REVIJA ZA ELEMENTARNO IZOBRAŽEVANJE
JOURNAL OF ELEMENTARY EDUCATION
Vol. 15, Spec. Issue, pp. 131–145, August 2022

PEDAGOGICAL POTENTIAL OF ONLINE MUSEUM LEARNING RESOURCES

JOVANA MILUTINOVIĆ[1] & KRISTINKA SELAKOVIĆ[2]

[1]University of Novi Sad, Faculty of Philosophy, Novi Sad, Serbia,
[2]University of Kragujevac, Faculty of Education, Užice, Serbia

Potrjeno/Accepted
8. 7. 2022

Objavljeno/Published
28. 8. 2022

CORRESPONDING AUTHOR/KORESPONDENČNI AVTOR
jovanajm@ff.uns.ac.rs

Abstract/Izvleček The COVID-19 era has changed the way most institutions operate, including museums and their educational activities. The aim of this paper is to investigate the types of online learning resources represented on museum websites, as well as to analyse their pedagogical features. Mixed research was applied, while the sample consists of museums included in the relevant portals that provide visibility for cultural institutions in Serbia. The analysis of the research results made it possible to determine the current level of development of pedagogical features of online museum learning resources and to identify opportunities for their improvement.

Keywords:
constructivism, digital resources, education, museum, online learning.

Pedagoški potencial muzejskih spletnih sredstev za učenje

Čas pandemije COVID 19 je spremenil način obstoja in delovanja večine institucij, vključno z muzeji, in njihovo pedagoško dejavnost. Cilji tega dela se nanašajo na raziskovanje različnih tipov spletnih (angl. on-line) sredstev za učenje vsebin, ki jih ponujajo spletne strani muzejev, kot tudi analiziranje njihovih pedagoških aspektov. Uporabljeno je kombinirano raziskovanje kvantitativnih in kvalitativnih raziskovalnih pristopov. Reprezentativni vzorec pomenijo muzeji s primernimi spletnimi stranmi, ki poskrbijo za vidljivost kulturnih ustanov v Republiki Srbiji. Analiza raziskovalnih rezultatov je omogočila, da se potrdita trenutni nivo preglednosti razvoja pedagoških vsebin muzejskih spletnih vsebin za učenje in identifikacija prostora za njihovo izboljšanje.

Ključne besede:
digitalni viri, izobraževanje, konstruktivizem, muzej, spletno učenje.

UDK/UDC:
069.12:004:37.018.43

DOI https://doi.org/10.18690/rei.15.Spec.Iss.131-145.2022

Introduction

Changes in today's world concerning the development of knowledge-based economies and the accelerated development of digital technologies affect the ways in which individuals and institutions function in society and point to the importance of using diverse sources of information and education. In such a framework, the importance and role of the museum should be considered, which today, among many functions - collecting, documenting, researching, preserving and presenting materials - places renewed emphasis on education. Hence, the task of the museum to develop its own educational roles and to cooperate with institutions that provide formal and non-formal education has become important. It is an important way for museums to contribute to the valuation, understanding and affirmation of local, national, and European heritage (Duh, 2015, 89). Thus, at a time of rapid social and technological development, museums are developing new approaches to documenting, preserving and displaying cultural heritage, as well as facilitating the learning process, including online learning opportunities. Although virtual museum environments have not been a novelty for a long time, the use of digital resources for the purpose of online learning has not been widely used in education so far. The COVID-19 pandemic accelerated the development of museums' digital dimension and posed new challenges to them. However, despite the construction of a fund of museum digital materials, tools and resources for learning, there is still a lack of research aimed at their evaluation from a pedagogical perspective. Conducting such research is important because the results would make it possible to see the gap between the respect for pedagogical scientific knowledge in the realization of digital activities of the museum and the current state of available online learning resources. In that framework, the subject of this study concerns online museum learning resources and their pedagogical potential.

Museum pedagogical activities: theoretical framework

Today, there are many theories in the scientific literature that clarify learning in museums from different perspectives, while contemporary educational discourse is undoubtedly dominated by constructivist ideas (Bautista, 2014; Hein, 2006; Witcomb, 2006).

Hein (2006) writes that the constructivist approach suggests that learning is a process of creating meaning not only under the influence of museum artifacts and the way they are presented, but also under the influence of culture, prior knowledge, visitor experience, and the circumstances of the visit. Building on these constructivist ideas, and to break the link between the mechanistic interpretation of interactive models and the effort to democratize the museum, Witcomb (2006) writes that serious dialogue should become the basis for a new understanding of interactivity. Furthermore, Falk and Dierking (2008) developed a model that considers learning in a museum as a highly contextual process; on the one hand, learning is very personal and is influenced by the prior knowledge of the individual, his experiences, interests, and motives. On the other hand, learning in a museum is influenced by society and culture, that is, the socio-cultural context. From a third perspective, learning always takes place in a certain physical environment; multiple architectural and design factors, including lighting, presentation, and context, as well as the quality and quantity of information presented, also influence the nature of learning that takes place there. These theoretical approaches reflect student-centred teaching practices that in recent decades have replaced the behaviourist tradition. This shift from the traditional transmission model of education as a process of transferring pre-built forms of knowledge, to a model that gives priority to personal experience, active learning and social activities, was adopted in the course of integrating digital technology into the online environment.

Online museum learning resources

Theoretical considerations of learning in the museum indicate the complexity of museum experiences, with the literature emphasizing that digital technology has the potential to improve the process of constructing meaning from those experiences; physical context variables such as digital tool design, navigation and content organization, are very important, but of equal - if not greater - importance to the personal and sociocultural context of visitors (Falk and Dierking, 2008). That is why it is important to position the experiences gained in the online museum environment in the wider context of the social community. Originally, digital technology in museums was used for internal needs, data recording, scientific research, and communication. Today, however, museums incorporate the latest technology to better serve visitors; they offer new content on their websites: games, databases, social networks, online shopping, videos, event calendars, etc. (Bautista, 2014).

The digital age has thus given birth to the idea of participation in the museum, which is especially related to young people who are accustomed to visual effects, who are fast and direct in communication and who are familiar with new technologies and means of data transmission.

In that sense, we can talk about a shift in the way of presenting content on museum websites: from using websites as a source of information, to creating museum digital learning environments. Diverse types of online resources are also represented on museum websites, from those that allow primary school students to manipulate artifacts and actively explore museum content, to those resources that only conditionally accept the philosophy of active learning (Sumption, 2001; Varisco and Cates, 2005). Given the availability of different types of online museum learning resources and the cognitive strategies they employ, it is important to acknowledge that the online environment can act in the direction of codification of outdated educational practices, this time in digital form. Following traditional lectures held online - teaching based on a transmissible approach - fails to take advantage of digital technology. Also, the literature (McTavish, 2006; Witcomb, 2006) re-examines the rhetoric of interactivity and points out that the use of interactive models that are mechanically or technically interpreted does not ensure effectiveness in achieving learning outcomes; the attitude of mental engagement is more effective than the activity of selecting and pressing the mouse button. Although museums today, more than ever before, are willing to make their content available to students and teachers, something more is needed than simply presenting museum collections online or merely introducing interactive models in through the technological medium.

The application of digital technology can encourage the development of new communication patterns and new solutions to promote active learning. The online environment has the potential to make it easier for primary school students to independently determine the content, place, and time of learning. The digital environment can also expand multiple learning opportunities; diverse learning possibilities, interaction, and online materials of distinct levels of complexity provide adaptation of the digital environment to students from varied cultural backgrounds, interests and levels of knowledge. Research findings (Puurula, 2002) suggest that digital technology also provides the potential for cross-curricular linking of content, with the application of various measures of differentiation and individualization. The literature also points out that digital technology can make opportunities for users to follow what interests them and to experiment with new ideas, gaining knowledge based on meaningful experience (Sylaiou et al., 2017).

The digital environment also allows a wide range of opinions (Witcomb, 2006), which would ensure that the interaction called for by museum websites is not reduced to passive computer use but encourages new ways of thinking. Thus, users are positioned not only as consumers, but also as creators of knowledge. In addition, various online platforms have been developed where users can communicate in real time. Museum websites also offer entertainment in the field of culture and the arts, to ensure learning through play. Research shows that elements of play, such as interaction, competition, and timely feedback, positively affect motivation to learn (Mikalef, Giannakos, Chorianopoulos, and Jaccheri, 2013). Finally, museum online learning resources create space for social inclusion; they can act in the direction of removing barriers when it comes to difficult or impossible access to museum buildings (travel costs, spatial distance, impaired mobility).

Evaluation of the museum digital learning environment: previous research

The trend of developing museum online learning resources, accelerated during the COVID-19 pandemic, has resulted in an increasing amount of research aimed at assessing the educational aspects of museum websites. For instance, there is a significant study focusing on the evaluation of digital applications of virtual museums, which found that the applications were rated highest in the information architecture component, and that less attention was paid to the educational value of museum content (Daniela, 2020). Although the conclusion is that most of the applications are learning tools with the potential to arouse interest, to upgrade existing knowledge and add new knowledge, and to introduce innovations and changes in organizing and presenting learning content, the study indicates that their application cannot completely replace the role and work of teachers. Another notable study has focused on researching interactivity as a key element in encouraging learning (He, Lanham, and Wood-Bradley, 2021). An analysis of digital learning units posted on immigration-oriented museum websites has shown that each learning unit can contain multiple levels of interactivity, but lower levels of interactivity were found to be most prevalent. When it comes to considering the level of interactivity from the aspect of digital content, the results of the study show that digital learning units can contain several types of digital content, each of which can encourage different levels of interactivity; while static content types can provide low level interactivity, semi-dynamic and dynamic content types can provide mid to high levels of interactivity.

Another study (Samaroudi, Rodriguez Echavarria, and Perry, 2020) examined ways in which, during pandemic lockdown, cultural heritage institutions sought to provide their users with the opportunity for enhanced museum experiences. Data collected from the websites of cultural heritage institutions in the UK and USA show that during this period, these institutions invested considerable effort in creating diverse web offers for regular audiences, while, at the same time trying to attract new users by implementing online resources on websites. The study concludes that cultural heritage institutions have used a significant part of their resources to ensure digital access to their content, but that there is also potential for online content development through the improvement of virtual visits and focusing on vulnerable groups. That there is a need for further development of virtual museum tours is also indicated by a study (Gutowski and Klos-Adamkiewicz, 2020) that was conducted in Poland, during the COVID-19 pandemic lockdown.

The present study and research aim

Our research aims can be expressed in the following question: what types of online learning resources are represented on museum websites in Serbia and to what extent they do include important pedagogical aspects? The aim of this paper was to research the types of online learning resources represented on the websites of museums in Serbia, as well as to analyse their pedagogical aspects. The aim was operationalised through two research tasks: 1. to examine what types of online learning resources are represented on museum websites, and 2. to examine the level of involvement of pedagogical aspects in learning resources in the online museum environment.

Method

Procedure and sample

Mixed research was applied, with a combination of quantitative and qualitative approaches. The quantitative approach was used in the categorization of museum online learning resources, as well as for calculating scores related to the inclusion of pedagogical aspects, while the qualitative approach was used for further analysis of their pedagogical value.

The study was conducted between October 2021 and January 2022, on a sample of museums included in the relevant portals that provide visibility of information on cultural heritage and cultural institutions in the Republic of Serbia:

Museums of Serbia (https://www.muzejisrbije.rs/) and Search Engines of Cultural Heritage of the Republic of Serbia (https://kultura.rs/). The first phase of the research included a sample of eighty-four museums, and after analysis of the content and data selection, the initial sample was reduced to seventy-six, because eight institutions did not have their own website. The sample of seventy-six museums consisted of the following types of museums: national museums (23), homeland museums (16), city museums (11), art museums (16), technical museums (4), theatre museums (2), historical museums (1), ethnographic museums (1), natural history museums (1) and military museums (1). The second phase of the research was to identify criteria for evaluating the pedagogical aspects of online museum learning resources. Examining the assumptions of constructivist pedagogy and analysing the literature on the educational potential of museum digital resources (Daniela, 2020; He et al., 2021) enabled summarizing key pedagogical aspects of online learning resources, i.e., formulating criteria that represent an appropriate combination of multiple features of the quality of the educational environment. The further processing of data included the evaluation of online museum learning resources using a checklist.

Instrument

The checklist compiled for the purposes of this research includes nine items, which are descriptions of the pedagogical aspects of online museum learning resources. The researchers and authors of the text expressed agreement with these items for each selected museum website on a scale from 1 to 3, where 1 means the lowest, 2 the middle and 3 the highest level of realization of the feature.

The items in the checklist for the analysis of pedagogical aspects of online museum learning resources were as follows: 1. Transparency and clarity - online museum resources are structured to allow clear navigation; 2. Multiple learning opportunities - differences in learning styles are taken into account; 3. Connecting content with previous knowledge and everyday life - it is possible to connect content with other information and with previous knowledge and experience; 4. Encouraging social interaction - exchange of experiences between students/users is supported; 5. Game context - attracting and maintaining attention through playful activities; 6. Encouraging the process of further learning - further research and use of various sources of information is supported;

7. Interactivity - two-way communication between artifacts and students, museums and students, and pairs of students is supported; 8. Adaptation for people with disabilities - different ways of receiving information are provided; 9. (Self)evaluation of acquired knowledge - the chance to monitor one's progress in learning is provided. For each item in the instrument, there was space for comments and more detailed description to facilitate qualitative analysis of the data.

Results

Types of online museum learning resources

To collect data on the types of museum online learning resources, based on the findings of previous studies (Sumption, 2001; Varisco and Cates, 2005) and search support for offerings on the websites of relevant institutions, the wide range of online resources was grouped into appropriate categories: 1. Online teaching - teaching activities harmonized with the school curriculum; 2. Online exhibits - 2D static images, with basic or more detailed information on digital material; 3. Virtual tours - virtual 3D tour of the museum with a functional presentation of museum content; 4. Lectures - video recordings of lectures, texts in electronic form and/or sound recordings; 5. Research databases - electronic database of museum materials, digitized books, exhibition catalogues and periodicals; 6. Learning activities - texts, videos and/or audio recordings that encourage learning activities; 7. Useable links - internal or external links offering additional information; 8. Conversation tools - chat rooms, blogs, e-mail, and bulletin boards. Table 1 presents the percentage of individual types of online museum learning resources in the total sample of museums that have their own website.

The analysis provided data for further quantitative and qualitative analysis of the websites of those museums whose rich online learning resources gave users clearer insight into their pedagogical aspects.

Table 1. Types of online museum learning resources (N = 76)

Type of museum	OT	OE	VT	L	RD	LA	UL	CT
National museum	3	23	10	14	17	7	11	18
Homeland museum		15	6	7	12	3	8	9
City museum		11	3	6	5		5	9
Art museum	1	15	4	10	11	2	7	13
Technical museum		4	2	4	3	1	3	3
Theatre museum		2	2	2	1	1	2	2
Historical museum		1		1	1			1
Ethnographic museum		1	1	1	1		1	1
Natural history museum		1	1	1	1			1
Military museum		1					1	
Full sample								
Frequency	4	74	29	46	52	14	38	57
N (%)	5.26	97.36	38.16	60.53	68.42	18.42	50.00	75.00

Note.
OT − Online teaching RD − Research databases
OE − Online exhibits LA − Learning activities
VT − Virtual tours UL − Useable links
L − Lectures CT − Conversation tools

Levels of involvement of pedagogical features in online museum resources

As part of the examination of the level of involvement of pedagogical goals in the resources of the museum online environment, a quantitative analysis of the websites of thirty-three selected museums was performed. The museums were selected for inclusion based on the digital development identified in the previous phase of the research (presence of more than half the identified types of online learning resources on the total sample of museum websites). Table 2 shows the average score values for each pedagogical aspect of online resources for the selected museums (the highest value is 3).

Table 2. Pedagogical aspects of online museum resources

Pedagogical aspects	Average value
Transparency and clarity	2.73
Multiple learning opportunities	2.39
Connecting content with prior knowledge and everyday life	2.12
Encouraging social interaction	2.67
Game context	1.42
Encouraging the process of further learning	2.09
Interactivity	1.70
Adaptation for people with disabilities	1.67
(Self)evaluation of acquired knowledge	1.21

Discussion

In the first task, (examination of types of online learning resources), it was determined that out of the total number of museums in Serbia that were initially included in the survey, 90.48% have websites. This result is significant, especially if we consider data from previous research (Krivošejev, 2013), which found that 57.50% of nominally regional museums in Serbia had their own websites, that the average website had only the most basic information, while virtual solutions were almost completely absent. Given the intense social and technological changes, it is logical that our research, conducted eight years later, yields a completely different picture.

Analysis of the data shows that only four of these museums have *Online teaching* (Museum of Vojvodina, Gallery of Matica Srpska, National Museum in Belgrade and National Museum in Niš) on their websites. The cultural-educational learning platform *eMuzej*, created in 2020 with support from the Ministry of Culture and Information, has certainly contributed to the development of thinking about establishing direct links between the school curriculum and museum artifacts. An important finding of this study concerns the fact that this platform has not yet been fully implemented. Furthermore, the data show that almost all the museums have *Online exhibits*. In general, two ways of presenting information and museum artifacts have been identified. While the first way concerns the provision of basic information about the artifact and the presentation of images in 2D format, the second way meets the criteria for "enriched educational exhibits" (Varisco and Cates, 2005). Although the analysis shows that most online exhibits on websites belong to the category of "enriched educational exhibits", the additional information offered is primarily intended for older ages - high school students, students and adults.

Although the *Virtual Tours* feature offers users a simulated version of touring real museums at any time and from anywhere and has the potential to encourage an active approach to learning (McTavish, 2006), analysis shows that this type of online resource is underrepresented on these museum websites. Moreover, more than half the websites have *Lectures* in audio and video format. However, these lectures are most often available on YouTube channels, and not directly on the museum websites. There is thus a high probability that younger visitors, older ones, or those who have not developed skills in the digital world will be deprived of certain museum content.

The study also shows that the museum websites include *Research databases*, where visitors can download the entire content for learning: collections, catalogues, publications, brochures, and books. However, even here, it can be noted that this type of online resource is intended primarily for students and adult users. Online publications for children are poorly represented. An exceptional example is the Gallery of Matica Srpska, which offers a series of publications on its web pages intended for children in preschool and early primary school (see https://www.gale-rijamaticesrpske.rs/en/children-educational-programs/preschool-and-elementary-aged-children). It is in this sense that we can talk about *Learning activities* on museum websites. In general, most websites include learning activities, meaning that the user can copy, save or print the text. Digital tools that help primary school students to develop a deeper understanding of content in formal and non-formal learning situations (worksheets, games, puzzles, or role-playing) are not widely available. A valuable example is the mobile application "Muzejonica" from the National Museum in Leskovac (see https://muzejleskovac.rs/mobilna-aplikacija-muzejonica). It is an interactive game that calls for assembly of puzzle pieces, on three levels of difficulty. The research also shows that about half the websites have *Useable links*, and that there is a large presence of *Conversation tools*, which enable communication via e-mail or social networks. More detailed analysis shows that tools that allow synchronous communication (communication of individuals or groups in real time) are not available.

The second task of the research was to analyse the pedagogical aspects of online learning resources. The results show that the *transparency and clarity* of these museum websites in Serbia were evaluated with very high marks, and that no museum received the lowest grade for these qualities. This is important, since learning always takes place in a physical environment (Falk and Dierking, 2008), in this case in an online environment where the nature of learning organization and content presentation are crucial. The average scores for provision of *multiple learning opportunities* are high. Of thirty-three websites, sixteen received the highest rating, which speaks in favour of museums presenting information and content on their websites in various ways, adapted to different learning styles. Valuable examples are the timelines on the websites of the Nikola Tesla Museum and the Museum of Yugoslavia.

The average score for the aspect related to the *connection of content with previous knowledge and everyday life* is also relatively high; visitors are offered the opportunity to connect museum content with what they already know and to choose the type and amount of information. This is an element of the constructivist learning environment, which assumes that meaning is constructed through dialogue between the object and the learner, building on his previous knowledge and experience, supported by the museum's digital environment (Prosser and Eddisford, 2004).

For the pedagogical criterion of *social interaction*, which is considered essential for building knowledge and stimulating metacognitive processes (Falk and Dierking, 2008), despite the high average scores, this is mostly related to interaction via social networks (Facebook, Twitter, Instagram). There are no tools available for collaboration or real-time conversation such as chat rooms or discussion forums where visitors can raise additional questions, share experiences, or share new knowledge. The *game context* criterion is very important, because it ensures that the digital environment is made more fun and that learning occurs through play. This idea is based on research (Stevenson, 1994, as cited in Witcomb, 2006), which shows that the entertainment value of interactive models can increase the amount of time visitors spend on the exhibition. However, the analysis shows that the game context is rarely represented on museum websites, i.e., the average score for that feature is low. Nevertheless, an excellent example is the Museum of Vojvodina, which offers several playful activities on its website, from a series of short, animated films to interactive comics in augmented reality (see https://www.muzejvojvodine.org.rs-/lat/category/mis-harlampije).

Research (Sylaiou et al., 2017) shows that the synergy of different sources and types of information ensures *the encouragement of the process of further learning*, which is a pedagogical goal with a relatively high average score. An excellent example of encouraging active research occurs, for example, on the website of Archaeological Park Viminacium, where a narrator guides the visitor through a virtual walk on the ancient site, while the text is formulated to invite the user to seek additional information about artifacts in reconstructed context (see http://viminacium.or-g.rs/izlozbe/viminacium-virtual-tour). The average score for *interactivity*, as a concept grounded in constructivism, is low. This is not about interactivity that is achieved by simply pressing a button, but about the representation of participatory environments, where a primary school student can change and build appropriate elements, test his ideas and become actively involved in problem solving (Roussou, 2010).

Only five of the websites received the highest score for this feature. A good example is the Gallery of Matica Srpska website, which offers an online questionnaire for sharing impressions; user ideas are considered when designing and creating new exhibitions, programs and events.

Although museums are important resources for social inclusion, when it comes to *adaptation for people with disabilities*, museum websites receive low scores. Nevertheless, there are outstanding examples of ensuring equal access to information; the websites of some museums have interactive applications in sign language (for example, Homeland Museum in Knjaževac, Museum of Vojvodina). The average scores for *(self)evaluation of acquired knowledge*, as part of the learning process, are very low. Exceptional examples are the websites of the National Museum in Valjevo, which offers the option of self-evaluation through a knowledge quiz, as well as the National Museum in Belgrade, where one can get feedback on the success of the activity (see http://igrice.narodnimuzej.rs).

This study comes with certain limitations. The first concerns the fact that the museum websites have never been completed because of the possibility of constant content changes. Another limitation is that, despite the application of the checklist, the evaluation still contains elements of subjectivity. These limitations could be partly overcome by continuing research activity in terms of monitoring the development of online museum resources, engaging an interdisciplinary research team, and further developing the content of the data collection instrument. Other sources of data should be included in future research, such as monitoring the reactions of online users - primary school students and individual interviews with museum educators.

Conclusion

Although this study has provided insight into the online resources that are currently available on the websites of museums in Serbia, the findings are not unequivocal. While, on the one hand, websites include varied types of learning resources, on the other hand, online teaching and learning activities are underrepresented. Even in post-COVID conditions, websites have been shown to focus on transmitting museum information. Online museum environments are mostly suitable for students or adults, who are interested in researching certain topics and who have sufficient prior knowledge to enable them to understand museum content. There is thus room

for improving online resources. It is important that museums base their pedagogical work in a framework including the chance for online activities to go beyond mere observation of exhibited artifacts in virtual space. It is essential to overcome the model of didactic interpretation (Hein, 2006), where museums retain the role of an authoritative source of knowledge and actualize the constructivist position according to which learning is understood as a process of constructing knowledge that gives meaning to the individual. Although it is noted that museums are finding ways to be relevant online and engage users, there is still a need for further development of interactive environments with hands-on and "minds-on" approaches implemented in the physical spaces of modern museums, as well as the curriculum of educational institutions. Significant attention should also be paid to vulnerable groups to respond to their needs and overcome the challenges related to digital exclusion.

Without neglecting the limitations of this study, it is clear that the analysis of the types of online museum learning resources and their pedagogical features, in addition to contributing to the corpus of scientific knowledge, also has practical implications. On the one hand, the research findings can benefit teachers who want to expand students' learning experiences outside the traditional educational environment, while on the other hand, they provide guidelines for creating and maintaining online opportunities for active learning, critical thinking, and dialogue in formal, non-formal and informal education.

References

Bautista, S. S. (2014). *Museums in the Digital Age: Changing meanings of place, community, and culture*. Lanham: AltaMira.

Daniela, L. (2020). Virtual museums as learning agents. *Sustainability, 12*(7), 1–24.

Duh, M. (2015). The function of museum pedagogy in the development of artistic appreciation. *Journal of Elementary Education*, *8*(4), 87–102.

Falk, J. H., and Dierking, L. D. (2008). Enhancing visitor interaction and learning with mobile technologies. In L. Tallon, and K. Walker (eds.), *Digital Technologies and the Museum Experience: Handheld guides and other media* (pp. 19–33). Lanham: Altamira Press.

Gutowski, P., and Klos-Adamkiewicz, Z. (2020). Development of e-service virtual museum tours in Poland during the SARS-CoV-2 pandemic. *Procedia Computer Science*, *176*, 2375–2383.

He, R., Lanham, E., and Wood-Bradley G. (2021). Review of interactive practices in online immigration museums. In K. Arai, S. Kapoor, and R. Bhatia (eds.), *FTC 2020: Proceedings of the Future Technologies Conference 2020* (pp. 812–826). Cham: Springer International Publishing.

Hein, G. E. (2006). Museum education. In S. Macdonald (ed.), *A Companion to Museum Studies* (pp. 340–352). Malden: Blackwell Publishing Ltd.

Krivošejev, V. (2013). Internet i muzeji, od promotivnog izloga do virtuelnih postavki. In O. Nikolić (ed.), *Internet u edukacionom i poslovnom okruženju* (pp. 93–98). Belgrade: Univerzitet Singidunum; Valjevo: Poslovni fakultet.

McTavish, L. (2006). Visiting the virtual museum: Art and experience online. In J. Marstine (ed.), *New Museum Theory and Practice: An introduction* (pp. 226–246). Malden: Blackwell Publishing.

Mikalef, K., Giannakos, M. N., Chorianopoulos, K., and Jaccheri, L. (2013). Does informal learning benefit from interactivity? The effect of trial and error on knowledge acquisition during a museum visit. *International Journal of Mobile Learning and Organisation*, *7*(2), 158–175.

Prosser, D., and Eddisford, S. (2004). Virtual museum learning. *Information Technology in Childhood Education Annual*, *2004*(1), 281–297.

Puurula, A. (2002). Searching for a pedagogical basis for teaching cultural heritage using virtual environments. In S. Karppinen (ed.), *Neothemi: Cultural heritage and ICT at a glance* (pp. 17–32). Helsinki: University of Helsinki.

Roussou, M. (2010). Learning by doing and learning through play: An exploration of interactivity in virtual environments for children. In R. Parry (Ed.), *Museums in a Digital Age* (pp. 247–265). London and New York: Routledge.

Samaroudi, M., Rodriguez Echavarria, K., and Perry, L. (2020). Heritage in lockdown: Digital provision of memory institutions in the UK and US of America during the COVID-19 pandemic. *Museum Management and Curatorship*, *35*(4), 337–361.

Sumption, K. (2001). Beyond museum walls - A critical analysis of emerging approaches to museum web-based education. In D. Bearman, and J. Trant (eds.), *Museums and the Web 2001* (pp. 2–10). Seattle: Archives & Museum Informatics.

Sylaiou, S., Mania, K., Paliokas, I., Pujol-Tost, L., Killintzis, V., and Liarokapis, F. (2017). Exploring the educational impact of diverse technologies in online virtual museums. *International Journal of Arts and Technology, 10*(1), 58–84.

Varisco, R. A., and Cates, W. M. (2005). Survey of web-based educational resources in selected U.S. art museums. *First Monday*, *10*(7). Retrieved from https://firstmonday.org/ojs/index.php/fm/-article/download/1261/1181.

Witcomb, A. (2006). Interactivity: Thinking beyond. In S. Macdonald (Ed.), *A Companion to Museum Studies* (pp. 353–361). Malden: Blackwell Publishing Ltd.

Authors

Dr. Jovana Milutinović, PhD
Full professor, University of Novi Sad, Faculty of Philosophy, Novi Sad, dr. Zorana Đinđića 2, 21000 Novi Sad, Serbia, e-mail: jovanajm@ff.uns.ac.rs
Redna profesorica, Univerza v Novem Sadu, Filozofska fakulteta, Novi Sad, dr. Zorana Đinđića 2, 21000 Novi Sad, Serbia, e-pošta: jovanajm@ff.uns.ac.rs

Dr. Kristinka Selaković, PhD
Assistant professor, University of Kragujevac, Faculty of Education in Užice, Užice, Trg Svetog Save 36, 31102 Užice, Serbia, e-mail: selakovick@gmail.com
Docentka, Univerza v Kragujevcu, Pedagoška fakulteta Užice, Užice Trg Svetog Save 36, 31102 Užice, Srbija, e-pošta: selakovick@gmail.com