Correlation Between School Success and Students' Digital Competencies

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Abstract – At the beginning of the 21st century, the European Framework for Key Competences was established, which should be developed by the end of compulsory schooling and represent the basis for further learning as part of lifelong learning. Among the key competencies is the digital competence, which includes independent and critical use of information and communication technologies for work, leisure and communication. This work refers to the connection between students' digital literacy and students' school success, i.e. it shows that students with a higher level of digital literacy have better success in school. The research was conducted among final year high school students in schools in Vojvodina. The obtained results show that there is a correlation between students' digital literacy and the achieved school success. This suggests the need for students' digital competencies to be developed not only in computer science classes, but also the teachers of other subjects should be involved in the process of developing students' digital competencies..

I. INTRODUCTION – STUDENT COMPETENCIES

In the world of education, competences are introduced as a concept in the last decades of the XX and the beginning of the XXI century. This is especially due to changes and demands on the labor market. Education responds to change by developing a concept of competence-oriented education and, based on them, outcomes. The entire education system is organized around what is essential for students - what they can do at the end of the education process.

Competence means a complex combination of knowledge, skills, abilities and attitudes required to perform a certain activity in a given context, in real circumstances where the person should be able to interpret the situation in a particular context and have a repertoire of possible actions he can take and is able to perform.

"The rapid technological progress of human civilization initiates the need for changes in the educational concept as well. New standards in the field of education have been accepted in the world, which have significantly shifted traditional understandings and models of teaching. "[1].

At the beginning of the 21st century, facing the changes and needs of the new age, the European Union (through the Council, the Commission and working groups) is taking steps to establish a European framework for key competences. This shifts earlier "basic skills" necessary for "survival" and make up the basic "life skills" - language and numerical literacy - to key competencies, which can be defined as follows: "Key competencies are transferable, multifunctional knowledge, skills and attitudes packages, needed by all persons for personal achievement and development, inclusion and employment. They should be developed by the end of compulsory schooling or training and should form the basis for further learning as part of lifelong learning. "[2].

A. Key competencies for lifelong learning

Key competencies are a set of integrated knowledge, skills and attitudes that are needed by each individual for personal fulfillment and development, inclusion in social life and employment.

Key competencies for lifelong learning include:

- Communication in the native language that includes the ability to express and interpret concepts, thoughts, feelings, facts and opinions orally or in writing,

- Communication in a foreign language that includes the ability to express and interpret concepts, thoughts, feelings, facts and opinions orally or in writing, including mediation skills by summarizing, interpreting, translating, paraphrasing and otherwise, as well as intercultural understanding,

- Mathematical, scientific and technological competencies that include basic numerical

reasoning, understanding of the world of nature, as well as the ability to apply knowledge and technology for human needs (e.g. medicine, communications, transport...),

- Digital competence that includes confident and critical use of information and communication technologies for work, rest and communication,

- Learning how to learn which represents the ability to effectively manage one's own learning with the aim of planning, managing time and information, as well as the ability to overcome obstacles in order to learn successfully using previously acquired knowledge and skills and their application in different situations, individually and / or in the group,

- Social and civic competencies that represent the ability to participate effectively and constructively in social and working life and engage in active and democratic participation in diverse communities,

- Sense of initiative and entrepreneurship that develops the ability to turn ideas into action through creativity, innovation and risk-taking, as well as the ability to plan and manage projects,

- Cultural awareness and expression that includes developing the ability to understand the meaning of creative ideas, experiences and emotions in various media such as music, dance, literature, fine arts and others.

"Competences referred to in paragraph 1 of this Article, in addition to the framework of traditional school subjects, include and engage school knowledge in preparing students to be competitive and functional in current and future educational and professional space and to competently and actively fulfill their civic roles." [5].

The general goals of education are defined by the Strategy of Education and the interpretation of the given goals of education "clearly shows the strategic orientation of the entire educational system towards modernization and modern exit competencies." [1].

B.   General interdisciplinary competencies

General interdisciplinary competencies are based on key competencies and are developed through the teaching of all subjects. They are applicable in different situations and contexts in solving different problems and tasks. They are necessary for all students for personal achievement and development, as well as for their inclusion in social environment and employment and form the basis for lifelong learning.

The goal of orientation towards general interdisciplinary competencies and key competencies is to combine knowledge, skills and attitudes relevant to different real contexts that require their functional application. In 2013, standards for general interdisciplinary competencies for the end of secondary education were developed in Serbia, including digital competence.

General interdisciplinary competencies for the end of compulsory primary education in the Republic of Serbia are:

1. Learning competence

2. Responsible participation in a democratic society

3. Aesthetic competence

4. Communication

5. Responsible attitude towards the environment

6. Responsible attitude towards health

7. Entrepreneurship and orientation towards entrepreneurship

8. Working with data and information

9. Troubleshooting

10. Cooperation

11. Digital competence

These interdisciplinary competencies are defined as mandatory, and the expected outcomes are defined only at the basic level. Digital competence is defined through the following outcomes where a student can:

- search, evaluate the relevance and reliability of data sources;

- analyze and systematize information in electronic form using appropriate ICT tools (devices, software products and electronic services);

- express in electronic form using appropriate ICT means, including multimedia expression and expression with elements of formally defined notations characteristic for the used ICT means (e.g. addresses, queries, commands, formulas, procedures, expressed in appropriate notation);

- present, organize, structure and format information using the possibilities of a given ICT tool in an efficient way;

- select appropriate ICT tools when solving problems, as well as to adapt the way of solving problems to the possibilities of those ICT tools;

- effectively use ICT for communication and cooperation;

- recognize the risks and dangers of using ICT and acts responsibly in this regard.

These outcomes can be grouped into five areas of digital competence: information literacy and data comprehension, communication and collaboration, digital content creation, security, and problem solving.

"Teaching and education are oriented towards general interdisciplinary and key competencies, because in that way a more dynamic combination of knowledge, skills and attitudes that are relevant to different real contexts that require functional application of knowledge and skills is enabled." [3].

C. Digital competence (digital literacy)

Digital literacy (or digital competence) is one of the eight key competences for lifelong learning and development in today's global, informational, digitalized society. It is an interdisciplinary competence that enables the acquisition of other key competencies. It is also a prerequisite for personal (social, professional, cultural) development of each individual. The right to acquire digital literacy skills is considered one of the basic rights of today's children and youth. The importance of digital literacy was recognized more than a decade ago in international educational documents. Although much time has passed since then, no theoretically sound and empirically valid definition of digital literacy can be found in the literature. It is a concept that is theoretically complex and multidimensional and has its foundation in several scientific disciplines.

During the 1990s, several authors used the term digital literacy to denote the ability to read and understand hypertext and multimedia texts. Thus Lenham (1995) equates digital literacy with "multimedia literacy", which is essentially different from traditional literacy, because it implies deciphering information given in different symbolic modalities (language, sound, image). In 1997, Paul Gilster, in his book Digital Literacy, was the first to define and popularize the concept of digital literacy. He defined digital literacy as "literacy of digital age" which is the ability to understand and use information from a variety of digital sources. Gilster believes that it is about "mastering ideas, not typing on the keyboard", thus emphasizing the importance

of critical thinking skills, instead of reducing digital literacy to technical knowledge and skills.

Despite numerous studies, there is still no well-founded and empirically valid concept of digital literacy. The search for answers to the questions of what digital literacy is, how it develops, what is the role of formal and non-formal education in its development is still being sought. According to proponents of new literacy, "digital technology has not only changed existing social practices, but has created new forms of practice." [4]. Literacy does not only mean reading, writing and arithmetic skills, but the term literacy is extended to the understanding of numbers, signs, various symbols, audio and video.

In addition to the term digital literacy, the term digital competence is often used in the literature. These two terms are most commonly used as synonyms, however some authors define digital literacy as a term that is superior to the term digital competence. According to one interpretation, digital literacy is a necessary ICT skill and it is the basis for acquiring digital competencies that are more specific and context-related [2]. Digital literacy within the project (DigEuLit) started in 2005 is defined as "awareness, attitude and ability of an individual to adequately use digital tools and skills to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge and communication with others in the context of specific life situations, in order to enable constructive social action."[16].

There are three levels in the development of digital literacy:

- digital competence,

- use of digital competence,

- digital transformation.

The first level, the level of digital competence, includes skills, from visual recognition through critical and conceptual approaches, to attitudes and awareness. The application of digital competence in professional and life contexts represents a key level in the development of digital literacy. It involves the use of digital tools to search, find and process information, develop products or solve problems. At the highest level is the application of digital competence, which is reflected through innovation and creativity. [17].

During 2011, the Digital Competence Framework for Citizens project was launched within the Institute for Prospective Technological Studies of the European Commission's Joint Research Center (JRC-IPTS), abbreviated DigComp. Based on the

data collected in 2013, the conceptual framework of digital competence was developed (DigComp 1.0).

In June 2016, this framework was revised and five domains of digital literacy were defined (Within each domain, a list of competencies is defined, a total of 21 competencies):

- literacy in the field of data information and digital content,

- communication and collaboration,

- creating digital content,

- security,

- Troubleshooting.

II. RESEARCH OF THE CONNECTION BETWEEN SCHOOL SUCCESS AND STUDENT COMPETENCIES

In addition to the digitalization of society, the development of digital literacy is becoming an important and very popular topic in academic and educational-political circles, within which the potential benefits of digital literacy for society but also for individuals are considered.

Although digital literacy can be conceptualized in different ways in terms of the components that are an integral part of it, it should not be insisted that the concept of digital literacy be limited to a linear set of skills that will suit all people for all time. Digital literacy is changing in line with the development of technology, digital tools are understood as technologies for giving and receiving meaning, such as language. These meanings are determined by social, cultural, historical and institutional practices, which usually, in addition to the use of language and digital technologies, include behavior, interaction, evaluation, beliefs and knowledge. For this reason, literacy is seen as a three-dimensional quantity, which complements functional literacy and technical competencies by contextualizing them in relation to culture, history, and power concentrations.

"The development of digital literacy is a gradual and continuous process, which involves several phases. The starting point in this process is the acquisition of instrumental skills, i.e. basic computer skills, after which we move towards the development of productive and strategic personal competencies. "[18] The lowest level in the process of developing digital literacy is mastering basic computer skills, in terms of acquiring basic skills and speed of performing actions with digital technologies that enable access to information, as well as collecting and exchanging information with others. Skills and competencies for the use of digital technologies are necessary, but not sufficient to master higher levels of digital literacy. It is also necessary to develop higher-order cognitive competencies that enable critical evaluation of information available through digital technologies.

Even if one accepts the view that today's generations are "digital natives", it is unreasonable to expect them to develop their digital competencies independently in the absence of systemic support from schools and school programs. Traditional teaching "is foreign to a young man, not motivating, uninteresting and cannot give the desired outcomes." [1].

This requires that within the institutions there are basic conditions for organizing teaching through digital technologies - availability of equipment, internet access, technical support, but also time and space for teaching and learning through digital technologies. When we talk about the school context, we primarily mean the availability and ways of using digital technologies in school, the support for access and use of digital technologies and the frequency of digital technologies usage by students and teachers, as well as the vision of the school on the application of digital technologies in teaching and learning processes. In this research, data on the school success of final grade students and their grades in informatics were collected, which represent the level of their digital literacy.

A. Research problem

There is an opinion in society that students develop digital literacy on their own because they use digital technologies every day, grow up with them and are therefore considered to be digitally literate. Also, it is believed that students who are digitally literate have better achievements in school because they can use digital technologies to find additional information that can help them fulfill school obligations and solve school tasks at school, as well as to acquire knowledge in various fields.

Since none of the existing questionnaires, nor the instrument for assessing digital competence that the author would create himself, would be objective, the author believes that the grade in informatics during high school is a good indicator of digital competence, although it does not cover all areas of digital competence. Existing instruments for assessing digital competencies rely mostly on self-assessment of digital abilities of respondents, which in most cases does not give objective results. This research looks at the relationship between students' digital competencies (in this case, grades in informatics course) and students' school success during high school.

B. Research goal

The goal of the research is to determine whether there is a statistically significant correlation between school success and students' digital competencies and whether there are differences in students' school success according to gender criteria.

C. Hypothesis

Focusing on the set goal of this research, the hypothesis of this research is:

H1: Students who have developed digital competencies achieve better success in school.

The derived hypotheses are:

H1.1 There is a linear correlation between students' digital competencies and student achievement in school.

H1.2 There is no difference in the school success of boys and girls which is conditioned by the level of digital literacy of students.

D. Research results

The research checked whether there is a dependence of students' school success on the development of their digital competencies by calculating the correlation coefficient. Based on the obtained value of the correlation coefficient and the interval to which it belongs, a conclusion was made about the connection between school success and digital competencies. Based on the collected data and their processing, the value of the correlation coefficient (Pearson's coefficient) of 0.854 (r) was obtained.

If we use the Pearson coefficient as a decision-making tool, the following statistical inference is common (Table 1):

Table I. PEARSON COEFFICIENT VALUES

The interval to which the value | r | belongs	Interpretation
[0.00,0.40)	Weak correlation
[0.40,0.75)	Moderate correlation
[0.75,0.85)	Good correlation
[0.85,1.00]	Excellent correlation

By comparing the obtained value with the data in the table, we can conclude that there is an excellent correlation of students 'digital literacy with their school success, i.e. that students' school success largely depends on the digital competencies level of development.

The coefficient of determination, i.e. the percentage of dependence of one variable on another (obtained by squaring the value of correlation) is 72.93%, which means that school success depends on digital literacy of students with 72.93%, while other phenomena (motivation, time spent learning, presentation, teaching content, readiness of teachers to help students in case of difficulties) with 27.06% affect the success of students in school.

The data can also be represented graphically using diagrams. The data presented are student achievement and their grades. Based on the drawn points, a trend of lines of the linear type was inserted, which indicates that there is a linear dependence among the presented data (Figure 1).
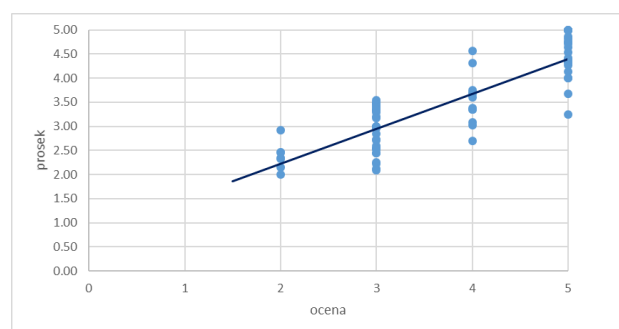

Figure 1. Linear dependence between student achievement and their grades

Interpreting the chart, we can say that if a student has a higher grade in informatics, he will have a higher school success, i.e. that the success of students in most cases depends on digital competencies.

Data analysis showed that in 70.83% of students (51 students) in the sample, the success of students coincides with the grade in informatics (a measure of digital competence in work), while in 29.17% (21 students) there is a deviation of success from the grade in informatics. When we present these deviations graphically, it can be seen that in as many as 25% of students the school success is lower than the grade in informatics and only three students have higher school success than the grade in informatics.

III. CONCLUSION

This research proved the hypothesis "There is a linear correlation between digital competencies of students and student achievement in school" to be correct based on the obtained correlation coefficient of 0.854 which corresponds to the interval of excellent correlation, which means that student success directly depends on digital competencies and

72.93% (obtained using the coefficient of determination) depends on the digital literacy of students, while other phenomena (motivation, time spent in learning, way of presenting teaching content, readiness of teachers to help students in case of difficulties) with 27.06% affect student success in school.

The development of digital literacy within formal education should be viewed strategically and as a whole, individual steps should be combined into one project that needs to be gradually implemented in order to reach an adequate practice of developing digital literacy. It is necessary to start systematically, from the level of educational policy; regulations and other legal documents to regulate the obligation, but also the manner of introduction and implementation of the practice of developing digital literacy among students; formulate goals and concretize tasks; provide appropriate opportunities for professional development of teachers in the field of digital technologies; and provide appropriate and necessary

technical and other conditions for the development of digital literacy in students.

Teachers also need to change their way of working in order to achieve teaching efficiency, to form a positive attitude towards integrating technology into teaching and to adopt a model of e-learning that causes students to be more motivated to learn and maintain attention to the teaching material. [1].

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