

E-Maturity in Schools

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Abstract

The successful integration of digital technologies in educational institutions is an imperative of any educational system in a developed society. Activities leading to the integration of digital technologies, i.e. implementation models, represent a challenge for developed countries as well as developing ones. In the European context, e-maturity in schools, is recognized as one of the key issues. The aim of this paper is to determine the indicators for assessing the level of e-maturity in Serbian schools and creating an evaluation model. In addition to a reinterpretation of the existing research and a comparative analysis, the method of modeling has been used in this paper. The proposed evaluation model can provide a basis for self-evaluation of e-maturity in schools and planning for the improvement of: digital culture at school; security and technical requirements and support; digital skills of teachers, students and employees in professional services; digital learning environment; inclusion of digital technology into the curriculum, as well as the effective implementation of digital technologies in the school organization. The evaluation model for e-maturity in schools is not only an instrument for evaluation, but also a model for effective management and decision-making.

Key words: e-maturity; principal; school; student; teacher.

Introduction

Education represents a very difficult and challenging field of research as mere provision of statistical data, and capability of interpreting them is not enough. In order to properly interpret the data about digital maturity at schools it is essential to be familiar with relevant documents, analyses and results of existing research, as well as international and national trends, respective educational policy, sociocultural and historical contexts and the real state of affairs in the field. For this reason, it is necessary to rely on a systematic approach and choose the appropriate work methodology which defines the way data will be treated and conclusions based on them reached. This paper presents qualitative research, which, apart from the reinterpretation and comparison of existing research, relies on the method of modeling.

Innovating and modernizing education and training are key priorities in several flagship initiatives of the Europe 2020 strategy, in particular Agenda for New Skills and Jobs, Youth on the Move, the Digital Agenda and the Innovation Union. The key challenge for research and policy is to make sure that the full potential of digital technologies is used for learning and that effective digital-age learning is made possible through systemic and holistic change. Progress in order to move towards full integration of digital technologies in education and training is still needed in many European countries.

ICT stands for “information and communication technologies”. This term is now widely used in educational research, policy, and practice. The term “ICT” encompasses much more than just computers. ICT can be defined as “anything which allows us to get information, to communicate with each other, or to have an effect on the environment using electronic or digital equipment” (Siraj-Blatchford & Siraj-Blatchford, 2003, p. 4).

The digital maturity of schools is a concept that is becoming more and more significant within the modern educational system due to the increasing importance of technology. The use of ICT in schools is no longer a matter of individual enthusiasm, but rather, it is planned and implemented at the level of the school as an organization, in accordance with local and state policies. The European Commission has recognized the importance of this concept and, through its policies and initiatives, systematically encourages the development of the digital maturity of schools.

ICT in education or e-learning provides a variety of learning tools, authoring tools, editing tools, analytic tools, collaboration tools, scenarios and lesson plans that create opportunities for open and collaborative innovation practices, creativity and innovation in the classroom. These technologies and tools help the educational system, empower individual teachers and learners to actively participate in the digital community and become creators of innovative processes (Balanskat, 2006; Bogнар, 2016). On this front, most European countries have made significant progress over the years, but the level of progress is not the same for all countries.

The analysis of modern trends in educational technology shows that only some *didactic-information science innovations* meet these criteria and that they can be applied in the classroom. Thanks to respective pedagogical-psychological, technical and creative bodies of knowledge, the implementation of modern and innovative didactic-computer science teaching technologies means combining internal and external teaching resources in a stimulating educational environment that can have a high degree of efficiency (Ristić & Radovanović, 2013). Appropriate use of didactic-computer science innovations makes the educational process much more interesting, effective and accessible to children, and contributes to a quality integration of various contents.

Developing new digital learning environments and positioning them successfully in operation requires a corresponding supportive atmosphere and culture. Contemporary ICT-based solutions can improve learning results only if the surrounding social

practices are updated and revised accordingly. However, the pedagogical shift is not the only factor that is challenging the operative working culture in the school context: also, the amount of administration and responsibilities has increased and thus reduced the time available for pedagogical development. How to react to these contemporary demands is, eventually, always a matter of leadership.

Digitally mature schools are the ones at a high level of integration of ICT in their lives, operation, and the system which supports them. In digitally mature schools, the approach to ICT use in school management and teaching processes is systematized. Such schools operate in a supportive environment, with adequate resources that include not only financial funds, but also classrooms, laboratories, teachers and students adequately provided with ICT equipment.

According to Becta, E-maturity is related to how effectively providers are using technology to deliver Harnessing Technology and meet other strategic priorities. It can be seen as: “The capacity of a college or learning institution to make strategic and effective use of technology to improve educational outcomes” (Becta, 2008, p. 12).

The above stated imposes the key question – whether our schools are digitally mature, i.e. whether there is a system framework for a more successful ICT integration, and which evaluation model should be applied.

System Framework for a Successful ICT Integration in Serbian Schools

Societies in which the teaching profession is fully respected, where learning is important for the general population and where national institutions promote and support a learning environment rich in ICT show exceptional results. For a constant advancement of the educational system in terms of effective application of ICT, it is essential to have continuous institutional support, underpinned by concrete actions, and to work on affirmative attitudes towards new technologies in the education and training system.

Due to their multidisciplinary nature, digital technologies have the potential to be successfully integrated into all aspects of education at all its levels and in all matters of educational policy. In order to understand the way the system environment in the Republic of Serbia supports successful integration of ICT in the educational system, the strategic, legal and institutional frameworks will be analyzed.

Within the European educational space, the development of ICT in education has been conceived in special strategic documents and action plans, such as the developmental strategy of e-education, which made an integral part of the strategy of development of information-based European society. For the Republic of Serbia, these documents are still relevant bearing in mind the fact that Serbia is a developing country, which has not participated in earlier EU programs and initiatives. The document Guidelines for promoting the role of ICT in education (NPS RS, 2013, p. 21) points to several forms of support which are a prerequisite for successful integration of ICT into the educational system:

1. giving access to the Internet and multimedia resources (for schools, teachers and students) to all schools;
2. building and strengthening of European networks that link other national, educational and research networks should be initiated;
3. developing digital literacy and introducing a general certificate of computer and Internet skills for secondary school students;
4. carrying out a comprehensive analysis of European market for e-learning, i.e. the analysis of European economic and social environment related to e-learning;
5. providing Internet access by means of the *eTEN* and *eLearning* programs for all students and researchers, and so on.

The plan also involved the support of the EU in the procurement of equipment, cooperation and exchange of experiences in the field of teacher education, educational research and development of distance education via the Internet (educational contents and services).

Džigurski et al. (2013), believe that there is no clear strategic approach to the improvement of the role of ICT in teaching both at the level of schools and local communities, and at the level of ministries and institutions in charge of regulation and development of the respective area. The development of the role of ICT is therefore primarily based on the enthusiasm of individuals and local communities which dictate equipping of schools for the implementation of ICT. The purchase of computer equipment and monitoring of progress in this area rely fragmentarily on the development plans, on the financial plans of institutions, on expressed needs of professional councils and the perceptions of managerial staff about the need for introducing ICT into teaching. Lack of organized support for the implementation of ICT in educational institutions has prevented planned acquisition, maintenance of equipment and organizing the training for the development of teacher competences. This is most clearly reflected in a wide range of arbitrary measures and various initiatives by means of which schools attempt to respond to the challenges in the process of introducing modern teaching methods and technologies. The respondents in this study particularly point out the lack of continuous technical and methodological-didactic support necessary for adequate implementation of ICT in teaching.

In respect of the legal framework, the starting points for the development of key forms of literacy necessary for successful work and life in an information-based society are stipulated in the Law on the Bases of the Education System (2009). According to this law, the school is supposed to develop special programs and thus work additionally on the improvement of students' education. One such program may be a program for the planning and integration of digital technologies in the work of educational institutions, especially with the aim to develop digital competences, which is in line with the recommendations of UNESCO (2002) referring to the formation of such teams at the level of educational institutions.

The Law on Primary Education (2009), Article 50, states that the school library is the place of library- and information-related, educational and cultural activities of the school, and that the task of school libraries is to develop in students the habit of reading and the use of library services, to enable them to use information in all forms and with all media and enable them to acquire the skills needed for lifelong learning.

Based on the analysis of the legal framework, it can be said that some of its elements need to be legally better formulated. In the first place, it is necessary to legally assign the obligation to the school to develop a program for the planning and integration of ICT in work at the level of the institution. The program should include activities aimed at increasing the level of digital competence of students and teachers, increased availability of hardware and software, better access to the Internet and the development of digital competences for the use of technology in the teaching process and in the work of the non-teaching school staff (administration and management). It is necessary to better promote the role of libraries and librarians in the process of integrating ICT into the education system. It is also necessary to create national standards of qualification for the application of ICT in education following the standards set by the International Society for Technology and Education, bearing in mind the generally accepted value of *International Society for Technology in Education* (ISTE) standards.

Rapid advances in technology have put new demands on educators and students. The refreshed ISTE National Educational Technology Standards (NETS) provides a framework for educators to use as schools transition from Industrial Age to Digital Age places of learning. The refreshed NETS guide teachers toward the following goals:

- 1) *Facilitate and inspire student learning and creativity* - teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity and innovation in both face-to-face and virtual environments.
- 2) *Design and develop digital-age learning experiences and assessments* - teachers design, develop and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills and attitudes identified in the standards.
- 3) *Model Digital-Age work and learning* - teachers exhibit knowledge, skills and work processes representative of an innovative professional in a global and digital society.
- 4) *Promote and model digital citizenship and responsibility* - teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.
- 5) *Engage in professional growth and leadership* - teachers continuously improve their professional practice, model lifelong learning and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources (ISTE, 2015).

Jobs which are, to a certain extent, related to the implementation and development of ICT in education at the national level in the Republic of Serbia, are dealt with by the following institutions, in accordance with their competences and capacities, procedures, plans and available budget: 1) The Ministry of Education, Science and Technological Development (MoESTD); 2) The Ministry of Foreign and Internal Trade and Telecommunications (MTT); 3) The Institute for Improvement of Education (IIE); 4) The Institute for Education Quality and Evaluation (IEQE); 5) Academic Network of the Republic of Serbia (ANRES). Activities related to monitoring, the development and improvement of the quality of education fall under the competence of three councils: 1) The National Education Council (NEC); 2) Council for Vocational Secondary and Adult Education (CVSAE) and 3) The National Council for Higher Education (NCHE).

Based on the analysis of the current state by means of interviews with representatives of all these institutions (activities in the field of ICT and education), the research conducted by Džigurski et al. (2013, p. 30), leaves the reader under the impression that each institution is very keen to support the development of ICT in education, and that in the past through various projects (*Digital school, Modernization of the system of vocational education, Empowering schools for inclusive education*) it mostly invested in the development of infrastructure. This trend has also been present in developed countries in the past two decades and what was observed is a high degree of imbalance in favor of investment in infrastructure in relation to investments in other areas, which also make basic spheres of support to successful implementation of ICT in education: the development of human resources, research, policy formulation and the like.

With regard to the educational potential of digital technologies and their rapid development, as well as the needs of the society, there is a need for further development of both human capacities within the institutions themselves and their synergies with the aim to provide system support in the implementation of ICT in education.

Models of Evaluating Digital Maturity in Schools

Digital maturity of schools is a concept which is becoming more and more significant within the modern educational system due to the increasing importance of technology. The use of ICT in schools is no longer a matter of individual enthusiasm, but rather, it is planned and implemented at the level of the school as an organization, in accordance with local and state policies.

It is clear that mechanism for evaluating digital maturity should be implemented in the school system in order to get timely feedback about the level of digital maturity in schools and its impact on learning outcomes. For this reason and the purpose of defining indicators for evaluating digital maturity in Serbian schools, seven models have been analyzed: Becta model (Becta, 2008); Shanghai model (Zhihua & Zhaojun, 2009); Belgian model (Schreurs, 2007); Eurydice (Eurydice, 2001); ICT-MM model from Chile (Solar et al., 2013) and e-Schools: Establishing a System for Developing Digitally Mature Schools (pilot project) model from Croatia (CARNet, 2016).

E-maturity has multiple dimensions, and although precise definitions may vary, most encompass issues related to ICT and e-learning infrastructure, staff skills, and use of ICT and e-learning with learners. Becta (British Educational Communications and Technology Agency) has developed an e-maturity framework to help support further education providers in working towards e-maturity. This framework sets out eight areas of maturity and detailed indicators for five stages of maturity within each. The five areas are: 1) leadership and vision; 2) contexts; 3) resources; 4) learning support; and 5) teaching and learning. This framework is intended primarily as a self-diagnostic tool, allowing providers to rank their levels of maturity within the eight areas and identify areas for improvement (Becta, 2008, p. 15). Self-evaluation of digital maturity is done by the management, as the carrier of the vision and change, and the teaching staff that is to improve the teaching practice.

Other countries, depending on their policy goals for education, might have a different focus, e.g. on improved learning and teaching processes or the acquisition of a variety of “new” skills and competences enabled through adequate and strategic use of ICT. In a shift away from the focus on the individual learner/teacher or the classroom level, countries increasingly want to know if their schools are “e-mature.”

The model of evaluation of digital maturity in schools can be based on internationally acknowledged and recognized standards, such as the standards of digital competence ISTE. The following model (Shanghai model) is not based on international standards. Zhihua and Zhaojun (2009) present a maturity model framework applied during the ICT Test Projects in Shanghai rural schools, providing appropriate structures to deliver effective educational experiences through ICT use. The framework includes six models: 1) Technology; 2) Curriculum; 3) Leadership/Management; 4) Workforce; 5) Inter/intra-institutional linkage and 6) External linkage. Each model consists of a number of dimensions, 63 dimensions in total for the six models. Each of the dimensions within these models may be treated on a six-point Likert scale with positive scoring; a school that meets all the attributes within a given level of a dimension is assigned an appropriate score. The authors suggest that the models could be used as an action guideline for school managers, one that would prevent deviation from the scheduled targets (Zhihua & Zhaojun, 2009). The mentioned authors point to the fact that schools with a higher level of digital maturity are more efficient and progress faster than schools of digital beginners.

A third self-evaluation instrument has been developed in Belgium (Schreurs, 2007). This assessment framework draws on the European Foundation for Quality Management (EFQM) excellence model which helps organizations, like schools, to determine at which point they find themselves on their way to excellence. Schreurs (2007) distinguishes three stages in the evolution of ICT at schools. The first stands for basic principles in using computers by teachers, the second for applying the computer as a passive and active medium such as the Internet and using it in various contexts. The third phase encompasses the seamless integration of ICT across the curriculum and

learning activities where the focus lies on the learner. The structure of the framework is divided into 6 sections: 1. The vision for ICT use in school (a strategy to achieve the ICT vision); 2. Secondary processes (school organization and management, teachers, ICT coordinators); 3. Resources and partners (ICT infrastructure, government regulations, funding programs); 4. Primary processes (curriculum development, integration of ICT in learning process, innovative learning model); 5. Desired results (results for the learner, teachers and ICT coordinators, parents, society and government); 6. Strategic goals (institution's global goals, specific learning goals).

According to Schreus (2007) the biggest challenge for the schools is the integration of ICT in the learning process. It stands for the third phase of the evolution of ICT use in schools. A number of strategic goals have been identified, some as institution global ones and some as specific learning ones. They must be seen as answers to the desired results of different stakeholders. The direct benefiting stakeholders from the school are the learner, the teacher, the ICT co-ordinator, and the school directorate. The indirect ones are the parents, the society, and the government. The main focus here is on the learner and how the learner can benefit from the use of ICT in the learning activities.

The Eurydice Network provides information on and analyses of European education systems and policies. It consists of 38 national units based in all 34 countries participating in the EU's Lifelong Learning programme, and is coordinated and managed by the EU Education, Audiovisual and Culture Executive Agency in Brussels, which drafts its publications and databases.

The main indicators used to describe the state of ICT application in education used by *Eurydice* are: 1. Number of pupils per computer, and number of pupils per computer with an Internet connection (primary and secondary education); 2. Responsibility for the purchase and maintenance of hardware (primary and secondary education); 3. Distribution of the specific budget between the purchase of equipment and expenditure on human resources (primary and secondary education); 4. Inclusion of ICT in the curriculum (primary and secondary education); 5. Percentage of teachers who use computers and/or the Internet in the classroom (primary and secondary education); 6. Average periods during which primary school teachers use computers (with or without Internet connections) in the classroom, in hours per week (primary and secondary education); 7. Approaches to ICT defined in the curriculum (primary and secondary education); 8. Objectives defined in the curriculum for the teaching or the use of ICT (primary and secondary education); 9. Reasons given for not using the Internet with pupils (secondary education); 10. Annual number of hours recommended for teaching ICT as a subject in its own right (general lower secondary education); 11. Specialist ICT teachers (primary and secondary education); 12. Inclusion of ICT in the initial training of all teachers (primary education); 13. Percentage share of compulsory teaching related to ICT, and the number of hours devoted to such teaching, in the initial training of all teachers; 14. Percentages of primary school teachers and secondary school teachers who have received official training in the use of computers and/or the Internet in their teaching (Eurydice, 2001).

Solar et al. (2013) presented in their paper a model titled Maturity Model for ICT in School Education (ICTE-MM). The proposed model is based on standards 1) Models that provide the standard structure of a Capability Maturity Model Integration (CMMI), 2) ISTE's National Educational Technology Standards (NETS), the NETS for Teachers, the NETS for students and the NETS for Administrators and UNESCO Competency Standards for Teachers.

They defined five Leverage Domains:

1. Educational Management – This domain is based on Technology Standards for School Administrations (School Management; Vision, Strategies and Policies; Organisation and ICT Management).
2. Infrastructure – Software, Networks, Hardware, Maintenance Plan, Security.
3. Administrators – Leadership and Vision; Learning and Teaching; Productivity and Professional Practice; Support, Management and Operations; Assessment and Evaluation; Social, Legal and Ethical Issues.
4. Teachers – Student Learning and Creativity; Digital Age Learning Experiences and Assessments; Digital Age Work and Learning; Digital Citizenship and Responsibility; Professional Growth and Leadership.
5. Students – Creativity and Innovation; Communication and Collaboration; Research Thinking, Problem Solving and Decision Making; Digital Citizenship; Technology Operations and Concepts.

The ICTE-MM model was validated with 19 stakeholders through different data collection instruments, a complementary self-assessment web tool was pilot-tested with six schools, and a fine-tuned version was generated that incorporates the participants' feedback and an ICT implementation roadmap for each evaluated school. The evaluation methodology is supported by a web tool (the web tool was developed in PHP, using PhpMyAdmin and MySql to run in Joomla), which supports the gathering and processing of information generated in each evaluation based on the ICTE-MM model.

It can be said that ICTE-MM is a reference framework for supporting the ICT strategy in schools, which is based on mutually recognized standards for ICT management and education. ICTE-MM model provides a basis for self-assessment and planning of improvement. In terms of theoretical implications, it is not just a diagnostic tool but has also been found to be useful for guiding the principals in moving towards best practices in management and ICT investment. The developed model was built and tailored to the characteristics of public schools in a developing country. This target school has a low budget and no in-house expert for technical assistance. Consequently, the ICTE-MM model is operationalized with a web tool for self-assessment of critical variables that acknowledge the capabilities of each school to carry out ICTE initiatives and guide principals in technical decisions.

Digitally mature schools have a systematized approach to ICT use in school planning and management, as well as in their educational and business processes. Such schools

operate in a supportive environment, with adequate resources, including not only the financial ones, but also adequate ICT equipment for classrooms, laboratories, employees and students. Digitally mature schools systematically approach the development of the digital competences of the educational staff and students, whereas the former ones use ICT for improving their teaching styles, through which teaching focuses on students, for the development of digital educational content and for evaluating students' achievements, in accordance with the learning outcomes and educational objectives. There is a developed cooperation between staff and students, as well as between the school and other stakeholders, realized through the use of online communication tools and e-services, which includes the participation of the school in projects related to the use of ICT.

In digitally mature schools, the appropriate use of information and communications technologies (ICT) contributes to the following: an efficient and transparent management of the school (direct objective); the development of digitally competent teachers prepared for the application of innovations in their own pedagogical practices (direct objective) and; the development of digitally competent students, who are prepared for a continuation of their schooling and competitive on the labor market (indirect objective). For this reason, a partnership program was developed in Croatia titled "e-Schools: Establishing a System for Developing Digitally Mature Schools (pilot project)" within which the Framework for the Digital Maturity of Schools was developed, a document that defines the areas and levels of digital maturity of schools and is coordinated with the European Framework for Digitally Competent Educational Organisations. The Croatian Framework for the Digital Maturity of Schools consists of five areas (Leadership, planning and management; ICT in learning and teaching; Development of digital competences; ICT culture and ICT infrastructure) and five levels of digital maturity of schools: 1. Digital beginners - Schools which refrain from the use of ICT and digital educational content in teaching; 2. Digitally empowered - Schools without a systematic approach to ICT and digital educational content in teaching, in which their individual use by intrinsically motivated teachers is possible; 3. Digitally competent - A systematic approach to the use of ICT and digital educational content in teaching, with limited resources and without the support of the wider educational community; 4. Digitally advanced - The school very clearly recognizes the advantages of ICT in all aspects of its activities and, in this respect, integrates ICT into all its strategic documents and plans, as well as in its practical work and 5. Digitally mature - A systematic approach to the use of ICT and digital educational content in teaching, in a supportive environment with adequate resources.

Analysis of Existing Research on the Use of ICT in Serbian Schools

Based on the analysis of existing research on the use of ICT in schools, we can say that there are few systematically collected data on the availability, access, use and impact of ICT in education in Serbia. Despite the fact that many countries do not

conduct research in schools at the national level, most ministries of education or national Bureaus of Statistics collect some basic information related to infrastructure and the availability of ICT in schools from which data can be obtained for further analysis and planning of the use of ICT.

Based on the analysis of the legal framework, we have concluded that schools are not legally obliged to develop programs for the planning and integration of ICT in the work at the institutional level. This is supported by research findings. The research shows that only 8% of schools in Serbia have a strategic document clearly defining the vision and strategy of the school regarding ICT, 34% do not have a strategic document, while 58% of schools define this matter through other strategic documents (Marić & Jevtić, 2015).

As far as ICT infrastructure is concerned, whereby this primarily refers to *cloud computing* and Internet access from schools and homes by teachers, students, staff, parents / guardians, there is no comprehensive research.

According to the survey by Džigurski and associates (2013) on the use of ICT in schools in Serbia, access to the Internet is provided to all primary schools. The Internet is primarily available to teachers, and in very rare cases, it is available to students in common school rooms. The most frequent argument for this practice is the preservation of stable and rapid data flow. However, regarding the use of the Internet and mobile devices, pupils of primary schools in Serbia are similar to their European peers. In fact, 84% of 4th grade students (10-year-olds) have a mobile phone while 87% of them use the Internet. Almost all senior pupils have a mobile phone while 95% of them use the Internet. Both teachers and parents are less likely to access the Internet than children (Popadić & Kuzmanović, 2013).

Regarding the use of ICT equipment in elementary schools in Serbia, in terms of its availability, research findings of Džigurski et al. (2013) indicate that the equipment in schools is very different and varies according to the size of the school, the level of economic development of the municipality, and the willingness of employees and parents to invest in the equipment, etc. Actually, equipping of schools is financed by local governments, and the availability of equipment depends on the local community. The consequence of connectedness of primary schools to local governments results in the primary school from large cities being better equipped and having more trained personnel on account of a good material and financial situation, in comparison to schools in smaller communities, where the equipment is poor, threatening the fairness of the education system. Encouraging information obtained from this survey is that equipment (computer with Internet connection and a printer) is available to most teachers on a daily basis or several times a week. Nevertheless, this level of equipment is insufficient, since most computers in primary schools are concentrated in digital classrooms for computer classes and are used primarily for teaching computer science while rarely being used for teaching other subjects. Except on these premises, computers and beamers are rarely found in classrooms. Some schools

have big problems with the use of ICT due to malfunctioning digital rooms. Using computers and digital rooms outside of teaching hours is not enabled (Džigurski et al., 2013, pp. 18-23).

Digital competence of teachers in Serbia is developed during initial education and within lifelong learning through accredited courses for in-service teachers. On the basis of research, in one of the previous papers, we concluded that teacher education faculties (faculties which train future primary school teachers) of which there are six in Serbia, pay considerable attention to the application of ICT in relation to non-teacher education faculties. However, most students do not gain advanced digital competence, i.e. competences which include creating a stimulating learning environment that in itself includes: identifying educational situations where it is useful to use ICT and select appropriate tools which can result in the fulfillment of the learning objectives and which facilitate students' learning. Developing competences to create innovative digital teaching environment, mastering systems for learning management, and building of an inclusive digital environment are not supported by compulsory syllabuses (Ristić & Radovanović, 2014, 2015).

In the Catalogue of continuous professional development of primary school teachers, preschool teachers and professional associates for the school years 2014/2015 and 2015/2016, the Institute for improvement of education offered 65 accredited seminars in the field of ICT (ZUOV, 2016). The largest number of seminars focused on basic ICT competences and the acquisition of technical knowledge and skills, such as creation of a website, programming, management of e-journals, and safe use of the Internet. Professional training for the application of innovative pedagogical models in the digital teaching environment, such as hybrid teaching models and creating an environment for digital inclusion was not offered.

Average teacher competences are reflected in the mastery of programs for writing text, e-mail correspondence and Internet search facilities. Although there is motivation to expand knowledge through seminars and training, the majority of respondents are hindered in that by the economic situation. This shortcoming is usually compensated for by an exchange of experience with more experienced colleagues. However, the fundamental problem is the lack of understanding of the competences expected of teachers, and also ignorance of the ways in which it is possible to adequately use ICT in teaching certain subjects. Internal training and individual accredited courses for continuing professional education are highly ranked among the opportunities for the acquisition of competences. What is particularly emphasized is the need for competences necessary for the development of digital teaching materials, use of equipment and use of specific computer programs (Džigurski et al., 2013).

ICT within the curriculum defines a percentage of ICT based content in all school subjects. In Serbia, digital literacy has been defined as a transversal competence, but so far, the use of ICT within the curriculum depends on the initiative of teachers alone. Therefore, 48% of teachers do not use ICT within the curriculum, 28% of them do that whenever it is possible, while 24% of teachers do it sometimes. The use of ICT within

the curriculum has only been strictly defined through the ICT subject, and also within 5 to 10 vocational subjects in vocational secondary schools (Marić & Jevtić, 2015).

From all of the above mentioned, it can be concluded that it is necessary to design national standards for the use of digital technologies in education and include courses of educational technology in educational programs for all teachers as well as professional training programs for in-service teachers.

Teaching and learning using ICT in modern education systems, especially in developing countries, building of a digital learning environment is based on digital learning objects, interactive multimedia applications (which can be used in the context of curricular and extracurricular activities) and on interactive learning which relies on the use of the electronic (*smart*) board.

Interactive multimedia applications are usually created in the form of: interactive tutorials, programs for training and self-assessment, simulations, instructional games, e-textbooks or e-textbook supplementary materials (which in Serbia is regulated by the Law on textbooks, "Official Gazette of RS" no. 68/2015) and the like. Teaching is supported by the electronic whiteboard and appropriate software, it can transform individual activities of students or frontal class teaching into interactive teaching, thus improving cooperation at all levels (among students and between students and teachers). In addition to the pedagogical advantages of interactive digital teaching materials, other benefits include availability, easier changes and lower distribution costs.

Research findings on the use of ICT in schools in Serbia indicate that *the use and creation of digital teaching materials* in Serbia depends primarily on the digital competence and enthusiasm of individuals, as well as knowledge of the English language as a prerequisite for access to a Web-based content and tools on international websites. The existing but scarce teaching materials in the Serbian language are not sufficiently promoted and are underused.

Programs that are most commonly used in the process of preparing and carrying out teaching are the MS Office package programs with the use of computers and beam projectors (and somewhat rarer use of the interactive whiteboard). Use of the Internet to gather information is mentioned by teachers as the most common form of using ICT. Also, equipment such as printers and scanners benefit teachers in the process of preparing materials for lessons. In addition to the above mentioned, findings show lack of information among students on the possibilities for acquiring competences through digital technology (Džigurski et al., 2013).

It is clear that there is no strategic or systematic approach to the integration of digital technologies in the system of basic education.

Concluding Remarks

In education, it is not easy to collect or show relevant evidence in a structured way, especially as all the evidence is not necessary, for such analyses are of a quantitative

nature. Projects in the field of education are very complex and difficult to unify and implement in the same way.

One of the main limitations of this study is that it was based on the analyses of secondary sources and could not provide deeper analysis of certain characteristics, but simply state the overall results and emphasize the need for intervention.

The research results point to the following facts.

The current position of ICT at all levels of the educational system is still inadequate compared to the needs and its role in developed EU countries. Indicators concerning the state of ICT in our primary and secondary schools show the need for systematic planning, design, maintenance and investment in ICT and educational technology.

It is necessary to strengthen the information and communication infrastructure. In this context, it is necessary to opt for a fast and safe infrastructure. Research shows that good ICT infrastructure that enables broadband access to the Internet, cloud services, and the use of web services and mobile devices creates good opportunities for innovating teaching and learning processes (Redecker & Punie, 2010).

The ability of the Serbian education system to incorporate ICT depends significantly on the professional skills of the managerial structures, teachers, students, administration and other employees in educational institutions. It is essential to use a systematic approach, through programs of initial teacher education and professional development of employees, to raise digital competences of all stakeholders in the education system. Prior to this, national standards of digital competences of all participants in the education system should be defined and specified.

It is necessary to define a legal obligation of the school to develop a program for the planning and integration of ICT in the work at the institutional level. A framework of strategic management of projects for the implementation of educational technologies in schools should be designed. It should serve school administrations to streamline their work in such a way that it is strategically thought out, clear and efficient. Such a framework does not guarantee success, but rather depends on the competences of those who use it. Therefore, competences of all employees in education should be strengthened.

Serbia is in the early stages of production of digital educational contents. For the exchange of learning objects and digital teaching materials there is a significant number of web communities which are based on teachers' initiative; however, there is no institutional support in the form of a specifically envisaged Web portal.

The strategic approach and support to the development of digital maturity in the educational system requires of the above mentioned competent institutions both constant development of human capacities within institutions themselves and their synergies in providing continuous support to schools in the application of ICT.

Based on the analyzed models, the key indicators for the assessment of digital maturity to which administration representatives and the employed in schools should direct attention in order to enable simpler, more focused and more effective

integration of educational technology in the work of schools, and especially in the teaching practice, are presented through five areas:

1. Leadership, planning and management (Vision, strategic guidelines and objectives of ICT integration; Plan and program of school development from the perspective of ICT; Managing the integration of ICT in learning and teaching; Managing the integration of ICT in the school's business activities; Managing data collected by means of information systems; Regulated access to ICT resources; Use of ICT in teaching students with special educational needs),
2. ICT in learning and teaching (Awareness; Planning; Use of digital contents; Evaluation of students; Students' experience; Special educational needs),
3. Development of digital competences (Awareness and participation; Planning; Purpose of professional training; Self-confidence in the use of ICT; Digital competences of students; Special educational needs; Informal learning),
4. ICT culture (Access to ICT resources by educational staff; Access to ICT resources by students; Network presence; Communication, information and reporting; Netiquette; Copyright and intellectual property; Projects),
5. ICT resources and infrastructure (Planning and procurement; Network infrastructure; ICT equipment in the school; ICT equipment for educational staff; Program tools in schools; Technical support; Equipment maintenance; Central repository of digital documents and educational contents; Information security system; Licensing control).

The importance of an evaluation model is the foundation for self-evaluation of digital maturity (Digital beginners; Digitally empowered; Digitally competent; Digitally advanced and Digitally mature) and planning of improvements.

Creating of an evaluation model should be based on a fully and thoroughly considered readiness of Serbia for education in the digital environment, and on the existing experience in the application of ICT in education.

Methodologically based and well-structured tools for self-evaluation, self-assessment, planning, performance measurement and the like, aimed at strengthening internal ICT capacities which include a wide range of topics and include a large number of participants, are relevant and optimal instruments for the promotion of development in the field of education as they rely on real capacities and take into account historical factors and characteristics of the immediate socio-economic environment. Based on the analysis of the existing models, we can see that creating such a model and Web tools, requires an interdisciplinary project approach, team work, support from relevant institutions and partnership.

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Digitalna zrelost škola

Sažetak

Uspješna integracija digitalnih tehnologija u obrazovne institucije imperativ je svakog obrazovnog sustava u razvijenom društvu. Aktivnosti koje vode do integracije digitalnih tehnologija, tj. modela implementacije, predstavljaju izazov za razvijene zemlje, kao i za one u razvoju. Pitanje digitalne zrelosti u školama, u europskom kontekstu, prepoznato je kao jedno od ključnih pitanja. Cilj je ovog rada utvrditi pokazatelje za procjenu razine digitalne zrelosti srpskih škola i stvaranje modela evaluacije. Osim reinterpetacije postojećih istraživanja i usporedne analize, u ovom se radu koristila metoda modeliranja. Predloženi model vrednovanja može pružiti osnovu za samoevaluaciju digitalne zrelosti u školama i planiranje poboljšanja digitalne kulture u školi; poboljšanja sigurnosti, tehničkih zahtjeva i podrške; digitalne vještine nastavnika, učenika i zaposlenika u stručnim službama; pružiti osnovu za digitalno okruženje za učenje; uključivanje digitalne tehnologije u nastavni plan i program, kao i osnovu za učinkovitu primjenu digitalnih tehnologija u organizaciji škole. Model ocjenjivanja digitalne zrelosti u školama nije samo instrument evaluacije već i model za učinkovito upravljanje i donošenje odluka.

Ključne riječi: digitalna zrelost; nastavnik; ravnatelj; škola; učenik.