How Teachers Used ICT in Education in 2015 and 2022 in Croatia: A Cross-Sectional Study

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Abstract: In this paper, the results of a cross-sectional study comparing two surveys on educational technology use are presented. The first survey included 1103 teachers and was completed in 2015 to explore the areas of in-class technology use, digital contents use, professional development, and other relevant issues in primary and secondary education in Croatia at the time. The second survey was administered seven years later and included 838 teachers in total. The two survey results were compared to identify changes in teachers' educational technology use and related issues. The results show large increase in technology and digital contents use in everyday primary and secondary school classrooms confirming these tools become more widespread and more accepted nowadays. On the other hand, the analysis shows pedagogical, and teacher professional development issues remain challenges even after 7 years, indicating those areas should be the focus on attention in terms of educational technology sustained use.

Keywords: ICT, teacher professional development, technology use, cross-sectional survey

1. Introduction

ICT (Information and Communication Technology) has become an integral part of education and is applied in a wide range of areas including lectures, communication with students and generally enables access to learning resources and is becoming a standard part of curriculum implementation (Vuk et al., 2020). ICT is often used to save time on highly redundant tasks so that teachers get to focus more on high quality work with the students. In the time of Covid-19 pandemic, classes without ICT would have been for the most part impossible.

A prior survey conducted by the authors in 2015 titled "The application of ICT in primary and secondary schools in Republic of Croatia" (in Croatian) analyzed the use of ICT with a focus on innovative use of technology in teaching and learning (Pović et al., 2015). The 2015 survey revealed that although 25% of teachers used technology in class, they were still keen on using even more technology in their classes but were not adequately educated for its use. In 2015, the lack of resources was often managed by the teachers themselves by buying equipment to be used in class, finding donors etc.

In order to map out the changes in the primary and secondary education between 2015 and 2022, the authors conducted a new survey which is presented in detail in this paper, in which teachers were asked about the current state of the use of ICT in education similarly as in the 2015 survey. The research was based on questions from the 2015 survey. Both surveys will be carefully compared side by side based on the teachers' answers. With the 2022 survey it was possible to draw the comparison between the change of technology use and the perception of technology use in education between 2015 and 2022 in Croatia. In addition to that, the teachers reported how Covid-19 affected their use of technology in class and how it has affected the quality of teaching. The outcome of this research contributes to better understanding the current situation of ICT use by the teachers and the possibilities for advanced implementation of ICT in Croatian schools (Ministry of Public Administration (Croatia), 2017; Ministry of Regional Development and EU Funds, 2018).

2. Teacher Technology Use and Adoption

Digital technologies present an important tool that is used for education and skill development. To take advantage of the full capacity of digital learning, a lot of prerequisites need to be met for both teachers

and students to gain access to digital equipment and fast internet connection. Furthermore, teachers need to be educated about the technology they will be using in their teaching in order to be competent to pass on the knowledge on adequate technology use to their students who will soon become teachers (Wei, 2020). The study carried out for the European Commission called "ICT in Education" discusses access and use of technology in education by surveying teachers and students from EU, Norway, Iceland, and Turkey to provide more data and evidence regarding digitalization in education (European Commission, 2019). The study explored teachers' and students' confidence in their own digital competence. One of their key findings is that teachers state there is insufficient number of digital tools such as laptops, computers, and tablets available. Moreover, although teachers are most confident in the areas of communication, safety, and basic ICT activities, they lack confidence in more complex tasks, such as coding.

Given the variety and the sheer number of resources, digital technologies can be transformative to the teaching process and improve decision-making in education. Covid-19 pandemic has further accelerated the digitalization process. There are different ways in which the digital technologies can be used for education systems such as: 1) objectives of learning for the students, 2) to support students in their learning, 3) to support teachers and 4) to support the management of schools and education systems (OECD, 2020). Given the constant technological progress individuals need a mix of skills rather than more specialized digital skills. For the teachers to teach they not only need to be skillful with the technology, but they also need to coordinate the use of technology, pedagogy, and subject matter. This seems to be *au pair* with the analysis done by PISA which warrants for a more in depth rethinking of the governance, funding, distribution, and management of ICT resources (OECD, 2019).

The survey conducted by Gudmundsdottir and Hatlevik (2020) has concluded that the teacher-students are poorly educated on the ways to find reliable content, on how to adhere to copyright rules and how to teach pupils safe and responsible ways of using ICT. Most of their knowledge regarding ICT and digital responsibility came from things they learned on their own, and not from the teacher development sessions (CARNet, 2017). Also, their experience regarding ICT during practice placement in schools is varied. Some were told to keep off technology as it is not used in the school, while the others were encouraged to use it and were even taught how to use it by teacher educators (Gudmundsdottir et al., 2020). The survey emphasizes that teacher-educators who taught teacher-students how to use technology focused more on the technical aspects and less on pedagogical or responsible ways of using ICT. In the first part of the survey, which was conducted before teacher-students' in-school sessions, teacher-students were able to check the reliability of online content by methodologically examining it. However, the methods for checking reliability of content are difficult to pass onto students, especially when it comes to knowledge on advanced search procedures (Avalos, 2011). Limited awareness of privacy issues was reported, while copyright rules were acknowledged but ignored due to convenience.

3. Methodology

The goal of the 2022 survey was to observe the evolution of teacher educational technology use in Croatia in the seven preceding years. To make the comparison of the two survey results possible, a decision was made to employ the original survey questions again in 2022 and to supplement them with new developments in the ICT use and COVID-19 specifics. As in the original survey, the teachers across elementary and high schools across Croatia were randomly chosen as the target survey population

54 questions general demographic data, electronic class register system called e-Diary, the use of computers, tablets and smartphones in lessons, use of digital educational content and smart boards, education on safe ways of using ICT, problems teachers encounter while using ICT in class and the effect of Covid 19 on ICT usage were devised. Survey was then sent to the ethical committee of the Faculty of Electrical Engineering and Computing University of Zagreb for the ethics approval of the study. The survey was then implemented using Google Forms and distributed to teachers using e-mail. Data collection occurred over one month - from 17th of January until 18th of February 2022. This specific time frame was chosen as this is typically the time of the year when teachers have less obligations and there are no school holidays, so they are more available.

838 teachers took part in the 2022 survey. Data analysis of the collected data was done in three parts: quantitative analysis, qualitative analysis, and the comparison with the 2015 survey results. Quantitative analysis was done in RStudio using the R programming language and in Excel. Qualitative

analysis on open-ended questions was done manually by grouping answers into categories. That way, spelling and grammatical errors were eliminated, and similar answers got grouped. Then, the frequency of answers in each group was calculated. The two survey results were compared in relative terms due to slight difference in the number of participants.

4. Results

a. General Information and Technology Use Frequency

In the 2015 survey there were 1103 participants, while the 2022 survey got completed by 836 teachers. As Table 1 shows, the gender structure of the participants remained comparable, while slight changes occurred in the demographic composition of the participants, where there is increase in more senior age group (>50) in 2022 in comparison to 2015. This can most likely be attributed to the increasingly aging population in Croatia and general emigration trends in recent years. At the same time the youngest age group (<30) shrank due to decreasing demand for teachers (since less students get enrolled).

Table 1. Gender and demographic structure of survey participants (2015 and 2022)

	2015	**2022**	**2015 (%)**	**2022 (%)**
Female	832	667	75	80
Male	271	169	25	20
< 30	150	88	14	10
30 - 40	411	262	36	32
40 - 50	327	249	30	30
> 50	215	237	20	28

The percentage of teachers who use computers, tablets and smartphones in education remained very high in both surveys (97% and 99% in 2015 and 2022, respectively), but the frequency of use increased. Table 2 shows that the frequency use of desktop computers and laptops increased across almost all-time options. The only decrease appeared for the "once a week" option which is compensated with a very notable increase in the "almost every lesson" option, indicating the teachers are adopting regular computer/laptop use in their classrooms.

Table 2. Frequency of technology in education use: "How often do you use computers/laptops in lessons?"

	2015	**2022**	**2015 (%)**	**2022 (%)**
Never	11	10	1	1
A couple of times per year	87	16	9	2
Once a month	79	42	8	5
Once a week	219	66	22	8
Almost every lesson	604	684	60	84

Table 3 shows that the general frequency of use of tablets increased across all options, with the first three options (a couple of times per year, once a month, once a week) showing the greatest increase.

Table 3. Frequency of technology in education use: "How often do you use tablets in lessons?"

	2015	**2022**	**2015 (%)**	**2022 (%)**
Never	766	434	77	53
A couple of times per year	65	119	6	15
Once a month	50	94	5	11
Once a week	47	101	5	12
Almost every lesson	72	70	7	9

The most substantial increase was recorded in smartphone frequency use (Table 4) with a drastic decrease in the number of teachers who never used smartphones in their lessons (from 66% to

23%) and very notable increase across all time options, with all the options surpassing the tablet use and some options even surpassing the desktop or laptop use.

Table 4. Frequency of technology in education use: "How often do you use smartphones in lessons?"

	2015	2022	2015 (%)	2022 (%)
Never	655	187	66	23
A couple of times per year	115	136	12	17
Once a month	74	164	7	20
Once a week	75	154	7	19
Almost every lesson	81	177	8	21

b. Digital Learning Contents Use

Digital learning contents examined in this paper come in a variety of forms, ranging from video tutorials to YouTube videos, web tools, smart games, and other digital educational contents. Table 5 shows that video educational contents were more frequently used across all time options in 2022 compared to 2015.

Table 5. Frequency of digital contents use – "How often do you use video tutorials from YouTube or similar sites?"

	2015	2022	2015 (%)	2022 (%)
Never	107	33	11	4
A couple of times per year	291	130	29	17
Once a month	255	244	26	29
Once a week	265	295	27	36
Almost every lesson	82	116	7	14

There is a very notable increase in Web 2.0 use across all time options in 2022 (Table 6). The proportion of teachers who never used such tools almost halved, while the number of teachers who use such tools at almost every lesson increased dramatically.

Table 6. Frequency of digital contents use – "How often do you use Web 2.0 tools?"

	2015	2022	2015 (%)	2022 (%)
Never	637	279	63.7	34.1
A couple of times per year	150	146	15.0	17.9
Once a month	87	151	8.7	18.5
Once a week	93	137	9.3	16.7
Almost every lesson	33	105	3.3	12.8

The use of smart games follows similar patters as the use of Web 2.0 tools, where teachers show more smart games adoption in general and more frequent use across most time options (Table 7).

Table 7. Frequency of digital contents use – "How often do you use smart games?"

	2015	2022	2015 (%)	2022 (%)
Never	514	173	51.4	21.2
A couple of times per year	249	186	24.9	22.7
Once a month	138	186	13.8	22.7
Once a week	79	190	7.9	23.3
Almost every lesson	20	83	2.0	10.1

Due to increased availability of native (Croatian) digital contents there is a notable increase of native contents use (Table 8).

Table 8. Digital contents use – "Do you use digital content made by Croatian publishers?"

	2015	2022	2015 (%)	2022 (%)
Yes	510	629	51.0	76.9
No	490	189	49.0	23.1

c. Access Control and Communication

Table 9 indicates only some teachers, and their schools, were able to provide access to computers/tablets to their students but this number rose significantly (from 17% to 56% of the surveyed teachers from 2015 to 2022, respectively). Nevertheless, access control mechanisms remain the same in 2015 and 2022, indicating there was no substantial development in this area over the years.

Table 9. Access control – "If students have access to computers/tablets, how do you control what they do?"

	2015	2022	2015 (%)	2022 (%)
Personally	122	267	64	57
Software	45	119	24	26
Combination of personally and software	20	48	11	10
Time limit	1	16	1	4
Do not control them	0	15	0	3

Communication between teachers and students reportedly improved with less teachers reporting they do not communicate with their students at all (Table 10).

Table 10. Communication – "How do you communicate with students outside of class?"

	2015	2022	2015 (%)	2022 (%)
I do not	286	6	31	2
E-mail	258	76	29	30
Social networks	124	43	14	16
Calls and/or text messages	91	63	10	24
Teams	84	69	9	26
Google Classroom	60	5	7	2

5. Discussion

The analysis presented in the preceding chapters reveals there exist very notable trends in ICT in education use that happened over the last 7 years in Croatia, since the initially administered 2015 survey. These trends happen in demographically and globally challenging times, where on one side the overall Croatian population is decreasing due to low birth rate and emigration, while on the other side the teacher population generally ages and is not supplemented with new junior teachers as fast as expected (Keržic et al., 2021).

Technology use remains high in classrooms in 2022, as expected. However, the frequency of technology use across all types of devices increased a lot. Standard classroom equipment such as desktop/laptop computers becomes widely available and is being predominantly used by the teachers during almost every lesson. Although frequency of use increased for tablet computers, the use of smartphones dramatically rose indicating such tools become more widely accepted in today's Croatian classrooms. Although such changes are most definitely fueled by high availability and lower prices of high-tech equipment and the Covid-19 pandemic drive for online learning, it must be noted that in 2022 compared to 2015 more devices used by the teachers come from the schools' and less are own teachers' devices. In terms of digital contents use, there is some increase in the use of video content at almost every lesson, and surprising changes are noted with a massive increase in the use and the frequency of use of Web 2.0 tools and smart games by the teachers. This change can be attributed to the structured and EU-supported approach to the development of a digital educational contents repository in Croatia

which was made available to all Croatian students and teachers. This is well confirmed by a large increase in the number of teachers using localized educational contents in 2022.

Although there is more than apparent use of educational tools and educational digital contents, the changes become less dramatic when teacher professional development or student resource access is concerned. Teacher professional development remains a challenge in 2022 with only a handful of initiatives available, most triggered due to the Covid-19 situation. Students' device access control is still being managed mainly on the personal basis, while more structured approaches to controlling students' device use in class remains on the 2015 levels. In terms of communication with the students out of class, teachers continue to use e-mail and social networks on the 2015 levels, and in 2022 used more calls/text messages and specialized software. This can be explained by the Covid-19 pandemic and the need to establish communication channels with the teachers in a time of need.

6. Conclusions

In this paper a survey on primary and secondary teacher use of ICT in education is presented. The survey was conducted in 2022 and compared to the survey conducted in 2015. This cross-sectional approach was employed to investigate the change in teacher educational technology use and compare the changes in the 7-year period. There is an increase in educational technology use and digital learning contents use in 2022 in comparison to 2015. What is more, the increase is even more emphasized in the technology and digital contents frequency of use, where teachers got empowered with the availability of educational tools and use them on almost daily basis in their classrooms. The challenges related to teacher professional development remain, where teachers need to manage their growing technological resources on their own and find ways of devising adequate pedagogies and manage different facets of daily technology and digital content use on their own. In this respect it is to be noted that mere technology and digital contents have their limits in truly transforming the educational arena and need to be truly embedded everyday in-class pedagogies to unleash their true potential.

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