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IWB INTEGRATION IN THE SCHOOL SUBJECT SCIENCE: PRIMARY SCHOOL TEACHERS' PERCEPTIONS

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This study investigates the integration of the interactive whiteboard (IWB) into Science teaching during the primary educational cycle and teachers' perceptions about the use of the information and communication technology (ICT) in the school subject Science. An online questionnaire was distributed to Croatian schools in 2015/2016. A total of 104 teachers expressed their perceptions, 65 of them were from schools without an IWB, while the remaining 39 responded to our online questionnaire from schools with an implemented IWB. The results indicate the higher usage of ICT in schools with an IWB compared to schools without an IWB. Teachers use IWBs and computers mostly once or twice per week and DVDs once per week. Additional results pointed to the positive teachers' perceptions on technology in linking student motivation to outcome levels in science. The findings reveal the constant education focused on IWB integration, and internet and technical support as a starting point for an innovative practice in science. Future studies are directed to the investigation of the use of technology in all schools in the Republic of Croatia.

Keywords: *information and communication technologies, interactive whiteboard, teaching processes, Science*

Introduction

Science education is very important for the technological development in the 21st century. In the Croatian education system, students learn about science during the first education cycle (1st to 4th grade) in

the school subject Science (Letina, 2015, 298). Science is an interdisciplinary subject about things, phenomena and living beings, and their cooperation in the world surrounding them. The interdisciplinarity of Science is reflected by the diversity of its basic content linked to the subjects Biology, Geography, Technical Culture, History, Sociology, Economics, as well as the content of special intercurricular areas (sustainable development, entrepreneurship, education for democratic citizenship, health education). In most European countries there is a related subject named Science that is taught in some countries during the first two years of elementary school, while elsewhere the subject is taught throughout the whole elementary education (Domazet, 2007, 509). In Croatia, Science is known as 'Priroda i društvo', in Slovenia as 'Environmental Studies', in Germany and Austria as 'Sachunterricht', in the United States as 'Social Studies/Science', in Australia as 'Studies of Society and Environment' (Braičić *et al*., 2015, 84).

Teaching Science offers numerous specific interdisciplinary opportunities for the implementation of Information and Communication Technology (ICT), especially for the use of computers in teaching. The National Curriculum Framework for Pre-school Education and General Compulsory and Secondary Education (MSES, 2011, 45) emphasises the importance of ICT in education; in order to become successful individuals, adaptable to quick changes in society, science and technology, pupils ought to acquire knowledge about technologies in general and about ICT and develop skills and abilities to use them under different circumstances (Zovko and Didović, 2013, 336). The Ministry of Science and Education proposed a Curriculum (MSE, 2017, 15) that enables the development of key competences essential in the process of realisation of one's personal potential, continuation of education and lifelong learning which is based on educational ICT developments in Europe and worldwide, but also on Croatian educational documents.

With the rapid changes in ICT, professional development with relation to ICT usage in Science lessons is essential in order to keep up with those changes and developments. The Strategy records the results of the process of strategic planning for the informatization of the education system in the Republic of Croatia which started in 2015 and culminated in 2018 with the work of the Commission for Drafting the Strategy on Digital Maturity. The process of strategic planning was initiated in order to direct policies, activities and projects in the technology implemen-

tation area in schools and in the education system by 2030, ensuring long-term sustainability and impact of initial investments. Furthermore, one of the objectives is also recognizing the work and role of teachers, school heads and employees in education agencies in the process of integrating ICT in the education system. The project "e-Schools" began about five years ago in several schools in the Republic of Croatia as part of the process of adapting ICT to the education system. The project's main goal is to generate a change in the school learning culture by implementing advanced technologies.

ICT tools are good for effective teaching and learning in Science (Kostović-Vranješ and Tomić, 2014, 304; Petrović, 2015, 220) and have strong motivational effects, develop communication and thinking skills and have positive impact on learning of difficult concepts in Science (Lukša *et al*., 2014, 28). ICT-based activities are often found as drive forces of educational improvement. Recently, the implementation of e-learning in the teaching process has been done in schools, but also in homework assignments by which students can receive and complete assignments, have them corrected, and receive feedback electronically (Bulić and Kostović-Vranješ, 2019, 127). The application of e-learning systems and ICT in Science and Biology classes affects student self-responsibility and homework performance, while the application of fully online e-courses in primary schools is still in its infancy. Despite the benefits brought on by ICT tools, research on teachers' use of ICT in their lessons shows that teachers are unlikely to develop their understanding of how technology can improve the teaching and learning process (Aflalo *et al*., 2018, 1). The majority of teachers use ICT when it fits into their traditional way of teaching and design general activities for motivation and work-enhancing purposes (Grimalt-Álvaro *et al*., 2019, 32) mostly by preparing their lessons via PowerPoint presentations and Word documents or by creating communication channels for students and parents through social media and e-mails (Spiteri and Chang Rundgren, 2018, 115; Parker *et al*., 2019, 567).

Although ICT tools like computers were already introduced to schools more than 30 years ago, many teachers do not use them in their daily teaching (Aflalo *et al*., 2018, 526). However, each teacher needs a board and the Interactive Whiteboard (IWB) may be the missing link in the connection between teaching and learning in the digital world. In other words, for many teachers the IWB may be an luring bridge to

the more significant use of digital technologies in class (Betcher and Lee, 2009, 151). The IWB is a large, touch-sensitive board connected to a computer and to a projector which offers an attractive colourful picture, enables the manipulation of texts by deleting, colouring and saving them, combining pictures, applications, programming web pages and so on (Aflalo *et al*., 2018, 525). Northcote *et al*. (2010, 494) observed that IWB technology became popular around the beginning of the twenty-first century in a number of schools throughout North America, Europe, and Asia. This popularity has been particularly pronounced within the context of elementary school classrooms. In the context of a study on the effects of interactive features on elementary students' learning, Balta and Duran (2015, 20) observe that in recent years IWB has been regarded as the most prominent information and communication technology auxiliary instruction device. IWB can be an important tool when combined with traditional methods, if the teacher combines their expertise with appropriate technology management (Stroud *et al*., 2014, 48).

Modern technologies could generate space for innovation, using more constructivist and interactive methods that focus more on the learning by inquiry, active learning, collaborative learning, and formative assessment (Voogt *et al*., 2009, 433). Sun *et al*. (2014, 400) found that more collaborative inquiry could improve the students' understanding of new concepts and enable them to move away from the traditional ways of teaching and learning Science. Teachers need to implement inquiry activities in Science (MSE, 2017, 15) such as project-based learning and problem-based learning that are child-centred and constructivist when compared with traditional ways of teaching (Dawson *et al*., 2006, 346; Tondeur *et al*. 2016; Spiteri and Chang Rundgren, 2018, 123). However, the use of IWB in the classroom does not necessarily lead to a shift in teaching methodology (Habeeb, 2018, 36). In other words, research shows that the uses of ICT tools in classes, particularly in science lessons, are at the service of the teachers' pedagogical purposes. In view of this, teachers need to be actively involved in changing their own methodological paradigm to make the most of ICT and IWB (Habeeb, 2018, 37; Grimalt-Álvaro *et al.*, 2019, 34). The teacher should be able to discover what interactive possibilities this technological tool offers, thereby generating a more interactive pedagogy within their traditional methods (Olivares and Castillo, 2018, 2320). The study conducted by Stroud *et al*. (2014, 44) noted the paradox of the

use of IWB for traditional lessons, which showed that most of the science lesson were performed with diverse IWB tools, although most of the time the teachers used tools as manipulating texts and presentations that supported teacher-focused interaction. Similar findings of teachers in Australia that used IWB mainly for presentations and for explicit instruction were showed in the study by Kearney and Schuck (2008, 8).

Experience of teaching and learning with an IWB is a period of time when pedagogic change in Science should be realised, but it is important to say that IWB appeared in primary schools several years after the introduction of computers. Many elements that are involved in or that can hinder the process of adopting IWB in Science classes have been identified in the literature. Some of them are obviously related to teachers having to contend with "technical" issues due to missing or inadequately provided equipment, and the lack of time or support available to implement the technology in teachers' environments (Topolovec and Fošnarić, 2017, 61; Barbarić Pardanjac *et al*., 2018, 256). Moreover, teachers' perceptions toward the use of IWB and ICT in primary education were found to be related to teachers' confidence, beliefs and self-efficacy and with a significant relation to the school culture (Salinas *et al*., 2017, 2177; Spiteri and Chang, 2018, 123). Studies indicate that initially elementary teachers did not feel confident when teaching with technology and that their self-efficacy beliefs improved with time, when they observed and worked with their colleagues (Wake and Whittingham, 2013, 186).

Aim of the study

The aim of this study was to investigate the implementation of the interactive whiteboard (IWB) into Science teaching during the primary educational cycle and teachers' perceptions about the use of IWB in the subject Science. Taking into consideration that the e-Schools project aims to increase information and communication technology (ICT) from 2015 in primary school in Croatia by providing ICT equipment and educational tools for schools and teachers, this paper tried to analyse the differences the perception of teachers teaching in schools that have an IWB and those teaching without them.

Methods

Participants

The study sample consisted of first to fourth grade teachers from several primary schools in the Republic of Croatia, which were surveyed during 2016. The teachers were divided into two groups based on the availability of the IWB in their schools. From the 104 teachers' responses, 65 of them were from schools without an IWB and 39 responded to our online questionnaire from schools with an implemented IWB .

Given that the application of educational software with the help of IWB is a novelty for the Croatian education system, online questionnaires were carried out to determine teachers' perceptions about their use of IWB and/or ICT in the Science teaching process.

Instruments

The questionnaire about ICT was developed for this study by observing and comparing the works by Lukša *et al*. (2014) and Kostović-Vranješ *et al*. (2014, 297), based on a literature review of prevailing conceptions of teaching (Blau and Shamir-Inbal, 2017, 777), and dialogues with students from the Faculty of Educational Sciences of the Juraj Dobrila University of Pula before their research practice. The research included forming and applying a questionnaire that consisted of four parts. The first part collected general information about gender, age and length of the respondent's professional experience. The second part included three general items dealing with the usage of ICT in Science teaching, education and attending lessons conducted with ICT by using responses on a 5-point Likert's scale (1 means "I strongly disagree" and 5 means "I strongly agree."):

– ICT Using: I use the majority of ICT available in my school.
– Online ICT Education: I participate to online education on ICT usage.
– ICT seminar attendance: I attend workshops and seminars about ICT education.

The third category included questions about the usage of ICT tools (IWB, Computer Projector, DVD, CD-ROM) and the frequency of usage during Science lessons (Cuckle and Clarke, 2002, 334). In the usage category of questions teachers could give the required responses on a 5-point Likert scale where 1 means never (less than once a month), 2 means rarely (once a month), 3 means sometimes (three to four times a month), 4 means often (once or twice a week) and 5 means always (three to five times a week).

The fourth category included questions (Türel and Johnson, 2012, 385) dealing with the types of interaction in the classroom when working with an IWB during Science lessons. The first three questions were open-ended, while others could be answered with yes/no.

– How many IWBs does your school have?
– In which themes do you prefer to use IWB during Science lessons?
– IWB competency: Do you think you are qualified to use an IWB for Science lessons? Please, give your comments.
– IWB development lesson: Do you prefer IWB for Science development lessons?
– IWB review lesson: Do you prefer IWB for Science review lessons?
– Educational outcomes: Do you think that IWBs promote higher learning outcomes in Science than the ones that would be obtained in traditional lessons?
– Creativity and motivation: Do you think that IWB encourages the creativity and motivation of students in Science lessons?

Statistical analyses

The data obtained in the questionnaire was analysed using the statistical package Statistica 12 (USA). The reliability of the used questionnaire for closed-ended question showed a high Alpha coefficient ($\alpha = 0.89$) that indicated a homogenous structure of the scale. The normality of distribution of the usage of ICT tools was tested with the Kolmogorov-Smirnov test which has shown that the results are normally distributed. Therefore, the t-test was used to determine statistically significant differences between teacher's perceptions and frequency usage from schools with and without IWB. The level of statistical significance

was set at $p<0.05$. The averages and standard deviation of the teachers' answers were calculated for each of the questionnaire categories.

Results and discussion

All teachers in the sampled primary schools were women, which is the usual current teachers' characteristic in the Republic of Croatia. Regarding age, most of the teachers were between 50-60 years old (38.88%), followed by those which were 40−50 (33.38%), 20−30 (16.67%) and 30−40 years old (11.10%). Most of the teachers in the sample (42.85%) had more than 10−20 years of teaching experience, followed by those with a 20−30 (33.33%) and 0−10 (23.80%) teaching years' experience.

In order to examine how the IWB implementation into schools affects ICT and IWB usage, we compared teachers' perceptions on ICT and IWB in Science teaching during the primary educational cycle. The results showed that teachers use ICT moderately in both schools with and without IWB. Moreover, teachers from schools with an IWB used ICT for Science lessons significantly more (see Table 1) than teachers from schools without an IWB. It is important to emphasize that the study was conducted mainly among teachers who were more than 40 years old. Half of the examined teachers have a 10−20 years' experience in teaching, which means that they did not have ICT in their university education. Our findings are consistent with previous studies in which teachers mostly explore the functions of new technology and do not necessarily use its full potential for enhancing teaching and learning (Aflalo *et al*., 2018, 526; Habeeb, 2018, 36). Although the usage of ICT is important at all levels of education, especially at the beginning of primary school education, the application of ICT for educational purposes depends primarily on individual ambitions and characteristics of a teacher (Kostović-Vranješ and Tomić, 2014, 302). Results found in this study on teacher's ICT usage can be explained by the fact that they do not attend seminars or online education to a satisfactory level. The professional development activities for ICT competence might increase ICT activities in Science teaching. With the growing attention paid to lifelong learning skills, teachers should be encouraged to participate in programs such as online ICT learning communities (Alt, 2018, 149).

Ongoing interactions might enrich primary school teacher's knowledge and skills obtained through periodic training programs. Through such communities and practice platforms, teachers can exchange information, converse through an online threaded discussion forum as well as within small and large group face-to-face meetings as part of their ICT professional development activities. Although ICT use, online education and seminar attendance did not show satisfactory results, by conducting the t-test it was found that teachers from schools without an IWB provided higher perspectives of ICT learning than in schools with an IWB (see Table 1). This could mean that schools, by introducing technologies, expect teachers to self-educate and study the literature accompanying ICT. From our perspective, professional development can act as a barrier hindering the introduction of ICT and IWB in Science, and also plays a key role in shaping and changing teachers' practices and beliefs.

Table 1. Results of the t-test on the influence of IWB in schools (school without and with an IWB) on ICT use, line education, and seminar attendance

Measurement	M	SD	M	SD	t-test
	Schools without IWB		Schools with IWB		
ICT use	3.20	0.75	3.60	0.62	2.97*
Online ICT education	2.80	0.92	2.40	0.49	-2.96*
ICT seminar Attendance	3.40	0.94	3.00	0.63	-3.84*

M – mean, SD − standard deviation, t – t-value functions, * statistical significance <0,001

The frequency of use of ICT in Science teaching for teachers teaching in a school with an IWB was higher than in schools without an IWB, however no significant difference was found by conducting the t-test (see Table 2). Teachers from schools with an IWB used it to a lesser extent. It is possible that after 3 or 4 years of IWB implementation teachers still do not feel that their technological skills are

sufficient for frequent use. Our results showed a relatively low level of computer usage in both schools without and with an IWB. It could be explained by the fact that schools and teachers were not equipped with computers to a satisfactory level. The e-School project started in 2005 and the experimental programme "School for Life" supports the e-Schools programme which was carried out through several projects aimed at introducing ICT into the school system and raising the level of digital literacy. Schools included in the project were be equipped with a computer for teachers, presentation classroom, tablets for students and an interactive classroom. Moreover, computers are desirable in Science teaching since they can be used to support digital textbooks which will be implemented with the new curricular reform "School for Life" in the Republic of Croatia. Other ICT uses like using the DVD and CD ROM in Science lessons are much less frequent. Teachers from both schools with an IWB and without it used them mostly less than computers in schools probably due to the increasing use of other ICT equipment. That was also the case for Science and other subjects in elementary schools (Cuckle and Clarke, 2002, 333).

Table 2. Results of t-test on the influence of IWB in schools (school without and with an IWB) on ICT use during Science lectures (n=104)

Measurement	M	SD	M	SD	t test	p
	Schools without IWB		Schools with IWB			
IWB	0.00	0.00	3.40	0.52		
Computer	2.95	1.67	3.36	1.17	0.74	0.46
Projector	3.65	1.52	3.34	0.97	-0.46	0.64
DVD	2.58	1.67	3.02	0.67	1.27	0.20
CD-ROM	2.40	1.22	2.77	1.40	1.00	0.32

M – mean, SD − standard deviation, t – t-value functions, p - statistical significance

All respondents from schools with an IWB reported the use of IWBs 3−4 times per month or once or twice per week (see Table 3). Almost the same number of teachers from schools with an IWB used the computer and projector on a monthly or weekly basis, or more of-

ten. DVD and CD-ROM usage in Science teaching for teachers from schools with an IWB varied in frequency, but was on average once a week. The use of some ICT in Science lessons was relatively frequent amongst teachers from schools without an IWB; computers and projectors were mostly used 3−4 times per month or once or twice per week. This is in sharp contrast to the earlier study from 2008 conducted in Croatian schools by Lukša *et al*. (2014, 32) which found that less than five percent of teachers used the computer and projector in Science lessons. This contrast is possibly due to the passage of time in which teachers developed skills and confidence for ICT usage. However, what was found to be a concerning fact is that around 20 percent of teachers used the computer and projector less than once a month. Computers and projectors were the mainly employed technology in Science lessons as was found in many studies (Cuckle and Clarke, 2002, 333; Zovko and Didović, 2013, 331). While access to computers and other ICT resources could be leveraged for enhancing student learning in Science, generally it has been found that teachers use technology more for administrative purposes or to support traditional instruction (Campbell *et al*., 2015, 562). Teachers from schools without an IWB used the DVD mostly once a month and the CD-ROM less than once a month. Teachers from schools with an IWB used the DVD mostly 3−4 times per month and the CD-ROM mostly less than once a month in Science lessons. Teachers in Science teaching have a variety of 3-D models, video contents, multimedia presentations on DVD and online contents that can allow a deeper understanding and visualisation of the teaching content. Thus, ICT plays an important role in the modernisation of Science education for teachers and students (Kostović-Vranješ *et al*. 2014, 288).

Table 3. Frequency (%) of ICT usage in primary schools without an IWB and with an IWB during Science lectures (n=104)

	<1 / month	1 / month	3-4 / month	1-2 / week	3-4 / week	<1 / month	1 / month	3-4 / month	1-2 / week	3-4 / week
ICT	Schools without IWB					Schools with IWB				
IWB	0	0	0	0	0	0	0	60	40	0
Computer	22	0	40	38	0	0	28	22	31	19
Projector	18	0	20	22	40	0	19	32	39	10
DVD	17	40	20	14	9	0	19	60	21	0
CD-ROM	34	23	20	15	8	10	49	10	11	20

All teachers from schools with an IWB indicated the availability of two IWBs which they could use during Science lessons. They emphasized that in their schools there is a small number of IWBs and IWB equipment compared to what they and their schools need. The penetration of the IWB to elementary schools is accelerated in the Republic of Croatia and in many countries due to e-School programmes and curricular reforms. Teachers were asked to describe the topics they prepared and used with an IWB in their Science lessons. Teachers reported the use of IWBs equally in each topic. Within all topics, depending on the grade, some teachers stated that experiments, proper nutrition and healthy food, puberty and plant parts were the most frequent topics shown on the IWB.

Table 4. Positive perspectives (%) on using the IWB expressed by Science teachers from schools without an IWB and schools with an IWB (n=104)

	School without IWB	School with IWB
IWB in development lessons	28.57	85.71
IWB in review lessons	100.00	100.00
Students creativity and motivation	80.00	100.00
Educational outcomes	57.14	78.57
IWB competency	35.71	42.86

Teachers were asked if they would use an IWB in developmental lessons if they had the IWB and support in their schools (see Table 4). There was little enthusiasm and little confidence for using IWB amongst teachers in schools without an IWB in the Republic of Croatia, while many teachers from schools with an IWB expressed their consent to its use. Teachers in school without an IWB preferred "traditional" methods in development lessons. This could be explained by the lack of time in Science Curriculum, despite the fact that IWB was found as time-efficient in classes (Türel and Johnson, 2012, 387); however, the majority of teachers in the previous study also admitted being unable to find enough time for their students to use the IWB. Moreover, the dialogic interaction between the teacher and the students in lessons using IWB was very limited (Aflalo *et al*., 2018, 534). Most of the time in primary school Science the teacher is at the focus of the lesson, determines the content, the structure and the space, so less space is left for the students' contribution. Use of technology, especially to support traditional instruction, sits in opposition to most recent standard documents in Science education that call for student problem solving and decision making with the help of ICT (MSES, 2011, 45). Therefore, except for the necessity of introducing ICT tools in school, it is necessary to interact with the students by giving lessons and asking questions with ICT. However, our results showed that the teachers would use an IWB in Science developmental lessons in schools with an IWB as it was found by the Aflalo *et al*. study (2018, 530). Furthermore, schools with an IWB went through a few years' technology assimilation, but the fact that teachers are optimistic gives us a chance for Science modernisation. Technology is changing rapidly and teachers are facing the difficult task of preparing themselves to the digital world in which all schools need to enable students to live in a technologically developed environment (Olivares and Castillo, 2018, 2320).

Teachers from school without an IWB and with it preferred to use the IWB in Science review lessons. Review lessons in Science should be used to enhance primary school students' skills, mainly related to visual literacy (Wake and Whittingham, 2013, 203). It is important that teachers had to consider multimodal reading and writing activities in Science.

The vast majority of teachers from schools without and with an IWB considered that IWB was relevant to student's creativity and that students were very motivated and enthusiastic about learning Science. Teachers thought that IWBs encouraged student motivation for Science. Balta and Duran (2015, 15) obtained similarly positive results from a study conducted in Turkey, exploring the students' perceptions that gave high ratings to their experiences and expectations with regard to IWBs. They also indicated that enthusiasm is greater among younger students and that it diminishes as they age.

About half of the teachers from school without an IWB and most of the teachers from schools with an IWB think that IWBs can raise the educational outcomes level in Science lessons. This is also reflected in natural sciences where IWB is steadily being integrated more deeply into the day-to-day context of elementary students' lives, contributing to a better realization of natural sciences outcomes, as well as motivated and interested students in schools (Petrović, 2015, 213).

Obtaining sufficient competency for the use of IWBs appeared very problematic. Less than half of the teachers in schools both without and with an IWB thought they were not educated for IWB usage. Comments were made about the general lack of the Internet and technical support in schools, IWB availability in classes, and the lack of all types of education for ICT use. These concerns ran across both school groups fairly equally. The research results indicate inadequate education of primary school teachers for the use of ICT in teaching Science, but also the general situation in our schools which can be seen in many studies (Kostović-Vranješ and Tomić 2014, 300; Lukša *et al*., 2014; Letina, 2015, 297). This research also shows the lack of appropriate materials in the Croatian language as one of the reasons for insufficient usage of ICT in teaching which is also in line with the teacher's comments from our study. As stated in the literature (Ertmer, 2005, 35), effective training to promote the use of ICT must be a long-term activity in order to support teachers in the integration of technology in Science teaching, which can last between five to seven years. Based on the fact that teachers' qualifications are the reason for applying or not applying ICT in teaching, we suggest that the government provide a laptop and internet connection, and make the attendance of seminars, workshops, conferences and refresher courses in ICT for Science teachers mandatory, like

in many other countries (Campbell *et al*., 2015, 577; Getenet *et al*., 2016, 21; Kontkanen *et al*., 2016, 919; Blau and Shamir-Inbal, 2017, 769; Lee *et al*. 2017, 1289; Grimalt-Álvaro *et al*. 2019, 18).

A key limitation in this study is that this research was done in 2016 at the beginning of the informatization process in Croatian schools. However, the application of technologies in teaching due to the Covid 19 showed the importance of ICT usage in distance learning. Technological advancements in education, especially in the area of ICT, enable teachers to employ various strategies that could actively engage students' interest for Science. These findings raise the importance of the place and role of the IWB in the advancement of pedagogic interaction in Science classes.

Conclusion

Due to the fact that this research was done at the beginning of the educational system informatization in the Republic of Croatia, the results of this study could depict the situation and offer basic information about teacher's perceptions on IWBs in schools.

In general, the teachers' perceptions toward the use of ICT in Science teaching in schools with an IWB are higher than in schools without it. What was found interesting in this study is that teachers from schools without an IWB attended more seminars and on-line educations on the use of ICT. This could suggest that teachers in schools with an IWB were more motivated to learn through instructions accompanying ICT tools or with the help of colleagues in their schools. The IWB is a dominant tool in Science teaching in schools with IWB, along with computers. Teachers use the IWB and computer once or twice a week, while they use DVDs mostly once a week. The computer and projector were used weekly or more often in Science lessons amongst teachers from schools without IWBs, while the DVD and CD-ROM were used once a month or less. Teachers that have two IWBs in their school showed very high perceptions toward the use of IWB in developmental and review lessons. What was very concerning is the fact that less than one third of teachers from schools without IWBs would use it if they had it, because they think that IWBs raise students' motivation and creativity for Science learning.

Since technology is continuously evolving, training with new tools must constantly be provided and this is quite challenging for the teachers, as they need to adapt their teaching to new digital tools. Moreover, schools should be equipped with at least one IWB and wired and wireless local area networks. Teachers should have laptops, tablets and projectors in order to introduce ICT into the educational and business processes.

Compliance with Ethical Standards. Ethical Approval: all procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee.

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STAVOVI UČITELJA O KORIŠTENJU PAMETNE PLOČE U NASTAVI PRIRODE I DRUŠTVA

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U radu se prikazuju rezultati istraživanja o korištenju pametne ploče u nastavi Prirode i društva te stavova učitelja o uporabi informacijske i komunikacijske tehnologije (IKT) u podučavanju tih nastavnih sadržaja. Istraživanje je provedeno putem online upitnika koji je bio poslan u škole u Hrvatskoj tijekom školske godine 2015/2016. Ukupno 104 učitelja iskazalo je svoje stavove: 65 učitelja iz škola bez pametne ploče, a 39 iz škola u kojima koriste pametnu ploču. Rezultati ukazuju na češću uporabu IKT u školama s pametnom pločom u usporedbi sa školama bez nje. Učitelji pametnu ploču i računala najčešće koriste jednom do dva puta tjedno, a DVD jednom tjedno. Rezultati također pokazuju pozitivne stavove učitelja o uporabi tehnologije za povećanje motivacije učenika i njihovih postignuća. Nalazi istraživanja ukazuju na kontinuiranu edukaciju usmjerenu na rad s pametnom pločom te tehničku podršku kao ključne za inovativnu nastavu. Buduća istraživanja trebala bi analizirati korištenje tehnologije u svim školama u Republici Hrvatskoj.

Ključne riječi: *informacijska i komunikacijska tehnologija, pametna ploča, nastava, Priroda i društvo*