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Characteristics of Using Digital Media as Predictors of Constructivist Teaching in Lower Secondary Education in Croatia

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Abstract

The aim of this research was to investigate whether particular socio-demographic characteristics of pupils in lower secondary education, their level of computer self-efficacy and motivation for using digital media in class are considered significant predictors of constructivist learning. Furthermore, the aim was to investigate the characteristics of possession of particular digital media, computer self-efficacy, motivation for using digital media and constructivist learning among pupils in lower secondary education in Croatia. The research was conducted on a sample of eighth grade compulsory school pupils ($N = 235$). The results show that certain socio-demographic features are either not significant or are significant to a small extent in constructivist learning. The level of computer self-efficacy was a somewhat more significant predictor, especially in terms of the use of computer software and the internet. The most significant predictors are attitudes towards the use of digital media in classroom instruction and the benefits thereof for pupils, especially in the sense of the expectation of better learning outcomes. The results and the implications of the results are discussed in this paper.

Keywords: digital media in classroom instruction, innovative learning, constructivist learning, compulsory education, computer self-efficacy, attitudes towards the media

Introduction

Creativity can be regarded as a skill for the 21st century, so it is justified to include it in school curricula (Piirto, 2011). Regardless of the theoretical basis of approaches to creativity (Kozbelt, Beghetto and Runco, 2010), researchers working in the field of creativity hold that innovation is its immanent feature (Piirto, 2011; Sawyer, 2006; Weisberg, 2006). From the aspect of didactics, innovativeness can be considered as innovative learning. The term innovative learning was defined by Botkin, Elmandjra and Malitza in the well-known Report to the Club of Rome titled "No Limits to Learning – Bridging the Human Gap (1979/1998). The authors define innovative learning as "…the type of learning that can bring change, renewal, restructuring, and problem reformulation" (Botkin et al., 1979/1998, p. 10). Besides, prominent features of innovative learning are participation and anticipation (Bognar and Matijević, 2002; Botkin, et al., 1979/1998). On the other hand, learning for the future, redefining and restructuring problems, and forming change are some of the characteristics of what has been

established over the last three decades as constructivist learning (e.g. Fosnot & Perry, 2005; Schwartz, Lindgren & Lewis, 2009). We cannot claim that innovative learning and constructivist learning are the same concepts, but they are nonetheless complementary. From the viewpoint of didactic theories, it is justified to say that innovative learning, as the implementation of creative ideas, the construction of one's own reality, or the creation of new ideas, is also one of the features of constructivist learning. This paper will analyse the link between constructivist learning and innovative learning as one of its features.

When we examine contemporary constructivist learning, it is necessary to take into account contemporary digital media (UNESCO, 2002). This primarily means that schools today have pupils who are members of the Net Generation (Tapscott, 1999). They should have access to active learning in which they cooperate, resolve problems, play, research, build, but with the assistance of digital technology. Therefore, it is justified to think about ways to organise constructivist learning via digital media.

Although there are various theoretical approaches to creativity (Kozbelt, Beghetto and Runco, 2010), one of its important aspects is divergent thinking, which is recognised from both the pedagogic and didactic aspect. The characteristics of divergent thinking, according to Guilford (1967) are: problem finding and solving, flexibility, fluency, elaboration, transformation, objectivity and selectivity, and aesthetic appreciation. Although not recent, Guilford's characteristics are current even in contemporary theories (Wright, 2010, p. 5). Jenkins (2006), in his explanation of pupils' skills in the digital and participatory culture of learning, offered a similar classification that might be regarded as manifest forms of the characteristics of creativity. In this sense, he mentions: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgement, transmedia navigation, and negotiation. Therefore, it is justified to presume that digital media can be significant for the development of innovation and can feature as an important variable in constructivist learning, especially in children of the Net Generation.

On the other hand, digital media are still mostly used in the paradigm of teacher -centred classroom instruction (Petko 2012). Issues that arise here concern what the significant factors of constructivist learning are and how these factors relate to one another. Such questions primarily include the role played by digital media, and the individual characteristics of pupils, such as the ability and motivation to use digital media in constructivist learning.

Constructivist learning and teaching in the digital age

We can analyse constructivism as philosophical, didactic and psychological theory (Kanselaar et al., 2002). Regardless of the type of theory, constructivism can generally be defined as the construction of one's own knowledge of the world and knowledge based on understanding and interpreting one's own experiences and interaction with the physical and social environment (e.g. Ernst, 1998, 2005; von Glasersfeld, 2003). The ideas and theories of constructivism are not new – they are a few thousand years old, especially in the philosophical (epistemological) context. It was only at the beginning of the 20th century that constructivism was differentiated from philosophy (Prichard and Woollard, 2010; von Glasersfeld, 2003). Since then, constructivism has been seen as the didactic and psychological theory of learning and teaching. There are two types of constructivism. The first is radical constructivism, defined as the wholly individual construction of reality and knowledge based on one's own experiences, prior knowledge and experience, and an understanding of interaction with the environ-

ment. The second type is social constructivism, defined as the individual construction of reality and knowledge, but greatly influenced by social interaction with other persons, and the social, cultural and historical context of the individual. Proponents of constructivism (irrespective of the type) are Ernst von Glasersfeld, Jean Piaget, Paul Ernst, Paul Watzlawick, Lev Vygotsky, etc. It is important to emphasise that this paper focuses on the didactic theory of constructivism and its features in learning, teaching and classroom instruction.

Constructivist learning and teaching can be defined as individual and cooperative, and the self-regulated and interpretative construction of one's own thoughts via active interaction with the social and physical environment (Fosnot and Perry, 2005). Yilmaz (2008, pp. 167-168), in his summary of the results of other studies, mentions the following features of constructivist teaching:

1) learning is an active process;
2) learning is an adaptive activity;
3) learning is situated in the context in which it occurs;
4) knowledge is not innate, passively absorbed, or invented but constructed by the learner;
5) all knowledge is personal and idiosyncratic;
6) all knowledge is socially constructed;
7) learning is essentially a process of making sense of the world;
8) experience and prior understanding play a role in learning;
9) social interaction plays a role in learning; and
10) effective learning requires meaningful, open-ended, challenging problems for the learner to solve (Boethel and Dimock 2000; Fox 2001, according to Yilmaz, 2008)

The didactic strategies of constructivist learning are inquiry-based learning, problem-based learning, cooperative learning, play-based learning, learning-by-doing, and project-based learning. They have been known since the early 20th century in the directions and movements of reform pedagogy, that is, in the ideas of Celestin Freinet, Maria Montessori, Rudolf Steiner, Georg Kerschensteiner, Alfred Lichtwark, Hugo Gaudig, Peter Petersen, and others (Matijević, 2001; Skiera, 2009). In this respect, it is justified to claim that the didactic elements of reform pedagogy are a precursor of what is now established under the term constructivist and innovative learning. In a more detailed analysis of the characteristics of reform pedagogy (Matijević, 2001; Skiera, 2009), we recognise what is referred to in creativity as the "four Ps" and, more recently, as the "six Ps" (Kozbelt, Beghetto and Runco, 2010), which stand for: *process*, *product*, *person (personality)*, *place*, *persuasion* and *potential*. These are some of the didactic elements emphasised by the directions and movements of reform pedagogy. On the other hand, they are also the elements of constructivist learning. In constructivist learning, it is important not only to learn something that is already known (discovered) but to create new knowledge, new information, to create and construct something new. It is precisely this creation of something new and useful that is the basic feature of innovation and creativity (Kozbelt, Beghetto and Runco, 2010).

Further, in terms of the question about the role of digital media in learning and teaching, one should start with what novelty digital media in classroom instruction offer in comparison with traditional media. When we abstract all the technological and functional characteristics of digital (new) media, what is really new is, according to Kanselaar et al. (2002): 1) the digital delivery and presentation of information in multimodal and simultaneous forms; 2) the performance of actions and actions via digital technologies that were until recently performed manually; and 3) computer mediated

communication. In the didactic context, these novelties allow for: 1) situational learning in "real" situations; 2) inquiry-based learning and problem-based learning with the help of digital media; 3) cooperative learning with digital media; 4) individualisation of classroom instruction; and 5) learning-by-doing (Kanselaar et al., 2002; Schulz-Zander and Tulodziecki, 2011). These are constructivist strategies of learning (Reich, 2006).

Acknowledging the mentioned premises on the role of digital media in constructivist learning, the results of empirical research show that in such teaching and learning the individual characteristics and differences of pupils must be taken into account (Leutner, 1993). Further, it is justified to claim that digital media encourage cooperative learning (Swak, Van Joolingen and De Jong, 1998). Intuitive knowledge can also be regarded as a characteristic of constructivist learning; Swak, Van Joolingen and De Jong (1998) claim that it develops through constructivist learning. It is precisely the use of digital media in constructivist classroom instruction that encourages the development of intuitive understanding, reflexive learning, flexibility, and knowledge integration (Reid, Zhang and Chen, 2003). The role of digital media should be viewed in terms of the motivation to learn, their role in cooperative learning, and the like (e.g., Schamburg and Issing, 2002). In other words, it is best to observe them as one of the variables of (constructivist) learning and teaching, and not as a predictor of efficiency in achieving learning outcomes (Tamim et al., 2011).

Although the role of digital media as a significant variable of (constructivist) lifelong learning has been recognised, the question still remains of how to implement such media in learning and in class. The question arises about what pupils' individual reasons to use digital media are when learning and when in class.

Use of digital media in class and in learning

Certain studies show that the human factor is more important for the optimum use of digital media in learning than the mere possession of such media (Beetham and Sharpe, 2007; Tamim et al., 2011). This is supported by Moos and Azevedo (2009) who claim that it is precisely motivation operating via computer self-efficacy and attitude that is significant for successful use of digital media. Pintrich and De Groot (1990) state the same thing when they include self-efficacy and the intrinsic values of learning as aspects of motivation and self-regulated learning.

The concept of computer self-efficacy is based on Bandura's theory of self-efficacy, and it is defined as conviction in one's own ability to perform a task (Bandura, 1977). It has been shown that the concept of self-efficacy is applicable in a number of fields, such as health, sports, business career, etc. (Bandura, 1997), but also in learning, teaching and classroom instruction (Tschannen-Moran, Woolfolk and Hoy, 1998). The concept of computer self-efficacy emerged in the mid 1980s as a result of the development of computer technologies (Murphy, Coover and Owen, 1989). Computer self-efficacy is defined as an assessment of one's own ability to use a computer for the purpose of achieving certain tasks and problem-solving (Whitley, 1997). It is interesting that younger persons apply a higher level of computer self-efficacy than older individuals (Topolovčan, Matijević and Dumančić, 2015; Whitley, 1997), which is significant in the context of classroom instruction. It is also interesting to mention that a higher level of computer self-efficacy can be connected with higher work control (Brosnan, 1998) and with self-regulated learning, cooperative learning, intrinsic motivation, and personal autonomy in work (Deng, Dool and Troung, 2004), which can be significant for constructivist learning.

Based on the well-known theory of motivation, that is, the expectancy-value theory of motivation, developed by Jacquelynne S. Eccles et al. (Eccles, 2005), which is often used in the context of classroom instruction and learning, Wozney, Venkatesh and Abrami (2006) developed a model of implementation and use of digital media in classroom instruction. Namely, they posited as their starting point that attitudes such as value and expectancy are important for the successful use of digital media. Value and expectancy relate to what digital media can bring about in the classroom. These authors added a third dimension of cost to the dimensions of value and expectancy. In their view, in terms of attitudes and the motivation to implement and use media in classroom instruction, expectancy, value, and cost are what are relevant. Accordingly, they constructed an instrument to examine the implementation of new technologies in the classroom, the Technology Implementation Questionnaire (TIQ), although they used it on a sample of teachers. The question is whether it applies to a sample of pupils.

Based on an analysis of the results of previous research, it is evident that the use of digital media in (constructivist) learning should be considered with regard to other factors, primarily motivation and the ability to use such media. In this respect, it is apparent that motivation and the ability to use digital media are significant but separate factors of constructivist learning and teaching. The question is what their role and relationship are when they are observed together as predictors of constructivist learning. The empirical research presented below was conducted to investigate this.

Methodology

The aim of this research was to examine whether certain demographic characteristics of pupils, the possession of digital media at home, computer self-efficacy, and attitudes towards the use of digital media (motivation) in the classroom can be regarded as significant predictors of constructivist learning. The research also aimed to investigate characteristics of possession of particular digital media, the levels of computer self-efficacy, motivation for using particular digital media in teaching, and constructivist teaching in lower secondary education.

Sample

The study included eighth-grade (ISCED level 2) compulsory school pupils (N = 235) from three counties in north-western Croatia (the County of Bjelovar-Bilogora, the County of Zagreb, including the City of Zagreb, and the County of Međimurje). The sample included 118 (50.2%) male and 117 (49.8%) female pupils. A total of 205 (87.2%) live in towns, and 30 (12.8%) pupils live in the country. Their final average results at the end of the previous grade were as follows: excellent for 91 (38.7%) pupils, very good for 105 (44.7%) pupils, good for 33 (14%), satisfactory for 5 (2.1%) pupils, and unsatisfactory for 1 (0.4%) pupil.

Instruments

Along with demographic data on gender (male/female), permanent residence (town/village), and the average overall mark in the previous grade, data were also collected on the possession of digital media at home, relating to the computer, access to the internet, mobile phone, smart phone, multimedia software, tablet, and a profile on one of the social networks, as recorded by a *Yes/No* answer. To collect data on computer self-efficacy, to the implementation of digital media in the classroom, and constructivist

learning, relevant scales were used: the Constructivist Learning Environment Scale (Taylor, Fraser & Fischer, 1997), the Computer Self-efficacy Scale (Teo & Ling Koh, 2010) and the Technology Implementation Questionnaire (Wozney, Venkatesh and Abrami, 2006).

Constructivist Learning Environment Scale

Data on constructivist learning were collected through the instrument Constructivist Learning Environment Scale (CLES) developed by Taylor, Fraser and Fischer (1997). The scale was translated into the Croatian language, with the permission of the authors, and, following back-translation into English, certain terms were modified. The scale originally consists of thirty-five items on a four-point Likert scale (1 – *strongly disagree* to 4 – *strongly agree*), where seven of them form five latent dimensions/ subscales: personal relevance, uncertainty, critical voice, shared control, and student negotiation. In this paper, in view of the nature of the problem and cultural differences, only four dimensions were used. The dimension of uncertainty of learning was not used. Considering that the scale was translated and that certain parts were modified, the exploratory factor analysis was conducted with a Varimax rotation and an eigenvalue greater than 1.0 and a saturation of 4.0. It was shown that the data are suitable for analysis (KMO = .843; and Bartlett's test of sphericity was significant, χ^2 = 2073.91; p = .000). Seven latent factors were obtained which together account for 57.67% of the total variance. In the original factor structure, there are four factors, and the scree plot test also revealed a potential four factors, so a confirmatory factor analysis with four factors was conducted. The four factors account for 45.43% of the total variance and they replicate the original factor structure (the number and distribution of items based on the original latent factors). For this reason, the original factor structure of the scale with the original number of dimensions and their items was retained. The factors show satisfactory internal reliability according to the Cronbach alpha test (Table 1). The possibility of using the original factor structure is also indicated by the intercorrelation of factors (Table 2).

Computer Self-efficacy Scale

To collect data on computer self-efficacy, we used the Computer Self-efficacy Scale (CSES) developed by Teo and Ling Koh (2010). With their permission, it was back-translated. The scale consists of twelve items on a four-point Likert scale (1 – *strongly disagree*, to 4 – *strongly agree*) which include three latent dimensions/subscales of computer self-efficacy. The first dimension is basic computer skills that consist of five statements, the second one is media-related skills with four statements, and the third one is web-based skills with three statements. The exploratory factor analysis was conducted with a Varimax rotation and an eigenvalue greater than 1.0 and a saturation of 4.0. Data were suitable for analysis (KMO = .891; and Bartlett's test of sphericity was significant, χ^2 = 1343.91; p = .000). Two factors together were shown to account for 59.55% of the total variance. Considering that the original factor structure consists of three factors, a confirmatory factor analysis with three factors was conducted. The three factors account for 67.13% of the total variance and they replicate the original factor structure, where the new third factor has an eigenvalue less than 1.0, that is, .91. This is why the original factor structure of the scale with an identical number of manifest statements and latent dimensions was retained. Based on the Cronbach alpha test, it was shown that the factors have mostly satisfactory internal reliability (Table 1). The

justifiability of using the original factors is also confirmed by their significant intercorrelations (Table 2).

Technology Implementation Questionnaire

Data on attitudes and motivation to use digital media in the classroom were collected through the Technology Implementation Questionnaire (TIQ) developed by Wozney, Venkatesh and Abrami (2006). The scale was translated following permission from the authors and, considering that it was originally constructed for a sample of teachers, it was modified for a sample of pupils. The scale consists of thirty-three items distributed into three latent dimensions/subscales. The first dimension is expectancy and includes ten statements; the second one is value and consists of fourteen statements; and the third one is cost and consists of nine statements. The statements are constructed in the form of the original six-point Likert scale, but for the purposes of this paper four points were used (1 – *strongly disagree*, do 4 – *strongly agree*). Considering that the scale was translated, and that certain parts were modified, an exploratory factor analysis with a Varimax rotation and an eigenvalue greater than 1.0 and a saturation of 4.0 was performed. Data were suitable for analysis (KMO = .91; and Bartlett's test of sphericity was significant, $\chi^2 = 2707.71$; $p = .000$). Seven latent factors were obtained that account for 54.37% of the total variance. Considering that the original factor structure includes three factors, and that the scree plot test indicated a potential three factors, a confirmatory factor analysis with three factors was conducted. The set three factors account for 39.71% of the total variance and they replicate the original factor structure in a satisfactory manner, that is, the factors obtained can be interpreted. This is why the original factor structure of the scale was retained with the original distribution of items and latent factors. According to the Cronbach alpha test, the factors showed low internal reliability (Table 1), but the intercorrelations of the factors were statistically significant (Table 2).

Table 1: Characteristics of used scales

Scale		N of items	Sample item	*M*	*SD*	á
Constructivist learning environment scale	Personal relevance	7	I learn about the world outside of school.	2.96	.57	.72
	Critical voice	7	It's OK to ask the teacher "why do we have to learn this"?	2.97	.57	.69
	Shared control	7	I help the teacher to plan what I'm going to learn.	2.39	.62	.72
	Student negotiation	7	I ask other students to explain their ideas.	2.71	.58	.73
Technology implementation questionnaire	Value	10	Is effective because I believe I can implement it successfully.	2.88	.51	.81
	Expectancy	14	Increases my academic achievement (e.g., grades).	2.71	.45	.63
	Cost	9	*Is not too costly* in terms of resources, time and effort.	2.31	.37	.29
Computer self-efficacy scale	Basic computer skills	5	I am able to use the internet to search for information and resources.	3.59	.58	.84
	Media-related skills	4	I am able to use video editing software (e.g. Microsoft Movie Maker, Adobe Premier, and Ulead Video Studio).	2.74	.87	.85
	Web-based skills	3	I am able to use conferencing Software (e.g., Yahoo, IM, MSN Messenger, ICQ, and Skype) for collaboration purposes.	2.97	.77	.60

The procedure

The data were collected in January 2016 in a survey questionnaire using the paper-pen method. The research was conducted in line with the code of ethics for research with children and young people. The completion of the questionnaire was completely voluntary and anonymous, and the respondents could decide to discontinue the questionnaire at any time.

Results

In terms of the possession of individual digital media at home, it was seen that 229 (97.4%) pupils own a computer, 226 (96.2%) have access to the internet, 227 (96.6%) have a mobile phone, 208 (88.5%) multimedia software, 224 (95.3%) pupils own a smart phone, 162 (68.9%) a tablet, and 220 (93.6%) have a social network profile. Further, it was revealed that pupils show an above-average level of computer self-efficacy, an interest in constructivist classroom instruction in most of its dimensions, and positive attitudes and motivation to use digital media in most of their dimensions (Table 1).

Table 2: Factor intercorrelations

2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
.10	.15*	-.10	-.15*	-.18**	-.06	-.10	-.09	-.12	.05	-.03	.18**	.04	.05	-.19**	.01	.00	.01	-.02
	-.02	-.06	-.01	-.00	-.05	-.02	-.01	.00	.04	.00	-.06	-.11	-.08	-.17**	-.09	-.18**	-.14*	.12
		-.10	-.24**	-.04	-.17**	-.08	.02	-.01	.20**	-.08	.00	.12*	.10	-.09	.06	.04	-.01	-.06
			.53**	.56**	.28**	.60**	.12	.39**	-.14*	.00	-.01	.11	.07	.14*	.09	-.11	-.12	.13*
				.69**	.41**	.58**	.15*	.49**	-.21**	.03	-.050	-.07	.02	.15*	.13*	-.12	-.08	.04
					.30**	.62**	.17**	.52**	-.12	.04	-.06	.05	.08	.21**	.10	-.07	-.06	.06
						.29**	.24**	.23**	-.17**	-.10	-.11	-.05	.07	.09	.07	-.12	-.09	.06
							.15*	.43**	-.13*	-.01	-.02	.06	.04	.11	.04	-.04	-.11	.01
								.12	-.03	-.11	-.09	-.05	-.04	-.02	.01	-.20**	-.10	.11
									-.20**	-.08	-.20**	.04	.06	.07	-.01	-.08	-.05	.06
										.55**	.49**	.16**	.17**	.05	.10	.25**	.18**	-.17**
											.64**	.20**	.17**	.18**	.13*	.20**	.16*	-.14*
												.15*	.19**	.13*	.20**	.22**	.11	-.18**
													.64**	.45**	.49**	.35**	.34**	-.22**
														.43**	.49**	.32**	.37**	-.24**
															.65**	.12*	.29**	-.07
																.21**	.25**	-.16*
																	.54**	-.53**
																		-.41**

*p<.5; **p<.01

Considering that there are satisfactory preconditions, a hierarchical three-step regression analysis was conducted. The correlations between factors are also satisfactory (Table 2). The steps of the hierarchical analysis followed the logic that the first step should entail fewer variable socio-demographic variables (such as pupils' gender, residence, marks, and the possession of digital media). The second step includes computer

self-efficacy. The third step, as a possible consequence of computer self-efficacy, includes attitudes and motivation to use digital media in learning and classroom instruction.

The hierarchical regression analysis (Table 3) showed that socio-demographic characteristics are important factors (F (10, 224) = 1.874; p = .050; R = .278; R^2 = .077), but they account for only 7.7% of the personal relevance of learning variance, where pupils who have access to the internet at home were shown to indicate more personal relevance. The second step of the analysis included computer self-efficacy that proved to be a significant predictor, along with the socio-demographic characteristics (F (13, 221) = 2.433; p < .001; R = .354; R^2 = .125), and accounts for a total of 12.5% of the variance. Computer self-efficacy on its own further increases the accuracy of the prediction of personal relevance of learning by 4.8% at a statistically relevant level (F changes (3, 221) = 4.043; p < .001). It can be seen that pupils who have access to the internet and who have a higher level of self-efficacy in using computer programmes are more likely to indicate a higher personal relevance of learning. In the final step of the analysis, attitudes to the implementation (use) of digital media in classroom instruction along with the previous two series of factors are significant predictors of the personal relevance of learning (F (16, 218) = 4.525; p < .001; R = .499; R^2 = .249), and they account for 24.9% of the total variance of the personal relevance of learning. At a statistically significant level, attitudes to the implementation of digital media in classroom instruction increase the accuracy of the prediction of personal relevance of learning on their own by 12.4% (F changes (3, 218) = 12.013; p < .001). In the final step of the analysis, it was shown that pupils who own a computer to a lesser extent, but who have greater access to the internet, who have a higher level of self-efficacy in using computer programmes and more positive values and expectations from the use of digital media in instruction are more likely to have a higher level of personal relevance of (constructivist) learning.

Socio-demographic characteristics are not significant predictors (F (10, 224) = 1.057; p > .05; R = .212; R^2 = .045), and they account for only 4.5% of the variance of critical voice. Further, computer self-efficacy and socio-demographic characteristics are statistically significant predictors (F (13, 221) = 1.856; p < .05; R = .314; R^2 = .098), and they account for a total of 9.8% of the variance. Computer self-efficacy further increases the accuracy of the prediction of critical voice in learning by 5.3% at a statistically significant level (F changes (3, 221) = 4.362; p < .01). In the third step, attitudes to the implementation (use) of digital media in classroom instruction along with the previous two series of factors are significant predictors of critical voice in learning (F (16, 218) = 4.131; p < .001; R = .482; R^2 = .233), and they account for 23.3% of the total variance. Attitudes to the implementation of digital media in instruction increase on their own the accuracy of the prediction of critical voice in learning by 13.4%, which is statistically significant (F changes (3, 218) = 12.713; p < .001). It was shown that pupils who own multimedia software to a greater extent and who have more positive expectations from the use of digital media in classroom instruction are more likely to have a higher level of critical voice in (constructivist) learning.

It was shown that socio-demographic characteristics are significant predictors (F (10, 224) = 2.800; p < .01; R = .333; R^2 = .111), and they account for 11.1% of the shared control in learning variance. Pupils who own a mobile phone and those who live in towns are more likely to have shared control in learning. Computer self-efficacy along with socio-demographic characteristics are statistically significant predictors (F (13, 221) = 2.772; p < .01; R = .374; R^2 = .14) of shared control in learning and they account for a total of 14% of the variance. Computer self-efficacy further

accounts for 2.9% of the total prediction, which is not a statistically significant increase (F changes (3, 221) = 2.494; $p > .05$). It should be noted that male pupils, those who live in towns, and to a lesser extent those who own mobile phones are more likely to have shared control in learning. In the third step of the analysis, the attitudes on the implementation (use) of digital media in classroom instruction, along with the previous two series of factors, are significant predictors of shared control in learning (F (16, 218) = 3.72; $p < .001$; $R = .463$; $R^2 = .214$), and they account for 21.4%% of the total variance. Attitudes to the implementation of digital media in classroom instruction, on their own, account for 7.4% of the prediction of shared control in learning at a statistically significant level (F changes (3, 218) = 6.87; $p < .001$). It was shown that male pupils and those who own a mobile phone to a lesser extent and who have more positive expectations from the use of digital media in classroom instruction are more likely to have a higher level of shared control in (constructivist) learning.

It was shown that socio-demographic characteristics are not significant predictors (F (10, 224) = 1.246; $p > .05$; $R = .230$; $R^2 = .053$) and they account for only 5.3% of the student negotiation variance. In the second step of the analysis, we included computer self-efficacy that together with socio-demographic characteristics is not a statistically significant predictor (F (13, 221) = 1.663; $p > .05$; $R = .299$; $R^2 = .089$) and it accounts for a total of 8.9% of the variance. Computer self-efficacy, on its own, accounts at a statistically significant level for 3.6% of the student negotiation prediction (F changes (3, 221) = 2.947; $p < .05$). It is evident that pupils who have a higher level of self-efficacy in using the internet are more likely to have better student negotiation. In the final step of the analysis, attitudes to the implementation of digital media in classroom instruction, along with the previous two series of factors, are significant predictors for student negotiation (F (16, 218) = 2.506; $p < .001$; $R = .394$; $R^2 = .155$), and account for 15.5%% of the total student negotiation variance. Attitudes to the implementation of digital media in classroom instruction on their own further account at a statistically significant level for 6.6% of the student negotiation prediction (F changes (3, 218) = 5.699; $p < .01$). It is evident that pupils with a higher level of self-efficacy in using the internet and more positive expectations from the use of digital media in classroom instruction are more likely to have better student negotiation in (constructivist) learning.

Table 3: Hierarchical regression analysis

Factor	Personal relevance		Critical voice		Shared control		Student negotiation	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	.077		.045		.111		.053	
Gender		.04		.06		-.13		.03
Residence		-.10		-.08		-.15*		-.09
Marks		.08		.11		-.06		.10
Computer		.15		.04		.03		.05
Internet		-.23*		-.05		-.03		.17
Mobile phone		.10		.11		.24*		.07
Multimedia software		-.02		.09		.03		.03
Smart phone		.04		-.03		-.03		-.08
Tablet		-.06		-.07		-.08		-.01
Social networks		.04		.06		-.05		-.12
Step 2	.048		.053		.029		.036	
Gender		.04		.04		-.15*		-.00
Residence		-.10		-.07		-.14*		-.07
Marks		.09		.10		-.05		.10
Computer		.16		.04		.02		.04
Internet		-.24*		-.06		-.04		.16
Mobile phone		.07		.09		.23*		.06
Multimedia software		.00		.12		.06		.06
Smart phone		.05		-.04		-.03		-.09
Tablet		-.04		-.06		-.06		-.00
Social networks		.0		.08		-.01		-.07
CSE-BCS		.050		.09		-.01		.03
CSE-MRS		.19*		.06		.10		-.01
CSE-WBS		-.01		.12		.09		.18**
Step 3	.124		.134		.074		.066	
Gender		.05		.04		-.16*		-.00
Residence		-.03		.01		-.11		-.02
Marks		.10		.11		-.03		.12
Computer		.21**		.09		.04		.08
Internet		-.22*		-.05		-.04		.17
Smart phone		.05		.06		.21*		.04
Multimedia software		.01		.14*		.07		.07
Smart phone		.04		-.03		-.00		-.08
Tablet		.01		-.01		-.06		.02
Social networks		.06		.07		-.02		-.08
CSE-BCS		-.02		.02		-.03		-.01
CSE-MRS		.18*		.03		.07		-.02
CSE-WBS		-.02		.11		.11		.17*
TIQ-Value		.19*		.13		-.05		.08

Table 3: Hierarchical regression analysis

Discussion

It is evident that over 95% of pupils own a computer, have access to the internet, have a mobile phone, smart phone, and a profile on one of the social networks, while to a lesser extent they own multimedia software and a tablet. The results are in line with previous studies (Topolovčan, Matijević and Dumančić, 2015), especially as confirmed by the growing trend of owning a tablet computer (ibid.). On the other hand, it was shown that pupils have an above-average level of computer self-efficacy in all its dimensions; this, along with possession, asserts that they are members of the Net Generation. This interpretation is confirmed by the result that pupils are likely to engage in constructivist learning and have positive attitudes and motivation to use digital media in learning and classroom instruction (see the arithmetic means in Table 1). This simply confirms that pupils of the Net Generation, either deliberately or unconsciously, seek classroom instruction that is student-centred via digital media.

It is evident that socio-demographic characteristics, including the possession of digital media as a major determinant of socio-economic status, are significant only in two dimensions of constructivist learning (personal relevance and shared control), while in the other two they are not, which can be explained in a way that for critical voice and student negotiation the possession of media is not of crucial significance. Even when they are significant as predictors, socio-demographic characteristics account for an extremely small variance of the prediction of the dimensions of constructivist learning, as confirmed by the fact that the possession of digital media in itself does not have much significance in learning (Beetham and Sharpe, 2007; Tamim et al., 2011).

On the other hand, computer self-efficacy, especially in the dimensions of personal relevance, critical voice and student negotiation, is more significant for constructivist learning. This can be explained by the fact that today many activities are connected with work via digital media, including searches for information as an important segment of critical voice, as well as cooperation and communication taking place via digital media, which is to a certain extent in line with some of the results of other research (Deng, Doll and Troung, 2004; Johnson, 2005; Teo and Ling Koh, 2010), while control of learning is not so connected with digital competence, although Brosnan (1998) claims otherwise.

The most significant and the highest percentage of prediction of all dimensions of constructivist learning relates to attitudes and the motivation to use digital media in learning and classroom instruction, especially the factor of expectation of improvement of learning with digital media. It is desirable to point out that two of the three dimensions had a lower level of scale reliability, which can have an impact on the result. Attention should be paid to the last step of the regression analysis where significant factors are visible amongst everything included in the analysis. Thus, the lower incidence of possession of a computer is relevant for the dimension of personal relevance of learning. This can be interpreted in that today's pupils do not regard the computer as an important element of holistic learning, but more of an everyday tool that they use unconsciously, inter alia, for learning. On the other hand, the significance of the male gender in shared control of learning can be explained by gender roles, where boys are still expected to control various situations. In the same dimension, a lower level of possession of a mobile phone is significant, that is, a higher level of possession of a mobile phone is connected with less shared control of learning. This can be explained by the fact that ordinary mobile phones have fewer functional possibilities

than smart phones that are some sort of mini computers. Thus, smart phones, it can be presumed, enable better shared control of learning.
At the level of comparative analysis, positive attitudes and a higher level of computer self-efficacy are more significant for constructivist learning than certain basic socio-demographic characteristics and the possession of digital media. This only confirms previous findings stating that the human factor is more significant for learning with digital media than technology (Beetham and Sharpe, 2007; Tamim et al., 2011; Topolovčan, Matijević and Dumančić, 2015).

Conclusion

Based on the theoretical, comparative and historical analysis, it is evident that the concepts innovative and constructivist learning, although not synonymous, are related and complemented concepts. Furthermore, it can be claimed that strategies of constructivist learning are not recent, but have been formed over 100 years ago in the directions and movements of reform pedagogy. Here we refer to pedagogical ideas of Celestine Freinet, Maria Montessori, Rudolf Steiner, John Dewey, Hugo Gaudig, and others. It is clear, particularly in the directions and movements of the reform pedagogy, that innovative learning and creativity development were encouraged. On the other hand, it has been recognized that today, in the 21st century, i.e. the digital era, the use of digital media in teaching emphasizes the need for constructivist learning. In other words, it reaffirms and provides new meanings to didactic elements of the directions and movements of the reform pedagogy, and in that way emphasized the development of innovativeness and creativity. Surly, previous studies have shown that for optimal constructivist learning with digital media, particular socio-demographic characteristics of pupils and their skills and motivation for using digital media are also significant.

On the basis of this empirical research, we can state that today almost all pupils own a computer, have access to the internet, have a mobile phone and smart phone, and a profile on one of the social networks, while they own multimedia software and tablets to a lesser extent, although possession of these last two is on the rise. Pupils also state that they have an above-average level of computer self-efficacy in all its dimensions and mostly have positive attitudes towards and motivation to use digital media in classroom instruction. This asserts that they are members of the Net Generation, and that they have a high level of possession of digital media.

The results show that pupils are more likely to engage in constructivist learning, which can to a certain extent be regarded as a good indicator of their readiness for lifelong (informal) learning in the digital age, although the extent to which such classroom instruction is organised for them is not known. The socio-demographic characteristics of pupils, including the possession of digital media, computer self-efficacy and attitudes towards using digital media in classroom instruction, account mainly for one quarter of the variance of the dimensions of constructivist learning, indicating that there are some other significant factors in learning other than the role of digital media (such as prior knowledge, type of material, learning outcomes, etc.). In the part that is accounted for, it is evident that the socio-demographic characteristics of pupils and the possession of digital media are the least significant for constructivist learning. On the other hand, a higher level of computer self-efficacy, especially in the skills of using computer programmes and the internet and more positive attitudes and motivation to use them in classroom instruction, and especially greater expectations in terms of improved learning with digital media, are more significant.

Overall, this research confirms that media are not the most significant factor in learning with such media, but that they are only one of the factors in the learning process. In this regard, and considering that they were not the subject-matter of this study, it is recommended that a wider spectrum of factors of potential significance for learning, and not only the issue of digital media, be encompassed in future research. Such research would yield much more complete knowledge about constructivist learning.
Finally, caution is necessary concerning certain limitations of this research. One of the possible limitations is that the instruments used in this study were constructed in different social, cultural and value contexts from those in Croatia, which might have caused slightly different factor structures. Another limitation is that the sample includes only eighth grade pupils of compulsory education. It is possible that the results would have been different if the study had included pupils from other grades, as well as secondary school pupils (ISCED level 3). These limitations also open new challenges for further research into these issues.

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