

## THE ROLE AND SCOPE OF INFORMATION COMMUNICATION TECHNOLOGIES IN THE RESEARCH OF UNIVERSITY TEACHERS IN SERBIA<sup>a</sup>

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### Abstract

The Strategy for Higher Education System Development in Serbia up to 2020 presupposes a certain level of digital literacy of all participants in education. Knowledge and skills in the area of Information Communication Technologies (ICT) are basic requirements. University teachers (UT) are also expected to develop skills to use ICT for both teaching and scientific research because they are both lecturers and researchers. This research is based on the primary assumption that UT would apply ICT to a greater extent if they were provided with actual possibilities to do so. The aims of this paper are to enable preliminary insight into (1) how UT understand the role of ICT in their research and which aspects of the scope of ICT they are familiar with; and (2) what UT believe could facilitate their scientific research. A survey was conducted with 166 UT in Serbia based on a mixed questionnaire. The data analysis confirmed that UT are familiar with both the role and scope of ICT but they lack the objective possibilities for a broader application of ICT. The respondents clearly stated that access to data bases, referenced journals and other sources, and the application of available programs and solutions, as well as training to use them in a proper way, should be enabled. The general conclusion is that solutions are needed at all levels of the entire education system to provide UT in Serbia with a better environment for both teaching and research based on ICT.

**Key words:** university teachers, lecturers, researchers, ICT application.

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## УЛОГА И ДОМЕТИ ИНФОРМАЦИОНО-КОМУНИКАЦИОНИХ ТЕХНОЛОГИЈА У ИСТРАЖИВАЊИМА УНИВЕРЗИТЕТСКИХ НАСТАВНИКА У СРБИЈИ

### Апстракт

Стратегија развоја образовања у Србији до 2020. године подразумева дигиталну писменост свих учесника у процесу образовања. Стицање знања и вештина у области информационо-комуникационих технологија (ИКТ) основни је предуслов. И од универзитетских наставника (УН) очекује се да стичу вештине за примену ИКТ како за потребе наставе тако и за потребе научноистраживачког рада, јер је наставник и предавач и истраживач. Основна претпоставка од које се у овом истраживању полази јесте да би УН домете ИКТ примењивали у далеко већој мери када би им се за то пружиле објективне могућности. Самим тим, циљеви овог рада су да (1) понуди прелиминарни увид у то како УН у Србији разумеју улогу ИКТ за потребе истраживања и који су им домети ИКТ познати и (2) на који начин би им се, по њиховом мишљењу, олакшало бављење науком. Анкетирано је 166 УН у Србији на основу комбинованог упитника и анализа резултата потврдила је да су УН у великој мери упознати са улогом и са појединачним дометима ИКТ, али да им недостају објективне могућности за њихову ширу примену. Испитаници су недвосмислено истакли да је потребно омогућити приступ базама података, референтним часописима и другим изворима, примену доступних програмских решења и технологија, као и обуку за њихову адекватну примену. Општи закључак је да су потребна системска решења на свим нивоима образовног процеса која би УН у Србији обезбедила боље окружење за наставни рад и научна истраживања уз примену ИКТ.

**Кључне речи:** универзитетски наставници, предавачи, истраживачи, примена ИКТ.

### INTRODUCTION

The Strategy of Higher Education System Development in Serbia up to 2020 recognizes the importance and role of new technologies in the process of developing the education system. The acquisition of knowledge and skills in the area of Information Communication Technologies (ICT) is one of the preconditions for social integration into the contemporary society and labour market (Guidelines, 2013). Pursuant to that strategy, digital literacy enables “digital competence, which is one of the eight key competences defined as a set of relevant knowledge, skills and attitudes necessary for life in a society based on knowledge” (Guidelines, 2013, p. 5). For this reason, the National Education Council (NEC) in Serbia initiated the drafting of a relevant document (Guidelines, 2013) outlining the principles based on which ICT application in the formal education process would be defined.

Such a strategy implies that teachers (the main actors in education) should change their approach to that process because there is an obvious

gap between teachers and students regarding ICT skills and knowledge. At the beginning of the new millennium, Prensky warned that students are digital natives who speak a different language than their teachers, who are digital immigrants speaking the language of the pre-digital era (Prensky, 2001). Students spend most of their lives surrounded by modern tools and they understand their environment in a different way than students in the past did, although this does not imply that students actually have the skills to apply ICT for educational purposes (Đorđević, 2011; Prensky, 2001). However, they do have an advantage compared to their teachers.

A tendency that may be observed among private users of modern technology as well as scientists and researchers is that they refer to ICT and its digital content, tools and applications as 'computer' and 'Internet'. The first term implies the application of various tools and programs within the limits of the personal computer whereas the second refers to the network of more computers within the World Wide Web. However, the terms 'computer' and 'Internet' have a much wider scope of implication in the system of education than in other areas of contemporary society. The reason why is that apart from relying on infrastructure and telecommunication, the educational system imposes that teachers engage in two segments: (1) teaching, in which the teacher is a lecturer (Bajčetić & Lazarević, 2007; Đorđević, 2014; Mandić & Ristić, 2006; Mišić Ilić, 2007; Ristić, 2009) and (2) science, where the teacher is also a researcher (Beatty, 2010; Kelly, Lesh, & Baek, 2014; Laurillard, 2008; Parsons & Brown, 2002). Both segments comprise the essence of the teacher's profession, especially in higher education.

The review of relevant literature shows that many authors (Bickle & Carroll, 2003; Fein & Logan, 2003; Klein, 2004; Koehler & Mishra, 2008; Sallmon, 2004) agree that nowadays the wider application of ICT in life and work is a challenge in modern education as well. Teachers are expected to acquire and develop competences enabling the adequate handling of the educational process in an ICT-dominated environment. For instance, Koehler and Mishra suggest that the education process relying on ICT should be based on three components: content, pedagogy and technology (Koehler & Mishra, 2008, p. 3). This means that teachers need training to be able to unite the three components. Another aspect pointed out is that standards have to be established to enable the development of the teachers' new professional competences in the new environment (Klein, 2004). Possible quality indicators of the methodological aspects of teaching relying on ICT need to be defined (Bickle & Carroll, 2003), as well as various strategies within the training of teachers to work in modern education (Fein & Logan, 2003). Finally, the role of the teacher (lecturer) implies that they accept the role of a moderator in the education process (Sallmon, 2004). In other words, the teacher should be an expert who creates the relevant environment for a dynamic exchange of knowledge and information, thus accepting to manage

educational activities with the objective that the participants in it develop and realize interaction and cooperation among themselves, both autonomously and with guidance.

Therefore, along with the development of the teachers' new role as lecturers, their role as researchers in the field of ICT needs to be developed. Many authors (Beatty, 2010; Kelly, Lesh, & Baek, 2014; Laurillard, 2008; Parsons & Brown, 2002) support the belief that the borderline between the teacher's role as a lecturer and researcher has been erased in the daily work conditions of modern education. Every teacher who chooses even basic ICT applications not only uses and implements technology in their teaching (Beatty, 2010) but also verifies the efficiency of such teaching (Laurillard, 2008), challenges and tests its possibilities so that they may analyse it in their research and publish their results and conclusions (Jacobson, 1999; Kelly, Lesh, & Baek, 2014; Parsons & Brown, 2002). Accordingly, the general recommendation is that more research is needed to identify the most efficient ways to help teachers use ICT as much as possible, both as lecturers and researchers (Thompson & Mishra, 2008). In Serbia, the NEC supports the same recommendation.

The basic assumption underlying the research described here is that university teachers (UT) in Serbia would apply ICT to a larger extent if they were provided with actual possibilities to do so. Therefore, the aims of this research are to offer preliminary insight into:

- (1) How UT understand the role of ICT in their research as well as which aspects of the scope of ICT they are familiar with and
- (2) What UT believe could facilitate their research activities.

A survey was conducted among 166 UT in Serbia based on a mixed questionnaire with nine closed-ended questions and one open-ended question. The research was not aimed at exploring the various aspects of ICT application among UT, but to provide insight into the general knowledge of the scope of ICT among them and to enable preliminary conclusions about their needs regarding a broader application of ICT in their research.

## METHODOLOGY

### *Research Methods, Techniques and Instruments*

The instrument used for this quantitative and qualitative research was a self-administered questionnaire (Lavrakas, 2008), because it is economical, efficient and anonymous.<sup>1</sup> The questionnaire was prepared by means of the online tool Survey Monkey and consisted of nine multiple choice close-ended questions and one open-ended question. When choosing

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<sup>1</sup> The questionnaire is available at <https://www.surveymonkey.com/r/VN5WR9J?sm=ySe%2bBxz%2fGEb0CyRxLIM7nw%3d%3d>

the target group, all branches of science represented in Serbia were equally included. At the beginning of October 2015 a link to the questionnaire was emailed to the addresses of the vice-rectors for scientific research at all Serbian universities asking them to forward the invitation to all the teachers at their universities. In addition, the link to the questionnaire was posted on the Facebook pages of the separate faculties of these universities with the call to forward the invitation to their colleagues.

As has been pointed out, the first aim of this research was to offer preliminary insight into the understanding of the role of ICT for research purposes as well as the knowledge of the scope of ICT among UT in Serbia. The second aim was to identify what UT believed could facilitate their research activities based on the answers to the last question. The criteria of objectivity and relevance were ensured by means of neutral questions. In addition, to provide better understanding, the term ‘computer’ was used in each question instead of ‘ICT’ following the expectation that the participants would recognize the computer as the basic device for ICT application in their research.

The multiple-choice answers to the first nine questions referred to how, in what way and to what extent UT use ICT in their research (e.g. application of tools for data analyses, types of analyses, referencing tools, etc.). The tenth open-ended question was expected to indicate what the respondents believed could facilitate their research activities. However, the planning of more than ten questions in Survey Monkey implies charges, which is why the questions prepared for this research were focusing on the research aim without investigating variables such as gender, age and years of work. More elaborate research in the future would have to be conducted with a different instrument to enable more than ten questions including variables such as gender, level of education, academic title and position. In that way the sample could be analysed in more detail, and more information relevant to the problem could be obtained.

By the end of December 2015, a total of 166 UT had completed the questionnaire. The lowest number of responses was obtained from teachers from natural sciences and mathematics (12.67%), medical sciences (1.60%) and art (1.60%) (Table 1).

*Table 1. Total number of UT per branch of science*

Branch of science	Total No. of UT
Natural sciences and mathematics	12.67%
Social sciences and humanities	52.60%
Medical sciences	1.60%
Technical sciences and engineering	31.53%
Art	1.60%
Total	100.00%

The reason for such a low response rate could not be investigated within the scope of this research but it is an important question to be included in future research. However, given the answers to the ninth question regarding the importance of the computer in modern research, almost all respondents (96.92%) believe that the computer is extremely important. The results obtained in this research point to the conclusion that the awareness of the role of ICT and the knowledge of its scope are indisputable, but it seems that the motivation to participate in research such as this is low. The reason may be low expectation that research will change the current situation. Both conclusions are strongly supported by the respondents' answers to the tenth question, which will be discussed in the next section.

### *RESULTS AND INTERPRETATION*

Due to the low response rate, the sample in this research is not representative, neither as a whole nor with respect to the separate branches of science; therefore, the conclusions may be regarded only as preliminary. More elaborate research should be conducted at an institutional level and with the support of authorities so that adequate scientific conclusions might be obtained. Because of the low response rate, a descriptive analysis of the data collected in this research was performed. However, for some of the variables additional correlations were established as it was assumed that they could yield relevant conclusions. Since the number of respondents was significantly different within the separate branches of science, the correlations were established with respect to the total number of participants but not to the separate branches. Nevertheless, the answers to the last question provided insight into the respondents' opinions regarding specific solutions they believed could facilitate their research activities. In brief, given the lack of relevant empirical data to support a deeper analysis, this section will present those results that undoubtedly indicate how, in what way and to what extent the respondents use the computer in their research. In addition, these results will be compared to the respondents' opinions stated in the answers to the tenth question. In that way, the research at least enables the author's subjective evaluation of the answers, thus yielding fairly precise conclusions.

Since the basic assumption in this research was that UT in Serbia know about the role and the scope of ICT but that they lack actual possibilities to implement ICT more, the data analysis was performed in several steps. The first step was aimed at establishing the extent to which the computer is used in research in general. The comparison of key computer applications among UT and the separate research phases they conduct (Table 2) indicates that a significant number of respondents uses the computer in all research phases. A total of 46.15% respondents use all available tools when preparing research instruments, 78.46% search and

analyse all sources, prepare notes, enter references and compile bibliography lists when preparing the theoretical background for their research and 53.30% perform both the quantitative and the qualitative data analysis.

*Table 2. Key computer applications applied by UT vs. particular research phase*

Most important computer applications	Research phase				
	Theoretical analysis	Final phase	All research phases	Total	
	%	%	%	%	
Preparing research instruments	Use some Microsoft Office tool	0	3.07	41.53	44.61
	Use tools available on the Internet	0	0	4.61	4.61
	Use all available tools	1.53	3.07	<b>46.15</b>	50.77
Preparing theoretical background	Search and analyse all sources, prepare notes, enter references, compile bibliography list	1.53	3.06	<b>78.46</b>	83.07
	Search sources, prepare notes and/or compile bibliography list	0	0	9.23	9.23
	Search sources	0	3.07	4.61	7.70
Analysis method	Quantitative analysis	0	3.07	4.61	7.70
	Qualitative analysis	0	0	26.15	26.15
	Neither	0	1.53	9.23	10.76
	Both	1.53	1.53	<b>53.30</b>	55.38

The correlation between the three variables shown in Table 2 (preparing research instruments, preparing theoretical background and analysis method) points to a significant relationship between preparing research instruments and the analysis methods that UT use in their research ( $r = .288$ ,  $p = .020$ ) (Table 3).

*Table 3. Correlation between computer applications when preparing research instruments, theoretical background and analysis method*

		Preparing research instruments	Preparing theoretical background	Analysis method
Preparing research instruments	Pearson correlation	1	-.038	.288 <sup>(*)</sup>
	Sig. (2-tailed)		.764	.020
Preparing theoretical background	Pearson correlation	-.038	1	-.106
	Sig. (2-tailed)	.764		.401
Analysis method	Pearson correlation	.288 <sup>(*)</sup>	-.106	1
	Sig. (2-tailed)	.020	.401	

\* Correlation is significant at the level 0.05 (2-tailed).

In brief, those UT who reported (Table 2) that they use all tools when preparing research instruments (50.77%), stated that they search and analyse all sources, prepare notes, enter references and compile bibliography lists when preparing the theoretical background (83.07%) and perform both qualitative and quantitative analyses (55.38%). The conclusion is that UT autonomously use those possibilities in their research that are available to them, i.e. the computer and the Internet.

The second step of analysis was expected to show the extent to which UT were familiar with the scope of ICT with respect to data analysis and referencing tools. The comparison between the number of UT who stated that they autonomously performed quantitative and qualitative analyses (55.38% in the total sample, Table 2) with the number of UT familiar with a tool used for preparing research instruments and data analysis shows that 33.33% of them know about SPSS, 25.00% chose Survey Monkey, 8.33% selected Google forms, 8.33% chose Poll maker while 25.00% did not know about any of the listed tools (Table 4).

*Table 4. Knowledge of tools used for research instruments and data analysis vs. analysis method*

	Knowledge of tools used for research instruments and data analysis				
	SPSS	Survey Monkey	Google forms	Poll maker	None
	%	%	%	%	%
Both quantitative and qualitative analysis (55.38%)	33.33	25.0	8.33	8.33	25.00
Total	74.99				

When comparing the number of UT who search and analyse all sources, prepare notes, enter references and compile bibliography lists when preparing the theoretical background for their research (83.07% in the total sample, Table 2) with the number of UT familiar with a referencing tool, it could be seen that 38.88% chose Microsoft Word, 25.92% selected EndNote (Thomson Reuter), 7.40% selected Mendeley and 7.40% chose RefWorks while 20.37% did not know about any of the listed tools (Table 5).

The correlation between the two variables indicating the knowledge of particular tools and possibilities provided by ICT (tools used for research instruments and data analysis vs. referencing tools) indicates a significant relationship between these two variables ( $r = .567$ ,  $p = .000$ ) (Table 6).



*Table 5. Knowledge of referencing tools vs. preparing theoretical background*

	Knowledge of referencing tools				
	Microsoft Office	EndNote	Mendeley	RefWorks	None
Search, analyse all sources, prepare notes, enter references, compile bibliography list (83.07%)	38.88	25.92	7.40	7.40	20.37
Total	79.60				

*Table 6. Correlation between knowledge of tools used when preparing research instruments and data analysis vs. knowledge of referencing tools*

		Knowledge of tools used for research instruments and data analysis	Knowledge of referencing tools
Knowledge of tools used for research instruments and data analysis	Pearson Correlation Sig. (2-tailed)	1	.567 <sup>**</sup> .000
Knowledge of referencing tools	Pearson Correlation Sig. (2-tailed)	.567 <sup>**</sup> .000	1

<sup>\*\*</sup> Correlation is significant at the level 0.01 (2-tailed).

In other words, those UT who stated they are familiar with tools used when preparing instruments and data analysis tools (74.99%) (Table 4) reported also they knew about referencing tools (79.60%) (Table 5). The conclusion is that UT not only know about the particular and specific aspects of the scope of ICT but they probably use all those possibilities they can access as much as possible. In other words, UT use programs and tools available to them, particularly the solutions offered by Microsoft Office as well as the data analysis program SPSS.

The third step in the analysis was related to the open-ended question. More than half of the respondents (56.06%) provided an answer to the last question, about how they believed their research could be made easier. It should be noted that the question did not make any reference to ICT at all but it was expected that the respondents would recognize their needs as related to ICT and mention research methods, techniques and tools, i.e. aspects of ICT that might aid their research activities. The analysis of the replies points to rather similar opinions stressing that UT needed (a) free access to data bases, referenced journals and similar sources (37.87%), (b) programs to prepare their research and conduct data analyses (16.21%) and (c) training to use programs and various technological solutions

(10.81%). In addition, a number of UT stated they needed better financial support (5.40%) while some of them (29.71%) stated their personal opinion about the current state of science in Serbia. However, the answers deemed relevant to this research (see (a), (b) and (c) above, i.e. 64.89% of all answers) indicate that UT know precisely what they need (examples of some of the respondents' opinions are shown in Table 7).

*Table 7. Examples of respondents' opinions about how to facilitate their research activities<sup>2</sup>*

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“Enabling unlimited (or at least considerably easier) access to articles written by other researchers shown when searching certain topics and problems”
“Purchase the newest hardware available on the market though the criteria are not really important. Most important would be the accessibility of information which goes without saying in the era of the Internet.”
“International network of libraries and accessibility of data as it used to be offered by the Kobson project when it was possible to read and even print articles from referenced journals.”
“Better knowledge of the computer in areas necessary for scientific research.”
“Access to international online journals and books (free of charge), intensive courses to improve technological knowledge related to new tools and methods, better financial support for skills development, conferences and fewer obligations related to the teaching process.”
“Accessibility to different analytical programs and the skills to use them, such as SPSS for statistical data analyses. In addition, programs for detecting plagiarism should be more accessible to academic staff because they are expensive and are charged.”

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## *CONCLUSION*

Pursuant to the recommendation of the National Education Council, a broader application of ICT in formal education is needed and the aim defined is that teachers should develop skills and knowledge to work in modern education based on ICT application. For this reason, a survey was conducted among 166 UT in Serbia based on a mixed questionnaire. The primary assumption was that UT in Serbia understand the role and scope of ICT but that they lack the actual possibilities to apply ICT to a greater extent.

The conducted research has revealed three main limitations. The first may be attributed to the fact that the questionnaire was prepared by means of the services offered free of charge by the online tool Survey Monkey, which is why only ten questions were prepared. Variables such as gender, level of education, academic title or position could not be investigated so that the

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<sup>2</sup> Translation from Serbian into English provided by the author.

sample could not be described in more detail, thus lacking deeper insight into relevant factors. The second limitation of this research is a result of the particular lay-out of the answers in the questionnaire. It would have been better and more relevant for the research if the respondents had been given the opportunity to evaluate the separate aspects investigated in the research, for instance based on a Likert-type scale. Another important limitation may be attributed to the low response rate (N=166) so that the sample is not representative enough. The reason for this remains unknown, which is why the data analysis offers only preliminary conclusions.

The data gathered from the questionnaire were analysed quantitatively while the last open-ended question enabled an additional qualitative analysis. With respect to the aims defined at the beginning of the research, the results point to the following conclusions:

1) Not only are UT familiar with the role and scope of ICT, but they seem to actually apply ICT to a large extent. The respondents search and analyse all sources, prepare notes, enter references, compile bibliography lists when preparing their theoretical backgrounds and they perform both quantitative and qualitative analyses. In addition, they are familiar with tools used for research instruments, as well as data analysis and referencing tools. However, the results show that ICT application among UT is limited mainly to tools and solutions that are free of charge.

2) The respondents' answers to the open-ended question point to the shared opinion that UT should be allowed free access to data bases, referenced journals and other sources, that they should be provided with programs to prepare their research and to conduct data analyses and that they should be trained to apply and implement ICT. In other words, the separate aspects of the scope of ICT mentioned by the respondents imply additional means which UT often do not have. Obviously, UT in Serbia would exploit the potentials of ICT much more if they were provided with better conditions to do so.

To conclude, active changes in the entire system of education are needed to provide solutions for the problems identified in this research:

1. Research is needed to investigate the motivation among UT for the application of ICT, both in their research and their everyday work.

2. A structured implementation of training for UT is of utter importance to help them apply ICT in their research, the computer being most important.

3. A priority of all institutions should be to provide UT with adequate tools and free access to all available online sources.

In brief, changes are needed at all levels of education to provide teachers in Serbia with a better and more modern environment in education to apply ICT both in their teaching and their scientific research.

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## УЛОГА И ДОМЕТИ ИНФОРМАЦИОНО-КОМУНИКАЦИОНИХ ТЕХНОЛОГИЈА У ИСТРАЖИВАЊИМА УНИВЕРЗИТЕТСКИХ НАСТАВНИКА У СРБИЈИ

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### Резиме

Стратегија развоја образовања у Србији до 2020. подразумева развијање дигиталне писмености и дигиталних компетенција свих учесника у образовном систему, а то подразумева и универзитетске наставнике. Неопходно је да наставници стичу и развијају компетенције које омогућавају адекватно вођење образованог процеса у окружењу којим доминирају ИКТ, али да стичу вештине за примену рачунара и за потребе научноистраживачког рада, јер су универзитетски наставници у исто време и предавачи и истраживачи. У том смислу, конципирано је и ово истраживање у коме се полази од претпоставке да би универзитетски наставници у Србији домете ИКТ примењивали у далеко већој мери када би им се за то пружиле објективне могућности. Циљеви овог рада су да понуди прелиминарни увид у то како универзитетски наставници у Србији разумеју улогу ИКТ за потребе истраживања и који су им домети ИКТ познати, а потом и да омогући увид у то на који начин би се наставницима, у складу са њиховим мишљењем, олакшало бављење науком. Анкетирано је 166 универзитетских наставника у Србији на основу индивидуално спроведеног комбинованог упитника. Девет отворених питања имало је за циљ да испита познавање улоге и домета ИКТ, а последње отворено питање да утврди на који начин би се по мишљењу испитаника наставницима у Србији олакшало бављење науком. Анализа резултата потврдила је да испитаници сматрају да су ИКТ изузетно неопходне и да самостално примењују могућности које су им доступне, на првом месту рачунар и интернет. Када је реч о конкретним програмима и алатима, испитаници су углавном наводили „Microsoft Office” и „SPSS”, па се може закључити да примењују програме и алате којима могу најлакше да приступе. Сем тога, више од половине испитаника понудило је конкретне одговоре на последње отворено питање, односно на питање о томе на који начин би им се олакшало бављење науком. Испитаници су сагласни да је потребно да им се омогући бесплатан приступ базама података, референтним часописима и другим изворима, да је неопходно да им се обезбеде програмска решења за припрему истраживања и обраду података и да је потребно организовати обуку да се програмска решења и разне технологије и користе. Упркос ограничењу које намеће мали број испитаника, може се закључити да би универзитетски наставници у Србији свакако користили све домете ИКТ када би за то имали објективне

могућности. Закључци такође указују на потребу да се испита мотивисаност наставника за ширу примену ИКТ, покрене системска имплементација обуке наставника за примену ИКТ, као и да се омогући набавка алата и приступ дигиталним ресурсима на нивоу институција у којима наставници раде. Ако би се спровела системска решења на свим нивоима образовног процеса, наставницима у Србији би се омогућило далеко боље окружење за наставни рад и научна истраживања у савременом образовању уз примену ИКТ.