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RESEARCH ON THE NEED TO USE NEW APPROACHES AND DIGITAL TECHNOLOGIES IN EDUCATION

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Abstract

The development of science and technology adds to the strength of the national economy and social structure of each country. Education should be the subject of continuous evaluation related to systemic, organizational and institutional solutions, as well as the methodological orientation aimed to the use of new methods and techniques in the process of knowledge acquiring. One of the key elements for achieving success is the introduction of digital technology into the acquiring knowledge process. The aim of this research is to intensify the application of new approaches and digital technologies in the educational process. The testing of hypothesis is enabled by the cross-tabulation method and the chi-squared test. Data processing and hypothesis testing were performed using the statistical software IBM SPSS, version 21. The results of the research can help efficient planning and redefining education policy in order to improve digital literacy.

Keywords: *approach, education, digital technologies, education policy.*

JEL Classification: *I25, O10, O3*

Introduction

Education is strategically important for the economic and social development of each country. A stable knowledge-based economy can be achieved with the help of a defined national policy in the field of education. In order for education to be an initiator of the development, it is necessary to establish a link between economy and education. It is necessary to identify what are the needs, demands and expectations of the users of the education services and all interested parties and define the development strategy accordingly. It is also necessary to establish a link between the research community and the creators of the education policy.

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Defining and implementing the appropriate strategy is crucial for the quality of education. When there is a large number of strategies in question, it is necessary to select the most adequate one, and in these cases it is possible to apply multi-criteria decision-making methods, which will be the subject of further research (Urošević et al., 2018; Karabašević et al., 2018).

Changes caused by scientific and technological development, recession or globalization, in general, have a direct impact on the field of education. The process of transition (Kirin et al., 2014), in which the Republic of Serbia found itself, led to the reduction of industrial production, the devastation of industrial capacities, reduced productivity in the industrial sector, outdated industrial equipment and technology, the reduction of competitiveness of the main industries and companies, reduction of the number of employees in the industrial sector, which inevitably created a decrease in the share of the industrial sector in GDP of Serbia. The process of transition caused the mismatch between the educational and the economic sectors, which created the lack of certain occupational profiles, as well as certain knowledge and the elimination of some job positions. The period after the long and difficult transition (Kirin et al., 2014) involves changing the entire economic structure of a country, reforming the legal and educational system, liberalization of the economy, strengthening state institutions and creating mechanisms for the direct foreign investments. Further development of the economy should be based on the diversity of education, research and innovation that will put the Republic of Serbia in the rank of high developed countries.

In order for education to make a difference, the education system should be efficient and effective, high quality and accessible. The concept of “modern education” should offer different content, approaches, methods, as well as the application of new technologies in the educational process and help students to acquire different competencies related to the application of new knowledge. When it comes to accepting the concept of “modern education”, it is necessary to motivate all participants in the educational process. Since motivation is a complex and dynamic process, it is necessary to choose an adequate motivation strategy (Janovac et al., 2018).

Digitization in education is one of the strategic priorities of the development of the Republic of Serbia. The Ministry of Trade, Tourism and Telecommunications in cooperation with the Ministry of Education, Science and Technological Development is implementing a capital project for the improvement of information and communication infrastructure in schools in the Republic of Serbia. The program entitled “Digital School” (Ministry of Trade, Tourism and Telecommunications, 2010) aims to provide each school in Serbia with a computerized classrooms that will enable students access to the computers and the Internet within classes and extracurricular activities. With this project, the line ministry supports Serbia’s economic growth.

New approaches to the knowledge acquiring

Knowledge is the most important human resource. Possession of knowledge (Wood, 2011) is crucially important for personal and social development. The knowledge acquiring process contributes to individual progress and the development of certain competencies necessary for inclusion in social processes. However, the way of acquiring knowledge is very different now and in the past. The process of transferring and acquiring knowledge accompanies the development of societies. Knowledge and skills were once being acquired exclusively based on experience and transmitted orally, so the education process itself was informal.

Over the past few decades, information and communication technologies have penetrated all spheres of human activity and the overall development has created the conditions for their application in the educational process. Under the influence of modern technologies, education, as well as the need to gain an ever-increasing knowledge, has changed drastically over the past few decades. Computer programs for learning have become an attractive tool for acquiring knowledge, because they combine verbal-conceptual and audio-visual information, which makes different learning requirements more concrete and far more interesting. Educational software enables interactive learning, quick access to useful information, instantaneous correction of errors and verification of acquired knowledge and skills.

From traditional toward modern education

Nowadays, the education system differs greatly from the period of thirty years ago or more, just like the process of knowledge acquiring itself. New information is generated every day, and general development continuously requires new knowledge and skills. New communication and information technologies offer great opportunities for acquiring practical knowledge. In addition to the advantages provided by modern technology, there are some practices that should not be changed. A lot of important methods of learning and students' development come from experiences that are difficult to transmit electronically. A result of the digitalization era there may be a loss of comprehensive knowledge, which is a major problem for the economy of each country.

Models of education systems are different in European countries. For example, in France, there is still an emphasis on traditional forms of teaching, while in the United Kingdom and some Scandinavian countries, new methods and modern technologies have become primary teaching methods. In Estonia, programming and coding are mandatory in elementary education; they use robots for interactive learning of programming and coding. In this country, schools have great autonomy, they have the freedom to create programs within a digital strategy, and they have developed an online learning system and an interdisciplinary approach to teaching.

According to the results of the PISA test (OECD, 2015), the largest international student testing, the top of the list of countries with the best education belongs to Singapore, followed by Japan, Estonia, China, Finland, Canada, Vietnam, South Korea, and other countries. The Dominican Republic, i.e. the knowledge of students from that country, is among the worst ranked countries. In 2015, the testing was conducted by the Organization for Economic Co-operation and Development (OECD), it included 540,000 students from 73 countries and the overall score was created summing points from three areas: reading literacy, mathematical and scientific literacy and ability to solve problems.

Table 1: Average scores of 15-year-old students on the PISA science literacy scale, by education system, 2015

Education system	Average score	s.e.	Education system	Average score	s.e.
OECD average	493	0.5			
Singapore	535 ▲	1.6	Hungary	470 ▼	2.7
Hong Kong (China)	527 ▲	2.7	Greece	467 ▼	4.3
Canada	527 ▲	2.3	Chile	459 ▼	2.6
Finland	526 ▲	2.5	Slovak Republic	453 ▼	2.8
Ireland	521 ▲	2.5	Malta	447 ▼	1.8
Estonia	519 ▲	2.2	Cyprus	443 ▼	1.7
Korea, Republic of	517 ▲	3.5	Uruguay	437 ▼	2.5
Japan	516 ▲	3.2	Romania	434 ▼	4.1
Norway	513 ▲	2.5	United Arab Emirates	434 ▼	2.9
New Zealand	509 ▲	2.4	Bulgaria	432 ▼	5.0
Germany	509 ▲	3.0	Turkey	428 ▼	4.0
Macau (China)	509 ▲	1.3	Costa Rica	427 ▼	2.6
Poland	506 ▲	2.5	Trinidad and Tobago	427 ▼	1.5
Slovenia	505 ▲	1.5	Montenegro, Republic of	427 ▼	1.6
Netherlands	503	2.4	Colombia	425 ▼	2.9
Australia	503	1.7	Mexico	423 ▼	2.6
Sweden	500	3.5	Moldova, Republic of	416 ▼	2.5
Denmark	500	2.5	Thailand	409 ▼	3.3
France	499	2.5	Jordan	408 ▼	2.9
Belgium	499	2.4	Brazil	407 ▼	2.8
Portugal	498	2.7	Albania	405 ▼	4.1
United Kingdom	498	2.8	Qatar	402 ▼	1.0
Chinese Taipei	497	2.5	Georgia	401 ▼	3.0
United States	497	3.4	Peru	398 ▼	2.9
Spain	496	2.4	Indonesia	397 ▼	2.9
Russian Federation	495	3.1	Tunisia	361 ▼	3.1
B-S-J-G (China)	494	5.1	Dominican Republic	358 ▼	3.1
Switzerland	492	3.0	Macedonia, Republic of	352 ▼	1.4
Latvia	488 ▼	1.8	Algeria	350 ▼	3.0
Czech Republic	487 ▼	2.6	Kosovo	347 ▼	1.6
Croatia	487 ▼	2.7	Lebanon	347 ▼	4.4
Vietnam	487 ▼	3.7			
Austria	485 ▼	2.8			
Italy	485 ▼	2.7			
Iceland	482 ▼	2.0			
Luxembourg	481 ▼	1.4	U.S. states and territories		
Israel	479 ▼	3.8	Massachusetts	527 ▲	6.0
Buenos Aires (Argentina)	475 ▼	7.2	North Carolina	500	5.4
Lithuania	472 ▼	2.7	Puerto Rico	410 ▼	7.1

Source: National Center for Education Statistics (2015)

Unfortunately, Serbia was not a participant in this international testing in 2015, so we do not have a real insight into the knowledge of Serbian students. Since the results of the new PISA testing held in 2018, which included the Republic of Serbia, will be published in 2019, the year 2018 could not be covered by this research.

A good test result of students from Asian countries (Singapore, Japan, China, Vietnam, and South Korea) can be explained by the economic take-off of Asian countries through technological development and innovations. Also, the reason for the success should be sought not only in a well-established and disciplined education system, but also in promotion of a culture of quality and education culture in East Asian countries. The basic instruments of social and economic development of these countries are science and education.

Modern way of life and the technology development change the way we live and work. The development and improvement of technology affect the economy, changing the structure of jobs and demand for certain occupational profiles, knowledge and skills. In line with the changes, the way we acquire knowledge changes, and consequently we have a need to change the whole education system.

Since digitization imposes itself as a development path, education must adapt to the new digital economy. Reform of the education system implies new definition of strategies in line with technological changes and demands of the education users. When it comes to the choice of development strategies, multi-criteria decision-making process (Urošević et al., 2018, Karabašević et al., 2018) can significantly contribute to decisions related to sustainable solutions.

Advantages of learning using digital technologies

Educational software mainly use program support for learning (courseware), based on Web and complemented by computer-mediated communication (CMC). The structure of educational software for self-learning depends on the goals set for learning and the nature of the teaching content. The most commonly used are linearly structured materials, in which students are instructed to work step by step. Instructions for adopting new contents, tasks for students, questions for self-evaluation etc. are taking turns. Learning through educational software guarantees a higher level of knowledge. The software enables teaching material to be quickly and better managed with constant knowledge testing. This avoids a campaign approach to learning and provides continuous improvement. Students are encouraged to pay more attention and better to concentrate. In addition to learning within educational institutions, the use of educational software is also possible at home, independently. One of the most important elements of interaction is providing feedback on what has been done (Bjelja & Janovac, 2012).

Application of interdisciplinary approach and new technologies in teaching has many advantages, especially when it comes to personalization of learning, increased level of motivation, training of students to create and use new knowledge, creation of a continuous learning culture, as well as the development of critical thinking and problem solving with the help of digital content.

Research methodology

The aim of this research is to point out the need for the application of new approaches and digital technologies in the educational process. For this purpose, an empirical research with two questionnaires was made. The first survey was intended for the management of the school (director, psychologist/pedagogue, coordinator of professional practice), while the second survey was intended for secondary school students. In the first survey participated 11, and in the second survey 408 respondents. The surveys were conducted in three schools of economy: the First Economics School in Belgrade, the Economic School “Nada Dimić” in Zemun and the secondary school “Kosta Cukić” in Novi Beograd. Surveys were conducted in October, 2017. Table 2 shows the frequencies of respondents (school management) of the first survey.

Table 2: *Characteristics of the first survey respondents (n=11)*

Characteristics (management)	of the respondents	Number of the respondents (n)	Structure (%)
Profession	Coordinator of professional practice	7	63,6
	Director	1	9,1
	Pedagogue/Psychologist	3	27,3
Do you consider professional practice an important element of the educational process?	Yes	11	100,0
	No	-	-
Do you think that it is necessary to introduce changes in knowledge acquiring, in line with the modern concept of education?	Yes	10	90,9
	Ne	-	-
	I do not know	1	9,1
What should be changed in the	Redefine study programs	1	9,1

process of knowledge acquiring?	Approach	7	63,6
	Introduce new advanced methods	3	27,3
What are the reasons for the introduction of changes?	Outdated teaching methods	4	36,4
	Modern approach to practical knowledge acquiring	6	54,5
	Uncoordinated programs with study demands	1	9,1
Do you consider educational software an adequate learning tool?	Yes	10	90,9
	No	1	9,1

Source: *Author's calculation*

According to the respondents' profession (school management), it can be noticed that there is 63.6% of professional practice coordinators in the sample, 27.3% of pedagogues/psychologists and 9.1% of directors. As far as we observe the frequencies of the management's responses to the questions from the first survey, we can conclude the following: all respondents consider that professional practice is an important segment of the educational process, while 90.9% of the respondents consider that the changes in line with the modern concept of education are necessary in knowledge acquiring process. When it comes to acquiring new knowledge, 63.6% of respondents believe that it is necessary to change the approach, 27.3% of respondents consider that it is necessary to introduce new advanced methods, while 9.1% of respondents consider it is necessary to redefine study programs. More than half of the respondents (54.5%) believe that modern approach for acquiring practical knowledge is the main reason for the introductions of the changes. Most respondents (90.9%) believe that educational software can be an active learning tool.

Table 3: Characteristics of the respondents of the second survey (n=408)

Characteristics of respondents (students)		Number of respondents (n)	Structure (%)
Sex	Male	160	39,2
	Female	248	60,8
Do you consider professional practice important for acquiring practical knowledge?	Yes	398	97,5
	No	10	2,5
Where would you like to do professional practice?	In an organization (bank, company)	306	75,0
	At school	10	2,5
	At a faculty that focuses on applied knowledge	62	15,2
	I have no opinion about the place of the professional practice	30	7,4
Would you like to get a certificate for acquiring certain knowledge and skills after completing professional practice?	Yes	398	97,5
	No	10	2,5
Would you like to acquire new knowledge using educational software?	Yes	364	89,2
	No	44	10,8

Source: *Authors' calculation*

According to the respondents' (students') sex, it can be noticed that there is 60.8% of female respondents and 30.2% of male respondents in the sample. If we observe frequencies of students' responses to the questions from the second survey, it can be noticed that the majority of respondents (97.5%) believe that the professional practice is important for acquiring practical knowledge. Most respondents (75.0%) have the desire to attend a professional practice in an organization (bank, company) and the majority (97.5%) would like to get a certificate for acquiring certain skills and knowledge after completing professional practice. Most respondents (89.2%) have a desire to gain new knowledge through the use of educational software.

Based on the analyzed theoretical background and the aim of the research, we have set the following hypothesis:

H₁: There is a statistically significant connection between the requirement for changes in acquiring new knowledge and concrete changes.

H₂: Respondents of the different professions (coordinators of the professional practice, director, pedagogue/psychologist) and students of different sex have the same attitude on educational software.

Testing of both hypothesis is made using the method of cross-tabulation and chi-squared test. Statistical software used for the data processing and hypothesis testing was IBM SPSS version 21.

Research results and discussion

Determination of the statistically significant connection between the requirement for changes in acquiring new knowledge and concrete changes

One of the tasks of this research is to examine whether there is a statistically significant connection between the requirement for changes in acquiring new knowledge and concrete changes (in the sample related to school management). It was set the following hypothesis.

H₁: There is a statistically significant connection between the requirement for changes in acquiring new knowledge and concrete changes.

To test the proposed hypothesis, it will be used cross-tabulation method, i.e. determining the frequency or proportions of cases in each of the categorical variables (Coakes, 2013).

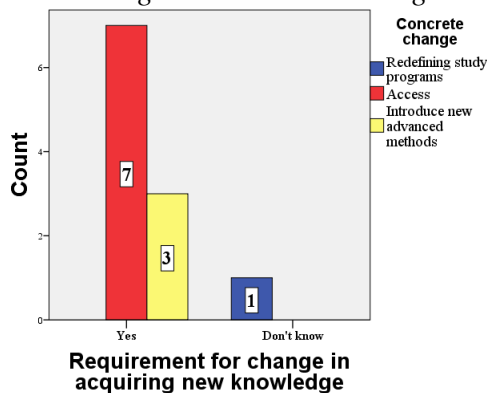
Based on the cross-tabulation of two categorical variables, *the requirement for changes in acquiring new knowledge* and *the concrete changes*, in Table 4, it can be noticed that among these respondents who insist on the necessity of changes in acquiring new knowledge, 7 respondents consider that it is necessary to change the approach (70%), while 3 respondents believe that it is necessary to introduce new advanced methods (30%) in order to acquire new knowledge in accordance with the modern concept of education. When it comes to respondents who are not sure whether the changes in acquiring new knowledge are necessary, 1 respondent thinks that it is necessary to redefine the study programs.

Table 4: *Testing the independent variables: requirement for changes in acquiring new knowledge and concrete change*

		Concrete change			Total	
		Redefine study program	Approach	Introduce new advanced methods		
Requirement for changes in acquiring new knowledge	Yes	Frequency	0	7	3	10
		Structure (%)	0,0%	70,0%	30,0%	100,0%
		% group in the sample	0,0%	100,0%	100,0%	90,9%
	I do not know	Frequency	1	0	0	1
		Structure (%)	100,0%	0,0%	0,0%	100,0%
		% group in the sample	100,0%	0,0%	0,0%	9,1%
Total	Frequency	1	7	3	11	
	Structure (%)	9,1%	63,6%	27,3%	100,0%	
	% group in the sample	100,0%	100,0%	100,0%	100,0%	

Source: *Authors' calculation*

Chart 1: *Frequency of requirements for changes in acquiring new knowledge and concrete changes*



Source: *Authors' calculation*

Pearson's chi-square test was used to determine the significance of the result (Table 5). To make the result significant, the significance value should be 0.05 or less (Gravetter, & Wallnau, 2013; Green & Salking, 2014). Considering that in the concrete case the significance value is lower than 0.05, we consider that there is a connection between the variables: the requirement for changes in acquiring new knowledge and concrete changes.

Table 5: *Pearson's chi-squared test*

	Value	Number of degrees of freedom	Significance value
Pearson's chi-square	11,000	2	,004
Probability percentage	6,702	2	,035
2-side linear connection	4,225	1	,040
Total number of observations	11		

Source: *Author's calculation*

The chi-square test of independence showed a significant connection between the requirement for changes in acquiring new knowledge and the concrete changes $\chi^2 (2, n = 11) = 11.0; p = 0.004; p < 0.05$. This means

that the proportion of respondents related to the requirement for change in acquiring new knowledge significantly varies according to what exactly should be changed in acquiring new knowledge. This implies that the assumption H_1 is approved: *There is a statistically significant connection between the requirement for changes in acquiring new knowledge and concrete changes.*

Determination of statistically significant difference in the attitudes of management and students on the application of educational software for acquiring new knowledge

One of the tasks of this research is to examine whether there is a statistically significant difference in the opinions of the management (coordinators of the professional practice, director, pedagogue/psychologist), as well as among the students of different sex regarding the application of educational software for acquiring new knowledge. It was set next hypothesis.

H₂: Respondents of the different professions (coordinators of the professional practice, director, pedagogue/psychologist) and students of different sex have the same attitude on educational software.

To test the proposed hypothesis, it will be used a cross-tabulation method, i.e. determining the frequency or proportions of cases in each of the categorical variables.

On the basis of the cross-tabulation of two categorical variables: *occupation* and *educational software* in Table 6, it can be noticed that 6 coordinators of the professional practice consider that educational software is an active learning tool (85.7%), while 1 of them considers that educational software is not an active tool for learning (14.3%). When it comes to directors, 1 respondent believes that educational software is an active learning resource. When it comes to pedagogues/psychologists, 3 respondents think that educational software is an active learning resource. If we observe the whole sample, 90.9% of the management believes that educational software is an active learning tool.

Based on the cross-tabulation of two categorical variables: *sex* and *educational software* in Table 6, it is noted that 142 male students want to gain new knowledge using educational software (88.8%), while 18 of them do not want to acquire new knowledge using educational software

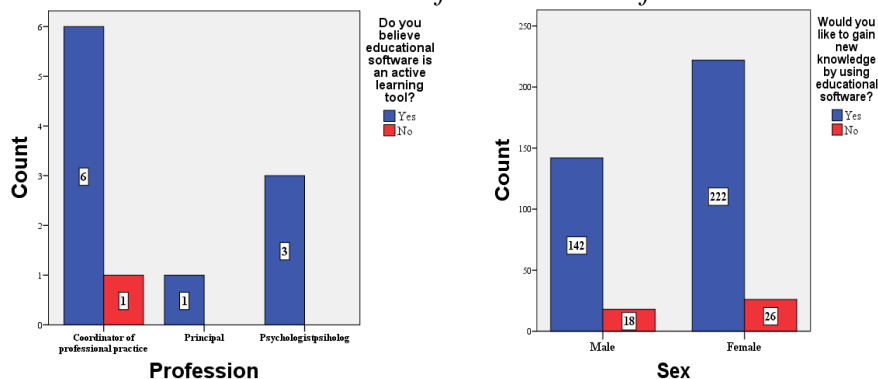
(11.2%). When it comes to female students, 222 of them want to gain new knowledge using educational software (89.5%), while 26 of them do not want to acquire new knowledge using educational software (10.5%). If the whole sample is observed, it can be noticed that 89.2% of students want to gain new knowledge using educational software.

Table 6: *Testing the independent variables: profession and educational software; sex and educational software*

		Educational software		Total	
		Yes	No		
Profession	Coordinator of professional practice	Frequency	6	1	7
		Structure (%)	85,7%	14,3%	100,0%
		% group in sample	60,0%	100,0%	63,6%
	Director	Frequency	1	0	1
		Structure (%)	100,0%	0,0%	100,0%
		% group in sample	10,0%	0,0%	9,1%
	Pedagogue/psychologist	Frequency	3	0	3
		Structure (%)	100,0%	0,0%	100,0%
		% group in sample	30,0%	0,0%	27,3%
Total	Frequency	10	1	11	
	Structure (%)	90,9%	9,1%	100,0%	
	% group in sample	100,0%	100,0%	100,0%	
Sex	Male	Frequency	142	18	160
		Structure (%)	88,8%	11,2%	100,0%
		% group in sample	39,0%	40,9%	39,2%
	Female	Frequency	222	26	248
		Structure (%)	89,5%	10,5%	100,0%
		% group in sample	61,0%	59,1%	60,8%
	Total	Frequency	364	44	408
		Structure (%)	89,2%	10,8%	100,0%
		% group in sample	100,0%	100,0%	100,0%

Source: *Author's calculations*

Chart 2: Distribution of respondents according to profession and sex related to the use of educational software



Source: Author's calculations

To determine the significance of the results it was used Pearson's chi-squared test (Table 7). To make the results significant, the significance value should be 0.05 or lower.

Table 7: Pearson's chi-square test

		Value	Number of degrees of freedom	Significance value
Profession	Pearson's chi-square	,629	2	,730
	Probability percentage	,960	2	,619
	2-side linear connection	,521	1	,470
	Total number of observations	11		
	Pearson's chi-square	,059	1	,808
Sex	Probability percentage	,059	1	,808
	2-side linear connection	,059	1	,808
	Total number of observations	408		

Source: Author's calculations

The chi-square test of independence did not show a significant connection between respondents and the application of educational learning software $\chi^2(2, n = 11) = 0.629$; $p = 0.730$; $p > 0.05$. In other words, the proportions of the coordinator of the professional practice, the director and the pedagogue/psychologist do not differ when it comes to the attitude that educational software is an active tool for learning. Although the result of

the comparison is not statistically significant, it only proves that educational software is, in relative terms, an active tool for learning, in the opinion of the coordinator of professional practice, as well as and in the opinion of the director and the pedagogue/psychologist. Also, it should be concluded that the majority of management staff (90.9%) believe that educational software is an active learning tool.

The chi-square test of independence did not show a significant connection between the sex of the students and the application of educational learning software $\chi^2 (1, n = 408) = 0.059$; $p = 0.808$; $p > 0.05$. In other words, the proportions of male and female students do not differ in the desire to acquire new knowledge using educational software. Although the result of the comparison is not statistically significant, it only proves that the desire to acquire new knowledge by using educational software is present, to the same extent, both for male and for female students. Also, it should be concluded that most students (89.2%) want to gain new knowledge using educational software.

Finally, the set assumption H_2 is proven: *Respondents of the different professions (coordinators of the professional practice, director, pedagogue/psychologist) and students of different sex have the same attitude on educational software.*

Conclusion

The influence of knowledge on the development of society is becoming more important than any other resource. Education is an important factor when it comes to the effective and fast economic development. Creating a stable knowledge-based economy can be achieved with the help of a defined national policy.

In order for research in the field of education to fulfil an important social role, it is necessary to establish a good communication between the research community and those interested in using research findings, including the creators of educational policies.

The results of the empirical research indicate that changes in the approach to knowledge acquiring are necessary and they have to be in line with the modern concept of education and the digital economy. The education system needs to be brought closer and adjusted to the users, which means

adapting learning methods and techniques, improving existing study programs and introducing new ones in line with market demands.

The results of empirical research indicate that most students (89.2%) want to gain new knowledge using educational software. Also, majority of the school management (90.9%) believes that educational software is an active learning tool.

Learning through digital technologies ensures a higher level of knowledge acquisition, better students' motivation, continuity in learning. The results of this empirical research can contribute to the efficiency of planning and redefining education policy in order to improve digital literacy.

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