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STUDENTS' VIEWS ON THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY AND EXPERIENTIAL LEARNING IN SCIENCE LESSONS

Abstract: In science classes, experiential work with concrete material is very important. Lessons may be enriched by integrating information and communication technology (ICT) which contributes to increased motivation, as well as better knowledge and satisfaction of students. The aim of the study was to find whether students in these times prefer science lessons in the classroom with practical activities or by using the computer, and to find possible differences in opinions of children from rural versus urban environment. The research included 125 Slovenian primary school students (9–10 years old), who answered a questionnaire. The results showed that students still prefer experiential learning, performing experiments, science days and operating with real objects in comparison to using the computers (film, games, etc.). An important finding is that students prefer learning in the classroom with their classmates rather than distance learning with the help of a computer.

Keywords: *experiential learning, information and communication technology, student's view, science lessons.*

INTRODUCTION

The modern, so-called information society nowadays focuses and relies primarily on information, knowledge and innovation, and consequently brings with it major changes. The fast pace and scope of these require constant adaptation from the society and the individual and the ability to cope with the changed situations.

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Modern times call for different and more complex knowledge and competencies. Learning is thus found in the center of attention and becomes crucial to social and economic progress, which poses a new and great challenge for the school (21st Century Skills, Education & Competitiveness, 2020; Dumont & Istance, 2013).

In recent decades, we have globally witnessed several education projects and reforms, which promote the skills that young people need for full integration into the society and for success in today's fast-changing world. Global forces have begun prioritizing demands for the creation of a quality learning environment within which students will be able to develop the so-called "21st century competencies". The latter include creativity and innovation, critical thinking and problem solving, the ability to communicate effectively, and mutual interaction, digital literacy and a range of most diverse life and career skills (Dumont & Istance, 2013; Partnership for 21st Century; Schleicher, 2019).

In addition, we should not neglect the wishes of the students themselves. Their views on teaching and learning with the help of ICT can be quite different. The environment in which the students live (urban or rural) is one of the factors influencing their interests and thus also their needs to use technology for both education and leisure. Knowledge and understanding of these needs and desires, however, is essential in deciding to use ICT in the learning process.

EXPERIENTIAL LEARNING IN SCIENCE LESSONS

Various authors (Buluş Kirikkaya, Bali, Bozkurt, Işeri, Vurkaya, 2010; Millar, Osborne, Nott, 1998) believe that science education should provide students with useful knowledge which would help them find solutions to the problems they face in everyday life more easily. To achieve natural science competencies and understand science concepts, science lessons must be designed to: (1) help students develop natural science (scientific) skills, (2) create a meaningful connection between science, technology, society and the environment, (3) enables students to develop values and a positive attitude towards science itself and (4) promotes a better understanding of science concepts (Osboren & Dillon, 2008).

To achieve standards and develop skills, it is very important that the teacher in science lessons provides students with a stimulating environment which allows for a better understanding of science (King & Ritchie, 2012). Students should be explained and shown scientific facts in an easy way. It is best if the explanation comes from their daily lives and the surroundings close to them (right there). Practical work or work with materials is indispensable in science lessons, as students are thus involved in direct observation and handling of objects and materials. Such work arouses interest in students, motivates them and has a positive effect on their learning and on the acquisition of knowledge through understanding (Abrahams & Reiss, 2012; Holstermann, Grube, Bögeholz, 2009). It is also important to teach science outdoors, to give students the opportunity to understand and comprehend the

nature, which is impossible to achieve in the classroom (Zoldosova & Prokop, 2006).

TEACHING AND LEARNING WITH ICT

Using ICT in science lessons

Many studies (Lowther, Inan, Strahl, Ross 2008; Weert & Tatnall, 2005) have proven that proper use of ICT in the classroom (connection to real-life situations) can make a significant contribution to the quality of education. Learning should become more interesting and attractive (Cox, Webb, Abbott, Blakeley, Beauchamp, Rhodes, 2004; Kler, 2014) and more effective and independent (Moore, 2005). ICT can change the dynamics of teaching in the classroom, as it enables experimentation, meaningful discussion and analysis through the active role of the learner (Baggott La Valle, McFarlane, Brawn, 2003). The benefits of using ICT cited by various authors (Fu, 2013; Lowther et al., 2008; McMahon, 2009) are also reflected in the creation of a creative learning environment, as it provides innovative ways to meet different learning needs through specific programs. In science lessons, ICT may contribute to a better understanding of various natural phenomena and can improve practical and experiential learning (Guerra, Moreira & Vieira, 2010). The fact that students can understand a particular experiment through simulations also makes the use of ICT in science lessons very important (Cox, Webb, Abbott, Blakely, Beauchamp, Rhodes, 2004). The research (Çavaş, Karaoglan, Çavaş, 2004; Tuzun, Yilmaz-Soyulu, Karakus, Inal, Kizikaya, 2009) furthermore shows that the use of ICT in the classroom has a positive effect on students' knowledge and motivation.

Using ICT in Slovenian schools

The results of the Teaching and Learning International Survey – TALIS 2018 reveal that almost 90% of Slovenian schools are well equipped with modern technology, which is above the European average. Progress in software availability is also recognized. A variety of educational portals with their e-materials (digitized textbooks and workbooks), as well as multimedia and interactive content allow the users to diversify the learning process and acquire knowledge in an entertaining manner, both in classroom and in independent learning at home. The results in the field of information literacy and digital competencies of Slovenian teachers are also very encouraging. Namely, they reveal that they are well trained for teaching with ICT and also confident in its use. Even though Slovenian schools are adequately equipped with modern technology and the teachers well prepared for teaching with the use of ICT, the research shows that the use of ICT for teaching and learning in Slovenia is still below average. Only approximately 37% of teachers enable students

to learn by frequently and actively using ICT, and a high proportion rarely make use of the modern technologies (Gerlič, 2013; OECD, 2018; TALIS Slovenia, 2018).

METHOD

Research problem

In science lessons, experimental work plays a key role in the learning process. With the introduction of modern technology in the field of education, teachers are using it more and more, since ICT enables active participation, encourages motivation and consequently more effective learning, as well as enables identification of possible differences in the opinions of children from urban and rural areas. Rapid technological development has also affected urban and rural development and thus the lives of children. The research shows that they are facing fewer and fewer challenges these days, as fast and user-friendly technology makes their lives easier and at the same time helps, them pass the time. Nevertheless, the lives of urban children remain very different from those of rural children. The main difference is largely reflected in the fact that despite all the technology, rural children still prefer to opt for outdoor activities, where they can be in contact with nature (Chapman & Pelicane, 2015).

Based on this, we tested the following hypotheses:

Hypothesis 1. Students from the city have better access to various modern technologies and the World Wide Web than the students from rural areas.

Hypothesis 2. Students from the city prefer to and use ICT in their free time more often than students from rural areas.

Hypothesis 3. Compared to rural areas, students from urban areas are more motivated to use ICT in the learning process.

Hypothesis 4. The opinion of most students regarding the use of ICT for learning and teaching is positive.

RESEARCH METHOD

Instruments and procedures

We used a quantitative research approach. As part of the implementation of quantitative research, we used a descriptive, causal non-experimental method of pedagogical research to process empirical data. Research data were obtained with the help of a questionnaire, which we compiled and designed with the help of

TIMSS questionnaires. It consisted of 11 questions, of which 4 were general (to obtain general student data) and 7 were specific questions. Among the specific questions, 1 was an open-ended question and the other 6 were closed-ended.

The respondents gave answers in the form of a 4-level Likert assessment scale to questions that required students to express their views (likeability, agreement):

- I really like it/ I like it/ I do not like it at all<
- I strongly agree/ I agree/ I do not know, indecisive/ neither nor/ I do not agree.

The initial part of the questionnaire provided general data related to the gender and age of students and their final grade in mathematics, Slovene language, science or biology and technology in the previous school year. The second set of questions enabled us to determine students' access to various technologies (computer, telephone, tablet, and the World Wide Web) and the frequency and purpose of their use. In the last part, we focused on the students' opinion on the use of ICT and learning with concrete material in science and technology lessons.

Upon reviewing the literature, we compiled a questionnaire based on research questions and hypotheses. Data collection was anonymous and took place online in April and May, and in person in June 2020. A random sample of students volunteered for the survey. Schools and parents of the participants were previously informed about the purpose of the research, the duration of the survey questionnaire and the anonymity of the participants, and they were asked for permission to conduct the research.

Participants

125 students from various Slovenian primary schools participated in the research, attending 4th and 5th grade in 2020, therefore, the average students' age was 10. Of all 125 participating students, 59 (47%) were boys and 66 (53%) were girls. Approximately the same percentage of students from 4th and 5th grade participated in the research, more specifically 60 (48%) fourth graders and 65 (52%) fifth graders. The group of students living in urban area (hereinafter US) consisted of 64 (51%) students, and the group of students from rural areas (hereinafter RS) consisted of 61 (49%) students.

Data analysis

Descriptive and inferential statistics were used in data processing. The data was processed with computer program SPSS. We measured the arithmetic mean and the standard deviation. To determine reliability, we calculated the Cronbach's α-coefficient ($\alpha = .701$), which showed that it was a moderately reliable questionnaire.

The correlation between the considered variables was calculated with the Mann-Whitney U-test and the χ^2 test.

In the interpretation of the results, it is also necessary to mention the influence of the specific period in which we conducted the research (the corona virus). Students and their parents used ICT more often in their learning and home environment. E-environment enabled us to perform the learning process even in such conditions.

RESULTS

The results of the research are presented in three chapters. (1) Homogeneity of students from the urban environment – US and the rural environment – RS, homogeneity with regards to gender, class and final grades in the subjects of Slovene, mathematics, science or biology and technology; (2) the use of modern technology in students' everyday life, within which we have shown the access, frequency and purpose of its use; (3) students' opinion on the use of modern technology in education.

Determining homogeneity of groups

Using the χ^2-test of the independence hypothesis, we checked and determined the statistical uniformity of the comparison groups:

a) According to gender

The number of boys and girls in both groups is equal. The result of the χ^2-test of the independence hypothesis ($\chi^2 = 0.011$; $p = .916$) shows that there are no statistically significant differences between the groups according to their gender.

b) According to class

The number of fourth graders and fifth graders in both groups is almost equal. The results of the χ^2-test of the independence hypothesis ($\chi^2 = 0.19$; $p = .537$) show that the US and RS groups do not significantly differ in statistical data according to the class.

c) According to the final grade in the subject of mathematics, Slovene, science or biology and technology.

From the results of the Mann-Whitney test, we find that the US and RS comparison groups are homogeneous, thus there are no statistically significant differences in terms of the final grade in school subjects ($p > .05$).

Use and availability of ICT in everyday life

Table 1 shows the *Mo*-mode, frequencies (f) and structural percentages (f %), as well as the *M*-arithmetic mean of the ICT use estimates and the results of the χ^2-test (N = 125). From the results of the χ^2- square test of the independence hypothesis, we find that there are no statistically significant differences between the groups in assessing the popularity of leisure activities *(p* = .196 and .989).

The activity of watching television or videos was frequently chosen as the least popular, which was assessed as *Mo* is 1 by 32% of students. Playing games on computer, phone or tablet as well as creating, conducting experiments, or exploring in nature were most often rated by students with *Mo* is 2, namely 26% of students chose the first and 25% chose the second activity. 24% of students rated sports activities with *Mo* is 3. Most students chose socializing with friends as the most popular activity, namely 38% of students. Students from the urban areas use ICT in their free time as often as student from rural areas. The environment in which students live is clearly no longer an indicator of what they wish to do in class and in their free time. Students' opinions on the use and accessibility of ICT in everyday life stated that the least popular activity was watching television or videos. Socializing with friends is the most popular activity, chosen by 38% of students.

The results clearly indicates that, regardless of the environment in which students live and despite all the available technology, students at the age of 10 still prefer spending their free time with their peers through ace-to-face interaction.

Table 1. Mo-mode, frequencies (f) and structural percentages (f %), M-arithmetic mean of the ICT use estimates and the results of χ^2-test (N = 125).

	Group	*Mo*	*f* %	*M*	χ^2	*p*
I watch TV and videos on computer	US, RS	1	40 32	2.4	1.276	.865
I play videogames on computer, phone or tablet	US, RS	2	32 26	2.8	0.659	.956
I create, conduct experiments or explore in the nature	US, RS	2	31 25	2.8	0.310	.989
I socialize with friends	US, RS	5	48 38	3.9	6.500	.165
I do sports activities	US, RS	3	30 24	3.3	6.037	.196

Mo – mode; *M* – arithmetic mean

Students' access to ICT at home

Table 2 shows the structural percentages (f %) of students in terms of ICT accessibility and the results of the χ^2-test for the US and RS groups. From the results of the χ^2-square test of the independence hypothesis, we find that there are no statistically significant differences between the groups in assessing ICT accessibility (*p* is between .053 and .322), therefore, the groups will be considered homogeneous.

Table 2. Structural percentages (f %) of students regarding ICT accessibility and the results of χ^2-test.

ICT	Group	*f* (%)	χ^2	*p*
Internet	US	98	1.135	.287
	RS	95		
Family computer	US	70	0.900	.343
	RS	62		
Own computer	US	22	3.756	.053
	RS	38		
Smart phone	US	80	1.158	.282
	RS	87		
Tablet	US	47	0.982	.322
	RS	56		

These very encouraging results show that not only the vast majority of children have access to the internet through a computer or other digital devices, such as a tablet or a smart phone, but also that there were no significant differences between students from rural and urban areas. The results of a Unicef research (2020) show that globally, there is a significant gap in home internet access between students who live in urban areas (41%) and their rural peers (41%). However, the data show that the presence of a rural-urban digital gap is to a significant extent related to a country's income levels.

Frequency of use of ICT in everyday life

Table 3 shows the structural percentage (f %) of students in terms of the frequency of ICT use and the results of the χ^2-test for the US and RS groups. The results of the χ^2-square test of the independence hypothesis reveal that there are no statistically significant differences in estimating the frequency of ICT use between

the groups (*p* is between .078 and .558), therefore we will consider the groups as homogeneous.

Table 3. Structural percentages (f %) of students in terms of the frequency of ICT use in everyday life and the results of the χ^2-test.

ICT	Group	Frequency of use				χ^2	*p*
		Every day *f* (%)	A few times a week *f* (%)	A few times a month *f* (%)	Never *f* (%)		
Phone or tablet	US	**78**	16	7	0	6.810	.078
	RS	**56**	32	10	2		
Computer	US	34	**39**	20	7	5.367	.147
	RS	18	**54**	25	3		
Internet	US	**65**	29	3	3	2.070	.558
	RS	**71**	26	3	0		

Frequency of ICT use in the learning process and in everyday life

Table 4 indicates the structural percentages (f %) of students in connection with the purpose of using ICT and the results of the χ^2-test of the independence hypothesis regarding the US and RS groups. We can conclude from the results of the χ^2-test that the US and RS groups are homogeneous in terms of the purpose of using ICT (*p* is between .143 and .569). Inhomogeneity between the US and RS groups occurs only in the case of the use of ICT for studying ($\chi^2 = 7.724$; $p = .021$).

Table 4. Structural percentages (f %) of students in terms of frequency of ICT use and the results of the χ^2-test

Activity (purpose of use)	Group	Frequency of use			χ^2	*p*
		Often *f* (%)	Sometimes *f* (%)	Never *f* (%)		
Watching entertaining videos	US	33	**59**	8	1.129	.569
	RS	41	**54**	5		
Studying	US	30	**59**	11	7.724	**.021**
	RS	54	**38**	8		
Playing games	US	45	**45**	10	1.507	.471
	RS	36	**49**	15		
Watching educational videos	US	41	**47**	12	3.892	.143
	RS	30	**64**	6		
Doing homework	US	**47**	34	19	1.513	.469

Activity (purpose of use)	Group	Frequency of use			χ^2	*p*
		Often *f* (%)	Sometimes *f* (%)	Never *f* (%)		
Browsing the internet for entertainment	RS	**57**	30	13	0.145	.930
	US	22	**50**	28		
	RS	25	**49**	26		
Online searching for data I need for school	US	41	**58**	1	1.518	.468
	RS	49	**48**	3		
Communicating with friends through Facebook or similar social media platforms	US	25	28	**47**	2.005	.367
	RS	31	34	**34**		

Students' opinions on the likeability of using different forms/methods of work in education

Table 5 presents the structural percentages (f %) of students according to the popularity of forms/methods of work in the classroom and the results of the χ^2-test regarding the US and RS groups. The results of the χ^2-test of the independence hypothesis indicate that the US and RS groups are homogeneous with regards to the popularity of the form/method of work in the class (*p* is between .169 and .666). As for the likeability of various forms/methods of work in education (working in pairs, watching educational videos, science days, doing tasks on computers, and conducting experiments) the students' opinion led to the conclusion that students like different forms/methods of work. Science days are one of more likable method of work for both of group. The goals of science days in Slovenian schools are primarily the active role of students, which includes active observation, learning and experiencing the landscape as a whole, as well as individual components of the environment (National Curricular Council, 1998). Various research (Cotič, Zuljan, Plazar, 2019) confirmed our results about students' likeability of science days and preforming experiments.

Table 5. Structural percentages (f %) of students according to the likeability of the form/method of work in the classroom and the results of the χ^2-test

Form/method of work	Group	*n*	Level of popularity				χ^2	*p*
			I really like it *f* (%)	I like it *f* (%)	I don't like it *f* (%)	I don't like it at all *f* (%)		
Pair or group work	US	64	**56**	38	6	0	4.015	.256
	RS	61	**43**	48	7	3		
Watching educational videos	US	64	**41**	52	8	0	5.037	.169
	RS	61	**57**	34	7	2		
Science days	US	64	**69**	30	2	0	4.782	.188
	RS	61	**57**	33	7	3		
Doing exercises online	US	64	48	**39**	9	3	5.621	.132
	RS	61	34	**48**	18	0		
Performing experiments	US	64	**58**	34	3	5	1.570	.666
	RS	61	**66**	25	5	5		

Students' opinion on the use of different educational technology in teaching

Table 6 shows the structural percentages *f* (%) of students regarding their agreement with the statements and results of the χ^2-test of the independence hypothesis of the US and RS groups. The results of the χ^2-test of the independence hypothesis reveal that the US and RS groups are homogeneous according to the verification of claims (χ^2 is between 1.476 and 7.781, *p* is between .075 and .658). From the results in table 6, we can see that students' still like conduct experiments in class, school in nature and work in pairs or groups with classmates. All this statements are based on experiential learning, which is the very important strategy of learning in schools. Various studies have confirmed the benefits of experiential learning (Djonko-Moore et al., 2018; Mehra & Kaur, 2010), where students observe and manipulate real objects and materials in the classroom. Positive effects of experiential learning are reflected in better results in knowledge tests and

enhancement of environmental awareness (Mehra & Kaur, 2010), and higher motivation for acquiring knowledge (Weinberg et al., 2015).

Table 6. Structural percentages f (%) of students according to agreement with the statements and results of the χ^2-test of the US and RS groups

Statements	Group	I strongly agree *f* (%)	I agree *f* (%)	I am indecisive *f* (%)	I do not agree *f* (%)	χ^2	*p*
Learning with the help of a computer seems interesting and fun	US	**23**	**48**	22	6	3.972	.265
	RS	**33**	**49**	10	8		
I like science days, as that is when I learn the most	US	**42**	**44**	13	2	4.295	.231
	RS	**44**	**30**	21	5		
I like to do homework on computer	US	**30**	**31**	27	13	4.147	.246
	RS	**33**	**44**	16	7		
I like it when we conduct experiments in class	US	**61**	**27**	6	6	1.467	.690
	RS	**70**	**21**	3	5		
I liked school in nature	US	**69**	**16**	13	2	2.767	.429
	RS	**66**	**25**	7	3		
I prefer to work in pairs of groups with classmates to working on a computer	US	**72**	**20**	6	2	7.781	.051
	RS	**50**	28	13	8		
I prefer to watch educational videos to having a lesson in the nature	US	9	11	28	**52**	1.608	.658
	RS	5	8	26	**61**		
I prefer to play with classmates to playing videogames on a computer	US	**73**	**16**	11	0	6.911	.075
	RS	**53**	**25**	16	5		

I prefer classroom instruction to distance learning, via computer	US	**73**	**16**	11	0	4.714	.194
	RS	**54**	**25**	16	5		

CONCLUSIONS

In today's world, digital technology is present at every step, which surely affects young people as well. In their research, Volk, Cotič and Istenič Starčič (2018) find that given the use of ICT in everyday life, Slovenian students do not differ much from their European peers. Students use the computer and other modern technology on a daily basis, most often for entertainment in their spare time (playing games and watching videos). We agree that it would be sensible and necessary to guide the students who spend more time in front of different screens from year to year and are strongly drawn to working with technology in the direction that technology would not only serve them to pass time but would also have educational effects.

The data from the latest international survey 2nd Survey of Schools: ICT in Education (2019) showing that Slovenian schools are above averagely equipped with powerful modern technology and high-speed Internet access are therefore very encouraging. Given the state and trends of informatization of Slovenian education, it would be expected that ICT is fully used in the educational process, but classical education still prevails and ICT equipment in schools remains quite unused (Brečko & Vehovar, 2008). We do not see reasons for this in teachers' poor digital literacy or inexperienced use of modern technology, as various studies show just the opposite. Teachers are well trained to use ICT in the educational process; however, they still do not use it to the extent expected. We assume that teachers adapt to the needs and desires of their students, and that perhaps modern technology is in fact not a good motivator for the teachers to use it too often. Regardless of the presence of modern technology, we cannot ignore the fact that Slovenia is a small country, and that despite larger cities, the influence of the Slovenian countryside still remains strongly present. The differences in urban and rural lifestyles have a great impact also on young people, their wishes and needs in everyday life.

Based on the results of the research, the following conclusions can be drawn taking into consideration that in our research work, we were interested in the attitudes of students towards modern technology, more precisely what are the differences in the urban and rural students' attitude towards ICT and its use in education. It was found that groups of students from urban and rural areas were mostly homogeneous in the opinions on the use of information and communication technology and experimental learning in science lessons, which is positive and

desirable. It was found that urban students do not have a better access to a variety of modern technologies and the World Wide Web than rural students. The studies of the Teaching and Learning International Survey – TALIS 2018 reveal that almost 90% of Slovenian schools are well equipped with modern technology, which is above the European average and is positive and desirable. Researches show that digital technologies may enable new opportunities for teaching and learning (Chauhan, 2017). It is necessary to be aware that in spite of its potential influence on teaching and learning, the extent of the presence of computer technology hardware does not necessarily lead to student progress (Li & Ma, 2010). The teacher's ability to properly use ICT in the classroom is very important. For quality science teaching the teacher should be able to thoughtfully combine different forms or methods of work, such as working in pairs with classmates, watching educational videos, science days, doing computer tasks, performing experiments and classroom work.

Teacher ICT competencies have become even more important during COVID 19 (König et al., 2020). The COVID-19 situation requires not only knowledge and skills but also confident teacher and students regarding success in online teaching. The COVID-19 situation also raised the open question of how to connect online science teaching with experiential learning in a professionally appropriate way.

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СТАВОВИ УЧЕНИКА О УПОТРЕБИ ИКТ-А И ИСКУСТВЕНОГ УЧЕЊА НА ЧАСОВИМА НАУКЕ

Резиме

На часовима науке, искуствени рад са конкретним материјалом је веома важан. Лекције се могу обогатити интегрисањем информационо-комуникационе технологије (ИКТ) која доприноси повећању мотивације, као и бољем знању и задовољству ученика. Циљ студије је био да се сазна да ли ученици у овим временима преферирају часове науке у учионици, са практичним активностима или коришћењем рачунара. У истраживању је учествовало 125 словеначких ученика основних школа (9–10 година), који су решили упитник. Резултати су показали да ученици и даље преферирају искуствено учење, реализацију експеримената, научне дане, манипулишу конкретним материјалом него употребу рачунара (филм, игре...). Важан закључак је да ученици више воле да уче у учионици са својим школским друговима него да уче на даљину са рачунаром.

Кључне речи: *искуствено учење, информационо-комуникациона технологија, поглед ученика, часови науке.*