The impact of school and home environment on computer attitude

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Abstract. *Present-day generations grow up surrounded by the omnipresent information and communications technology (ICT). Computers have become an integral part of instruction at all levels of education but that fact alone does not enable one to acquire nor to use the appropriate and necessary knowledge. The period of formal education is regarded to be the key to a better knowledge systematization (and preparation for the future). Since ICT-related knowledge acceptance is strongly affected by computer attitudes and the positive computer attitude can affect computer application knowledge in a positive way, it would be important to understand how various factors interact and influence the teaching and learning process involving the use of computers and maybe help us improve the whole educational process.*

This study examines and evaluates the influence of several factors in student's environment (at home and in school) on computer attitude among primary and secondary-school and college student population aged 14 - 21. The initial model was tested by structural equation modeling, using SmartPLS 2.0.

Keywords. Computer attitudes, attitudes toward computers, computer education, CAMYS

1 Introduction

Today, computers are a common part of our everyday life. We use them intensively for various purposes: for fun, for work, for teaching and learning, etc. Computers have incited a dramatic change of the global human society. Information and communications technology (ICT) has impacted on every aspect of our lives and that makes mastering of ICT essential. The educational system has a very important role in the adoption of new knowledge, and therefore it has to be adapted to these new challenges. Each member of our community has to be well prepared for that challenge.

Computer use ratio has increased dramatically since the time of the first personal computers. However, computer acceptance was a long and arduous process while computer-based knowledge presented a big challenge for a significant number of students. Therefore, an educational system adapted to these new technological circumstances, that will meet the demands of our modern times and enable an efficient reception of these new computer skills is obligatory.

Today, computer technologies are to a large extent involved in the education process both as the object of study and as educational tool assisting one in acquiring new knowledge. Educational system today has to ensure acquiring of computer literacy; therefore all the factors that can help us with that should be taken into account.

One of the important factors associated with computer literacy is the computer attitude. Positive attitude toward computers can foster acceptance of ICT in both educational process and future everyday life [7]. Since computers have become an important integral part of education, a thorough research of computer attitude can help us shape the educational process in the most efficient way. Researchers singled out many factors which can influence one’s computer attitude. There are, for example, studies which have shown a connection between gender and computer attitude [1].

The last decades saw a rapid development of computer technology, as well as various different attitudes students have toward computers. The present-day generation of students is significantly different from previous generations. Today's generation has been brought up in a

digitally rich environment. The average student profile has underwent a radical change so many researchers refer to students as 'digital natives' to highlight the impact that ICT has had on their growth and need to tailor educational process to their needs [12].
In a similar manner, an average present-day student is no longer a person that our educational system was designed to teach. That is why present-day students' attitude toward computers should be reviewed. Their environment should also be reexamined as an important factor associated with students' computer attitude [5].

Studies have shown that computer attitudes have changed over the last two decades as the use of computers dramatically increased. For example, the amount of time spent using a computer and computer attitude proportionally affect one other in a positive way, which cannot be said of the number of college computer courses [10]. Such findings imply that we should re-examine all the factors associated with computer attitudes.

1.1 Measuring user's computer attitudes

The user's attitude towards computers in education and other training settings is an important factor in computer usage. A positive attitude can improve ICT acceptance in education [7]. A considerable effort has to be invested in the research of user's computer attitude since computers are very important in education. That information can help us shape the educational process in the most efficient way.

Numerous methods have been developed during the course of years in order to measure user's computer attitudes. There is no universal or generally acknowledged method for this purpose. The so called scales are one of the most common methods of measuring computer attitudes. Scales are usually a Likert-style questionnaire with questions focused on some aspects of computer attitude. Answers have numerical values, so the sum of one's answers figures as a degree of his or her computer attitude. Many different scales have been developed for different purposes, different study locations, samples and different aspects of computer attitude. Some of the most prominent scales are:

- CAS - (Computer Attitude Survey) is instrument devisedby G.S. Nickell and J.N. Pinto [8] in 1986. It is composed of 20 items witch measure positive (8 items) and negative (12 items) attitudes toward computers. All items are Likert style with scale from 1 (strongly disagree) to 5 (strongly agree), and accordingly total score range from 20 (very negative attitude) to 100 (very positive attitude). This scale is fairly generic in nature and has been widely used.
- ATCUS - (Attitudes Toward Computer Usage Scale) was originally created in 1986 by P.M. Popovich, K.R. Hyde, T. Zakrajsek, and C. Blumer [11]. The scale consists of 20 items designed to measure the evaluative reactions to computers as well as behavioral beliefs about computers and related technologies. Responses range from 1 (strongly agree) to 7 (strongly disagree). Due to technological development which occurred during the past 20 years this scale was updated [6] in 2009 while the newly refined 22-item ATCUS v2.0 was developed by changing a few of the original items in order to reflect those changes.
- CACQ - (Computer Attitudes and Confidence Questionnaire) was designed by T. Levine and S. Donitsa-Schmidt [4] in 1998. It was administered to seventh to twelfth grade students in order to define computer-related attitudes and computer-related confidence. Originally, this instrument was a 57-item Likert-style questionnaire, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). It was designed to test the hypothesis that positive computer attitudes and computer confidence reciprocally affect one other in a positive way, and that both positively affect commitment to computer learning.
- CUE - (Computer Understanding and Experience) is the result of joint work [13] of D. Potosky and P. Bobko in 1998. This instrument is a 12-item Likert-style questionnaire, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores suggested greater computer experience. The CUE items are statements on various uses of computers and on the extent to which computers are used for particular reasons. It is basically a self-report measure of computer experience. Some of the statements in the CUE-questionnaire are outdated (like "I often use a mainframe computer") so the accuracy of this instrument is obviously questionable and it has to be updated [3].

1.2 Computer attitude measure for young students (CAMYS)

The CAMYS (Computer Attitude Measure for Young Students) scale [13] was developed by T. Teo and J. Noyes in 2008. It is basically a 12-item Likert-style questionnaire, with responses ranging from 1 (strongly disagree) to 5 (strongly agree) aimed to identify the overall user's attitude towards computers. Items are divided in three subscales (each consisting of four questions): perceived ease of use (PEU), affect towards computer (ATC) and perceived usefulness (PU).

The coefficients are as follows: the overall alpha coefficient is 0.85; perceived ease of use = 0.64, affect towards computers (positive or negative) = 0.81, and perceived usefulness subscales = 0.74. These coefficients (>0.60) are regarded as acceptable for scale construction. Factorial validity for the CAMYS was addressed through the use of confirmatory factor analysis using structural equation modeling (SEM) techniques. The fit indices selected for the analysis were as follows: (a) the goodness of fit index (GFI); (b) the comparative fit index (CFI); (c) the incremental fit index (IFI); and (d) the root mean square error of approximation (RMSEA). Adequate model fit is represented by GFI, CFI, and IFI values greater than 0.90 and RMSEA values below 0.05, and obtained values were: GFI = 0.96, CFI = 0.98,IFI = 0.98, and RMSEA = 0.04 (LO 90 = 0.02; HI 90 = 0.06).

2 Objectives Of The Study

With so many computer attitude scales it can be a problem to choose the best suited for the study. Some sources [13] listed as many as 31 scales, and new ones are still being created. For the purpose of this study CAMYS scale was chosen, because it is technologically updated and practical for use. It consists of only 12 items and it is suitable for students who were the main participants in this research.

The aim of this study was to examine the connection between young students' attitude towards computers and some of the factors present in their environment (at home and in school). The fact that the present-day young generation grows up side by side with the computer technology which has become an integral part of our everyday lives at all levels, does not automatically imply that all young students have a positive computer attitude. This was a very important data because computer user acceptance is positively affected by users' attitudes towards computers. In fact, the improvement of the student's computer attitude will positively influence the teaching and learning process involving the use of computers.

3 Sample and methodology

The main instrument of this study was the survey questionnaire. The survey was conducted on a random sample, and there were not any eliminatory or preliminary questions. Participants were instructed to respond as honestly as possible as there were no right or wrong answers. Anonymity and confidentiality were guaranteed. The participants could also withdraw from the survey during or after the data collection period. The survey questionnaires were administered to 148 randomly selected participants from six public educational institutions in Pula, Croatia. For a more detailed description of the demographic data, see Table 1. The survey instrument consisted of the 12 CAMYS-scale questions and of the additional 13 questions regarding home and school environment. The collected data were analyzed with Microsoft Excel, JMP7, and SmartPLS 2.0 using the SEM.

Survey had 25 questions divided intothree groups: school, home and computer attitude toward computer (CAMYS). All were Likert-type questions with answers ranging from ''strongly-disagree'' to ''strongly-agree'' on a 5-point scale.

The basic research question was whether SCHOOL or HOME, has an impact on attitudes towards computers.

Table 1. Respondent data

		Female		Male		All	
Educational level	av. age	N	%	N	%	N	%
Elementary school	14	27	18,2	10	6,8	37	24,8
Secondary schools	18	26	17,4	21	14,1	47	31,6
University	21	21	14,1	44	29,5	65	43,6
		74	49,7	75	50,3	149	100

The aim of the study was to define the influence of some variables, namely SCHOOL and/or HOME on students' ATTITUDE TOWARD COMPUTERS. The model for the study consisted of three constructs:
HOME
SCHOOL
ATTITUDE

Each of these main categories (constructs),iscomposed of several attributes.
The first group, (SCHOOL consisted of 10 questions:

- (SC1)School is well equipped with IT
- (SC2)Teachers know how to use computer
- (SC3*)Computers are insufficiently used during lectures
- (SC4)School/university encourages the use of computers
- (SC5)Computer knowledge from school can have a practical application
- (SC6*)We learn too much computer theory in school
- (SC7*)I learned more about computers outside school than in school itself
- (SC8)Useful things about computers can be learnt in school
- (SC9)To what extent is your teacher indispensable when acquiring new computer knowledge?
- (SC10)Computer helps me to deal with school assignments

(*Indicates negative assertions which will be recoded before the analysis)

Second group, (HOME) consisted of3 questions:

- (HO1) How many computers do you have athome ?
- (HO2) Do you have your own computer?
- (HO3) To what extent are your family members indispensable when acquiring new computer knowledge?

The third group, (ATTITUDE - computer attitude toward computers) was divided in three subgroups (PEU, ATC and PU).
Perceived ease of use (PEU):

- (PEU1):I use the computer to learn things
- (PEU2) I feel that I am in control when I use a computer
- (PEU3) It is easy for me to learn how to use the computer
- (PEU4) The computer is easy to use

Affect towards computer (ATC):

- (ATC1) I look forward to use the computer
- (ATC2) I am not scared to use the computer
- (ATC3) I enjoy using the computer
- (ATC4) It is fun to use the computer

Perceived usefulness (PU):

- (PU1) I use the computer to help me do my work better
- (PU2) It does not take much time for me to find things on the computer
- (PU3) I like to do assignments which allow me to use the computer
- (PU4) The computer allows me to do my work faster

The technology has become an integral part of the educational process. Student's attitude toward computers is an important factor in the effective acceptance of ICT. This study examines the following hypotheses:
H0: SCHOOL and HOME have no significant effect on ATTITUDE toward computers
H1: SCHOOL and HOMEhave a significant impact on user´s positive ATTITUDE toward computers.
The hypothesis could be further elaborated as the following sub-hypotheses:
H1A: HOME has a significant impact on user´s positive ATTITUDE toward computers,
H1B: SCHOOL has a significant impact on user´s positive ATTITUDE toward computers.

4 Results

The initial model, shown in Fig.1., was tested with structural equation modeling. The reliability of the applied measurement scales was assessed by the Cronbach's Alpha Coefficient.

Table 2. Internal reliability

	AVE	*Composite Reliability*	*Cronbachs Alpha*
ATTITUDE	0,2492	0,7304	0,6683
HOME	0,5636	0,6272	0,457
SCHOOL	0,3326	0,7143	0,5992

As can be seen in Table 2, the internal consistency of constructs did not surpass the 0.7 [9] for the Cronbach's Alpha Coefficient and the 0.8 for Composite Reliability.

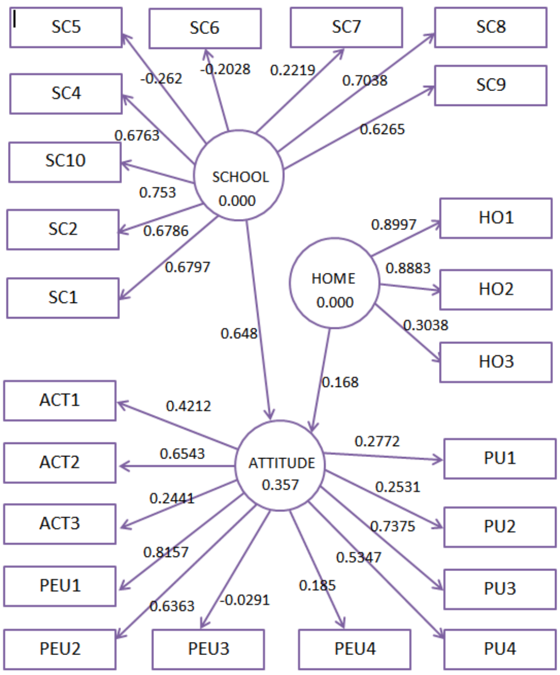

Figure 1. Model

Table 3 shows the Cronbach's Alpha Coefficients for the three constructs. The questionnaire consisted of 24 items, 11 of which have a value under 0.6 which is considered the lower limit for the introduction of new elements.

Table 3. Reliability - outer loadings

	ATTITUDE	*HOME*	*SCHOOL*
ATC1	0,4212		
ATC2	0,6543		
ATC3	0,2441		
HO1		0,8997	
HO2		0,8883	
HO3		0,3038	
PEU1	0,8157		
PEU2	0,6363		
PEU3	-0,0291		
PEU4	0,185		
PU1	0,2772		
PU2	0,2531		
PU3	0,7375		
PU4	0,5347		
SC1			0,6797
SC10			0,753
SC2			0,6786
SC4			0,6763
SC5			-0,262
SC6			-0,2028
SC7			0,2219
SC8			0,7038
SC9			0,6265

Based on results from Table 3, the following attributes were excluded from the further analysis: ATC1, ATC3, HO3, PEU3, PEU4, PU1, PU2, PU4, SC5, and SC6, SC7.
The new revised model is represented in Fig. 2.

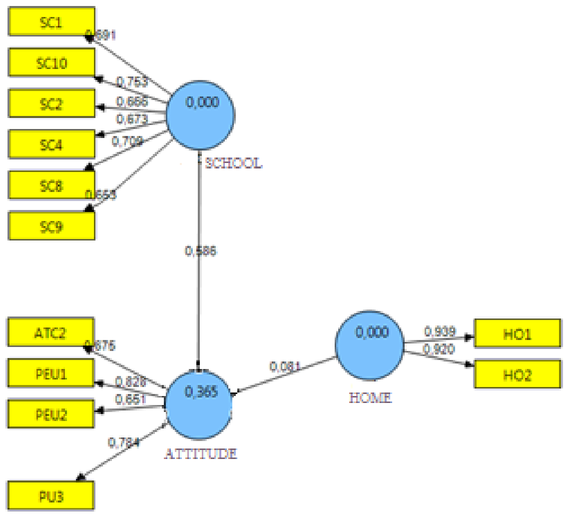

Figure 2. Revised model

After extracting the redundant items, both internal and external reliability were re-estimated, as shown in Table 4 and Table 5.

Table 4. Reliability – outer loadings

	ATTITUDE	*HOME*	*SCHOOL*
ATC2	0,6754		
HO1		0,9386	
HO2		0,9195	
PEU1	0,8283		
PEU2	0,6505		
PU3	0,784		
SC1			0,6912
SC10			0,753
SC2			0,6662
SC4			0,6731
SC8			0,7088
SC9			0,653

Table 5. Internal reliability

	AVE	*composite reliability*	*Cronbachs Alpha*
ATTITUDE	0,5451	0,8259	0,7314
HOME	0,8632	0,9266	0,8422
SCHOOL	0,4784	0,8459	0,7944

As can be seen from Table 5, the internal reliability of the constructs is far above 0.7 for the Cronbach's Alpha Coefficient and 0.8 for composite reliability. The average variance extracted (AVE) for all constructs except school is above 0.5, which partially satisfies the condition of convergent validity. Table 4 shows the Cronbach's Alpha Coefficients for the three constructs. All attribute values were below 0.6 which is the lower limit outer loading.

Table 6. Validity cross-loadings

	ATTITUDE	*HOME*	*SCHOOL*
ATC2	**0,6754**	0,0148	0,3296
HO1	0,1674	**0,9386**	0,1617
HO2	0,1469	**0,9195**	0,1175
PEU1	**0,8283**	0,1819	0,5662
PEU2	**0,6505**	0,0883	0,3295
PU3	**0,784**	0,1657	0,4767
SC1	0,2542	-0,0788	**0,6912**
SC10	0,6215	0,1459	**0,753**
SC2	0,306	0,1281	**0,6662**
SC4	0,446	0,1574	**0,6731**
SC8	0,349	0,1431	**0,7088**
SC9	0,2856	0,0351	**0,653**

Discriminant validity is satisfied. All indicators, the Fornell-Larcker [2] criteria and cross-loadings, met the expectations.

SmartPLS software blindfolding method was applied, and the obtained values were above 0.35. That means the model is suitable for prediction. The results are shown in Table 7.

Table 7. Suitability prediction

Total	*SSO*	*SSE*	*1-SSE/SSO*
HOME	294	51,5704	0,8246
ATTITUDE	588	268,8046	0,5428
SCHOOL	882	461,8581	0,4764

The bootstrapping procedure was carried on a sample of 2000 item copies.

All the hypotheses have received substantial empirical support.

Table 8. The analysis of the model

	The original sample	Arithmetic mean of the sample	Standard deviation	*Standard error*	*T stat.*
HOME -> ATTITUDE	0,0808	0,0805	0,0293	0,0293	2,7549
SCHOOL -> ATTITUDE	0,5864	0,5872	0,0154	0,0154	37,9782

5 Conclusion

The aim of this work was to examine the influence of constructs SCHOOL and HOUSE on the user's computer attitude. The constructs consist of attributes describing student's home and school environments. The survey was performed with 24-items questionnaire. The initial model was tested by structural equation modeling. Some of the elements (11 items) did not meet the expectations, so they were not relevant for further research. The new revised model was submitted to further testing, and proved to be suitable to predict computer attitude.

This study identified that the analyzed factors have a significant impact on students' computer attitudes. Furthermore, HOME proved to have greater impact on computer attitude than SCHOOL.

The element HO3 in construct HOME does not influence computer attitude, so it was removed from the initial model. S8 and S10 in construct SCHOOL are the elements with the greatest impact on computer attitude. Four items of the original CAMYS scale proved not to be relevant for further research. Item PEU1 from that group has the highest validity cross-loading.

The limitations of this work lie in the fact that the chosen model, CAMYS, is a model developed to measure computer attitudes of the younger primary school students , while the testing was conducted on three different age groups.

One of the suggestions resulting from this study would be to repeat the testing using some of the models suitable for the whole range of different age groups involved in the testing. It would be also advisable to repeat the testing based on a sample of middle and high school students aged 14 – 18 using the model developed appropriately for that age group. It would be interesting to investigate why and how the construct HOUSE has such a big impact on computer attitudes.

Furthermore, it would be advisable to determine a scale for each age group, in the first place, and then to repeat this study by focusing on age groups

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