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ELEMENTARY TEACHERS COMPETENCES FOR MULTIMEDIA LEARNING MATERIALS PRODUCTION

KOMPETENCIJE UČITELJA U OSNOVNIM ŠKOLAMA ZA PRIPREMU MATERIJALA ZA MULTIMEDIJSKO UČENJE

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Abstract

Advancement of computer hardware and software authoring tools has enabled wider use of multimedia learning materials in elementary education. Elementary education (lower level primary school) teachers should consider the advantages of multimedia learning materials. They are not just users of readymade multimedia learning materials, but also producers or disseminators. Teachers' competency level in the application of multimedia learning materials is growing. Introductory courses and increased availability of educational technology equipment have changed the teaching paradigm. Even elementary teachers in primary schools should have competencies for creating e-learning materials. The differences between recommendation and reality can only be established with data, and in our case we use surveys. The work of elementary teachers as creators of multimedia learning materials and their motivation are discussed in this article. Our research is focused on teachers at lower levels of primary schools (elementary education) as they are the first step in the educational pyramid.

Sažetak

Napredovanje računalnog hardvera i softvera, te autorskih alata omogućilo je širu uporabu materijala za multimedijalno učenje u osnovnom obrazovanju. Nastavnici u osnovnom obrazovanju (niža razina osnovnoškolski) trebaju razmotriti prednosti materijala za učenje multimedijalnih sadržaja. Oni su ne samo korisnici gotovih materijala za multimedijalno učenje, nego i proizvođači ili širitelji. Nastavnička razina kompetencija u primjeni multimedijalnih nastavnih materijala raste. Uvodni tečajevi i povećana dostupnost obrazovne opreme su promijenili nastavni paradigmu. Čak i nastavnici u osnovnim školama trebaju imati kompetencije za stvaranje e-learning materijala. Razlike između preporuka i stvarnosti mogu se utvrditi samo s podacima, a u našem slučaju koristimo se anketama. Rad nastavnika kao tvoraca multimedijalnih materijala za učenje i njihovu motivaciju promatra se u ovom članku. Naše istraživanje je usmjereno na nastavnika na nižim razinama osnovnih škola (osnovno obrazovanje) jer su oni prvi korak u obrazovnoj piramidi.

INTRODUCTION

A new paradigm of teaching is required at all levels of education as result of changes in learning (educational) technologies introduced in primary and secondary schools. ICT literacy is the key to promoting concepts of learning in society and life-long learning trends on a global scale. Schools must adapt to constantly changing educational requirements, and life-long learning should become a standard procedure in the teaching profession. "Because changes are in progress dynamically, it is necessary to guarantee them (teachers) effectively [sic] next education and training e.g. multilevel education training for pedagogues, for purpose [sic] of evolution."

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ing innovation [sic] pedagogical approaches with exploitation [sic] information communication technology (ICT) at tuition process, etc" /1/. Today's knowledge-based society requires quality education for the development of individuals and society as a whole, and to implement this properly, teachers must have digital competences. The concept of competence in pedagogy was introduced by Roth (1971), who described it as ripeness and maturity, productivity and critical ability; these are a prerequisite for responsible decision-making skills, as well as central general education goals. In his opinion, maturity is regarded as a competence for responsible action in three crucial areas: (1) self-competence, (2) expertise and (3) social skills. "Competence makes the connection between knowledge and skills and is seen as the ability to deal with different situations" /2/. Competences can also be combinations of knowledge, assessment ability, communicational skills, and learning skills. "Competences are abilities of the person to solve professional problems even in conditions of uncertainty, to accept critical decisions, creatively to work, constantly to study" /3/. On the other hand, competences can be viewed as combinations of knowledge, skills, attitudes, and positions according to Šorgo. Because authors have different opinions about the value of general competences in education, they regard learning objective competences as more appropriate for education: "yes, it is right to provide strong competencies in the center, to emphasize the use value, but also the personal coping ability of the learned and to the learning ends. No, it's not a didactic enrichment, and certainly not to replace simplification, learning objectives competencies" /4/. This is another form of the discipline specific competences that were studied extensively and meticulously by Šorgo and his colleagues. In educational experts' discussions on competences, the topic of monitoring and measuring of competencies improvement often arises. This issue is also considered by Bartosch when he says, "It is obvious that competencies are based on complex foundations, complex in its empirical appearance and are difficult to measure," and continues: "Again and again we will encounter the necessary work, what should be competence in the specific case to justify" /5/. Competence is the ability to combine needs

and challenges. Teachers also require certain necessary attitudes, motivation and social skills /6/. The conceptual framework of key competences described by the DeSeCo project divides them into three categories: (1) Autonomous action ductivity, (2) Interacting in heterogeneous groups and (3) Interactive use of media and means: "First, people should be able to explore different media tools, or tools such as effective use of information technology or the language. You should understand these "tools" well enough to adapt them for their own purposes - to use interactively." /7/. The OECD documents emphasize the effective use of information technology, indicating the need for digital competences. TESE-II research defines competences as combinations of knowledge, understanding, skills, abilities, and values /8/. But competences can also be combinations of knowledge, assessment ability, communicational skills and learning skills. ICT competences of teachers are fundamental requirements for successful professional role of teachers in educational processes. They are also the requirements for their career growth and lifelong learning according to Tatković and Močinić. Digital competence, as defined in the EC Recommendation on Key Competences /9/ involves the confident and critical use of ICT for employment, learning, self-development, and participation in society. This broad definition of digital competence provides the necessarily context (including knowledge, skills and attitudes) for working, living and learning in the knowledge society." /10/. Other authors claim that "digital competences are one of generic competences that individuals have to master in contemporary society" /11/. There is no question that these abilities, knowledge, and adjacent topics are needed in our society. "Identifying competency only with ability or proficiency is limiting of its essence - the main difference is in defined level of practice (way of confirmation - very often formalized as in case of abilities) and realizing results of human activities. Competence - is harmonious compose of knowledge, proficiency, understanding and desire. I know and I want to do it well." /12/.

The dilemma of "Digital competences" versus "e-competences" in education has already been resolved; e-competences are part of digital competences. According to Duh, Bratina

and Krašna they are focused on a special electronic concept of education, accepting the reality of constant changes and never-ending evolution. A digital school environment requires different, new and innovative types of teaching and learning. The responsibility of schools today is to nurture their employees' skills in acquiring required e-competences. In this manner, the concept of e-competences as the ability to rationally use ICT in education and teaching is appropriate /13/. These researchers have also discovered that there are differences between e-competences at individual and institutional levels. Their analysis of university educational processes shows that lecturers' e-competences comprise the ability to apply ICT in their pedagogical work. Institutional e-competences are defined as the policy of the university toward ICT in research and education. There is a strong bond between these two types of e-competences (competences of teachers and institutional competences). Lib and Walat present a list of criteria that should be taken into consideration during specification of tasks in the design of didactic programs. The list of criteria is: (1) criteria of goals, (2) criteria of content, (3) criteria of pupils' specification (4) criteria of teachers' specification (5) economic criteria (6) organizational and technical criteria /14/. ICT, therefore, offers various opportunities in education, but we must be aware that teachers should be digitally competent because virtual educational interaction differs from normal human dialogue.

Modern multimedia learning materials are not only an opportunity but also a requirement for contemporary teachers (Hardy, Jefferies, Beetham, Martin, Walker, Jameson, and Ryan). Teachers have to use them competently. At all educational levels and in specific study disciplines, reasonable implementation is required. Although there is a large amount of multimedia learning materials available, not all of them meet didactic or technical quality requirements. ICT itself is not enough, since it is only a set of tools. But ICT is required and have high impact to the students' performance (Cvjetičanin, Pećanac, and Djurendić-Brenesel). Being aware of the availability of ICT and the changes that ICT imply are only the first step in the process of mastering (ICT). New tech-

nology requires new competencies and new levels of literacy, skills and abilities of all participants in the educational system. Therefore, modern schools require competent teachers who are able to create their own e-learning materials.

Competencies for the creation of e-learning materials

When we speak of competencies for the creation of e-learning materials, we need to keep the general requirements for high performance e-learning materials in mind. These requirements enable us to understand the advantages and disadvantages of ICT and specific ethical rules for their use. A technological ethics code for teachers' /15/ consists of three basic rules: (1) Teachers must provide each student the same access to the technology; (2) Teachers must provide equitable technology resources for all students; (3) Teachers should use the least restrictive restrictions for internet and software. There is a law in Slovenia that grants student's uncensored access to information (CIPA – Child Internet Protection Act).

Teachers are taught during their university study and during professional development seminars how to acquire necessary competences for independent and competent teaching. E-competences are a vital part of the required competences for teachers.

In the development of modern ICT in education, competence of teaching staff is highly important. A teacher's ability to create her own learning materials is a new aspect of the educational process in a dynamic educational environment. The teacher's competency in today's school includes the ability to plan, prepare, and implement didactically structured learning materials suitable for electronic use. Production of such learning materials is no longer limited to a handful of experts who may be far removed from real teaching practice. (e)Learning materials must be designed according to established educational requirements. A range of factors needs to be taken into account when planning a course. Lib and Walat recommend that three factors must be taken into consideration in the creation of e-learning materials /16/:

1. To define "outlet point", distinction in what condition the lesson is started;
2. To define "point of coming" it means the goal to be reached for that lesson;
3. To forecast teachers' and pupils' operations, methods of teaching and learning, didactic methods, and organization form of pupils' work connected by a common idea from "outlet point" to "point of coming".

Development of e-learning materials is just the beginning and must be followed by distribution. Therefore, the topic of accessibility of e-learning material should be considered in the design process. Teachers have different options for didactically suitable learning management systems. Many teachers in Slovenia use Moodle, since it is freeware and has good support for multiple languages. Other options include Word cloud, Dropbox, Facebook learning, and Vodcast learning. With Vodcast learning, teachers can use MP4 files to combine auditory and visual information. *"Regarding the impact of visual stimuli, this educational technique is highly appreciated by learners. Also for the lecturer, to give an assignment to the learners, it is easy to show to them what they need to do and how, instead of writing this information in a word document"* /17/. It is easy for the teacher to produce a movie because software for Vodcast is user-friendly and does not require extensive ICT skills. Only knowledge about the didactic suitability of video and basic computer skills are required to use Vodcast. Though not required in Vodcast, it is helpful if teachers also have skills in modern e-learning materials design. *"A competent teacher needs namely high-quality expertise and didactic knowledge, good knowledge of e-learning tools, assessment skills and good communication skills"* /18/. A teacher with these competences will have no problems using and creating e-learning materials.

Our educational practice reveals a wide range of issues related to the development of ICT competence. These issues pertain not only to the abilities and skills required of teachers to use and develop e-learning materials, but also to other dimensions of educational work. *"This highlighted the necessity for teachers to acquire competence in the use of modern information and communication technologies in education, which*

should be an important component of education and professional development of teachers" /19/. It is still an open question how well-formed are the digital competences for the creation of e-learning materials of teachers in Slovenian schools?

METHODOLOGY

In the past few years many changes have occurred in educational institutions in Slovenia. During a period of prosperity many projects for e-learning materials development were funded by The Ministry of Education (now The Ministry of Education, Science and Sport) and now e-learning materials are available on their web pages. Despite the fact that digital data can be stored almost indefinitely, e-learning materials have an expiration date. They are subject to different demands to reflect new developments, learning paradigms, and ICT format changes. Therefore, the aim of our research is to acquire current data from Slovenian teachers about e-learning materials' applicability, modification, and new development.

We prepared a survey to test the current state of teacher competences in the application of education technology and the production of multimedia learning materials in primary schools. The web questionnaire was sent to all schools in Slovenia and 474 teachers of elementary education in Slovenia from all Slovenian regions participated in the survey. Elementary education in our society means lower levels education in primary schools from first to 4th year of study of the 9th year primary school education.

The survey contains a combination of single and multiple-choice questions. Our analysis was performed using SPSS. In some cases only responses meeting certain criteria were included in our analysis. Such examples will be noted in the interpretation section.

Our research was focused on the following research questions:

- Do teachers produce their own e-learning materials (RQ1)?
- Which components/elements do teachers use in the preparation of e-learning materials (RQ2)?

- Are their e-learning materials publically available (RQ3)?
- How do teachers distribute their e-learning materials (RQ4)?
- How do teachers estimate their competence in using e-learning materials (RQ5)?

RESULTS AND INTERPRETATION

Do teachers produce their own e-learning materials?

Today many e-learning materials are available on the market. On the web page of The Ministry of Education, Science and Sport of Slovenia, publically available e-learning materials are freely accessible. Teachers have many opportunities to use ready-made e-learning materials. On the other hand, teachers often express the wish to modify these materials to suit their

Table 1 shows the number of teachers who answered the question (RQ1) – How often do you produce your own e-learning materials. We have tested the questionnaire with the small group of teachers to verify the efficiency of the questionnaire. From the multiple feed-

needs. We know that some teachers are more digitally competent than others and we want to know their ability to create their own e-learning materials. When choosing between the terms **e-learning materials** or **multimedia learning materials**, we prefer **e-learning materials** because this term covers a wider spectrum of learning materials and avoids any potential misunderstanding of terminology. In the teaching community, the term “e-learning materials” means any learning materials published on the web, even plain text or pdf files which are non-multimedia learning materials. In the analysis of teacher’s attempts of producing their own e-learning materials only valid (checked) responds were included (N=410) since some respondents did not answer this particular question.

backs of misunderstanding of teachers that prepare e-learning materials in groups with colleagues we add additional response “in cooperation with colleagues”. Our research intention was not just who made its own e-learning materials but who made it at all.

Table 1: Teachers’ e-learning materials production attempts (/additional option was added to the questionnaire – see text above)

<i>Have you ever produced any e-learning materials?</i>			
	f	f%	modified f%
More than once	150	36.6	63.5%
Once	33	8.0	14.0%
Unsuccessful tries	11	2.7	4.7%
<i>Never</i>	174	42.4	–
In cooperation with colleagues/	42	10.2	17.8%

Regarding only suitable responses for our research (those who answer “never” are subtracted from the sample) in the research question (RQ1) the results may be considered surprisingly positive. At least 36.6% (63.5%) of teachers produce their own e-learning materials more than once (we have no data if those who pick the last answer/ made more than one e-learning materials). The production of e-learning materials is mostly individual work

since only about 10.2% (17.8%) of e-learning materials are produced in cooperation with colleagues. On the other hand, the results show that about 42.4% of teachers never even tried to create e-learning materials. There are still much to do in the area of life-long learning for teachers. Some intention to change legislation for mandatory use of e-learning materials and digital technology may not be the only answer (Yeung, Taylor, Hui, Lam-Chiang, and

Low). Just 2.7% (4.7%) of teachers tried and failed. The results are also problematic from a pedagogical perspective because they suggest that teachers do not follow the contemporary teaching paradigm. The pedagogical value of high quality e-educational material should not be overlooked. Such materials have been shown to be more successful than traditional textbooks in the current generation of students and much more motivational (Cvjetičanin, Pećanac, Djurendić-Brenesel, Van Loon, Ros, and Martens).

Which components/elements do teachers use in the preparation of e-learning materials?

In our previous section we explained the fear of misunderstanding of multimedia. We used the term e-learning materials. The survey answers show us two things. Teachers produce

both types of learning materials – multimedia and non-multimedia. PDF and Word documents with graphics are multimedia learning materials by definition. On the other hand, pictures or audio alone are not multimedia learning materials. Despite the obvious risk of misunderstanding we have decided to accept the answers to these questions. The answers to our question about the structure of multimedia learning materials are shown. Discussion of the results is therefore viewed from a conservative viewpoint. This question was a multiple choice type and gives us detailed insight into the amount of all multimedia elements used. Only responses from teachers who had already produced their own e-learning materials were analyzed though.

Table 2: Forms and components of e-learning materials

<i>What was the form of your multimedia learning material?</i>	
	f%
PDF file	18.1
MS Word document	21.3
Picture or picture book	21.3
Audio	10.1
Video	12.7
Combination of text, picture, audio and video	16.6

The prevailing forms or components of e-learning materials from teachers' perspective are text and images. PDF file and MS Word documents can be considered as text and they represent more than 40.5% of e-learning materials. Such approach is questionable in elementary education, because kids are not capable to read large amounts of text.

The high portion (21.3%) of learning materials containing pictures and a significant portion (12.7%) of containing video are very encouraging. We suspect that these results depend more on easy accessible internet contents than teachers own production. Adding also the 10.1% of audio learning materials, all three multimedia elements are well represented in 44.1% of cases.

At the first sight the portion of only 16.6% of combined learning materials may seem discouraging, but considering the fact that production of such learning materials is a de-

manding process that requires higher specific digital competences, the result is not bad at all. Often the development of mixed learning materials requires sophisticated technological equipment and additional personnel. Consequently, just one or two teachers can hardly achieve the production of such multimedia learning materials.

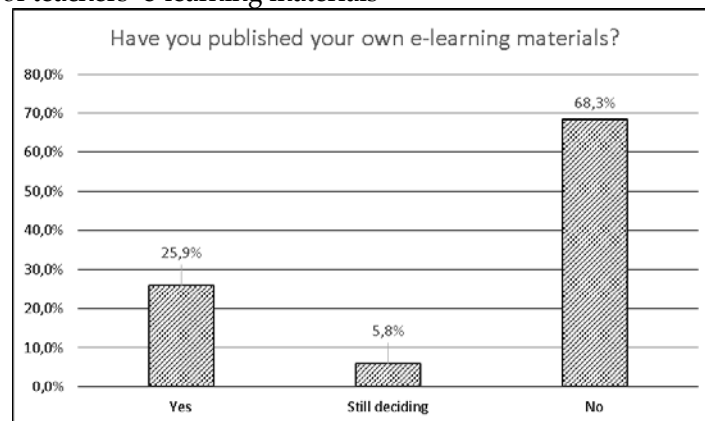
Therefore the answer to the RQ2 is that in the teacher's produced e-learning materials all the components are present favoring the textual component.

Are their e-learning materials publically available?

We know that the production of e-learning materials is not the end of the development process. The materials must be accessible to users in order to have any value at all. Our third research question therefore is dealing with teachers' willingness to publish their e-learning materials: Only the responses from

the teachers who had already produced their own e-learning materials were analyzed.

Figure 1: Publishing of teachers' e-learning materials



Little more than a quarter (25.9%) of the produced multimedia learning materials have been published and made available to others. Though this may be surprising, it is not. It just reveals the fact that teachers are uncertain about the quality or suitability of their multimedia learning materials. The reason for this may be the lack of widely disseminated guidelines for multimedia learning materials production. But there are also other possible explanations that are equally plausible:

- Their materials are in such a state that only they can use it, or
- They do not have knowledge how to publish materials on the web, or
- Their materials contain copyrighted content or other elements that should not be publicly available.

After consideration we can claim that the answer to the RQ3 is: "produced e-learning materials are not published and available in general". The most plausible explanation for their reluctance to publish can be seen from the results in the Table 3. The results show that in less than third of cases are dedicated systems such as Moodle used for the distribution of multimedia learning materials. Most often direct delivery to students or colleagues is used.

How do teachers distribute their e-learning materials?

Distribution of learning materials is often a challenging task for individuals. It requires technology and knowledge often beyond the scope of the average teacher. Schools employ professionals (computer science teachers and computer support professionals) who offer services for their teachers, but the distribution is a cooperative work; it cannot be done just by the support professional. Even the authors of learning materials need to prepare the materials to be suitable for distribution. Most simple materials are computer files, but elaborate forms like SCORM packagers can also be used and are highly suitable for LMS distribution. Distribution styles of teachers' learning materials are presented in table (Table 4). The analysis of multiple choice question was performed on responses from teachers who had already produced their own multimedia and learning materials and decided to publish them.

Table 3: Ways of distribution of multimedia learning materials.

How do you distribute your e-learning materials?	
	f%
Using Moodle or similar LCMS	31.0
Published on the school's website	11.2
Directly delivered to my pupils	15.5
Shared with my colleagues	25.9
Presented at a teachers' workshop	16.4

Dedicated systems for learning materials distribution are used in only 31% of schools. This

result looks surprising, since every school in Slovenia has its own learning contents management system (LCMS). We expected that the percentage of distribution by LCMS would be much higher, but interviews and informal talks with teachers of computer science (our former students) at primary schools uncovered the problem of password policies in Moodle. The newest version of Moodle demands complex passwords by default and often pupils at lower levels of education are unable to type the complex password in order to log into the system. The default setting for complex passwords can be changed, but system administrators are reluctant to change the policy. This could be solved with two Moodle applications per school: one for lower levels of education, and a second (highly secured) for others. By understanding this problem, we might solve the problem of this low LCMS usability.

The portions of direct distribution of multimedia learning materials are 15.5% and could potentially be distributed by LCMS. A quarter (25.9%) of teachers share their learning materials with their colleagues. This can be seen as in-house training and/or good practice dissemination.

The teachers are distributing their e-learning materials using different ways of distribution (RQ4) where dedicated LCMS are not used as often as expected. The advantages of using LCSM should be regularly presented at teachers' workshops and in life-long learning (LLL) of active teachers. Practical use and implementation of LCMS must be the key topics in every corresponding course.

How do teachers estimate their competence in using e-learning materials?

It is difficult to electronically measure the competences of individuals - especially in surveys, but a personal opinion may be relevant for individual assessment. Although we do not have hard evidence, it is interesting for us to understand the desire of teachers for LLL. Table 4 presents teachers' estimations of their own competencies in using multimedia learning materials during their lectures. Since we have data from surveys conducted in the year

2011 and 2013 on populations of elementary school teachers, a trend can be computed.

Estimate your competency for using e-learning materials during the lecture.	2011	2012	2013
	f%	f%	f%
Competent enough	42.0	48.6	49.1
Partially competent	53.2	46.0	45.2
Not competent	4.8	5.4	5.6

Table 4: Estimation of personal competency in using multimedia learning materials in lectures from 2011 to 2013

The self-estimation of competency in using e-learning materials during lectures has increased during the last three years, which is a positive outcome. The increase is not statistically significant yet but a positive trend is noticeable. On the other hand their share remains under 50%, which is still unsatisfied.

The decreasing estimation of *partially competent* is constant and considered as positive trend. The result at "*Not competent enough*" estimation shows that more effort is required in education of teachers to raise their self-confidence. We believe that with the raise of competency, teachers would be more productive in e-learning materials development, distribution and application to the learning process. The results clearly show that progress is gradual and cannot be achieved in a short time. Life-long learning and regular training of teachers are therefore a priority for our society.

DISCUSSION

The teachers produce their own e-learning materials but their portion of slightly more than 50% is below the desired expectations. In the years 2008 – 2013 during the project of e-school (slv. e-šolstvo) free courses in ICT were offered to teachers in Slovenia therefore the acquired insight of teachers' creation of e-learning materials did not significantly improve. Even the possible excuse, that elementary education do not benefits significantly with the application of ICT in the education, is just an empty word. In most cases the production is made by the individuals and only occa-

sionally in cooperation with colleagues. If materials are produced they are mostly in single media format – images, drawings, graphs and schemas, video, text. The combination of multimedia elements in e-learning materials is less common due to technological and skills constraints. Most of produced e-learning materials are not distributed or made available to the kids or colleagues. The main reasons may be (1) the lack of knowledge how to publish materials, (2) very raw state of preparation, and (3) lack of the quality. There are different ways for distribution of teacher's e-learning materials. Starting from dedicated systems, followed by sharing among the colleagues and to the direct delivery to the kids. The teachers estimate their personal competency in using multimedia learning materials as enough competent or partially competent. The trend toward "enough competent" estimation is increasing during last three years. But their estimate of "enough competent" is still under 50% of cases. This fact should be taken into account during preparation and application of regular training cycles for active teachers. In general, all the results lead us to the conclusion that the quality of achievement in practice, education, and professional development of teachers still needs to be improved through life-long learning (LLL) and/or regular training.

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