra (2001) showed evidence to suggest that the attitudes of teachers toward ICT are directly related to computer use in the classroom. Success of student learning in using ICT depends largely on teachers' attitudes towards ICT (Teo, 2006). If teachers show positive attitudes towards ICT then they can easily provide useful insights about acceptance and usage of ICT in teaching for students. Many researchers emphasized the dimensions of attitudes towards ICT. Some examples are perceived usefulness of ICT and confidence about using ICT, training (Tsitouridou & Vryzas, 2003), gender, anxiety and liking/disliking

(Yıldırım, 2000). Integration of ICT into science and technology curricula and classroom practices can be achieved by science teachers showing positive attitudes toward ICT. These positive attitudes toward ICT can be more easily gained in pre-service teacher education by courses such as Computer, Computer Supported Learning, Information and Communication Technologies, Teaching Methods, and Design of Instructional Materials for Teaching, etc. It is important to provide prospective teachers and in-service teachers with courses and trainings, because lack of time is one of the main reasons stated by teachers for not employing ICT in teaching. Planning, practicing, and trying to integrate ICT into lessons are all time consuming. But with proper training teachers can do it with more confidence and in less time. On the other hand, a lack of ICT pedagogical training at teacher training colleges constitutes a barrier for using ICT in the classrooms; and, although individual ICT skills might be high for personal use, the transfer of these skills to the classroom environment may become problematic (Cuckle & Clarke, 2002). Integration of ICT into the teaching process can also be impeded by other barriers like lack of equipment, lack of access to the right types of technology in appropriate location, cost of technology, and poor administrative support. All these aspects can create negative attitudes towards ICT. Many explorations are focused on finding gender differences in attitudes and using ICTs. Dorup (2004) found that males had more access to computers at home, and held more favorable attitudes toward the use of computers in their medical studies as compared to females. A small proportion of students reported that they would prefer not to use computers in their studies. Males were also significantly more inclined to replace traditional teaching activities with ICT resources. A more recent study of Palaigeorgiou et al. (2005) also confirmed that both men and women had similar engagement with computers and held concerns for the future effects of continuous computer use, but women were more anxious about hardware usage, and judged less positively the consequences of computers in personal and social life. Research on gender differences in ICT has shown that in most countries girls and women are often behind in ICT usage and ICT knowledge and skills. In most countries, the participation of females in ICT professional careers and pathways is low and unfortunately continues to depreciate. Finally, a lot of research studies have shown that females and males differ in their preferences for specific computer activities. In the literature there is a controversy among studies on attitudes towards ICT with respect to students' age. Although it is reported that younger pupils have more positive attitudes toward computers than the older (Laguna & Babcock 1997), among others, a more recent study reported the opposite (Bozionelos 2001). On the other hand Spernjak & Sorgo (2009) did not find differences based on age among lower secondary school students aged between 10 and 14 when performed three laboratory exercises (Activity of yeast, Gas exchange and breathing, heart rate) as classic, computer-supported and virtual laboratory exercises. Pupils chose computer-supported laboratory as the most popular method of laboratory work. Classically performed laboratory work followed, while computer simulation was the least popular approach toward laboratory exercises.

The main aim of this study was to investigate university students' attitudes towards ICT and this article explores the following research question: Is there any difference in attitudes toward ICT between students with the respect on gender, residence and grade of students?

3 Methodology

A total 316 Czech students attending one university participated in the study. The participating students were majoring in teaching middle school / high school science (biology, geography, chemistry). The ages of the participants were between 17 and 30 ($x = 20.44$; $SD = 1.45$). The sample size was created by 100 males and 216 females, 62 students from village, 90 students from town and 164 students from city, 128 freshmen, 105 sophomores and 83 third year students. All Czech respondents were in the time of research owners of computers. Students' attitudes toward ICT in science subjects were measured by 5 scale Likert type items. We used a modified version of the ICT Attitude Questionnaire (Kubiatko & Haláková, 2009). This questionnaire was originally created to probe student attitudes towards ICT specifically in biology. Due to the nature of the current study the word "biology" was replaced with "science subject" or "science subjects" in the entire questionnaire. The questionnaire items are related to common ICT activities and ICT usage. There were items related to influence of ICT on the process of teaching ("ICT make lessons more

interesting"); items focusing on the influence of ICT on health and human body ("using ICT related equipment may cause spine injuries"). Other group of items focused on using ICT in teaching ("I reach more information from internet than from textbooks"). A couple of items were related to ICT as didactic equipment ("I think that I achieve worse evaluation by the written examining with the ICT assistance"). We were interested in, if students are satisfied with ICT and their employment in lessons ("I am not satisfied with employment of ICT in science lessons at our school"). The questionnaire consists of 33 items that were rated by the participants from 1 (strongly disagree) to 5 (strongly agree). There were items worded both positively (e.g., "I do my homework quicker, when I use ICT") and negatively (e.g., "I have got a fear, when I used a computer") (Oppenheim, 1999). Negative items were reversed in scoring. The total score of individual participants provides a composite index of attitudes towards ICT usage in science subjects. A low score reflects a relatively negative attitude and a high score reflects a relatively positive attitude towards ICT. The validity of the questionnaire was established through review by two experts in the field of using ICT/computers in education. Reviewers were asked whether the items were relevant to the aim of the study. Revisions were based on their comments and suggestions. The first part of the questionnaire contained demographic questions: gender, age, year of study, owning of computer and type of residential area (i.e., village, town, or city). The main difference between town and city is that cities are designated by a population greater than 100.000. All students from Czech Republic are owners of computer, for that reason we did not analyze attitudes to ICT with respect to owning of computer. Age was as covariate. Questionnaires were administered in one university. Students in this study participated by knowing that participation was anonymous and that it would not affect their course grades. They were informed that the aim was just a research attempt to examine student attitudes towards using ICT in science subjects. The questionnaire was randomly administrated. No time limit was given during completion of the questionnaire, but the longest time of filling was about 15 minutes. The data were analyzed statistically by conducting a factor analysis with Varimax rotation and five factors with Eigen values greater than 1.00 were derived. The five factors (dimensions) were labeled as: 1. Influence of ICT on teaching process (7 items), 2. Influence of ICT on human body and environment (4 items), 3. Using of ICT during teaching process (7 items), 4 School and ICT (3 items), 5. ICT as didactic equipment (6 items). These five factors explained 39.23 % of total variance. Most of this variance was explained by the factor/dimension 1 and 2 (18.66 % and 7.00 %). Items (6) with factor score more than 0.30 loaded in more than one factor and factors with factor score less than 0.30 were excluded from the next analyses (Anastasi, 1990). Next reliability of the questionnaire was measured. The Cronbach's alpha for the whole instrument was 0.72, which indicates high reliability of the questionnaire (Nunnaly, 1978). The values of alpha coefficient for the scale ranged from 0.58 to 0.89 indicate an acceptable reliability (Nunnaly, 1978).

Analysis of covariance (ANCOVA) with age as covariate, mean score as dependent variable and demographic variables (gender, residence, grade and owning of computers) as independent variables were also conducted. For obtaining statistically significant differences in results between variables t-test and ANOVA were performed. Results showed statistically significant differences on the levels: $p<0.05$; $p<0.01$ and $p<0.001$.

4. Results

A factor analysis with Varimax rotation was performedon the data. After a careful examination of the table of factors, items with factor score greater than 0.30 loaded in more than one factor were excluded from further analysis. Questions with factor scores less than 0.30 were also eliminated (Anastasi, 1990). The total score was 3.57 (SD = 0.42), what indicates a relatively positive attitudes toward using ICT in science subjects. It was also examined whether statistically significant differences existed in the results between variables of gender, type of residential area lived and year of study. In performing an ANCOVA age was taken as a covariate. The influence of age on the results was not showed. In the all variables was also not found out statistically significant difference in results. Males achieved an average score of 3.63 (SD = 0.05), whereas the average score for females was 3.55 (SD = 0.04). Students living in towns had a more positive attitude than students living in villages or cities (their average score was 3.67 and SD = 0.08). Students living in cities achieved an average score 3.61 (SD = 0.04). And

students living in villages have got the lowest average score (x = 3.50; SD = 0.05). Sophomore students achieved the highest average score (x = 3.69; SD = 0.05) and freshmen students achieved the lowest average score (x = 3.51; SD = 0.04) and third years students achieved an average score 3.57 (SD = 0.08).

By the analyzing of dimension, we found out statistically significant difference by the influence of gender in the dimension "Influence of ICT on human body and environment" (figure 1), next statistically significant differences by the influence of grade in the dimensions "Influence of ICT on teaching process" and "School and ICT" (figure 2) and the statistically significant difference was found out by the influence of residens in the dimension "Using of ICT during teaching process" (figure 3).

Figure 1 Differences between attitudes in five dimensions with respect on gender (NS = non-significant; *** p < 0.001)

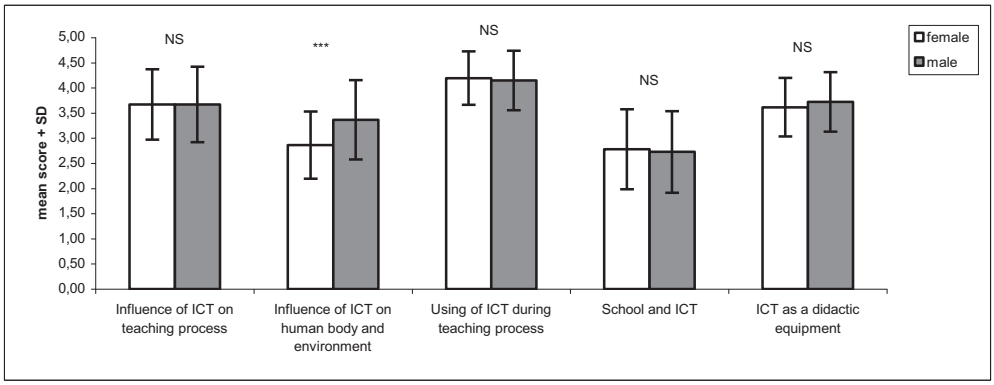


Figure 2 Differences between attitudes in five dimensions with respect on grade (NS = non-significant; ** p < 0.01; *** p < 0.001)

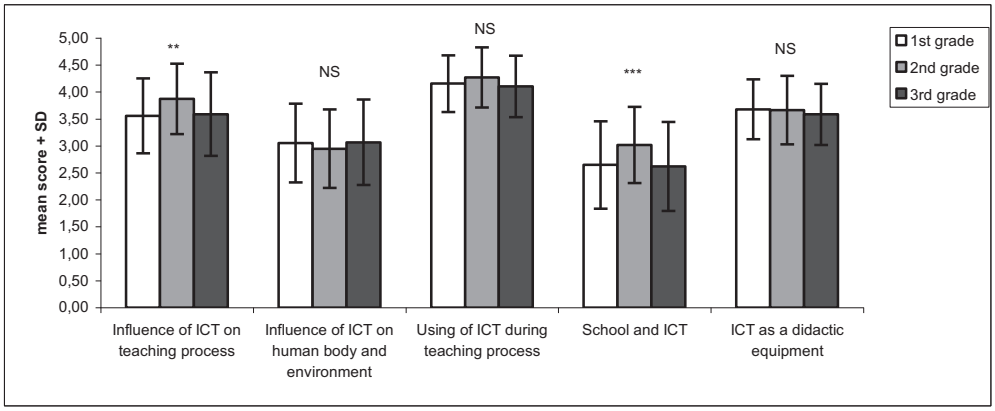
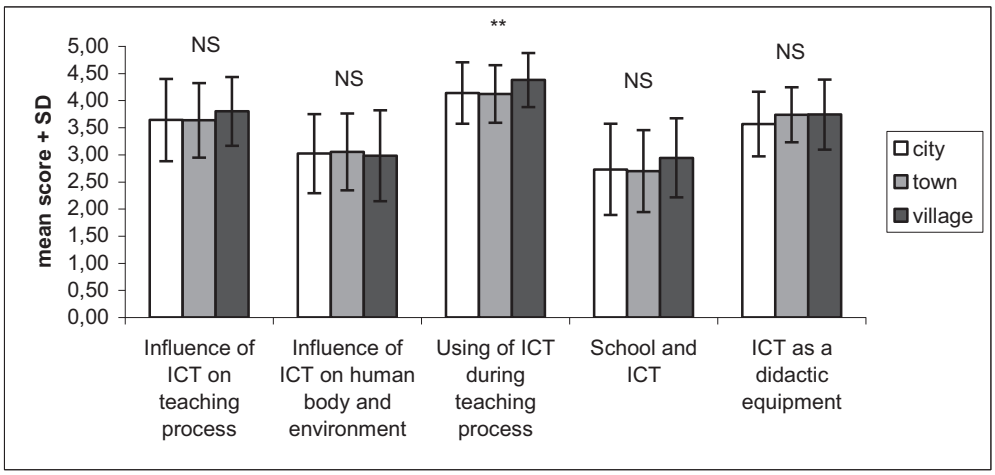


Figure 3 Differences between attitudes in five dimensions with respect on residence (NS = non-significant; ** p < 0.01)



5 Discussion

In this study the aim was to determine prospective science teachers' attitudes towards ICT. The selected variables were gender, residence and year of study. Age was chosen as the covariate. The factor analyses yielded five factors with Eigen values greater than 1.00. The five factors (dimension) were constructed as follows: 1. Influence of ICT on teaching process (7 items), 2. Influence of ICT on human body and environment (4 items), 3. Using ICT during teaching (7 items), 4. School and ICT (3 items), 5. ICT as didactic equipment (6 items). Examining university students' attitudes towards ICT is an important and necessary for determining perceptions and the current status. In this way it can be revealed if the students are taking the full advantages of using ICT in education. It can also be determined if ICT are being used properly in teaching.The finding of this study reveals that the participant university students had positive attitudes towards ICT used in science teaching. Similar findings were also reported before (Simsek, 2008) revealing that a majority of students accepted the use of ICT for learning and they maintained positive attitudes toward using ICT. Kubiatko & Haláková (2009) also asserted that secondary grammar school students had positive attitudes towards ICT for teaching and learning biology.In this research study it is revealed that males have more positive attitudes towards ICT as compared to females. This finding supports the common view that "males are technically more competent than females," despite all efforts worldwide to train females at least equally competently with males in science and engineering. The similar assertions were also made elsewhere (e.g., Cooper, 2006). Cooper indicated that the public in general believes that males are more interested in using computers, and hence they are more competent in using computers. The negative attitudes of females, in turn, negatively impact their performance in using computers. Knowing that females have negative attitudes towards computers and are reluctant to use them only reinforces the stereotypical view that computers are for males and not for females. Females may have been socialized differently in today's computer generation to have them feel more comfortable with using computers and, hence, removing barriers to opportunities for receiving better training, at least partially. 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 Computer attitudes and computer skills are related to gender in favor males, that is, males have better attitudes towards computers, attain improved computer skills and experiences as compared to females (Varank, 2007). In the analysis another variable was students' year of study. Sophomore students had the highest positive views and the freshmen expressed the least favorable views towards ICT. But, it is not known whether age plays a role in this dimension, since age and year of study does not necessarily match. All that can be said is that there is statistically significant differences among students in different years of study. In the literature there are just few empirical studies focusing on age and attitudes towards ICT. In other studies it findings were contradictory: while in some studies it is reported that there existed a significant correlation between age and attitudes towards ICT (e.g., Handler, 1993). The last variable in this study was the type of residential area lived. The three types were as follows: village, town, and city. There is no other study, to the best of our knowledge that reports on this variable and its relation to attitudes towards ICT. As a result of this study it is seen that students coming from towns have attained more positive attitudes as compared to students coming from villages and cities. Also, students coming from villages have the least favorable views towards ICT.

6 Conclusion

Attitudes results toward ICT using in science subject among high school students were based on statistical evaluation. Students, whose were respondents of our investigation showed an interest about using ICT in the science subjects, it was obvious from their answers. It is important awake to, that ICT can enhance students' learning in science from an early age. An effective use of ICT could have the additional benefit of improving attitudes and computers skills, which in turn could improve the effectiveness of ICT, thus creating a positive feedback spiral.

7 References

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