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Fourth Industrial Revolution and digital competences of teachers

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Abstract

The new era of the 4IR requires changes in teachers' initial education and in their professional advancement. Serbia is a developing country whose institutions of education are technologically underdeveloped and whose expansion in the field of digitalization is still insufficient to be on par with the developed western countries. The authors' research goal was to determine whether potential improvement in teachers' digital competences has occurred. The general hypothesis postulated implied a low level of the use of digital tools in schools on the territory of Serbia. The descriptive method and scaling technique were used. The research results show that science and technology teachers apply digital tools while teaching more frequently than the teachers of social sciences and humanities. The research implies that a strategic approach to Serbian teachers' digital education is necessary even during their undergraduate studies by introducing digital technology courses and subjects in the conventional academic curricula.

Keywords: Education, Digital competences, Teachers, Serbia, Fourth Industrial Revolution

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1. Introduction

The development of the digital culture in the twenty-first century has contributed to a frequent use of digital resources and tools in schools (Kong, 2014). Social changes characterized by an upward trend in digitalization have initiated an alteration in the competences expected from teachers who educate future generations (Yaman, Aydemir, & Demirtaş, 2012). In an electronically oriented society, digital literacy is a crucial factor in employment and involvement in many aspects of social life (Martin & Grudziecki, 2006). Digital competences are one of the most frequently used concepts in scholarly papers and reference materials (Porln & Snchez, 2016). However, the digital competence of teachers employed at schools is still regarded not as a standardized but rather as an evolutive concept connected to a growing development of digital technologies (Ilomäki, Paavola, Lakkala, & Kantosalo, 2016).

Teachers' capacity and suitability for applying digital tools are described in scholarly literature by various terms, the most recurring being competences, literacy and skills (Aesaert, van Nijlen, Vanderlinde, & van Braak, 2014), the terms which are frequently used as synonyms and in similar contexts (Markauskaite, 2006). The concept of digital competences and literacy has been in existence since 1980 (Buckingham, 2015). Yet, the definition of the concept of digital competences is still a matter of scientific debate (Jara et al., 2015).

One of the fundamental characteristics of competences is the ability to work and act successfully in altered contexts and conditions (Modelski, Giraffa, & Casartelli, 2019). Teachers' digital competences cannot be analyzed as an isolated collection of knowledge and skills, but rather as a constituent part of a group of various competences essential in a digital era (Voogt, Erstad, Dede & Mishra, 2013), the competences necessary for a successful accomplishment of professional roles, tasks and obligations in contemporary schools (Machado, Sepúlveda & Montoya, 2016). Ristić (2018) states that teachers' digital competences are dynamic and complex not only because of the already dynamic development of the ICT but also because of their being closely related to teachers' pedagogical, psychological, methodical, didactic and subject knowledge competences, the development of teachers' digital competences aimed at fostering a stimulative teaching environment starts with the basics of the ICT education and continues up to the moment teachers are competent enough to apply the ICT in teaching and later in their professional improvement. Digital technologies are useful only on condition teachers working in institutions of education be skilled and able to use them. It is worth mentioning that the process of the development of teachers' digital competences presupposes the following stages: 1. detection of the digital technologies' potential in teaching, 2. teachers learn how to use digital tools, 3. teachers know where and when to use these tools, 4. teachers are trained to use these tools, depending on the characteristics of the subjects they teach.

This leads to a conclusion that the acquisition of knowledge and skills for the application of digital technologies is the teachers' full responsibility and obligation if they tend to be competitive at the labour market and functional in the education system of a digitalized society (Ferrari, 2012). Teachers who teach in a modern school system have to be skilled to educate present and future generations of pupils who are technologically literate and experienced in using digital tools (Ally, 2019). However, teachers' digital competences presuppose much more than simple skills of handling digital devices; they include numerous cognitive, motor, sociological, emotional skills (Eshet-Alkalai, 2004), as well as instrumental knowledge necessary for the use of digital tools and media, skills of communication, cooperation, learning, problem solving in a digital environment and attitudes to the use of digital resources in a critical, creative, responsible and autonomous manner (Atabek, 2020; Ala-Mutka, 2011).

A digitally competent and literate teacher is able to communicate with colleagues, students and parents, using various digital tools and applications (mobile phones, Internet, etc.). Moreover, such a

teacher possesses the skills needed for searching the web, understanding and critical approach to digital information that they transfer to their students in class as well as the knowledge necessary for an adequate interpretation of media contents (regarding the fact that the majority of contemporary media are digitalized) (Ferrari, 2012).

Martin (2005) emphasizes that digital competences involve an indivdual's conscience, consciousness and ability to appropriately use digital tools and devices for the purposes of digital resources' identification, access, management, integration, assessment, analysis and synthesis.

In accordance with the aforementioned, it is concluded that a teacher's digital competence represents a multidimensional concept that implies not only technical skills but also various cognitive and metacognitive processes needed for an efficient application of digital products and tools in teaching (Calvani, Fini & Ranieri, 2010).

Kruz and Diaz (2016) demonstrate that, regardless of schools being equipped with digital resources and technological potentials of the so-called "Internet generation", the essential role in the development of students' digital competences is that of teachers who are able to successfully integrate modern technologies in their teaching practice (Tondeur, Aesaert, Pynoo, van Braak, Fraeyman & Erstad, 2017; Makoe, 2012). However, it is important to emphasize that teachers' willfulness to use digital products does not necessarily imply their application in a critical, adequate and reasonable manner in education (Lei, 2012). Reasearch results frequently prove that teachers do not use digital tools' potentials to their full nor do they apply digital products in an appropriate manner in teaching. These results are partially explained by the fact that teachers' training in this field is not very efficient (Jones, 2014). Also, teachers have difficulty in accomplishing and sustaining their level of digital competence owing to the fact that digital technologies are prone to rapid changes (Artun, 2016) and innovations with which it is not very easy to keep the pace (Lock & Kingsley, 2007).

Additionally, schoolchildren, the so-called digital natives, are most often more competent digital tools' users than their teachers. Mark Prenski (Prensky, 2001) explaines in numerous of his published articles that the capacities of the students of the new generation are inherent self-confidence in using new technologies, such as the Internet, video games, mobile phones and other digital tools.

Yet, the results of the reasearch conducted by Guo and his associates (Guo, Dobson & Petrina, 2008) show that the differences related to the level of digital literacy between the so-called "digital natives" (students, pupils) and digital immigrants (teachers) are exaggerated and are more evident in the fact that children use technologies more often and acquire digital skills at a very young age than in the fact referring to the capacity of both groups to use digital tools. In accordance with the aforementioned, the fact remains that schoolchildren being the most faithful users of modern techologies does not necessarily imply that they possess inherent digital skills and competences that they apply when they study (Comba, 2011). Therefore, it is assumed that the new millenium teachers develop their own digital competences continually in order to provide their students with more efficient learning, more creative teaching and more training for the use of digital tools in a critical and productive manner. Besides training and courses of digital technologies, it is necessary to continuously assess the level of teachers' digital literacy and competence (Põldoja, Väljataga, Laanpere & Tammets, 2014).

Teachers' digital literacy is determined by law and relates to the level of their knowledge, planning, informing, application and improvement, defining teachers as the subjects in this process, whereas direction and motivation of students for the use of digital technologies is not stated (Ristić, 2018). However, Ślusarczyk (2018) explaines the concept of Industry 4.0 is a new reality of the modern economy as a very important role in each organization. Despite the fact that there exist national

frameworks and standards pertaining to teachers' digital competences in theory, the lack of tools and instruments necessary for their correct, reliable and valid assessment is evident (Põldoja et al., 2014). The Fordist-type of mass-producing manufacturing are increasingly obsolete in the 21st century. Technological innovations have heralded a Fourth Industrial Revolution (Naudé, 2017). The aforementioned leads to the conclusion that the new ear, characterized by information and communication technologies understood as a prerequisite for modern education, requires that teacher's initial education and professional advancement be thoroughly changed. Qualifications, competencies and experiences of teachers are very important in planning and maintaining teaching activities in classroom (Wright & Akgunduz, 2018, p. 53). To be more precise, teachers' professional improvement should be directed towards the development of those competences that correspond to the needs of modern education, which means that training and education in the field of digital tools should start during teachers' bachelor academic studies at teacher education faculties. This is the reason why, in the past decade of the twenty-first century, the issues related to digital literacy and competence has become the focus of interest in major academic courses taught at teacher education faculties, which qualify future teachers for their vocation.

Based on the aforementioned, it can be concluded that the era of the Fourth Industrial Revolution, which promotes information and communication technologies as a way of modernizing education, requires changes in teachers' initial education and in their professional advancement. To be more precise, teachers' professional training and education should be accorded with the competences corresponding to the requirements of contemporary education, whereas gaining knowledge in the field of digital tools and their application should begin during teachers' bachelor academic studies. Therefore, the issue related to the digital literacy and competence has become the focus of attention of major academic programmes studied at university, which are aimed at qualifying future teachers for efficient teaching.

Serbian teachers, who teach in the time of the Fourth Industrial Revolution, are expected to implement new technologies in education and to prepare their students for their future jobs in companies and firms, which all demand that their employees be digitally literate. Moreover, it is an imperative that Serbian teachers contribute to students' leaving the practice of memorizing and pure reproduction of learned materials, and provide instruction in solving problems, active listening and critical thinking. It is evident that there will be more to teaching in Serbia than just acquiring a degree and completing formal education. Future teachers will have to accept the concept of lifelong learning and adapt to new technologies as the products of the Fourth Industrial Revolution.

Digitalization of schools in the education system of Serbia has become the priority for the Serbian Ministry of Education. Innovations, such as online textbooks, interactive digital teaching materials and electronic textbooks, have been implemented in classes. Considering the fact that a digital era needs "digital" teachers willing and prepared to educate future generations of students by using modern digital technologies, this research was aimed at the study of the present state of affairs and potential progress in the field of digital competences of Serbian school teachers.

2. Methods

2.1. Research Model

Serbia can adequately respond to the demands posed by the Fourth Industrial Revolution by reforming the system of education that will qualify future employees to be technologically literate, imaginative, creative, adaptable and flexible. It is thus necessary that the whole society, especially the Government and Ministry of Education, Science and Technological Development of the Republic of

Serbia, unite their efforts in an attempt to understand and respond appropriately to all technological trends that alter lives of contemporary and future generations of students. The following research tasks were defined:

1. To determine whether teachers use digital tools for the assessment of students' accomplishments;

2. To determine whether teachers are qualified to use digital tools and which type of professional training they deem the most efficient one for acquiring digital competences;

3. To determine whether teachers use digital tools and contents in their classes;

4. To determine whether teachers possess the knowledge needed for searching, creating and storing digital contents.

The general hypothesis postulated implied a low level of the use of digital tools in schools on the territory of Serbia, but a rather high level of teachers' readiness to attend professional training in order to be better skilled and qualified for the use of their digital competences.

2.2. Sample

The research was conducted on the territory of the Republic of Serbia with the sample of 500 respondents during the academic year 2019/2020. The research was conducted in two stages. The first stage involved the online searching in order to determine the exact number of primary and secondary schools in Serbia. The data obtained from the Statisctical Office of the Republic of Serbia showed that there were 3,350 primary schools and 509 secondary schools active on the territory of Serbia at the end of the school year of 2018. The second phase of the research involved the field work, i.e. the distribution of the instruments for the assessment of teachers' digital competences (TDC) to primary and secondary school teachers in all districts of Serbia. The method of the deliberate sampling was applied. Moreover, all of the respondents were informed about the goals and nature of the research, as well as about the anonymity and confidentiality policy. The research sample was constructed on the basis of teachers' voluntary agreement to participate in the empirical research.

The teachers' attitudes were analyzed in relation to their place of work (primary school teachers and secondary school teachers), school subjects taught by them (science and technology teachers and teachers of social sciences and humanities), teaching experience (teachers with fewer than 10 years of teaching experience and teachers with more than 10 years of teaching experience) and their professional training in the filed of digital competences (yer or no).

2.3. Instrument and Procedures

The descriptive method and scaling technique were used. The Likert-type scale was constructed for the purposes of this research, containing 41 items. The five-degree assessment range of teachers' digital competences (TDC) was the following: 1 – strong disagreement, 2 – partial disagreement, 3 – indifference, 4 – partial agreement, 5 – strong agreement. The multi variance technique of the factor analysis was applied to extract the factors from the TDC scale and for the identification of common characteristics of the majority of the variables. The interpretation of the indicators that justified the application of the aforementioned techniques (KMO and Bartlett's test) and the statistical procedure led to the decision to maintain five characteristic factors. Further statistical data processing made use of the parametric statistics (*t* test), in accordance with the independent variables used in the research.

2.4. Data analysis

The research question and the nature of the instrument detrmined the methods: descriptive, inferential statistics and multivariance statistical. The extraction of the characteristic factors was followed by a further statistical analysis and the use of the parametric statistics, t test, to determine statistically significant differences between the respondents' attitues considering their place of work, gender, school subjects taught, teaching experience and professional training in the field of digital competences. The data obtained were processed in the program for the statistical data processing, SPSS, and presented in the tables.

3. Results

The assessment scale of TDC consisting of 41 items and used to examine teachers' digital competences was subjected to the factor analysis in the first stage of the data statistical processing with the purpose of reducing the data to the latent factors. The data adequacy was tested by the interpretation of the values of the KMO test, whose bordering value should be higher than .600, and by Bartlett's test of sphericity, whose value should be statistically significant (p<.050).

Table 1. *KMO and Bartlett's test*

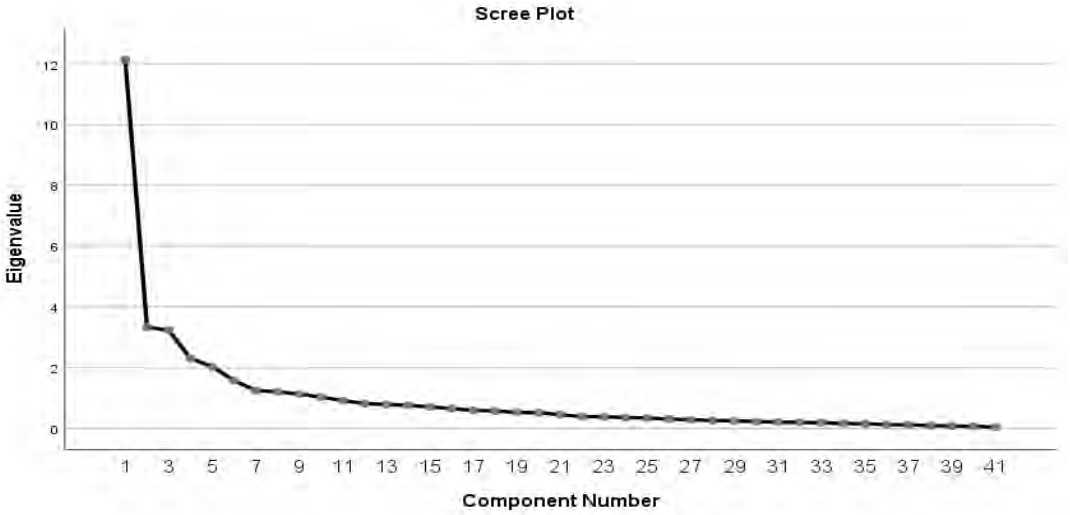
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.813**
Bartlett's Test of Sphericity	Approx. Chi-Square	15089.867
	df	861
	Sig.	0.000

The results presented in Table 1 show that the value of KMO is the coefficient of 0.813, whereas the Bartlett's test is statistically significant (χ^2 = 15089.867, p<.000), which leads to the conclusion that the application of the factor analysis was justified.

Table 2. *Structure matrix of the extracted factors*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings(a)
	Total	Per cent of Variance	Cumulative per cent	Total	Per cent of Variance	Cumulative per cent	Total
1	12.189	29.021	29.021	12.189	29.021	29.021	7.729
2	3.366	8.015	37.036	3.366	8.015	37.036	6.849
3	3.305	7.869	44.905	3.305	7.869	44.905	6.787
4	2.357	5.611	50.517	2.357	5.611	50.517	6.700
5	2.093	4.982	55.499	2.093	4.982	55.499	4.912
6	1.612	3.838	59.337	1.612	3.838	59.337	4.703
7	1.258	2.996	62.333	1.258	2.996	62.333	5.591
8	1.228	2.924	65.257	1.228	2.924	65.257	4.553
9	1.141	2.716	67.973	1.141	2.716	67.973	2.051
10	1.051	2.503	70.477	1.051	2.503	70.477	3.439

The Guttman-Kaiser Criterion presupposed the extraction of ten components, i.e. factors that explained 70.47 per cent of the total variance (12.189, 3.366, 3.305, 2.357, 2.093, 1.612, 1.258, 1.228, 1.141, 1.051).



Graph 1. Curve diagram

The curve diagram, presented in Graph 1, indicates that there were extracted 10 factors by the application of the factor analysis. More precisely, all the factors positioned above the slope point (in the presented case, the point where the slope of the curve was clearly leveling off was detected at factor 11) were supposed to be generated by analysis. Regarding the fact that 10 factors was a large number to analyze, it was decided to consider 5 factors that explained more than 50 per cent of the cumulative variance.

In the course of the factor analysis, Promax rotation was applied, which generated the structure matrix of the rotated factors, shown in Table 3.

Table 3. *Structure matrix of the rotated factors*

	Component				
	1	2	3	4	5
p1	0.901				
p2	0.894				
p3	0.877				
p4	0.866				
p5	0.680				
p6	0.607				
p7	0.575				
p8		0.880			
p9		0.872			
p10		0.798			
p11		0.783			

p12	0.750				
p13	0.689				
p14	0.632				
p15		0.826			
p16		0.779			
p17		0.772			
p18		0.655			
p19		0.564			
p20			0.798		
p21			0.701		
p22			0.699		
p23			0.698		
p24			0.690		
p25					0.842
p26					0.837
p27					0.650
p28					0.517

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.[a]

Since 5 factors were maintained for further analysis, the following items were eliminated from any further examination: p26 (I use the Internet to communicate with parents, students and colleagues), p28 (I use e-mail to communicate with parents, students and colleagues), p21 (I exchange information with students via social networks), p29 (I create groups on WhatsApp, Viber and Messenger to improve my communication with parents, students and colleagues), p30 (I create or visit blogs to have discussion with parents, students and colleagues), p31 (I create or visit Internet forums to exchange information with parents, students and colleagues), p31 (I post notices and information for students and parents on the school web site), p12 (I use education softwares in teaching), p7 (I create tables and graphs in Excel), p40 (I am satisfied with the offered range of teachers' professional training related to acquiring digital competences), p41 (I need professional training in the field of the use of digital tools in class), p27 (I use social networks (Facebook, Instagram, etc.) to communicate with parents, students and colleagues) and p19 (I use electronic education reports for my students).

The first factor explained 29.021 per cent of the total variance and included the items related to the use of digital tools for the assessment of students' accomplishment (I create online questionnaires and scales for the assessment of students' accomplishments, I use digital applications for the assessment of students' accomplishemnts, I create online quizzes for the assessment of students' accomplishments, I create online knowledge tests for the assessment of students' accomplishments, I provide online study materials, I use the e-portfolio in teaching and I use interactive smart boards in teaching). All items comprising this factor had high factor loadings, whereas the highest factor loading was detected in those items related to the use of online questionnaires, scales and digital applications for the assessment of students' accomplishemnts. Based on the aforementioned characteristics, factor 1 was named "Assessment of students' accomplishments by the use of digital tools".

The second factor explained 8.015 per cent of the total variance and involved the items related to teachers' professional training for the use of digital tools (I can improve my digital competences by

attending training and seminars, I can improve my digital competences by attending workshops and courses, I think that the use of digital tools facilitates and increases the effectiveness of the cooperation between teachers and students, parents and colleagues, I can improve my digital competences by being informed about updates on digital technologies development, I can improve my digital competences by reading relevant scholarly papers, I can improve my digital competences by exchanging experience with colleagues and Teachers' professional training for the use of digital tools is a prerequisite for a truly modern education). The highest factor loading was observed in the items related to the improvement of teachers' digital competences by attending training, seminars, workshops and courses. Consequently, factor 2 was accordingly named "Forms of teachers' professional training for the acquisition of digital competences".

The third factor explained 7.869 per cent of the total variance and was comprised of the items related to the use of digital products in teaching (I use the projector and video beam in classes, I use audio and visual teaching materials, I use the Internet in classes, I use digital textbooks and I use computers in teaching). All the items contained in this component carried high factor loadings. Yet, the highest factor loading was observed in the items referring to the use of the projector, video beam, audio and visual teaching materials. Factor 3 was therefore named "The use of digital tools in teaching".

The fourth factor explained 5.611 per cent of the total variance and was comprised of the following items: I create texts in Microsoft Word, I create documents that contain links and pictures, I download digital photographs, films and animations to use in class, I create presentations in Power Point and I keep digital contents in PDF, PTT and Microsoft Word formats. Based on the aforementioned characteristics, factor 4 was named "Creating, downloading and storing digital data".

The fifth factor explained 4.982 per cent of the total variance and contained the items related to the online searching of databases (I search the sites for downloading digital teaching materials, I search blogs and Internet forums for downloading digital teaching materials, I search data on the Internet by myself and I download and install programs and applications on the PC). Based on the aforementioned characteristics, factor 5 was named "Searching digital/online databases".

The parametric statistics was applied during a further statistical analysis: t test for determining a statistically significant difference in the respondents' attitudes in relation to the independent variables used in the research. The results of the t test for each individual factor are presented in what follows.

Table 4. Differences in the teachers' attitudes to the assessment of students' accomplishments by the use of digital tools in relation to the independent variables

			Mean	SD	t	df	p
Assessment of students' accomplishments by the use of digital tools	School subjects taught	Sciences and technology	20.328	7.312	2.607	493	0.009
		Social sciences and humanities	18.577	7.546			
	Teaching experience	Up to 10	17.750	7.676	-3.564	493	0.000
		More than 10	20.238	7.245			
	Gender	Female	19.112	7.299	-1.846	72.881	0.069
		Male	21.229	8.529			
		Yes	20.139	7.495	6.356	498	0.000

	Professional training	No	14.428	5.711

Table 4 presents statistically significant differences in the teachers' attitudes to the assessment of students' academic accomplishments by the use of digital tools, in relation to the subjects they teach, teaching experience, gender and their professional training in the field of the development of digital competences. The results presented were calculated by the parametric t-test.

The research results prove that the subjects the respondents teach have a statistically significant impact on their attitudes to the assessment of their students' accomplishemnts by the use of digital tools ($p=0.009$; $p<0.050$). More precisely, the analysis of the arithmetic mean shows that science and technology teachers (M=20.328) use the products of modern technologies for the assessment of students' accomplishemnts more frequently than the teachers who teach social sciences and humanities (M=18.577).

At the level $p<0.050$ ($p=0.000$), there was also detected a statistically significant difference in the teachers' attitudes to the use of digital tools for the assessment of students' accomplishments in relation to teaching experience. The research results show that the teachers with the teaching experience longer than 10 years (M=20.238) apply digital tools, such as online tests, questionnaires, scales and quizzes, to the assessment of students' accomplishemnts more readily than the teachers whose teaching experience is shorter than 10 years (M=17.750).

Regarding the gender of the respondents, the research results demonstrate that male teachers (M=21.229) use digital tools for the assessment of students' accomplishments more frequently than female teachers (M=19.112).

The results also prove the postulated hypotheses regarding teachers' professional training in the field of the development of digital competences, which is reflected in the teachers' positive attitudes to the use of digital tools for the assessment of students' accomplishments as regards this variable. The analysis of the arithmetic mean shows that the teachers who attended seminars, workshops and courses aimed at stimulating the development of digital competences use digital resources for the assessment of students' accomplishments more frequently (M=20.139) than those who did not undergo any professional training in this field (M=14.428).

The research implications state that there exists no strategic and systematic approach to the integration of digital tools in teaching at all levels of education, so that the use of digital teaching materials in Serbian schools depends on the teacher's individual enthusiasm and their own digital competences. Moreover, another difficulty is the fact that the existing meager teaching materials in the Serbian language are neither promoted nor used sufficiently (Ristić, 2018, p. 4).

Table 5. Differences in the teachers' attitudes to the forms of teachers' professional training for the acquisition of digital competences in relation to the independent variables

			Mean	SD	t	df	p
Forms of teachers' professional training for the acquisition of	School subjects taught	Sciences and technology	30.502	4.736	3.258	493	0.001
		Social sciences and humanities	29.059	5.045			
	Professional training	Yes	29.896	5.001	2.628	498	0.009

digital competences	No	28.285	4.625	

Table 5 shows statistically significant differences in the teachers' attitudes to the forms of professional training in the field of the development of digital competences in relation to the school subjects taught and the respondents' professional training. The research results prove that the independent variables gender (female and male), teaching experience (up to 10 years and more than 10 years of teaching) and place of work (primary school teachers and secondary school teachers) do not have a significant impact on the teachers' attitudes to this issue.

The analysis of the respondents' answers shows that science and technology teachers evaluate the importance of professional training, seminars, courses, continuous update on digital technologies development, reading relevant academic papers and exchange of experience with colleagues more positively (M=30.502) than the teachers of social sciences and humanities (M=29.059).

The research results also show that the teachers who had some experience regarding professional training in the field of the development of digital competences (M=29.896) evaluate its contribution to their digital literacy more positively than the teachers who did not attend any professional training in this field (M=28.285).

Table 6. Differences in the teachers' attitudes to the use of digital tools in teaching in relation to the independent variables

			Mean	SD	t	df	p
The use of digital tools in teaching	Place of work	Primary school	21.380	4.128	2.167	249.15	0.031
		Secondary school	20.562	3.355			
	Teaching experience	Up to 10	19.895	3.998	-4.529	278.05	0.000
		More than 10	21.473	3.034			
	Professional training	Yes	21.253	3.268	5.289	91.166	0.000
		No	18.415	4.496			

The research results shown in Table 6 prove that the use of digital tools in teaching is determined by the place of work, teaching experience and professional training in acquiring digital competences, which is statistically significant. However, school subjects taught and gender do not have any statistically significant impact on teachers' tendencies to modernize their teaching by the use of the products of digital technologies (at the level of statistical significance of $p<0.050$, no statistically significant difference was detected in the teachers' attitudes to this issue).

The analysis of the arithmetic mean states that the teachers who teach in primary schools use digital tools more frequently (M=21.380) than those who teach in secondary schools (M=20.562). The results shown in Table 6 also prove that the longer the teachers' experience, the more frquent the use of digital tools in class (up to 10 years of teaching experience: M=19.895 and over 10 years of teaching experience: M=21.473).

In accordance with the aforementioned results, the data presented in Table 6 imply that professional training in the field of the development of teachers' digital competences has positive effects. Namely, the teachers who attended professional training apply digital tools in class more

frequently (M=21.253) than the teachers who did not have any form of professional training in the field of the development of teachers' digital competences (M=18.415).

Table 7. Differences in the teachers' attitudes to creating, downloading and storing digital data in relation to the independent variables

			Mean	SD	t	df	p
Creating, downloading and storing digital data	Place of work	Primary school	20.896	4.570	-3.235	217.58	0.001
		Secondary school	22.197	3.042			
	Teaching experience	Up to 10	22.709	2.388	4.375	482.87	0.000
		More than 10	21.473	3.879			

Table 7 shows statistically significant differences in the teachers' attitudes to creating, downloading and storing digital data in relation to the independent variables place of work and teaching experience. At the level of statistical significance of p>0.050 for the variables gender, professional training and school subjects, there was determined no statistically significant difference in the teachers' attitudes.

The arithmetic mean analysis demonstrates that secondary school teachers (M=22.197), as well as the teachers with a shorter teaching experience – up to 10 years (M=22.709) create texts in Microsoft Word, edit documents with links and photographs, create Power Point presentations, download digital photographs, films and animations to use in class and store digital materials in PDF, PTT and Microsoft Word formats more frequently than primary school teachers (M=20.896) and the teachers with the teaching experience longer than 10 years (M=21.473)

Table 8. *Differences in the teachers' attitudes to searching digital/online databases in relation to the independent variables*

			Mean	SD	t	df	p
Searching digital/online databases	Teaching experience	Up to 10	17.697	2.157	5.132	482.48	0.000
		More than 10	16.390	3.495			
	Professional training	Yes	16.673	3.306	-2.288	134.03	0.024
		No	17.402	2.413			

Table 8 shows statistically significant differences in the teachers' attitudes to searching digital/online databases in relation to the independent variables teaching experience and professional training in the field of the development of teachers' digital competences. The independent variables gender, place of work and school subjects did not demonstrate any statistically significant differences in the teachers' attitudes at the level of statistical significance of p<0.050.

The obtained p value (p=0.000 i p=0.024) proves that searching sites, blogs, Internet forums, Internet data and installing digital applications on the PC are conditioned by teaching experience and professional training of teachers.

Namely, the aforementioned activities are done by the teachers with a shorter teaching experience more frequently (M=17.697) than by those with a longer teaching experience – more than

10 years (M=16.390); also, these activities are practised by the teachers with no experience in professional training more often (M=17.402) than by those with such an experience (M=16.673).

The authors of this paper believe that it is very important to get an insight into teachers' digital competences by conducting an empirical research in order to observe and check the present state of affairs and possible progress in this field. Regarding the fact that, besides parents, teachers are another significant factor of young people's education, it is concluded that digital literacy of future generations, the pillars of our country in the future, depends on teachers' ability to be true models for using digital technologies, professionally and personally.

4. Discussion and conclusion

The obtained research results prove that the Serbian teachers' attitudes to the use of digital tools for the assessment of students' accomplishments vary depending on school subjects taught by the teachers, teaching experience, gender and professional training. Considering the fact that science and technology undergraduates acquire basic digital competences during their studies, it is reasonable to assume that the result presented in this paper implies that science and technology teachers use online questionnaires, scales, digital applications and quizzes more frequently than the teachers of social sciences and humanities.

It is important to emphasize that the analysis of academic curricula shows that Serbian faculties that qualify students for teaching professions do not offer enough academic courses necessary for acquiring digital competences for the application of modern technologies. To be more precise, future teachers who study at faculties that award degrees in teaching do not gain digital competences during their formal education – academic curricula do not contain mandatory academic courses for acquiring digital competences, whereas the number of such elective courses is small and are attended by a negligible number of students.

Contrary to the dominating prejudices about younger teachers being more willing to digitalize their teaching and having less resistance to the implementation of new technologies in teaching, the research results prove that the teachers with the teaching experience longer than 10 years use digital tools for the assessment of students' accomplishments more frequently than the teachers with a shorter teaching experience (up to 10 years of teaching). Therefore, the longer the teaching experience, the more frequent the use of digital tools in teaching. Gender stereotypes related to the distribution of roles, duties and obligations was observed during the analysis of the research results. Namely, in accordance with the assumptions about gender roles, male teachers use digital technologies more often than female teachers. The obtained result that the teachers who attended seminars, training, courses and workshops use digital tools for the assessment of their students' accomplishments and in classes more frequently than those who did not attend any professional training confirms that professional training in the field of the development of teachers' digital competences has positive effects.

Besides the fact that science and technology teachers use digital technologies more frequently than the teachers of social sciences and humanities, they also evaluate the importance of professional training in the IT more positively. This result is explained by the fact that the training experience has a positive impact on the implementation of modern technologies in teaching.

The research results show that primary school teachers use the projector, video beam, audio and visual teaching materials, Internet and computers more frequently than secondary school teachers. These results might be explained by the social context and the fact that the digitalization of education

in Serbia has been primarily and most intensively applied to primary education, characterized by pilot projects of creating digital classrooms and digital textbooks.

Contrary to the aforementioned research result indicating that the teachers with a longer teaching experience and primary school teachers use digital technologies more often, the research results also prove that the teachers with a shorter teaching experience as well as secondary school teachers use digital technologies for their class preparation considerably, and create texts in Microsoft Word, create Power Point presentations, download digital photographs, animations and films, store digital contents in PDF, PTT and Microsoft Word formats, search sites, blogs, forums and data on the Internet.

Serbia still belongs to the group of underdeveloped countries and it is devoted to continuous transformations and introduction of innovations. The Fourth Industrial Revolution thus represents a good opportunity for Serbia to come closer to developed countries in this field. This can be accomplished by investing in education. The system of education in Serbia, which qualifies young people only for one profession or one field of work, has long become obsolete. The Fourth Industrial Revolution presupposes education that qualifies young people for the jobs of the future that are still unknown to us, just as the necessary skills and knowledge required by these jobs are. This is the reason why teachers are expected to teach their students how to think, not what to think.

Although the Fourth Industrial Revolution has just begun in Serbia, there are tendencies directed towards a complete digitalization of education to be achieved up to 2021. In addition, considerable finances have been invested in retraining so that employees can be adequately prepared for working in the constantly changing world.

The present interest in the study of teachers' digital competences on the territory of the Republic of Serbia has stemmed from the fact that modernization and digitalization of education in Serbia has become essential in the past few years. Its goal is to harmonize education in Serbia with modern trends and good practices of developed countries in the world which have already started the process of digitalization of education. Ample finances have been invested in the equipment of the so-called smart classrooms (in urban and rural areas alike), numerous electronic textbooks have been published, digital textbooks are used in schools, around 10.000 teachers have been trained to apply digitalized teaching and more than 30.000 teachers' training courses have been organized. As regards the fact that the aforementioned activities were performed at the start of 2019, this research was conducted with the purpose of determining whether the efforts of experts and professionals in the field aimed at improving the quality of education in our country were reflected in practice by proving an increased level of teachers' digital competences.

The research implies the necessity to create a strategic approach to teachers' digital competences in the Republic of Serbia, which would require obligatory digital literacy of future teachers during their bachelor studies. This research recommends the innovation of academic curricula regarding the academic courses related to digital technologies. All other additional actions, such as voluntary teachers' training, yield less significant results. Serbia can raise its competitive status in the period of the Fourth Industrial Revolution only by qualifying the workforce that possess the appropriate scientific and technological knowledge.

The changes initiated by the Fourth Industrial Revolution has had an impact on all layers of society, the education system included. Firstly, the changes are evident in the position and roles of teachers, who are expected not only to teach students, but also to prepare them for their future jobs and life. In order to accomplish this goal, teachers use numerous technological innovations and devices

that enable an easier access to knowledge, such as mobile phones, tablet computers, applications, educational softwares, Internet, social networks, etc. The Fourth Industrial Revolution has transferred teaching into a virtual environment and teachers are expected to train students to manage this virtual world successfully. The use of technological tools undoubtedly facilitates the access to information, it improves the quality of teaching itself and frees is from spatial and temporal restrictions. However, it requires that the teacher's role be modified – teachers are expected not only to transfer knowledge and professional experience to their students and to assess their students' accomplishments, but also to train their students in acquiring the skills of active listening, active knowledge acquisition, learning and critical analysis of information.

The era of artificial intelligence, robotics and 3D printers will certainly result in the disappearance of contemporary jobs and the emergence of the new ones. Only those workers who provide profit to society by being productive and economical will persevere. Yet, the teaching profession will surely persist because what is needed for the development of a creative and critical point of view among young people is the living word of the teacher.

The research results show that digital tools and technological products are frequently used in teaching, and that teachers are willing to follow technological trends and to attend seminars, workshops and courses in order to improve their digital competence. In conclusion, the standards and requirements established by the Fourth Industrial Revolution have inevitably changed the teaching profession in the Republic of Serbia.

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