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INVESTIGATING STUDENTS ATTITUDES AND PREFERENCES TOWARDS DISASTER LEARNING MULTIMEDIA TO ENHANCE PREPAREDNESS

Abstract: This paper presents quantitative research results regarding students' attitudes and preferences towards disaster learning multimedia to enhance preparedness. The research was conducted during February and March 2021, where the respondents' answers were collected by sending an online survey questionnaire electronically to the email addresses of high schools. The general hypothesis refers to verifying the claim that the application of multimedia in children's education in schools about disasters ensures that students are acquainted with disasters and develop skills for safety and risk management in case of disasters. The regression model within the conducted research confirmed that the education of students through multimedia has the most significant impact on safety and risk management in disasters. Future directions of research in this field should move towards the analysis of different simulation models that can be of great help to acquaint students with the dangers arising from disasters. Given that simulation has proven to be an effective tool in acquiring knowledge, their application in educating students about disasters would inevitably have significant effects.

Key words: disasters, preparedness, students, attitudes, e-learning, multimedia, Serbia

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Introduction

Social media empowers local communities by enabling interactive communication and strengthening cooperation with disaster relief agencies. The application of social networks plays a significant role in reducing the risk of disasters. Their role is reflected in raising awareness of the existing dangers in the environment and educating about preventive measures as an essential factor in mitigating or eliminating the consequences of disasters (Cvetković et al., 2018; Palen & Hughes, 2018; Yan & Pedraza, 2019; Page, 2021). They also play an essential role in informing citizens, collecting aid for affected people and the vulnerable. In addition, the use of social networks has negative consequences, which are primarily related to misinformation, raising fear levels, and the like. Through social networks, users can get acquainted with risk maps in the areas they live. An interactive online campaign improves the level of emergency preparedness (Houston et al., 2015; Anson et al., 2017; Ghosh et al., 2018; Aleksandrina et al., 2019; Kumiko & Shaw, 2019; Mano & Rapaport, 2019; Ocal, 2019). On that occasion, it is possible to use videos, text, and photos to get acquainted with the characteristic dangers of a given area. There was a great interest in the use of social networks in order to exchange information about disasters, primarily due to concerns for the safety of other people. In order to make the most efficient use of social networks in disseminating information about disasters, it is necessary to educate users on how they can help emergency rescue services in carrying out activities aimed at reducing the risk of disasters (Cvetković et al., 2018; 2021; Tešić et al., 2020; Durljević, 2021; Langović et al., 2021;).

Policymakers have focused on developing a new approach to persuading people and creating leaps in disaster risk reduction (Kostadinov et al., 2017a, 2017b; Petrović et al., 2021), such as training children, the general public, especially vulnerable people, taking into account the increased risk of disasters and vulnerability to climate change, development, increased inequality in income and low host readiness (Morrow, 1999; Brodie et al., 2006; Kagawa & Selby, 2012; Bosschaart et al., 2016). Disaster education aims to provide knowledge, skills, motivation to individuals and groups to reduce their vulnerability to disasters. Even educating vulnerable people makes practical actions for other people or communities (Rohrmann, 2008). Disaster education is a practical, logistical, and cost-effective risk management strategy (Center, 2008). Research has confirmed that poor awareness and inadequate understanding of risk negatively affect people's readiness, response to hazard warnings, personal protection measures, and recovery (Wisner, 2006). Special training and attention are provided with the assistance of professional and certified personnel should be directed towards vulnerable people due to their limitations and the conditions in which they live (Muttarak & Pothisiri, 2013; Rundmo & Nordfjærn, 2017).

Children, particularly those who are enrolled in school at the time of the disaster, are among the most vulnerable demographic groups during a disaster. During the disasters, school buildings were destroyed, taking precious lives of children and teachers and stopping access to education after the disaster. Renovation of these schools can take years and is very expensive (Selby & Kagawa, 2012). Incorporating disaster awareness into school curricula usually has long-term value (Carter, 2008). Mangione et al. (2013) confirm that disaster and risk education should be part of the national curriculum of primary and secondary schools and be included in several school subjects, such as geography, social sciences, biological sciences, forensics, physics, history. Various

educational materials are available today and can raise awareness and gain knowledge about disaster management.

When developing a disaster risk reduction educational plan, it is important to weigh the benefits and drawbacks of various approaches. While social and video games may raise awareness and understanding about catastrophes, simulations have a special position. Participants may learn about disasters and the inherent uncertainties and hazards that come with them via simulations of real events. Modern schooling is heavily reliant on multimedia. The concept involves using sound, text, and video to create interactive encyclopedias and instructional discs. Multimedia is a mix of many technological mediums. To produce auditory and visual effects in classrooms using color text, graphics, animation, and music is a goal of educational presentation (Budi, 2006). Images, videos, and animations talk louder than words. Therefore, students more quickly absorb information while viewing multimedia presentations (Solaković, 2018).

Learning about disasters and how to react in such situations is crucial in reducing the risk of disasters. This type of learning should become an integral part of every society, and as such, it should be integrated into school curricula, and children should be introduced to knowledge about disasters as soon as possible. For these reasons, the authors examine students' attitudes and preferences towards disaster learning multimedia to enhance preparedness.

Materials and methods

The research aims to examine the interrelationship between educating students about disasters through multimedia. Exploring the connection between educating students about disasters and reducing the risk of disasters also means considering different ways of acquiring knowledge about disasters and their impact on good action in the event of disasters. The impact of the school's cooperation with professional institutions in transferring knowledge and experiences about disasters was examined to determine the interrelationships between educating students about disasters through multimedia and reducing the risk of disasters. Also, the impact of acquiring knowledge about disasters through other subjects in high schools on the connection between educating students about disasters through multimedia and reducing the risk of disasters was examined.

The second segment of the research aimed to assess the extent to which multimedia content is used in the school in order to improve teaching and acquire knowledge from disasters, as well as how familiar students are with disasters, and with adequate response and action in case of disasters. Knowledge and information about the education of students through multimedia in school was obtained through the evaluation of the stated claims. Through these claims, there was a decline in the extent to which the use of multimedia is represented in the school, how much knowledge is gained through its application, how much students are involved in their preparation and development, and whether students are introduced to various evacuation exercises through multimedia and practical examples. Also, by evaluating the stated claims, the students indicated the extent to which they are familiar with the different segments of disaster risk reduction. First of all, the evaluation of the stated claims revealed data on how much students are aware of disasters, with adequate response in case of their occurrence, preventive and safety actions, and risk management in disasters. The students evaluated the stated statements

using the Likert scale, where they stated on a scale from 1 to 5 to what extent they agree with the stated statements, where 1 - do not agree at all, 5 - agree at all.

The research was conducted during February and March 2021, where the answers and attitudes of the respondents were collected by sending an online survey questionnaire electronically to the email addresses of high schools. The research was aimed at final year students of secondary vocational schools and gymnasiums. Students' attitudes regarding the acquired knowledge about different types of disasters through the acquisition of knowledge through the study of different subjects during secondary education were examined.

In designing the research hypotheses, we started from previous research that dealt with analyzing students' education about disaster risk reduction. The application of computer games, simulations, and educational videos in schools can raise the level of readiness of students and citizens to react in case of disasters (Cvetković & Katarina, 2019). Research shows that students can actively participate in implementing safety measures in schools and work with teachers and other people in the community to reduce risk before, during, and after disasters (UNICEF, 2011). The role of teachers is to build disaster awareness through the curriculum (Kartal et al., 2018; UNESCO, 2014).

The general hypothesis refers to the verification of the claim that the application of multimedia in the education of children in schools about disasters ensures that students are acquainted with disasters and that they develop skills for safety and risk management in case of disasters. Concerning the general hypothesis, the paper starts from three particular hypotheses:

- Particular hypothesis 1. Variables of student education through multimedia show statistically significant correlations with variables of disaster risk reduction.
- Particular hypothesis 2. Variables of student education through multimedia show statistically significant correlations with variables of disaster risk reduction with a moderative effect of cooperation with professional institutions.
- Particular hypothesis 3. Variables of student education through multimedia show statistically significant correlations with variables of disaster risk reduction with a moderating effect of acquiring knowledge about disasters from other subjects.

Basic characteristics of respondents

The research sample included 376 students. The research was aimed at many high schools in the Republic of Serbia. However, given the low response, the survey covered 25 high schools, including about 5% of the total number of high schools that educate children in the Republic of Serbia. The most significant number of students who responded to the research are from the following schools: Aviation Academy and Sports Gymnasium from Belgrade, Technical School "Ivan Sarić" and Chemical-Technological School from Subotica, Technical School from Vlasotince and Technical School from Užice. Considering that the surveyed students are in the final years of high school, they are adult children whose ages are 18 (88%) and 19 (12%) years. When it comes to the gender of the respondents, it can be said that the research covered a relatively equal number of genders, i.e., 190 (50.5%) male respondents and 186 (49.5%) female respondents participated. The most significant number of students, 156 (41%), achieved perfect results, slightly fewer 141

(38%) achieved excellent results. About 73 (19%) students achieved good results in school, while 6 (2%) stated that they achieved good success.

Questionnaire Design

Data on students' attitudes towards disasters and their knowledge about them were collected through a survey. The survey questionnaire consisted of two segments. The first segment referred to general issues related to students - respondents. In this segment, respondents cited general questions related to gender, age, level of education of father and mother, who makes up the community in which they live. In addition, information was obtained within this segment on how they are familiar with various disasters and through which sources they are most aware of them. The questions were also related to whether the knowledge about disasters comes through the study of other subjects in school and whether they might prefer to have a subject that would deal exclusively with the analysis and knowledge of disasters. Then, through the questions, it was found out whether the school cooperates with certain professional institutions on improving knowledge in the field of disasters and whether the parents of students are involved in that process. Respondents stated whether members of their families were involved in some disasters.

Analyses

After preparing the collected data, we proceeded to the analysis of individual questions, the results of which are presented by tabulation to determine the empirical distribution of the analyzed variables. In addition, after the descriptive statistics and the analyzed variables used in the research, a correlation analysis of the mentioned variables was approached to define the mutual relations and relations between them (Tabachnick et al., 2007). Regression analysis defined the individual influence of the analyzed variables. The collected data on the research were processed in the statistical program SPSS Statistics 25.

Results

Several questions aimed to determine the extent to which students were familiar with certain types of disasters, how they came to know about them, and whether anyone close to them was a participant in the disasters. According to the research results, the students pointed out how they most often get information about disasters and gain knowledge about them. The following graph indicates the structure of the respondent's response.

Based on the data shown in Fig. 1, most respondents stated that information on disasters is obtained by searching data on the Internet, which is considered by almost half of the respondents 185 (49.2%). Approximately 105 (27.9%) respondents came to know about information through the media, while 40 (11.2%) stated through conversations with family members. Only 28 (7.4%) students stated that learning about disasters comes through learning at school, while the smallest number stated through social and video games, i.e., 16 (4.3%). In light of the fact that the study was done in vocational high schools, where broad topics (such as geography, which provides an opportunity to discuss disasters) are underrepresented, this is a reasonable conclusion. The extent to which the surveyed students are familiar with the different types of disasters can be seen based on Tab. 1.

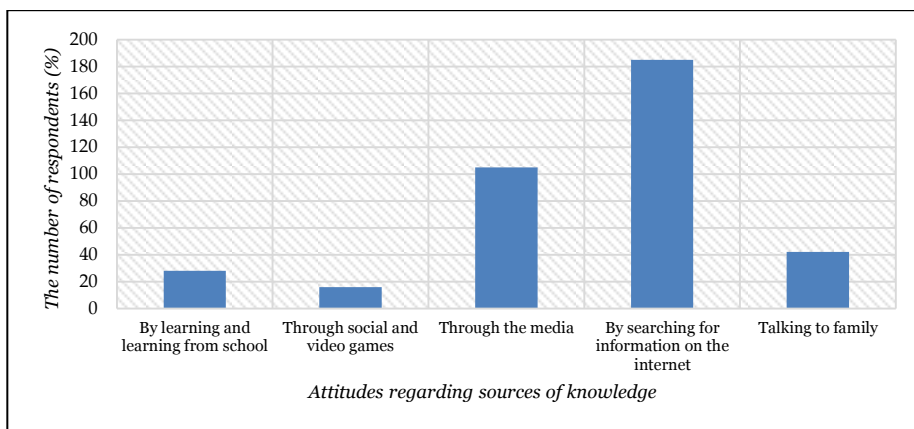


Fig. 1. Frequency of sources of knowledge and information about disasters by students

Tab. 1. Familiarity of students with the essential characteristics of disasters.

Disasters	Not fully aware	Not familiar with it	Familiar with it	Fully aware
Earthquake	40 (10.6%)	144 (38.3%)	180 (47.9%)	12 (3.2%)
The flood	32 (8.5%)	125 (33.2%)	212 (56.4%)	7 (1.9%)
Landslide	102 (27.1%)	160 (42.6%)	110 (29.2%)	4 (1.1%)
Forest fires	37 (9.8%)	121 (32.2%)	208 (55.3%)	10 (2.7%)
A pandemic	13 (3.5%)	64 (17%)	270 (71.8%)	29 (7.7%)
An explosion	81 (21.5%)	133 (35.4%)	149 (39.6%)	13 (3.5%)
Accidents	109 (29%)	152 (40.4%)	109 (29%)	6 (1.6%)

The research aimed to determine the extent to which students are familiar with the following types of disasters: earthquakes, floods, landslides, pandemics, fires, exposures, and accidents. Based on the research results, it can be seen that they are most familiar with these disasters. Of the analyzed disasters, the most significant number of students (71.8%) are familiar, while a significant number (7.7%) are fully aware of the pandemic. Given the current global situation with the coronavirus pandemic, it is inevitable that there is a large amount of information and knowledge coming to students. Therefore, a great deal of information and knowledge about this type of disaster is apparent. The students cited fire and floods as disasters known to them. Frequent floods in our country and the great floods from May 2014 indicate that a large amount of information about this catastrophe is placed through the media. Of the mentioned disasters, the students stated that they were the least familiar with accidents, where a large number of them stated that they did not know this type of disaster, which is considered by 29% of the surveyed students.

The research indicated that students are primarily users of social networks, which 367 (97.6%) students considered, while 9 (2.4%) stated that they do not use social networks. Of the total number of students who participated in the research, 60 (16%) stated that some of their family members experienced direct or indirect consequences of the disaster. On the other side, 216 (84%) stated that they did not have such a case in the family. When it comes to the cooperation of the school with professional institutions (Sector of emergency management, Serbia water, Civil protection units, etc.) in terms of acquiring knowledge about disasters, 174 (46.3%) students stated that their school

cooperates with such institutions, while 202 (53.7%) gave a negative answer. About 125 (33.2%) students believe that the school finds ways to involve parents in cooperation to more effectively acquaint students with disasters, while 251 (66.8%) stated that such cooperation does not exist. Disaster learning is the subject of study through the contents of other subjects, a statement with which a more significant number of students agree 204 (54.3%), while the negative to this question was given by 172 of them (45.7%). That students are interested in this area and ready to acquire knowledge about disasters through the introduction of a new subject in the field of disasters was confirmed by the fact that a slightly higher number of students, 199 (52.9%), said they were in favor, while against the introduction of a new subject 177 (47.1%) students.

The research segment analyzed the application of multimedia content in disaster learning and the impact that learning has on reducing disaster risk. This section of the study examined factors indicating student education via multimedia and disaster risk reduction. Tab. 2 presents descriptive statistics of the analyzed variables of student education through multimedia, where the mean, minimum and maximum value, standard deviation, and variable labels that will be used in further research are listed.

Tab. 2. Descriptive statistics of variables student education through multimedia

Variable	Label	N	Min	Maks	Mean	SD
Multimedia application	EUM1	376	1	5	2.77	1.252
Multimedia learning	EUM2	376	1	5	3.15	1.277
Student involvement	EUM3	376	1	5	3.24	1.256
Simulation via multimedia	EUM4	376	1	5	3.66	1.281
Multimedia visualization	EUM5	376	1	5	3.78	1.210

Based on the research results of descriptive statistics in Tab. 2, we can see that all variables of student education through multimedia are rated above the average value, which is 2.5. The lowest rated variable is multimedia, which only indicates that this type of learning is not sufficiently represented in high schools. The best-rated variables, which significantly exceed the average knowledge, are visualization and simulation via multimedia. This is precisely the advantage of this type of learning because teenagers and young adult citizens can gain complete insight and experience the actual visual effects of a catastrophe through this technology's possibilities. Therefore, various evacuation exercises and practical examples of disasters and actions can provide students with valuable knowledge and experiences that can help them in their occurrence. Tab. 3 presents descriptive statistics of disaster risk reduction variables, where the mean value, assessed by students, minimum and maximum value, and standard deviation are given.

Tab. 3. Descriptive statistics of disaster risk reduction variables

Variable	Label	N	Min	Max	Mean	SD
Knowledge of disasters	SRK1	376	1	5	3.46	.987
Adequate response	SRK2	376	1	5	3.28	1.094
Preventive action	SRK3	376	1	5	3.27	1.119
Safety operation	SRK4	376	1	5	3.23	1.095
Risk management	SRK5	376	1	5	3.26	1.159

Descriptive analysis of disaster risk reduction variables found that all analyzed variables were rated significantly higher than the average value of 2.5, as shown in Tab. 3. It can be seen that the best-rated variable is disaster knowledge, which only indicates that students have some knowledge about the disasters they have acquired during their previous schooling and collected from other sources of information, such as the Internet,

the media, and indeed through the experience passed on to them by their family members. Slightly lower scores, but relatively uniform, were given to other variables related to disaster response, action, and management. The lowest rated variable is safety action, which only confirms that children should be shown practical knowledge and guidelines on how to behave in the event of a disaster. Based on the descriptive statistics of the variables of student education through multimedia and the variables of disaster risk reduction, a correlation analysis of the mentioned variables was performed, and their mutual influence was determined. The following Tab. 4 shows the relations obtained by correlation analysis.

Tab. 4. Pearson's correlation analysis between the variables of student education through multimedia and the variables of disaster risk reduction

	Application of multimedia	Learning through multimedia	Involvement of students	Simulation through multimedia	Visualization through multimedia
Knowledge of disasters	.262**	.347**	.303**	.299**	.268**
Adequate response	.341**	.386**	.273**	.279**	.257**
Preventive action	.290**	.369**	.242**	.319**	.231**
Safety operation	.307**	.406**	.300**	.328**	.285**
Risk management	.280**	.423**	.314**	.272**	.212**

** Correlation is significant at the level of 0.01.

These results show statistically significant correlations, which can be seen based on the presented research results in Tab. 4. All shown correlations are positive and indicate a moderate or significant correlation of the analyzed variables. The observed relationships show that the variable learning through multimedia has a significant relationship with risk management and safety in disasters. In addition, the mentioned variable achieved a significant correlation with the variables adequate response and preventive action. Therefore, it is concluded that the application of multimedia in educating students about disasters can significantly contribute to adopting the necessary knowledge and skills essential for preventive action, adequate and safe action in case of disasters. In addition, multimedia in the acquisition of knowledge about disasters greatly influence risk management, which is essential for reducing the consequences of a disaster. A critical connection has also been established between multimedia summaries and the variables preventive and safety action. Simulations significantly contribute to a realistic experience of a disaster.

Through this type of learning, children more clearly adopt the necessary knowledge about what to do to avoid possible disasters caused by man and how to behave in disasters to save their own lives and the lives of other people. Through the simulation, the procedures and methods of evacuation and behavior in case of different types of disasters can be clearly indicated. Variables that have established lower-intensity, but undoubtedly statistically significant, relationships are multimedia visualization and risk management. Visualization certainly contributes to a more accessible acquaintance of students with different characteristics and dangers that disasters bring with them. However, the application of simulations in learning has a much stronger effect on the perception of knowledge. This is supported by statistically significant higher intensity relations established between the variables of simulations through multimedia with all variables of student education through multimedia to the correlations established by the variable visualization through multimedia to the observed variables of student education.

When it comes to the relationship between the analyzed variables, the mutual correlation of these variables was determined by whether the school cooperates with professional institutions on improving knowledge in the field of disasters in its students, or it is not the case. These relationships show statistically significant differences between the correlations of the analyzed variables in those schools that cooperate with professional institutions in terms of educating students about disasters and those schools that do not practice it. In schools that cooperate with professional institutions, there is a significant connection between educating students through multimedia and the variables of disaster risk reduction. The variable simulation achieved a vital connection via multimedia with the variables disaster knowledge and adequate response. Also, the variables safety performance and risk management indicate an essential correlation with the variables simulations via multimedia and learning via multimedia. In addition, a significant correlation between these variables was achieved with the variable student involvement, while this variable showed a statistically significant correlation with the variable knowledge of disasters. All these relations indicate that cooperation with professional institutions contributes to a better acquaintance of students with disasters. The effects of professional knowledge, original video, and accurate simulations are visible in improving knowledge about disasters and learning about preventive and safety actions due to disasters. Also, involving students in creating multimedia and participating in discussions on various forms of disasters contributes to the easier acquisition of knowledge when it comes to knowledge of disasters and risk management in disasters.

Tab. 5. Correlation analysis between the variables of student education through multimedia and the variables of disaster risk reduction from the aspect of school cooperation with professional institutions

	Student education	Application of multimedia	Learning through multimedia	Involvement of students	Simulation through multimedia	Visualization through multimedia
Cooperate	Knowledge of disasters	.248**	.401**	.424**	.520**	.463**
	Adequate response	.335**	.412**	.352**	.519**	.358**
	Preventive action	.314**	.422**	.326**	.422**	.311**
	Safety operation	.299**	.446**	.409**	.490**	.336**
	Risk management	.306**	.486**	.403**	.454**	.345**
	N	174	174	174	174	174
Doesn't cooperate	Knowledge of disasters	.179**	.251**	.214**	.203**	.181**
	Adequate response	.224**	.256**	.178**	.176**	.203**
	Preventive action	.175**	.252**	.152*	.267**	.183**
	Safety operation	.193**	.287**	.200**	.255**	.250**
	Risk management	.168**	.323**	.230**	.187**	.143*
	N	202	202	202	202	202

** Correlation is significant at the level of 0.01.

* Correlation is significant at the level of 0.05.

When it comes to the correlation relations between the analyzed variables in those schools that do not cooperate with professional institutions, it is realized that relations of lower and insignificant intensity were recorded. Namely, a slight correlation was established between the variables learning through multimedia and risk management and between the variables simulations through multimedia and security performance. The results of the correlation analysis are shown in Tab. 5.

The analyzed relationships between the observed variables of student education through multimedia and the variables of disaster risk reduction were observed from studying knowledge about disasters through the contents of other subjects. Namely, the mutual relations between the analyzed variables were considered in those students who stated that they acquire knowledge about disasters through other subjects and in those students for whom this is not the case. Tab. 6 shows the results of the correlation analysis.

Tab. 6. Correlation analysis between the variables of educating students through multimedia and the variables disaster risk reduction from the aspect of learning about disasters through other subjects

Education		Application of multimedia	Learning through multimedia	Involvement of students	Simulation through multimedia	Visualization through multimedia
Learning through other subjects	Knowledge of disasters	.298**	.356**	.281**	.304**	.293**
	Adequate response	.369**	.390**	.263**	.269**	.270**
	Preventive action	.295**	.366**	.211**	.305**	.227**
	Safety operation	.315**	.411**	.292**	.350**	.343**
	Risk management	.304**	.424**	.311**	.282**	.245**
	N	204	204	204	204	204
Not learning about through other subjects	Knowledge of disasters	.076	.311*	.397**	.207	.114
	Adequate response	.185	.389**	.324*	.295*	.179
	Preventive action	.289*	.396**	.335**	.303*	.163
	Safety operation	.267*	.406**	.321*	.189	.008
	Risk management	.159	.428**	.332**	.189	.059
	N	172	172	172	172	172

** Correlation is significant at the level of 0.01.

* Correlation is significant at the level of 0.05.

The correlations of the observed variables analyzed from the aspect of learning about disasters through other subjects indicate statistically significant differences between correlations in those students who acquired some knowledge about disasters through studying other subjects and those who did not. A strong correlation was established in most of the correlations between the analyzed variables in those students who acquire knowledge about disasters through other subjects. A statistically significant correlation was achieved between the variable learning through multimedia and risk management, and safety performance. When it comes to students who do not acquire knowledge about disasters through other subjects, it can be seen that only the variable learning through multimedia showed a statistically significant correlation with all variables disaster risk reduction. Furthermore, it may be stated that there is a statistically significant association between student participation and not just multimedia.

In contrast, most other correlations did not establish any statistically significant correlation. This indicates that the knowledge in the field of disasters that children acquire through other subjects greatly helps them accept and adopt the necessary information related to preventive and safety action and adequate response in case of

disasters. Based on the confirmed interdependence of the analyzed variables, a regression analysis was performed. Regression analysis determined the individual impact of independent variables of student education through multimedia on the dependent variables of disaster risk reduction. The results of the regression analysis are shown in Tab. 7.

Tab. 7. Results of regression analysis between disaster risk reduction and educating students through multimedia.

Depend	Independent	β	t	Sig.	R ²	F	Sig.
DRR1	ESTM1	-.011	-.190	.849	.170	15.106	.000**
	ESTM2	.210	3.652	.000			
	ESTM3	.046	.904	.367			
	ESTM4	.143	2.363	.019			
	ESTM5	.017	.269	.788			
DRR2	ESTM1	.103	1.642	.102	.190	17.327	.000**
	ESTM2	.222	3.527	.000			
	ESTM3	-.025	-.446	.656			
	ESTM4	.164	2.472	.014			
	ESTM5	.012	.176	.861			
DRR3	ESTM1	.053	.823	.411	.198	18.288	.000**
	ESTM2	.267	4.163	.000			
	ESTM3	-.066	-1.169	.243			
	ESTM4	.307	4.555	.000			
	ESTM5	-.102	-1.431	.153			
DRR4	ESTM1	.005	.089	.929	.218	20.627	.000**
	ESTM2	.296	4.770	.000			
	ESTM3	-.011	-.210	.834			
	ESTM4	.206	3.168	.002			
	ESTM5	.003	.042	.966			
DRR5	ESTM1	-.076	-1.164	.245	.214	20.149	.000**
	ESTM2	.381	5.787	.000			
	ESTM3	.057	.984	.326			
	ESTM4	.189	2.738	.006			
	ESTM5	-.074	-1.021	.308			

Note: DRR – disaster risk reduction; ESTM - educating students through multimedia.

** Correlation is significant at the level of 0.01.

The contribution of the variables of student education through multimedia for the total R square of the regression with the variables disaster risk reduction was examined by the regression method. These results indicate that the variables of student education through multimedia are the best predictors of safety performance ($R^2 = 0.218$) and risk management ($R^2 = 0.214$). This indicates that the most significant importance for safety and risk management in disasters is the education of students about disasters. Thus, multimedia disaster learning explains 21.8% of variations in disaster safety and 21.4% disaster risk management. Based on the results presented in the table, we can conclude that the variable learning through multimedia showed a statistically significant impact on all observed variables of disaster risk reduction.

In contrast, the variable simulation through multimedia had a statistically significant impact on preventive and safety action variables. Based on the above, we can conclude that the influences and effects of multimedia in disaster learning have confirmed the impact on reducing the risk of disasters. The importance of learning through multimedia is especially emphasized through simulations, while the effects of this learning are most visible on acquiring knowledge about safety and risk management in disasters.

Discussion

It has been pointed out that disaster education provides knowledge and skills (Xuesong & Kapucu, 2019; Jha et al., 2021) to individuals that enable them to reduce the risk of disasters and when it comes to vulnerable groups (Rohrmann, 2008), as is the case with children. The presented research in the paper is similar to the results of previous research (Wisner, 2006; Center, 2008; Aguilar & Retomal) confirmed that disaster education is a functional tool for disaster risk management and affects the readiness to respond in such situations. As children belong to a vulnerable group, it is necessary to get acquainted with disasters and disaster risks as soon as possible, and previous research has indicated the importance of including this topic in school curricula (Carter, 2008; Petal & Izdahlkhal, 2008; Mangione et al., 2013), whose importance is confirmed by the research conducted in this paper. Also, students' awareness of the importance of this topic was confirmed through research, where it was indicated that more students favor learning about this topic in school through an independent subject.

Similar to previous research (Cvetković & Miladinović, 2017), the research results show that students are most familiar with disasters, mainly with the pandemic, which is expected given the current situation with the coronavirus. They also cited floods and fires as disasters about which they have much knowledge. The necessary information on disasters is obtained by searching the Internet and through the media. Acquiring knowledge about disasters through school learning is very little represented as a source of information and knowledge. Students prefer to learn through multimedia, video games, and the Internet, as evidenced by the fact that 97.5% of them are active users of social networking sites, which, if used correctly, could be a valuable source of information about future disasters. Student enthusiasm in disaster learning is reflected in the fact that a higher percentage of them (52.9%) indicated that they would support the introduction of a new subject in the area of disasters.

Previous research has demonstrated a positive relationship between the quality of acquired knowledge and simulation (Karal et al., 2010; Cvetković & Andrić, 2019), animation (Mayer & Moreno, 2002), information and communication technologies (Al-Tamimi, 2003), and multimedia (Watters & Dieymann, 2007; Terzić & Miljanović, 2009; Solaković, 2018). Within this research, a correlation analysis was conducted between the variables of student education through multimedia and the variables of disaster risk reduction. The obtained relations confirmed that there is a statistically significant correlation and influence between the analyzed variables. This indicates that improving the education of students through multimedia, and primarily by using simulations, provides a reduction in the risk of disasters, primarily through preventive and safety action. Based on the above, it can be concluded that particular hypothesis 1 of this paper was confirmed, i.e., that the variables of student education through multimedia show statistically significant correlations with the variables of disaster risk reduction.

The finding of statistical significance between the variables prompted more research into the interaction between schools and professional institutions in disaster management. Statistically, schools that work with professional institutions and teach pupils about disasters have higher correlations than schools that do not. This indicates that student instruction through multimedia has statistically significant associations with catastrophe risk reduction, with the moderating influence of professional institution

cooperation. The relationships between factors were studied to learn more about disasters from other subjects. To what extent does educating students through multimedia about disasters impact reducing the risk of disasters if students have already acquired specific knowledge in this area by studying the content of other school subjects. A very significant correlation was established in those children who had some prior knowledge in the field of disasters and where the already acquired knowledge could improve and create the knowledge necessary for adequate response and safety in case of disasters. Based on the determined, different levels of statistical significance of the observed relations of the analyzed variables, a particular hypothesis 3 was confirmed.

The influence of the variables of student education through multimedia on the variables of disaster risk reduction was also confirmed through the regression model. This model found that educating students through multimedia makes the most outstanding contribution to safety and disaster risk management. Also, this model confirmed that the most significant impact on reducing the risk of disasters had been learned through multimedia and the application of simulations in multimedia. The statistical significance of mutual relations and influences proved specific hypotheses. The primary hypothesis of this paper was confirmed, i.e., that the application of multimedia in educating children in schools about disasters will ensure that students become acquainted with disasters and build safety and management skills.

Conclusions

The regression model within the conducted research confirmed that the education of students through multimedia has a significant impact on safety and risk management in disasters. When it comes to educating students about disasters, the most excellent effect is achieved by learning through multimedia and using simulations to show actual events within multimedia content. These statements prove the hypotheses of this paper and the achieved goal of the research. Based on that, it can be concluded that the application of multimedia in student education significantly reduces the risk of disasters, primarily through risk management by knowing the ways and methods of preventive and safety action in such situations. The contribution of the research is reflected in the importance of learning about disasters on adequate response and safety action due to their occurrence, and thus to reduce the negative consequences of disasters. Introducing students to some basics of disasters, the dangers they bring, practical experiences, and evacuation routes as ways out of such situations is the only way to reduce the risks of disasters and teach them to behave in such emergencies.

This research confirmed the impact of multimedia learning on disasters as an effective way to transfer knowledge through videos and simulations. Further directions of research can go in the direction of finding specific learning programs for high school children, which were the subject of this research, as well as creating simulation models of behavior in case of different types of disasters. Future directions of research in this field should move towards the analysis of different simulation models that can be of great help to acquaint students with the dangers arising from disasters. Given that simulation has proven to be an effective tool in the acquisition of knowledge, their application in educating students about disasters would inevitably have significant effects. Also, progress in improving knowledge about disasters can be implemented within school programs, where a particular subject would be introduced that would deal with the study

of content related to this issue. By showing the content through multimedia, students would be faced with real situations and the harmful effects of disasters and instructed how to react adequately and act in such situations.

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References

- Aguilar, P. & Retamal, G. (2009). Proactive Environments and Quality Education in Humanitarian Contexts. *International Journal of Educational Development* 29, 3-16.
- Aleksandrina, M., Budiarti, D., Yu, Z., Pasha, F. & Shaw, R. (2019). Governmental Incentivization for SMEs' Engagement in Disaster Resilience in Southeast Asia. *International Journal of Disaster Risk Management*, 1(1), 32-50.
- Al-Tamimi, D. M. (2003). Application of information and communication technologies in medical education. *Journal of family & community medicine*, 10(1), 67-76.
- Anson, S., Watson, H., Wadhwa, K. & Metz, K. (2017). Analysing social media data for disaster preparedness: Understanding the opportunities and barriers faced by humanitarian actors. *International Journal of Disaster Risk Reduction*, 21, 131-139.
- Bosschaart, A., van der Schee, J., Kuiper, W. & Schoonenboom, J. (2016). Evaluating a flood-risk education program in the Netherlands. *Studies in Educational Evaluation*, 50, 53-61.
- Brodie, M., Weltzien, E., Altman, D., Blendon, R. J. & Benson, J. M. (2006). Experiences of Hurricane Katrina evacuees in Houston shelters: Implications for future planning. *American Journal of Public Health*, 96(8), 1402-1408.
- Carter, W. N. (2008). *Disaster management: A disaster manager's handbook*, Asian Development Bank.
- Center, A. D. P. (2008). *A study on impact of disasters on the education sector in Cambodia*. Asian Disaster Preparedness Center, Bangkok.
- Cvetković, V. & Miladinović, S. (2017). Examining students' attitudes and knowledge about landslides as natural hazards]. *Ecologica*, 24(85), 1-5.
- Cvetković, V. & Katarina, A. (2019). Edukacija građana o smanjenju rizika od katastrofa korišćenjem multimedijalnih sadržaja – društvene igre, kompjuterske igrice i simulacije. *Vojno delo*, 71(6), 122-151.
- Cvetković, V., Filipović, M., Dragičević, S. & Novković, I. (2018). The role of social networks in disaster risk reduction. *Paper presented at the Eight International Scientific Conference "Archibald Reiss Days"*, October 2-3, Academy of Criminalistic and Police Studies, Belgrade.
- Cvetković, V., Roder, G., Ōcal, A., Tarolli, P. & Dragičević, S. (2018). The Role of Gender in Preparedness and Response Behaviors towards Flood Risk in Serbia. *International Journal of Environmental Research and Public Health*, 15(12), 2761.
- Cvetković, V., Tanasić, J., Ocal, A., Nikolić, N. & Dragašević, A. (2021). Capacity Development of Local Self-Governments for Disaster Risk Management. *International Journal of Environmental Research and Public Health*, 18.
- Durlević, U. (2021). Assessment of torrential flood and landslide susceptibility of terrain: Case study-Mlava River Basin (Serbia). *Bulletin of the Serbian Geographical Society*, 101(1), 49-75.

- Ghosh, S., Ghosh, K., Ganguly, D., Chakraborty, T., Jones, G. J. F., Moens, M.F. & Imran, M. (2018). Exploitation of social media for emergency relief and preparedness: Recent research and trends. *Information Systems Frontiers*, 20(5), 901-907.
- Houston, J. B., Hawthorne, J., Perreault, M. F., Park, E. H., Goldstein Hode, M., Halliwell, M. R. & McElderry, J. A. (2015). Social media and disasters: a functional framework for social media use in disaster planning, response, and research. *Disasters*, 39(1), 1-22.
- Jha, D., Bhattacharyya, R., Shyam, S. & Ratnayke, U. (2021). Indicator based assessment of integrated flood vulnerability index for Brunei Darussalam. *International Journal of Disaster Risk Management*, 2(2), 47-70. <https://doi.org/10.18485/ijdrm.2020.2.2.4>.
- Kagawa, F. & Selby, D. (2012). Ready for the storm: Education for disaster risk reduction and climate change adaptation and mitigation. *Journal of Education for Sustainable Development*, 6(2), 207-217.
- Karal, H., Fýþ Erümýt, S. & Çýmer, A. (2010). Designing and Evaluation of the Computer Aided Teaching Material about Reproduction of Plants. *Journal of Turkish Science Education*, 7(2), 158-174.
- Kartal, V., Lovren, O.V., Milošević, M., Majkić, J., Čalić, J., Milanović, P., Belij, S., Štrbac D., Panić, M. & Miljanović, D. (2018). *Kako se zaštititi od prirodnih nepogoda*. Beograd: Savez učitelja RS.
- Kostadinov, S., Dragičević, S., Stefanović, T., Novković, I. & Petrović, A. M. (2017a). Torrential flood prevention in the Kolubara river basin. *Journal of Mountain Science*, 14(11), 2230-2245.
- Kostadinov, S., Košanin, O., Petrović, A. & Dragičević, S. (2017b). Extreme climate events and erosion control in headwater catchments of Serbia. In *Ecosystem services of headwater catchments* (pp. 215-222). Springer, Cham.
- Kumiko, F. & Shaw, R. (2019). Preparing International Joint Project: Use of Japanese Flood Hazard Map in Bangladesh. *International Journal of Disaster Risk Management*, 1(1), 62-80.
- Langović, M., Dragičević, S., Novković, I., Živković, N., Tošić, R., Milojković, B. & Čvorović, Z. (2021). Assessment of the soil loss caused by riverbank erosion in Serbia. *Bulletin of the Serbian Geographical Society*, 101(1), 31-47.
- Mangione, G. R., Capuano, N., Orciuoli, F. & Ritrovato, P. (2013). Disaster Education: a narrative-based approach to support learning, motivation and students' engagement. *Journal of e-Learning and Knowledge Society*, 9(2), 129-152.
- Mano, R., A. K. & Rapaport, C. (2019). Earthquake preparedness: A Social Media Fit perspective to accessing and disseminating earthquake information. *International Journal of Disaster Risk Management*, 1(2), 19-31.
- Mayer, R. E. & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational psychology review*, 14(1), 87-99.
- Morrow, B. H. (1999). Identifying and mapping community vulnerability. *Disasters*, 23(1), 1-18.
- Muttarak, R. & Pothisiri, W. (2013). The role of education on disaster preparedness: case study of 2012 Indian Ocean earthquakes on Thailand's Andaman Coast. *Ecology and Society*, 18(4).
- Ocal, A. (2019). Natural Disasters in Turkey: Social and Economic Perspective. *International Journal of Disaster Risk Management*, 1(1), 51-61.
- Palen, L. & Hughes, A. L. (2018). Social media in disaster communication. *Handbook of disaster research*, 497-518.
- Petal, M. & Izadkhah, Y. O. (2008). Concept note: Formal and informal education for disaster risk reduction. In: *Prepared for the International Conference on School Safety*. Islamabad, Pakistan.
- Petrović, A. M., Novković, I. & Kostadinov, S. (2021). Hydrological analysis of the September 2014 torrential floods of the Danube tributaries in the Eastern Serbia. *Natural Hazards*, 1-15.
- Rohrmann, B. (2008). Risk perception, risk attitude, risk communication, risk management: A conceptual appraisal. In: *15th International Emergency Management Society (TIEMS) Annual Conference*.
- Rundmo, T. & Nordfjærn, T. (2017). Does risk perception really exist? *Safety science*, 93, 230-240.
- Selby D. & Kagawa, F. (2012). *Disaster Risk Reduction in School Curricula: Case Studies from Thirty Countries*. UNESCO, Paris/UNICEF Geneva.

- Solaković, I. (2018) E-učionica kao inovativni model interaktivnog učenja u razrednoj nastavi, *Doktorska disertacija*, Univerzitet u Novom Sadu, Pedagoški fakultet u Somboru.
- Tabachnick, B. G., Fidell, L. S. & Ullman, J. B. (2007). *Using Multivariate Statistics* (5th ed.). Boston, MA: Pearson.
- Terzić, J. & Miljanović, T. (2009). Efikasnost primene multimedije u nastavi biologije u gimnaziji (Efficiency of multimedia application in biology teaching in high school). *Nastava i vaspitanje*, 58(1), 5-14.
- Tešić, D., Đorđević, J., Hölbling, D., Đorđević, T., Blagojević, D., Tomić, N. & Lukić, A. (2020). Landslide susceptibility mapping using AHP and GIS weighted overlay method: a case study from Ljig, Serbia. *Serbian Journal of Geosciences*, 6(1), 9-21.
- UNESCO (2014). Disaster Risk Management in the Educational System. Retrieved from <https://en.unesco.org/news/disaster-risk-management-educational-system>. Accessed on 11th September 2021.
- UNICEF (2011). Disaster Risk Reduction and Education. Retrieved from <https://www.unicef.org/environment/files/DRRandEDbrochure.pdf>.
- Watters, J. J. & Diezmann, C. M. (2007). Multimedia resources to bridge the praxis gap: modelling practice in elementary science education. *Journal of Science Teacher Education*, 18(3), 349-375.
- Wisner, B. (2006). *A Review of the Role of Education and Knowledge in Disaster Risk Reduction*. ISDR System Thematic Cluster / Platform on Knowledge and Education.
- Xuesong, G. & Kapucu, N. (2019). Examining Stakeholder Participation in Social Stability Risk Assessment for Mega Projects using Network Analysis. *International Journal of Disaster Risk Management*, 1(1), 1-31.
- Yan, L. & Pedraza- Martinez, A. J. (2019). Social media for disaster management: Operational value of the social conversation. *Production and Operations Management*, 28(10), 2514-2532.

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ИСТРАЖИВАЊЕ СТАВОВА И ПРЕФЕРЕНЦИЈА УЧЕНИКА ПРЕМА МУЛТИМЕДИЈАЛНОМ УЧЕЊУ О КАТАСТРОФАМА У ЦИЉУ ПОБОЉШАВАЊА ПРИПРЕМЉЕНОСТИ

Резиме: Овај рад представља резултате квантитативног истраживања у вези са ставовима и преференцијама ученика према мултимедијалном учењу о катастрофама како би се побољшала спремност. Истраживање је спроведено током фебруара и марта 2021. године и одговори испитаника су прикупљени слањем online анкетног упитника електронским путем на email адресе средњих школа. Узорак истраживања је обухватио 376 ученика. Истраживање је било усмерено ка великом броју средњих школа на територији Републике Србије. Међутим с обзиром на слаб одзив, истраживањем је обухваћено 25 средњих школа, што обухвата око 5% од укупног броја средњих школа које образују децу на територији Републике Србије. Највећи број ученика који се одазвао на истраживање је из следећих школа: Ваздухопловна академија и Спортска гимназија из Београда, Техничка школа "Иван Сарић" и Хемијско-технолошка школа из Суботице, Техничка школа из Власотинца и Техничка школа из Ужица.

Анкетни упитник се састојао из два сегмента. Први сегмент се односио на општа питања везана за ученике. У овом сегменту испитаници су наводили општа питања везана за пол, године старости, ниво образовања оца и мајке, ко чини заједницу у којој живе. Осим тога, у оквиру овог сегмента дошло се до информација о томе у којој мери су они упознати са различитим катастрофама и путем којих извора највише долазе до сазнања о истим. Питања су била везана и за то да ли до сазнања о катастрофама долазе кроз изучавање других предмета у школи и да ли би можда више волели да имају предмет који би се искључиво бавио анализом и упознавањем са катастрофама. Затим, кроз питања дошло се до сазнања да ли школа сарађује са одређеним стручним институцијама по питању унапређења знања из области катастрофа, као и да ли су у тај процес укључени родитељи ученика. Испитаници су навели да ли су чланови њихових породица били учесници неких катастрофа.

Општа хипотеза се односи на проверу тврдње да примена мултимедије у образовању деце у школама о катастрофама обезбеђује да ученици буду упознати са катастрофама и развију вештине за безбедност и управљање ризиком у случају катастрофа. Регресиони модел у оквиру спроведеног истраживања потврдио је да едукација ученика кроз мултимедију има најзначајнији утицај на безбедност и управљање ризицима у катастрофама. Када је у питању ефекат едукације ученика о катастрофама, највећи учинак се постиже учењем путем мултимедије и коришћењем симулација за приказивање реалних догађаја у оквиру мултимедијалног садржаја. Наведеним тврдњама доказане су постављене хипотезе овог рада и

остварен циљ истраживања. На основу тога може се закључити да примена мултимедије у едукацији ученика знатно доприноси смањењу ризика од катастрофа, превасходно кроз управљање ризицима познавањем начина и метода превентивног и сигурносног деловања у таквим ситуацијама.

Допринос истраживања огледа се у томе да се потврди значај учења о катастрофама на адекватно реаговање и сигурносно деловање услед њиховог настанка, превасходно код деце и да се тиме утиче на смањење негативних последица катастрофа. Упознавањем ученика са катастрофама, са опасностима које оне са собом носе, практичним искуствима и евакуационим путевима као излазима из таквих ситуација представља једини начин да се смање ризици од катастрофа и да науче да се понашају у таквим ванредним околностима. Будући правци истраживања у овој области требало би да се крећу ка анализи различитих симулационих модела који могу бити од велике помоћи да се студенти упознају са опасностима које проистичу од катастрофа. С обзиром да се симулација показала као ефикасан алат у стицању знања, њихова примена у едукацији ученика о катастрофама неминовно би имала значајне ефекте. Такође, помак у унапређењу знања о катастрофама може да се спроведе и у оквиру школских програма, где би се увео посебан предмет који би се бавио изучавањем садржаја везаног за ову проблематику. Приказивањем садржаја путем мултимедије ученици би били суочени са реалним ситуацијама и негативним утицајима катастрофа, али и упућени како да адекватно реагују и делују у случају настанка таквих ситуација.