

Attitude to ICT and Self-Evaluation of Fluency in Using New Digital Devices, Websites and Software among Pre-Service Teachers

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Abstract—The objective of the research was to obtain data on the attitudes of the future generation of teachers towards using new media in their didactic and educational activities. Additionally, the text presents the level of these teachers' self-evaluation regarding the use of new ICT-based devices. Indicators of both variables are compared. The research was conducted in the biggest Polish pedagogical university, using a sample of 450 students. The technique used was the diagnostic survey. The data were collected in the first half of 2019 as part of the international project SELI. Based on the data obtained, it was noticed that pre-service teachers do not form a homogeneous group, which means there are individuals presenting a very positive attitudes towards the introduction of new media as well as those who are careful when it comes to using ICT in teaching. Most respondents emphasize that using ICT in education is necessary and that this trend is irreversible. There is a minor group of future teachers who do not know about websites and software to support learning and teaching (about 10%). Almost half of the respondents present divided views regarding the role of ICT in stimulating engagement, motivation and interest among students. However, it should also be noted that almost half of the interviewees state that the use of smartphones at school should be banned. A positive attitude to new technologies in one area coincides with a high opinion about ICT in other areas. The self-evaluation of the teachers' own competencies is also internally coherent, meaning that respondents who declared that they had no problems with using, for example, new devices, also have no problems with using new websites or software.

Keywords—Students, pre-service teachers, ICT, Internet attitudes, new devices, Poland, SELI, media education, university, TPACK.

1 Introduction

The modernization of the education system in many countries must begin with an increase in the key competencies of active and pre-service teachers. Among these key competencies, skills and knowledge regarding the use of information and communication technologies (ICT) play a very significant role. This competence is increasingly

emphasized in research reports and education development strategies in many countries. Looking at the improvement of didactic and education processes, it is important to consider the stage the information society has reached [1] [2]. Due to the development of high-speed Internet, media convergence, the transition of many activities from the offline to the online environment, the intense transformations of ICT-mediated leisure activities, and the digitization of didactic processes, pre-service teacher education needs new research and solutions to improve the quality of academic training. Re-defining approaches to ICT in the preparation of future teaching staff has become the key challenge for pedagogical universities and other higher-education units. This text presents a summary report from the research on the attitudes to ICT and the level of literacy in using new digital devices, websites and software among pre-service teachers. These two variables are important components of the smart, sustainable and methodologically correct application of ICT in schools.

2 Theoretical Framework

Education is an area which, it would appear, does not change quickly. The introduction of new, ICT-based solutions is a noticeable exception. This results mainly from the rapid development of the information society, which is characterized by the emergence of new devices, websites and computer applications [3]. The ability to recognize and introduce these solutions into teaching processes is considered as one of the key competencies of teachers. When analyzing the issues surrounding the computerization of modern schools, one should consider the fact that teachers are a heterogeneous group and present different levels of digital literacy [4]. This diversity is not determined simply by socio-demographic features or teaching specialization in certain subjects (for example, it is obvious that IT and computer teachers naturally use ICT more) but also results from the educational policies implemented in certain countries. However, researchers point out that one of the critical factors in the implementation of ICT is the ability to experiment with new technologies [5] [6] [7]. Individual preferences and overcoming resistance to new, ICT-based solutions have a significant impact on the modernization of the education system, increasing the attractiveness of classes and strengthening learners' motivation [8] [9]. Consequently, this text is an attempt to show how pre-service teachers, classified as digital natives (the generation that grew up in the information society), use new technologies.

Of the various concepts that describe the knowledge, skills, and attitudes connected with new media among teachers, the most prominent is TPACK. It assumes that the effective use of ICT depends on knowledge of technology - digital literacy, knowledge about the given area – and subject and pedagogical competencies. When integrated, these three areas create an ecosystem which facilitates the proper realization of the didactic and education processes. The lack of such integration leads to the failure to meet operational goals [10] [11] [12] [13]. Of course, the presented theoretical framework has some gaps. One of the main ones is the difficulty of transferring beliefs into practice [14]. The TPACK concept also identifies a variable related to attitude - the attitude towards new technologies. Attitudes are variable and not fixed

and vary depending on the development of digital literacy and changes in the digital world [15] [16] [17]. In the debate on introducing digital media into education, attitudes toward ICT become the starting point in regard to the preparation of the future generations of teachers [18]. Both variables mentioned above have become the main focus of the analyses of students of pedagogy who will soon have the opportunity to start their careers in the education sector.

3 Methodology

3.1 Research objective and problems

The objective of the research was to investigate the attitudes of the future generation of teachers towards using new media in their didactic and educational activities. Another goal was to obtain the results of self-evaluation of the ease of use of new websites, devices and applications among students of pedagogical studies. The research is diagnostic and classified as studies into the basic problems of media pedagogy. The research objective was motivated by the need to diagnose the components of digital literacy and individual and environmental conditions of the future generation of teachers. The study is embedded in the opportunity's paradigm of media pedagogy; that is, the positive opportunities connected with the implementation of new media in education [19]. The research was part of the international project Smart Ecosystem for Learning and Inclusion – SELI ERANet17/ICT-0076, financed by the National Centre for Research and Development [20]. The following problems were formulated:

- What is the attitude to new media among pre-service teachers?
- What are the relationships between certain elements of that attitude to new media among students of pedagogical specializations?
- How do pedagogy students evaluate their own skills in terms of the ease of use of new devices, websites and software?
- What is the strength of correlation between the ease of using new websites, software, and computer applications?
- To what extent does the self-evaluation of digital literacy coexist with the self-evaluation of fluency in using new ICTs?
- Which elements of the attitude to new media determine the level of satisfaction in using the new technologies?

3.2 Research tool

The research tool was designed by the international team of researchers engaged in the SELI project. It was subject to a pilot study in Poland and eight other countries in Latin America, the Caribbean and Europe. Two variables are mentioned in the text:

- Attitude to new media. The tool shows high internal coherence - McDonald's $\omega = 0.849$; Cronbach's $\alpha = 0.822$; Gutmann's $\lambda_6 = 0.853$. The variable has 9 indicators

of evaluation of using new media in didactic and educational work. The tool was created based on the previous research conducted by the author [21].

- The perception of ease of use of ICT consists of four indicators which determine the subjective feeling regarding the use of new technologies. One of the indicators describes general satisfaction from using new technologies. The whole variable has good internal coherence - McDonald's $\omega = 0.860$; Cronbach's $\alpha = 0.849$; Gutmann's $\lambda_6 = 0.830$ [22] [23].

3.3 Sample and research procedure

The research was conducted among the students of pedagogical courses in the biggest Polish pedagogical university. The technique used was the diagnostic survey which was conducted among 450 students of the Faculty of Pedagogy, the Pedagogical University of Krakow in Poland. The study was carried out in May-June 2019. The average age of the students was 22.66, with a standard deviation of 4.23. The research was conducted according to ethical standards. Participation in the survey was voluntary. The data do not enable the identification of individual respondents. The research enables the generalization of the results only in regard to the population of students of the Pedagogical University (Faculty of Pedagogy). We wish to thank the financing institution: The National Centre for Research and Development (NCBiR, Narodowe Centrum Badań i Rozwoju), the interviewers: Dr Joanna Wnęk-Gozdek and Dr Anna Mróz and the teams from nine countries who contributed to the development of the tool [24].

4 Results

As discussed in the theoretical section of this paper, it is the subjective perception of new media that is one of the main factors determining the correct implementation of new technologies in education, learning and teaching processes. Tables 1 and 2 present the descriptive statistics for nine variables which are the factors selected to characterize the attitude of students to using ICT in schools. Based on the data collected, it can be noticed that prospective teachers have diverse opinions about the influence of new technologies. Almost half of them think that ICT brings positive changes into our lives. Almost two-thirds of the pedagogy students interviewed state there is no way back (to pre-digital times) and that the use of ICT in didactic work is necessary. Only one in ten students declare that they did not know any websites that can be helpful in teaching. It is interesting that this young generation of teachers are not extreme techno-optimists. This is visible in the diverse opinions they share as they compare “old” and “new” didactic methods. About a quarter of the respondents emphasize the point that ICT is better than the analogue equivalents. Almost 40% of the young people have divided opinions regarding the positive impact of ICT on learning.

Table 1. Descriptive statistics for variable Attitude to new media - Part I

	Digital technologies have positively changed our lives	It is necessary to use digital technologies in the process of learning and teaching	Web sites are useful for teaching and learning	Digital teaching aids are better than physical teaching aids on improving learning	The use of digital technologies by the teacher has a positive impact on student learning
Valid	450	450	450	450	450
Mean	3.571	3.727	3.811	2.976	3.402
Median	4.000	4.000	4.000	3.000	3.000
Mode	4.000	4.000	4.000	3.000	3.000
Std. Deviation	0.930	0.912	0.916	0.942	0.935
Variance	0.865	0.832	0.840	0.888	0.873
Skewness	-0.601	-0.955	-1.170	0.161	-0.503
Kurtosis	0.400	0.829	1.501	-0.045	0.304
Shapiro-Wilk	0.872	0.817	0.788	0.894	0.878
P-value of Shapiro-Wilk	< .001	< .001	< .001	< .001	< .001

The prospective teachers recognize the potential of new media. Almost half of them declare that they definitely agree or agree with the statement that using ICT in school has a positive impact on students’ motivation and engagement. Only about 14% suggest that the teacher’s use of ICT does not have a positive influence on satisfaction from learning. It is interesting to compare these data with the opinions about using smartphones in schools. Almost half of the respondents’ state that the use of smartphones at school should be prohibited, which is contrary to their previous declarations.

Table 2. Descriptive statistics for variable Attitude to new media - Part II

	The use of digital technologies by the teacher has a positive effect on student motivation	The use of digital technologies by the teacher has a positive effect on student involvement	The use of digital technologies by the teacher has a positive effect on student satisfaction	Students should be prohibited from using cell phones at school
Valid	450	450	450	450
Mean	3.367	3.458	3.493	3.356
Median	3.000	4.000	4.000	3.000
Mode	4.000	4.000	4.000	4.000
Std. Deviation	0.975	0.981	0.947	1.187
Variance	0.950	0.961	0.896	1.410
Skewness	-0.426	-0.479	-0.463	-0.363
Kurtosis	-0.205	-0.214	-0.042	-0.690
Shapiro-Wilk	0.891	0.886	0.886	0.903
P-value of Shapiro-Wilk	< .001	< .001	< .001	< .001

Given the non-parametric distribution of factors, the co-existence of answers was calculated using Spearman’s rho correlation coefficient. The data collected enabled

several important conclusions to be drawn. First, a positive attitude to new media in one area co-exists in other areas. Second, save for a few exceptions related to motivation, engagement and satisfaction, the strength of correlations does not exceed the mean values. Third, the pre-service teachers who stated that smartphones should be banned at school are not, however, techno-pessimists. Thus, there is no linear correlation between the attitude to new media and the opinion held about using phones at school. The details about the strength of correlations for the attitude to new media factors is presented in Table 3.

Table 3. Spearman’s rho correlation coefficient for indicators of variable Attitude to new media

Variable	1	2	3	4	5	6	7	8
1. Digital technologies have positively changed our lives	—							
2. It is necessary to use digital technologies in the process of learning and teaching	0.443***	—						
3. Web sites are useful for teaching and learning	0.332***	0.340***	—					
4. Digital teaching aids are better than physical teaching aids on improving learning	0.390***	0.403***	0.331***	—				
5. The use of digital technologies by the teacher has a positive impact on student learning	0.489***	0.508***	0.350***	0.495***	—			
6. The use of digital technologies by the teacher has a positive effect on student motivation	0.365***	0.329***	0.280***	0.348***	0.571***	—		
7. The use of digital technologies by the teacher has a positive effect on student involvement	0.320***	0.356***	0.254***	0.342***	0.486***	0.716***	—	
8. The use of digital technologies by the teacher has a positive effect on student satisfaction	0.348***	0.311***	0.203***	0.350***	0.474***	0.655***	0.700***	—
9. Students should be prohibited from using cell phones at school	0.110*	0.115*	0.008	0.002	0.115	0.045	0.057	0.026

* p < .05, ** p < .01, *** p < .001

The vast majority (85.5%) of pre-service teachers declare that they like using new technologies. Almost two-thirds of the respondents (60.9%) emphasize that they find using new software easy or very easy. Slightly more than three-quarters of the students declare that they have no problems with using new websites. In turn, 62.4% think they will be able to operate new devices at a satisfactory or very high level. Thus, the respondents' perception of their own digital literacy in terms of using new devices and software is very high. They are, therefore, a typical example of a generation that grew up in the information society. The details regarding the indicators are presented in Table 4.

Table 4. Descriptive statistics for variable Perception of easy use of ICT

	I like to use digital technologies	Using a new software is easy for me	Using a new website is easy for me	Using a new electronic device is easy for me
Valid	450	450	450	450
Mean	4.087	3.544	3.829	3.571
Median	4.000	4.000	4.000	4.000
Mode	4.000	4.000	4.000	4.000
Std. Deviation	0.955	1.065	0.996	1.097
Variance	0.912	1.135	0.993	1.203
Skewness	-1.560	-0.611	-1.117	-0.716
Kurtosis	2.787	-0.294	1.143	-0.128
Shapiro-Wilk	0.743	0.876	0.813	0.868
P-value of Shapiro-Wilk	< .001	< .001	< .001	< .001

An attempt was made to evaluate certain components of digital literacy. For this purpose, the two indicators connected with the use of new technology solutions and the self-evaluation of digital literacy in the use of elements of the office package were selected. The variables are compared in Fig. 1. It can be noted that individuals who evaluate their own competencies in using the office package as high, also highly regard their skills in using devices and websites. This correlation is linear with one exception. The students who declare they have problems with the office package are also those who, in general, like or very much like using new technologies. At the same time, it should be emphasized that respondents who perceive their own digital literacy in using office packages as low gave the most diverse answers. This group is highly heterogeneous.

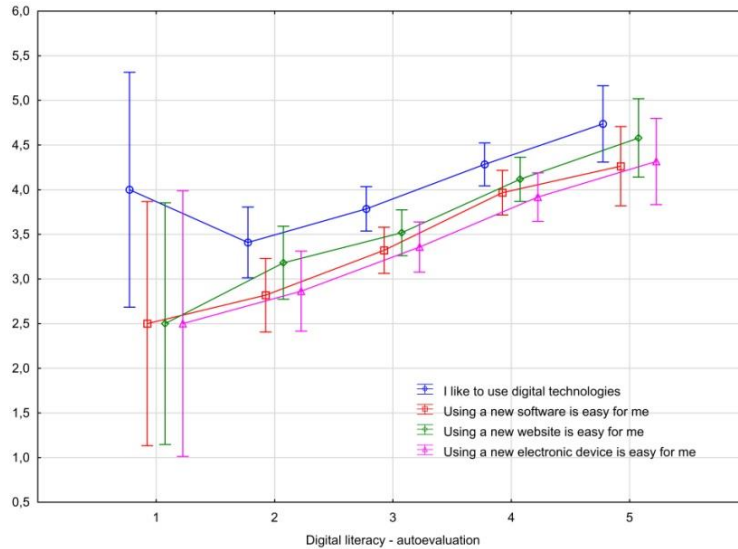


Fig. 1. Comparison of self-evaluation of digital literacy and perception of easy use of ICT

The students declaring that using new technologies is easy are very consistent in their declarations. It can be noted that individuals who state that using one type of ICT-based solutions is very easy for them, give similar declarations regarding other areas. Thus, one can speak of an internal coherence in the self-evaluation of using new devices. The details about the correlations are presented in Table 5.

Table 5. Spearman’s rho correlation coefficient for indicators of perception of easy use of ICT

	1	2	3
1. I like to use digital technologies	—		
2. Using a new software is easy for me	0.348***	—	
3. Using a new website is easy for me	0.321***	0.717***	—
4. Using a new electronic device is easy for me	0.343***	0.747***	0.772***

* $p < .05$, ** $p < .01$, *** $p < .001$

Considering the model approach to the indicator I like to use digital technologies, it was noticed that when the multi-linear regression analysis is used, only two factors of the proposed model are in relation with the dependent variable. Given the assumption adopted which explains 37.9% of cases, the growth of the I like to use new technologies indicator is in positive correlation with the first three indicators. The first three indicators (digital technologies have positively changed our lives; it is necessary to use digital technologies in the process of learning and teaching; web sites are useful for teaching and learning) are not directly connected with the individual didactic aspects (as opposed to the others, which are not statistically significant). The variables that are related are connected with general assumptions of digitally mediated pedagogy rather than with specific elements of didactics.

Table 6. Multilinear regression analysis - dependent variable: I like to use digital technologies

N=450	Dependent variable: I like to use digital R= 0.616 R2= 0.379 R2= 0.367 F(9,440)=29.956 p<0.000					
	β	SE	b	SE	t(440)	p
Intercept			0.985	0.222	4.437	0
1. Digital technologies have positively changed our lives	0.27	0.049	0.278	0.05	5.548	0
2. It is necessary to use digital technologies in the process of learning and teaching	0.187	0.048	0.196	0.05	3.896	0
3. Web sites are useful for teaching and learning	0.247	0.044	0.257	0.046	5.609	0
4. Digital teaching aids are better than physical teaching aids on improving learning	0.01	0.047	0.01	0.047	0.222	0.825
5. The use of digital technologies by the teacher has a positive impact on student learning	-0.015	0.057	-0.016	0.058	-0.272	0.785
6. The use of digital technologies by the teacher has a positive effect on student motivation	0.081	0.062	0.08	0.061	1.317	0.189
7. The use of digital technologies by the teacher has a positive effect on student involvement	-0.047	0.064	-0.046	0.062	-0.732	0.465
8. The use of digital technologies by the teacher has a positive effect on student satisfaction	0.083	0.058	0.084	0.058	1.437	0.151
9. Students should be prohibited from using cell phones at school	0.007	0.038	0.005	0.031	0.173	0.863

5 Discussion

The digital school is a relevant and important issue. The importance of the implementation of digital media in didactics and educational activities is noticeable in both the scientific discourse and in more general debates. The use of ICT has become even more significant in these times of the COVID-19 pandemic [19]. It has forced stakeholders to acknowledge how important it is to equip teachers and students with those competencies that facilitate their access to digital learning and teaching ecosystems [24]. In an age of intense changes caused by computerization, present and prospective teachers face many challenges regarding the use of new media. The above-mentioned factors raise many questions too. The areas of self-evaluation of digital literacy and attitude to new media presented herein are one such element.

Referring to the data collected, it is clear that the future generation of teachers is not fully united in their opinions that new technologies bring with them only positive changes. Their opinions are divided. Thus, declaring that digital natives (the sample representatives) agree fully that ICT should be considered only in the light of opportunities for development is not true. Some representatives of digital immigrants share similar concerns as digital natives [25] [26]. This also sheds new light on the still extant and artificial division of teachers into those from the pre-digital era and those who grew up and are growing up in the information society. It is also interesting that, despite recognizing the potential of new media, about half of the pre-service teachers declare that the use of smartphones should be prohibited during school education. This causes some cognitive dissonance, as the new generation denies some attributes assigned to their age group. A ban on smartphones is problematic and has not been

solved by researchers, methodology experts, teachers, parents or public opinion [27] [28] [29].

Nevertheless, two thirds of the respondents point out that using new media stimulates students' engagement, motivation and make them see classes as more attractive. These answers provide some guidance for modernization but it must be mentioned that about 30% of the respondents hold a completely different opinion on this matter. These persons (about 30%) are classified as techno-pessimists or techno-ignorant, who do not believe in the positive impact of all or some new technologies on education. They are pre-service teachers who appreciate the role of "traditional" (i.e. analogue) didactic means [30] [31] [32]. A positive attitude in one area describing ICT in education is strongly correlated with other areas. Consequently, the group of techno-optimists is internally coherent. These persons may prove particularly valuable in the process of school modernization which can be implemented through the efforts of the young teachers.

6 Conclusion

The research presented sheds an interesting light on the changes to the education system and the training of pre-service teacher training. The future of education depends largely not only on political changes and further equipping schools with digital solutions but also on competencies, skills, knowledge and attitudes. These last factors are especially important as the generations change. In many schools, new teachers can be and are those who transform the methods of working with students, through the implementation of ICT as well as by other means. However, it must be recognized that the preparation of teachers is, to a large extent, the responsibility of the institutions that provide teacher training. High self-evaluation of digital literacy and relatively positive attitude to new media should be complemented with the knowledge of methodology and digital literacy regarding the educational aspects of using new digital devices and software. This means that the academic courses must be improved. In the age of the rapid development of the information society, the process of changes is never-ending. The permanent nature of changes and life-long learning are the variables which should be included in the new research models and education policies at lower (e.g. university) levels.

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