Opportunities of VR for Teaching History

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Abstract: The present study examines the opportunities of VR in the context of humanities and arts and – within their frameworks – in that, of history. Its novelty clearly lies in the fact that in this fields' cyberspace is not used either by public or by higher education. The inclusion of info-communication tools for history teaching, does not really follow the current trajectory of development. Educators usually work according to methods that have become the most common and familiar. This research clearly revealed that students, who regularly use the VR space, in a History course of teacher training, consider it experiential, user-friendly, simple, problem-oriented and thus, easier to visualize historical facts. The regular and widespread use of VR software could greatly and easily help to progress the historical curriculum space.

Keywords: VR; MaxWhere; history teaching; visualisation; Moodle

1 Introduction

In conformity with the objectives set out in its development strategy, in the years from 2016 to 2021, István Széchenyi University carried out a project aiming at the modernisation of education content. The project focused on proper development of the subjects meeting the requirements of digital, methodology and market needs. The project was granted assistance by the European Union (identification number: EFOP-3.4.3-16-2016-00016).

More than 210 subjects were updated or developed within the framework of Moodle e-learning, used by the university and in the 3D virtual education space, facilitating educational activities, as well as student co-operation more effectively. Lecturers from all the 9 university departments participated in the project, meaning that, the program had a great impact on the whole institutional education system.

As a result of the project developing lecturers had the chance to re-think or revise the content of their subjects, such as core curriculum or additional content, to revise the structure of the contents, as well as to modernise their methodological culture in a way, particularly characteristic of digital education [27]. As a consequence of the COVID-19 epidemic, such developments played a vital role for the successful realization of distance education last year.

The aim of our study is to first of all, define the concept of e-learning and then, to give a general picture – based on a previous research – of the usability of the electronic learning materials developed by Széchenyi István University in Moodle and on the MaxWhere 3D platform. Consequently, we will show herein, how effective the VR interface can be, when used for history teaching.

2 Preliminaries

E-learning contents of István Széchenyi University can be found in Moodle e-learning system from which educational contents can be visualized in MaxWhere 3D VR application with the help of links.

Though it does not have an unanimously accepted conceptual definition, the simplest way the concept of "e-learning" can be interpreted as a kind of education being realised through the application of digital solutions appearing on the computer, the Internet as well as on a wide range of infocommunication technologies, which support learning and the improvement of learning performance [4, 9, 16, 26].

Various advantages can be gained from the development of e-learning programmes, such as: [2, 3, 16, 17]

- Bridging geographical distances and fighting obstacles or hurdles resulting from locality
- Offering the possibility of individual learning paths, e.g. as a kind of support of the advancement of students' different individual learning rhythms
- Ensuring the development of lecturers' digital skills and abilities
- Improving the quality and efficacy of education through the latest educational methods

2.1 The Role Moodle Plays in Content Development

Moodle containing developed curricula, is an e-learning system of open source code, free of charge, in which, apart from following up the activity and progress of those participating in the education itself, it is also possible to compile, construct and store course content (curricula).

Created electronic learning environment means one where tools of both electronic information technology and communication technology play a decisive role in establishing the conditionalities of teaching and learning [4-6] and one that can have virtual dimensions as well [28].

2.2 Virtual Spaces and Education

Though there have been several attempts to give an exact definition to VR, no single definition has successfully been set out yet [21]. Hungarian Ollé [14] tries to interpret virtual environment as a 3D, artificial space, non-existent in reality, where both us and others can coexist in a 3D form, space and time whilst seeing this all the same from their own points of view.

Lopreiato finds that VR environment means a wide range of computer applications generally associated with extremely visual, fascinating 3D characteristics that enable participants to look around and navigate in an apparently real or physical world [20-22].

According to the US Ministry of Defence: VR means the usage of computing to create an interactive 3D world in which spatial presence is sensed by objects as well as both virtual environment and virtual world are synonyms for virtual reality [21, 23].

A considerable characteristics of such spaces is that they can be connected through computer based, cooperative and technical instruments [14, 18]. Therefore, virtual reality is a simulated environment intending to describe and simulate the processes of the real world, with the help of computer models. It is partly a common, shared space, where various users can be present at the same time.

As a consequence, events, activities do happen in real time, providing for direct communication and cooperative work through internet-based applications.

Users can produce, create or develop contents and construct common documents [10, 12, 13].

A great advantage of VR environment is that it is accessible from space and time, it is cost-effective and easy to use. 3D VR student environment helps the processes of obtaining, filtering, admitting, processing and using information through parallel and arranged presentation or the visualisation of information [7, 10, 11].

2.3 Maxwhere 3D VR Platform

When entering deliberately designed and equipped virtual education spaces during the activity (i.e. teaching) in 3D virtual spaces, those interested (teachers/lecturers and students) can gather information essential for studying. Equipped spaces not only make activities more spectacular in the digital environment, but makes

information gathering faster and cooperative activities easier to realise, too [8, 9, 15, 19].

Nowadays Hungarian developments can also be found among the available virtual spaces, such as MaxWhere, the development of which is being carried out with the help of the University. MaxWhere can be used in the fields of education, project management, presentations as well as in interactive 3D presentations, too. In addition to the Moodle system, Széchenyi University focuses on the MaxWhere platform, when developing course contents (curricula). MaxWhere is a software that is easy to manage and free to access, which can be found at www.maxwhere.com.

Using MaxWhere may speed up workflows, therefore its application in the field of education is of particular importance. Well equipped space a priori offers a learning path considered effective beside which only contents previously filtered by a formulator, meaning that users can work using authentic sources. It does make the usage of various (teaching) applications in VR space possible.

So-called smartboards can be found MaxWhere spaces where digital materials to be visualised or presented can be loaded to. Each smartboard is considered to be an individual or separate "monitor" or "screen" where – apart from various file types (texts, images, videos, voice, etc.) – websites and applications can also be presented and used. Today MaxWhere grants a cloud computing (CC) service as well, therefore it is needless to send files because everything becomes immediately available when entering the given VR space. Moving in space takes place with the help of a mouse, and the scrollers and keyboards help precise movements, in which suggested routes can be set to reach course contents.

2.4 Comparison of Classical, e-learning and MaxWhere VR-based Learning Frameworks [8]

In the following, we begin by outlining the 3 most common techniques used for sharing digital workflows. We then compare those techniques based on the conceptual framework outlined in earlier sections. 1. Classical – TXT based message This technique consists of sending digital elements and digital content to a group of recipients as attachments to a text-based message, or as web links inside a textbased message (e.g. sent via e-mail or any kind of messenger application):

1) **Classical – TXT based message:** This technique consists of sending digital elements and digital content to a group of recipients as attachments to a text-based message, or as web links inside a textbased message (e.g. sent via e-mail or any kind of messenger application). Because of the text-based medium it uses, the classical technique can be regarded as an example of Digital Comprehension of the 1st order. In the case of digital workflows conveyed through text, the associated digital elements cannot be integrated into the text (although links to web-based content can).

2) **Online interfaces such as Moodle:** This technique consists of helping users access and / or download digital elements and digital content through an online web-based interface. In the simplest of cases, the approach of using online interfaces can be equivalent to the classical approach (with the added quality of being web-based), such that the task to be carried out is described using text, and the required digital elements are listed in some order at the end of the text. At the same time, an important advantage of online interfaces is that links embedded into the text can be used to share not only digital elements that have a web-based url, but more generally any kind of digital format (EDE). Thus, the digital elements can be ordered inside the text as required by the digital workflow, and sequential DGs can be conveyed without a problem, as long as the digital elements are ordered and users are able to move between them using a scrolling operation or a specific combination of keys (e.g. page up and page dn). Online interfaces are not amenable to the presentation of digital elements in a 2D process diagram. Thus, even if a digital workflow is presented through an image or a diagram, this solution can be regarded as only partial in view of the requirements of 2nd order DCs.
3) **The MaxWhere Operating System:** From an IT perspective, the MaxWhere OS contains no digital elements. Instead, it gives users access to a single (pack or bundle) file, which can be loaded and which contains references to all of the digital elements that are in turn loaded recursively. All digital content and elements thereof are displayed in thematic groups in 3D. Digital elements are displayed in smartboards, or opened using browser technology integrated into smartboards, hence the representation of the elements is of type EDE. In contrast, to text-based descriptions, the entire process underlying the workflow is in this case represented spatially, through digital elements that are laid out and opened in space.

2.5 Experimental Evaluation of User Effectiveness [8]

2.5.1 Digital Workflow

The key to solving the digital workflow effectively was the appropriate organization of the digital elements. Thus, users had to make sure that they could answer the questions on the first three tests based on the information contained in the PowerPoint file, the PDF file and the video file, respectively; and that they could answer the questions on the final test based on all 4 webpages provided to them in the context of that test. Since the task could be carried out by considering the digital elements in sequential order, the DW can be regarded as being of the 1st order. Naturally, the fact that in specific cases users could decide to go back to the previous digital elements for clarification does not mean that they are required to do so, and does not increase the order of the DW.

2.5.2 Sharing of the Digital Workflow

Classic: one group of users received the DW based on the classical approach, through e-mail. The body of the email contained a textual description of the workflow, and the digital elements required for the workflow were attached to the e-mail. Finally, the webpages and tests were included as links at the end of the body of the email. The naming of the attachments and links were chosen to reflect the identity of the digital elements well. B. Lampert et al., MaxWhere VR-Learning Improves Effectiveness over Classical Tools of e-learning – 138 –

Online Interface: A second group of users received the DW on through the Moodle platform. Similar to the classic approach, the description of the workflow was text-based in this case as well. However, a simple form of digital guidance was also available to users in this case, given that each step within the description of the workflow included an embedded reference to the digital elements required for that step. As a result, users were able to perform the workflow step by step, instead of first having to obtain a holistic overview of the workflow. In effect, the users' ability to scroll through the steps guaranteed a DG of type S in this case.

MaxWhere: Regardless of whether this group of users received the workflow on an online surface or through the classical approach, they could import the digital elements into MaxWhere, which then provided a spatial arrangement of EDEs in smartboards. In the case of the PowerPoint file, each slide was added to a separate smartboard. The tests were loaded in smartboards that were closest to the digital elements related to them. The MaxWhere Operating System also had built-in functionalities for S and R type DG, which could be made use of by the test subjects.

2.5.3 Results of the Experiment [8]

The number of students tested using the classical e-mail with attached content and with linked content, online platform and MaxWhere-based approach were 115, 77, 97 and 90 respectively.

Figures 1, 2 and 3 show the results of the test. The horizontal axes represent the time required to complete the test. The vertical axes represent the percentage of users corresponding to the given number of minutes.

The average and standard deviation of the time required to complete the workflow in each of the cases were:

E-mail with attachment:	average: 6:42	standard deviation: 3:02
E-mail w/ Google Drive links:	average: 5:54	standard deviation: 1:39
Moodle:	average: 6:42	standard deviation: 3:03
MaxWhere	average: 3:11	standard deviation: 0:46

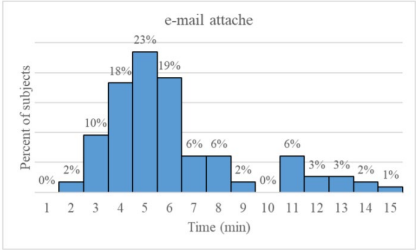

Figure 1
Test in which files were sent via e-mail attachment

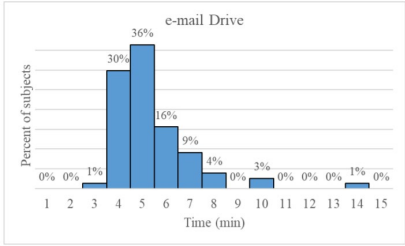

Figure 2
Test in which digital content was sent through Google Drive links via e-mail

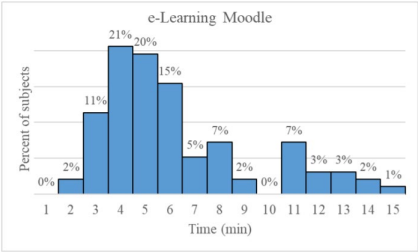

Figure 3
Test in which the digital workflow and digital content was shared through the Moodle e-learning framework

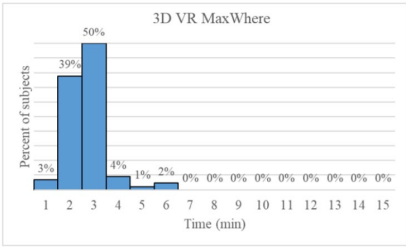

Figure 4
Test in which the digital workflow and digital content was shared through the MaxWhere 3D environment

The results: the MaxWhere VR environment could complete digital workflows in considerably less time (i.e., 50% faster) than using the more traditional (e-mail based and content management system based) approaches. It is also remarkable that the standard deviations of completion times are considerably smaller in the case where the MaxWhere-based approach was used. Although the reasons behind this observation may need to be clarified through further investigations, it nevertheless points to the conclusion that the whole process of comprehension is rendered clearer than usual in 3D environments capable of representing 4th order digital workflows with automatic guiding, as pointed out in the paper [8].

2.6 Methodological Issues of Teaching History

Educational methods are the set of procedures, activities, organizational methods and techniques that are consciously planned and applied, with the help of which the set educational goal is achieved. The term is derived from the Greek/Latin word ‘methodus’, which means the path to the goal. The main features of the teaching methods are that they:

- Are repeated regularly

- Allow Teachers, as the controllers of teaching/learning, to consciously plan and apply
- Let Learners, spontaneously and/or consciously learn and apply them as subjects, in the learning process
- Are goals (content and aid dependent)
- Interact with each other, to form combinations of methods

The specific methods and teaching strategies of the individual pedagogies, such as history pedagogy, are influenced by the cognitive techniques and processes which are characteristic of the subject. The conscious purposeful choice of methods is influenced above all by the aims of teaching, the peculiarities and content of historical cognition.

Those who teach history undertake to assist their students professionally in the process of cognition of history. They direct students' attention to the past and help them learn about, understand, reconstruct, and interpret the past. The history teacher is called upon to play an active role in shaping the so-called 'narrative competence' of the students. In the course of learning history, students learn facts, data, knowledge and interrelation that form the basis of their general historical education. However, their acquired historical knowledge and knowledge of specific data will only become relevant and useful knowledge for themselves and society if they are able to flexibly adapt the constructions, schemes and concepts offered by historical science to their understanding of the past and the present.

This requires not only historical knowledge, but also an intellectual ability (critical analysis, readiness to debate, adaptive, problem-solving thinking, etc.) to handle and process historical problems, use the acquired knowledge and apply it to the present. Thus, learning history means not only – and not primarily – learning historical knowledge. Historical learning means, above all, historical thinking, the ability of the learner to think in the three dimensions of the past-present-future, to know and apply the most important components of historical research procedures according to their age characteristics and level of development.

The historical literacy material learned in school can no longer be a closed, extremely canonized set of knowledge. If we start from the fact that life prospects of today's students can be predicted for at least 50–60 years after completing their schooling, then orientation knowledge for the future must be open, expandable, and self-improving. This condition is only guaranteed if there is a conscious and well-practiced methodological competence. Future generations must therefore have historical knowledge based on a cognitive content base that is adapted to the receptivity of students, both in terms of science and history, and of methodological competence that contributes to the development of their own historical consciousness. The historical knowledge and the methodological knowledge intended for their processing are in close interaction, it can also be said that the specific way of thinking of the subject of history is verified in and through the methods.

The main goal of teaching history is to develop a conscious, enlightened, reflected view of history in students, which enables them to understand the possibilities and limitations of people and human communities in the past, the motives of their actions, referring the historical problems to the present and orient them in the future [24]. The question is… What modern "info-communication" tools and methodological innovations, can be used to achieve it?

2.7 Challenges of History Teaching in the 21st Century

There have been spectacular changes in classroom practice since 2005. The diversification of tools, the regular, daily routine use of textbooks and task collections, the conscious and professional use of different forms of group organization, the frequent activities of students, the reflective application of knowledge acquisition procedures, and the monitoring of student performance can all be considered encouraging signs. However, learner-centred, cooperative classroom management strategies, projects, controversial and multi-perspective approaches are still lacking or they are present to an insignificant extent, and what is more, political and event history still prevails. In addition, the use of info-communication tools and aids also leaves something more to be desired.

This is also supported by a study based on transcripts of 48 lessons (6 schools, including 4th and 8th grade grammar schools, different age groups from 5 to 12 grades) and the observations of teacher candidates. On the lessons, which the study is based on, the teacher candidates observed the use of the following tools and media (in order of their frequency): blackboard, map (wall map and student atlas), teacher worksheet, overhead projector, textbook, workbook, instructional and art film, projector. As for the board, it can be said that it is almost exclusively a tool for creating a teacher's outline, but it is strange that it is also used only in a fraction of the lessons. The same can be said for almost any device. All history teachers used some kind of tool (on average one or two per lesson), however, this affects a relatively narrow range of tools and we found a partial or complete lack of important tools. (For example, the map did not appear in one of the history lessons examined, where the teacher explained ancient folk movements.) In none of the lessons examined were computers, Internet, interactive tools or student presentation tools used.

Worksheets prepared by teachers have once more become a popular tool, used partly for practice but mostly for measurement and evaluation. In almost all cases, the workbooks were used to draw the students' attention: during the oral presentation, the students in the class were to solve exercises in the workbook individually and then checked the solution together. Thus, the solution of the exercises is extremely formalized, it is not built in the content structure of the lesson almost anywhere, and it does not principally serve the purposes of development, but a disciplinary tool and a tool for preparing for the exam.

Regarding the forms of group organization, the frontal class, the teacher's presentation (presentation, explanation) and the method of expressing the question are still popular, but teachers no longer use individual problem solving and plenary discussion (although based on the minutes, we can conclude that the conversation involves teacher questions and student responses) as well as pair and group work. (In 3 and 3 history lessons of the 50 examined). There was also individual collecting activity, drama pedagogical and role-playing tasks.

In terms of content, the guideline for most of the lessons has remained event-related topics. Problems were raised in two or three lessons, and contemporary problems were discussed in connection with historical phenomena (e.g., a discussion of ancient and contemporary slavery). On some occasions, students were also given the opportunity to ask questions. Students' knowledge was tested in a significant part of the examined classes. The most important forms of examination are oral response and written dissertation, which are usually followed by oral as well as written (graded) assessment. We did not find any examples of student self-assessment or portfolio building.

When evaluating the practice of teaching history, although we see massive survival of previous frontal methods, we need to see more frequent and conscious use of other methods considered desirable in content regulators (including tool use, learning organization procedures, and various forms of teacher-student interactions), the organization and awareness of the chosen methods and contents.

It is worth briefly considering the aspects and attitudes of the protocol writers. The choice of observation criteria selected by the teacher colleagues or students majoring in teaching (teacher questions, disciplinary methods, the logic of the teacher's explanation, the observation of the use of tools) is very specific. These aspects of observation allow us to conclude that although university students majoring in history have become acquainted with many modern methods and tools during their university history teaching studies, their approach to modern methods beside their curiosity about them is largely based on their own grammar school experiences and unconditional trust in a conservative methodological culture (understand: teacher and knowledge-centred, descriptive-explanatory, static), hence it can be characterized by some distrustful attitude towards form-breaking, learner- and problem-oriented methods.

Thus, it can be stated that the methodological and content renewal of history teaching has started on the basis of the above mentioned experiences in the curriculum documentations, the output regulation of the graduation exam and the teaching practice of educating teachers, but the achieved results can still be considered partial [25].

However, as the above results show, the inclusion of info-communication tools in history teaching does not really follow the current trajectory of development. Educators usually work according to the methods that have become the most common and familiar. And this can clearly pave the way for VR in teaching history,

which can open up a whole new perspective in it, making history curriculum lively and easy to handle.

3 The Thesis

Humanities and Arts is the least affected area of VR content development. It is a method used more and more frequently in technical, information and, among others, social sciences as a consequence of which it can open new perspectives in teaching history as well. At the Apáczai Csere János Faculty of Humanities, Education and Social Sciences the chosen literacy field of Man and Society presented a great opportunity to adapt History course transmitting the core curriculum to MaxWhere as well as to develop its curricula. This course is generally completed in this chosen literacy field by 5 to 10 students per year. Two lectures and two seminars are included in the course on a weekly basis meaning considerable amount of workshops apart from teacher lectures. According to our hypothesis, those who have already encountered it regularly use the VR curriculum belonging to the already completed History course due to its versatility, simplicity, spectacle and easier visualization of historical events.

4 Method

The aim of our empirical research is to examine how easy and accessible the one-semester material of the History course can be found in the Moodle system and through this access point on the MaxWhere 3D platform. For the research, we created an online questionnaire using Google Form. The questionnaire contained 19 items. Of the questions, 6 were closed questions, 8 open-ended questions and one assessment scale question. The respondents were participants of the course, a total of 6 people. They were all 3rd grade students with an average age of 21.5 years. The questionnaire was completed at the last seminar of the course.

5 Discussion

Be it either public or higher education, history in Hungary has been taught mainly through traditional methods in 2023 – within this, frontal classwork has been the most frequent form of teaching. Though modern electronic learning materials are already available for students both at primary and secondary schools, making visualisation of history materials much better and easier to understand with the help of smart tablets and other infocommunication tools available at the institutions, such materials are still rarely used by the teachers – reasons for this vary.

Teaching history is a rather complex process that has to present not only the facts, concepts and correlations of greater importance, but it also has to affect students' complete personalities, too, while "human shaping", emotional education and that of will also form part of it. Teaching history rests on the three fundamental methodology pillars of i) story, ii) history and iii) student activity. These three pillars help us reach the essence of history. Students get to know the elements building up history through stories told. The story itself is the phenomenon, history is the essence which requires the analysis of both learning materials and sources, and it also trains us to think and make others think [1].

Based upon the above we can say that teaching history, independent of its level, can indeed be adapted to VR spaces by leaving the old methodology. Integration of e-learning materials becoming increasingly available in MaxWhere imply a new perspective on fulfilling its aims and mission.

Another reason why piloting the curriculum or learning material of the course transmitting the core curriculum was so important in the case of the chosen literacy field of Man and Society was to provide students with ideas and innovative tools for the methodology of teaching history.

One of the most important aspects during the preparation of the 14 module-curriculum was familiarising with the software itself. One of the aims for students was to improve and increase management and usage of the programme, unknown until then. The other aim was to make their historical approach change as well as sense of both space and time develop and to make them see historical correlations clearly. (Figure 5)

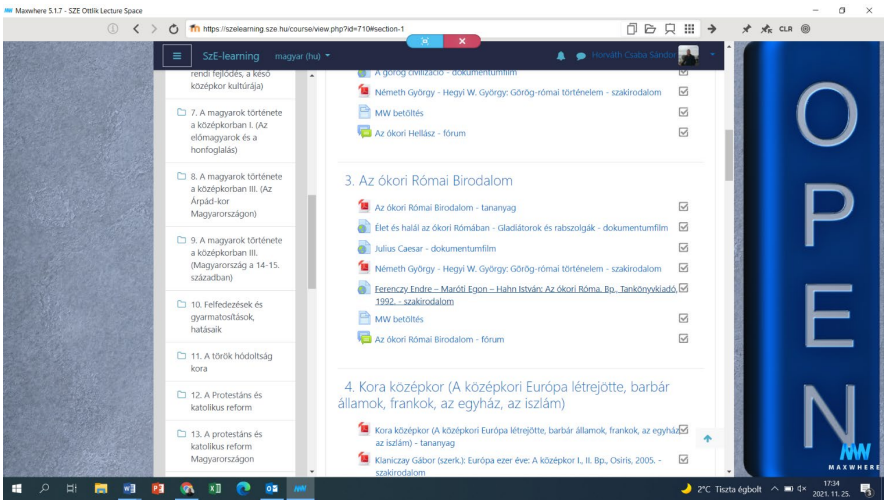

Figure 5

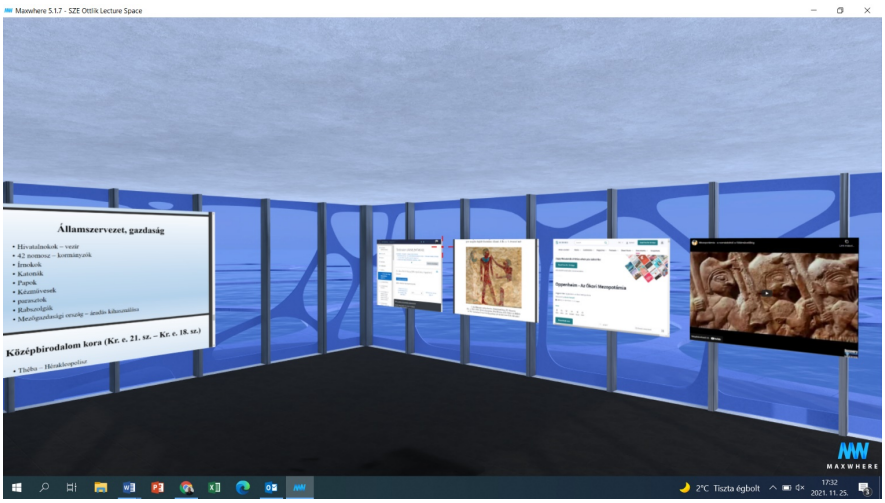

Figure 6

As far as curriculum is concerned it was of great relevance that students be able to process the given amount of knowledge in admissible, well visualised way, even individually (alone), with the help of the least explanation or guide available.

From the ancient Eastern culture to modern times, each unit contains a draft elaborated by the lecturer, which are updated versions of former PPTs.

The main idea here, too, was that the slides gave a kind of sketch and focus on qualitative history teaching in the most simple way possible and emphasizing nodes/junctions – i.e. not focusing on years and dates (this way avoiding one of the mistakes and difficulties of old times' history teaching), but starting from stories and concentrating on connections by mounting them on a chronological thread. This inevitably requires thorough visualisation of the topic, and introduction/presentation of various images and both material and written sources.

The next idea was to make indispensable material and written sources immediately available (apart from the PDF drafts appearing in VR space) for students in the given space (mostly in Ottlik Lecture Space) on further boards. (Figure 6)

In the previous one even the Giza pyramids can be examined with the help of a documentary film available on the Internet looking for its then contemporary importance and connections resting in the social arrangements as well as the size and construction of the tombs. (Figure 7)

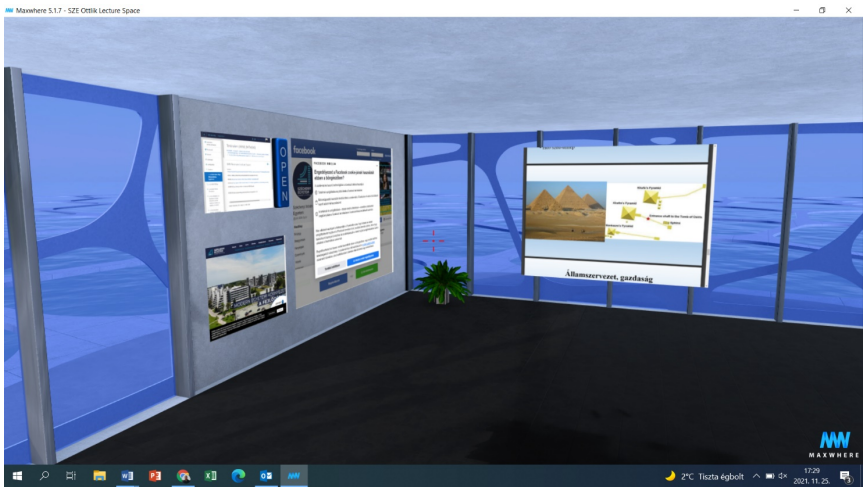

Figure 7

Just here, in another "window" hieroglyph texts can be presented through a translation programme with the help of which students have the possibility to decode the given texts and, as part of the following exercise, they will be able to transcribe Hungarian expressions to hieroglyph letters. Working in a common space makes everyone's creativity as well as the extent to which students understood the given task can easily be checked and verified.

These kinds of exercises perfectly fit workshops where students can do former, usually dry and boring source analysis kind of together in the virtual space. Besides, scientific literature relevant in terms of the lecture and available on the Internet can also be presented, making students' work easier. A kind of "mini library" of indispensable and compulsory special or scientific literature can also be created in the VR space.

As far as curriculum/learning materials are concerned, their position in the historical space is also of great importance. It requires the common study and analysis of maps presenting the given age or era guided by lecturers.

VR space make the visualisation of numerous maps possible, the best ones of which are picked by the lecturer. It is also necessary to use blank maps, too, in order to develop students' topographic knowledge and orientation. In this respect, the usage of the common educational space is considered as novelty, because students can do their tasks in a digital way – instead of paper-based materials – the correction and common control of which – even at home – is also made much easier.

This way the two competences most difficult to develop, that is the learning or mastery and extension of the senses of historical space and time, can be broadened with a kind of help never seen before through VR. Finally, students can present and visualise the topics chosen through a board – this way, making them understandable

for everyone while the given learning material becomes easily verifiable and evaluable for lecturers. (Figure 8)

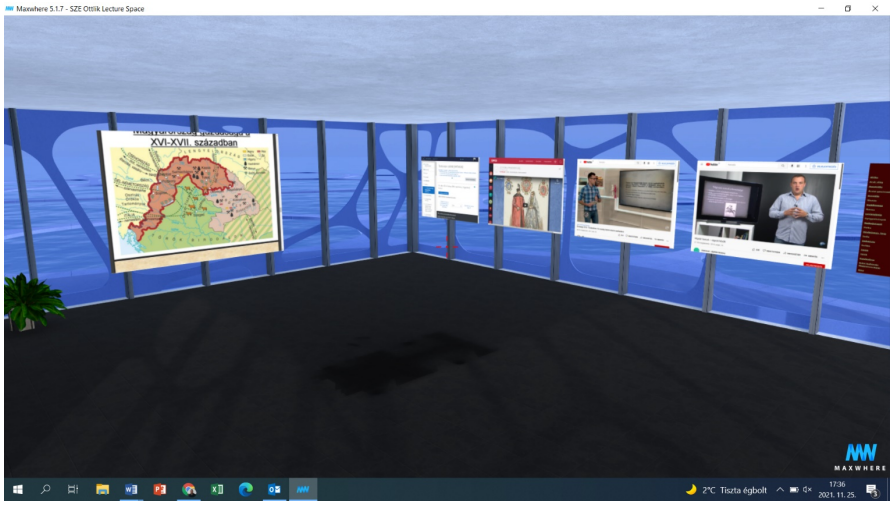

Figure 8

The new methodology has, without a doubt, increased students' motivation in getting to know history. During education in the virtual space it was also a great advantage that, especially in times of the pandemic, it was possible to join the courses online in their real time and that units uploaded are also available.

The next aspect was simplicity. Following a little practice everyone is able to manage and use MaxWhere in a self-confident way, perfectly orientate in it, to quickly find everything or can even develop, complete and upload their tasks.

As a consequence, the usage of the software is highly recommended in the case of different courses of history, too. It can be extremely useful when giving lessons of history didactics and, later on, it could also be applied either in teaching history at public or secondary schools.

The only difficulty it has is its high hardware need on behalf of the students who may not always be able to guarantee it from home either.

5.1 Student Evaluation of the Moodle e-learning System

After evaluating the questionnaires, the following results were obtained:

A significant number of students (83%) have been using the Moodle e-learning framework for 1-3 years in various courses. Based on their answers to the open-ended question, they are generally satisfied with Moodle. Their justification is that they can access a lot of learning materials on it, they can easily navigate the

interface, they can practice for tests related to exams. One of them also highlighted that the interface is constantly evolving.

What they are particularly satisfied with is that they can find all the learning materials in one place, complete with a bibliography. The interface is simple, clean, easy to understand. However, two students complained that the interface was not spectacular, while two students emphasized the slowness of opening and downloading materials.

The development proposals are also related to this. They would make the interface more colorful and spectacular (2 people), simplify and speed up the opening of uploaded files (2 people). A student would be happy if it could be used offline.

5.2 MaxWhere 3D VR Student Rating

67% of students (4 people) first encountered the MaxWhere 3D VR interface in a course, 1 person used it in the previous semester, and one person declared that they have been using it for 1-3 years.

The general opinion about the 3D VR interface is that the interface is much more colorful and spectacular than Moodle. Meanwhile, it is also relatively easy to use. There were (1 person) who perceived it faster than Moodle. Two students emphasized that learning materials (text and image files) load quickly into the space, and you don't have to open multiple windows at once like in a traditional browser, because everything is in one space. "We can see several things at once."

Three people emphasize easier learning in 3D space, e.g. "In a 3D environment, a person can connect the given material to space." or "You can build a learning line." This is especially important because the student realized that the learning materials in the space are not random, but the instructor consciously placed them behind each other (learning path).

Compared to Moodle, they can open materials in space with fewer clicks.

It is also considered an advantage of the 3D VR interface that communication with peers and instructors can be realized within the space, there is no need to open other surfaces or use a separate smartphone. "It is possible to communicate via video call without leaving the space."

Navigating in space can be highlighted as a difficulty from the research, but this was also evaluated by the student as having to be practiced at the beginning and easy afterwards. So, you have to get used to the new system, but one student suggested that there should be a separate course just to learn how to use MaxWhere. After that, they can easily use it in the other courses. Another development proposal was the "optimization of software", by which the student meant to be able to run stably even on a machine with weaker hardware.

Already while using it, students found it faster to open materials in MaxWhere than in Moodle. We checked this intuition in the next task, where they had to open the same curriculum in Moodle and MaxWhere while counting how many clicks they managed to solve.

In the case of Moodle, everyone (n=6) needed 12 clicks, while in MaxWhere 4 people (67%) managed to open the curriculum with 3 clicks and 2 people (33%) with 4 clicks. This means that 67% of students needed a third as many clicks to open the curriculum.

In the final stage of the questionnaire, students had to evaluate 5 statements, where 1 reported "strongly disagree" and 5 reported "fully agree." (Figure 9.)

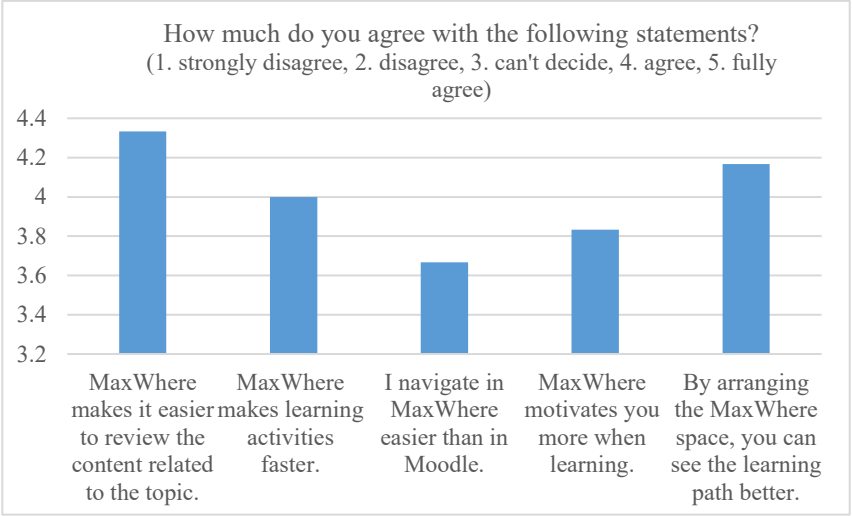

Figure 9
What students think about MaxWhere. (n=6)

What students agree on more significantly is that:

- "MaxWhere makes it easier to review the content related to the topic." Avg. 4.33 (n=6).
- By arranging the MAxWhere space, you can see the learning path better. Avg. 4.167 (n=6)
- MaxWhere makes learning activities faster. Avg.: 4 (n=6)

And what they no longer clearly agree on is that:

- I navigate in MaxWhere easier than in Moodle Avg. 3.67 (n=6)
- MaxWhere motivates you more when learning Avg. 3.83 (n=6)

Conclusions

All in all, it can be stated that VR does provide numerous and unique possibilities for Arts and Humanities and, within this field, for teaching history. Though this kind of curriculum development has only been realised in the case of history courses, the advantages of teaching and learning in VR can already be noticed. It made each others' availability and the accessibility of learning materials much easier for both lecturers and students – especially during the pandemic – as well as it resulted in a new approach to the pedagogy of history as a subject. At the same time, they pointed out the shortcomings of today's history didactics, which could be flexibly healed by them. Resulting in an experiential, problem-oriented, illustrative, stimulating for self-teaching and multi-perspective history teaching. However, a more thorough examination is needed, in order to be able to make further statements and conclusions.

The empirical research revealed that most of the students only encountered MaxWhere's 3D interface for the first time in the History course. However, after that, those who also use Moddle regularly also worked with VR. The reason for this is mostly its simplicity, clarity, spectacle, richness of content, easier communication with the instructor and easier visualization of historical events, so our hypothesis was confirmed, and the students even presented other advantages. The research also confirmed that the same content can be accessed with a lower click rate compared to Moodle. The difficulty was navigating the software, which would be greatly facilitated by wider use. The optimization of the program was indicated as a development proposal. Therefore, it can be concluded that both software programs can greatly help the processing of the content of the History course, and the regular use of MaxWhere can open up new horizons for students and motivate them better.

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