FOLIA 366

Annales Universitatis Paedagogicae Cracoviensis

Studia ad Didacticam Biologiae Pertinentia 12 (2022)
ISSN 2083-7267
DOI 10.24917/20837267.12.17

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Can VR replace an axe and a hammer? Research of a new methodology of conducting hands-on activities

Teaching to create, whenever possible, is a challenge for any teacher.
Pilar Lacasa

Introduction

A concept to learn by playing video games arouses enthusiasm since the early 70s (Zhen, 2021), which is not surprising at all, considering how efficient such a method can be. Along with the development of new technologies, more and more possibilities to implement modern learning methods occurs. In this article, I would like to show the potential that they carry for both students and teachers. Furthermore, I will emphasize one of the newest phenomena in the game industry – VR – and present a project of implementing an educational survival game prototype for the Oculus headset.[1] A research preceding the implementation process is also depicted in the article. I based the application design on a simple shelter-building scenario that covers one hour of technology classes and, at the time of writing this text, the game was already tested by small a group of Polish students.

Educational potential of video games

The first-ever-made educational video game – *Logo* – was released in the year 1970 and was meant to teach the basics of programming. By typing specific commends, players could move a turtle around the screen and draw shapes, which became more and more complex, as the player keeps progressing. *Logo* remains in use at today's schools.

While coding seems like an obvious subject to teach with games, the scope of matters covered by this method is a lot wider. Let us take a look at what makes games a unique medium. Following P. Lacassa:

1 The game design is adjusted to the polish educational system and technology curriculum prepared for grade schools.

> video games are considered interactive art forms; in this sense, they are going to be different from other media. They are experiences that require activity on the part of participants. We could also refer to the difference between reading about the hero and being the hero. [...] The classroom walls are broken, and work takes place in contexts that are much closer to everyday reality. (Lacasa, 2013, p. 137)

It might seem that anything can be learned, when adopting such an approach. It is true – the wide area of subjects taught with games is documented by many researchers like K. Franceschi, R.M. Lee, S.H. Zanakis, and D. Hinds, who conducted a social experiment with the participation of university students (Franceschi, Lee, Zanakis, and Hinds, 2009), or the abovementioned Lacasa who organized many workshops for elementary school children (2013).

It is not only a matter of the in-game content corresponding to the curriculum. Above that, the whole process of learning changes as children no longer follow a strict teacher's instruction. They are given the freedom to interact with a game in their own way, make their own decisions, and face the consequences. It boosts students' engagement greatly,[2] as well as creates conditions much closer to real-life than traditional school exercises.[3] Thanks to that, kids learn the value of effort put to complete each activity. As mentioned in *Gamifikacja w edukacji: przegląd wymagań dla platformy gamifikacyjnej*[4]:

> In a natural way, video games build the awareness of an awaiting task, possible to complete (adjusted to player's knowledge and skills). According to that, the gamification of the educational process should be supported by implementing such tasks, awarding the effort, and avoiding punishment for failure.[5] (Wawrzyniak and Marszałkowski, 2015)

Main differences between the classic and modern school

It is worth mentioning that a school environment (buildings, facilities, interior design, etc.) has remained the same since the XIX century and so today's children find it extremely difficult to adapt themselves to it. When the last bell rings, they immediately come back to our current world – the media world. The gap between students and teachers expends, as school is becoming less and less appealing with each following year. In addition to an unfriendly environment, there is a lack of connection between children's interests and the curriculum. As a consequence, a strong disjunction between school life and everyday life arises. All the knowledge and skills

2 According to Engaging Group E-Learning in Virtual Worlds (Franceschi, Lee, Zanakis, and Hinds, 2009): "team competitions involving virtual constructions can be so engaging that students start to ignore their other classes".

3 According to *Gamifikacja w edukacji: przegląd wymagań dla platformy gamifikacyjnej* (Wawrzyniak and Marszałkowski, 2015).

4 *Gamification in education: overview of the requirements for a gamification platform.*

5 Author's own translation.

gained in classes are used to pass exams, while the solutions for ordinary problems are found online. Unless teachers start to perceive technology as an educational aid, the issues with reaching students will deepen.

The up-to-date teaching-learning process has crossed the concept of the traditional, omniscient teacher, and developed a model of mutual learning. The aforementioned freedom of interaction in games allows everyone to find their own solutions. This leads to a simple conclusion – no teacher will find them all. Not only an element of surprise occurs during a lesson, but also the student's motivation and self-esteem rise with each new path that they discover.

A classic way of acquiring skills starts with a theoretical explanation and is followed by gradually more demanding exercises. It seems logical, however very often children are left alone with the most difficult ones (so-called homework). It happens because the curriculum scope intended to cover during one class is frequently too wide, and teachers have to rush with an explanation. But sometimes there is no one to explain the subject once again at home, and kids end up not finishing their assignments. This problem does not exist when considering video games or educational applications. Every gamer perfectly knows the feeling of being stuck consequently, the community has developed a few methods of approaching it. Searching for the solution online is probably the easiest way. Many developers implement hints or tutorials available at any needed moment, in which the player can search for the tips themself. If a kid prefers to keep trying on their own, it is a decision – not a must.

Practical group projects are the most interesting and engaging learning method, but they are also the most time-consuming. For that reason, teachers usually dedicate more than one lesson to accomplish them. It creates a few technical problems for students: to progress with the project they should be identically prepared for each class (i.e., remember to take necessary materials); during manual works, like creating posters, or building mockups, some parts are easily destroyed when they need to be stored in school. Once again, the modern technology could be a perfect solution, considering that:

> virtual worlds are persistent in that they continue to exist between the times of users' interactions. This means that the results of a shared endeavor, such as building and furnishing a virtual house, will be there the next time the parties log on. (Franceschi, Lee, Zanakis, and Hinds, 2009)

There is one last difference to mention:

> students in virtual learning environments have to be organized and must manage their time in order to succeed […], while students in the traditional learning environment rely heavily on the instructor for organization and time management, which affects their performance on collaborative tasks. (Franceschi, Lee, Zanakis, and Hinds, 2009)

It seems only logical when we consider once again that the media world is the natural environment for kids.

VR enrichments

I have mentioned that games create conditions closer to real-life than traditional classes. With VR technology this aspect can be raised to a whole new level. Imagine replacing all theory-based lessons with hands-on activities, during which a teacher could concentrate completely on students' work, and would not have to worry about safety issues. To say that such classes will be much more efficient and interesting is indisputable. The blockbuster of this thesis refers to the immersion level experienced by players. While PC and console games raise immersion mainly with addictive gameplay, VR creates it instantly when one enters the virtual world. As J. Guja and A. Żądło state in their recent article's manuscript: *Jak zrobić (VR)ażenie będąc awatarem? W stronę antropologii Virtual Reality*: "VR technology aims for integration: the cyberbody is supposed to be «my» body in the truest sense of this word[6] (2021)". In conjunction with Kolb's experiential learning theory stating that "knowledge results from the combination of grasping and transforming experience (1984)" one could not think of a better solution to bring back the practical exercises to schools.

Due to the recent outbreak of the Covid-19 pandemic, teachers were forced to adjust their previous methods to e-learning. Many of them have never before conducted online classes, and they are lost as no training was provided by the educational authorities. While foreign teachers explore the potential of the new circumstances,[7] Polish educators are going out of their way to stick to the familiar methods: a lecture evolved into e-lecture, exercise pfds replaced exercise books, etc. The situation is identical as a few years ago when new interactable boards were installed in schools – until now, most teachers use them either as a regular board for writing or as a projector screen. Remote learning brings in the most fitting conditions to plan the group projects, though! I already described why and how are virtual worlds better suited for cooperation and practical work than a traditional classroom. Group work in VR however, is not only the closest to a real-life project, not only allows parties to save the progress without the fear of getting parts of it destroyed or lost but above all fulfills the need for social interaction during the lockdown. I will, once again, dish up Guja's and Żądło's contemplation:

> we have years of experience in video games and Second Life but contact in VR is a bit different. Although we meet each other as avatars, we perceive the place of meeting as a physical environment. VR engages the body: mirrors our gestures and facial expression in a better or worse way. Our avatars are no longer puppets which we control with pads or mouse – we literally «embody» the cyberskin.[8] (2021)

6 Author's own translation.

7 The best example is a math lesson conducted in *Half-Life: Alyx*: https://www.youtube.com/watch?v=R3g9jrqjOZs

8 Author's own translation.

As humans, we intuitively feel that such embodiment is way more profitable as a learning experience than a classic, "book-reading" approach. But why? According to Brown's studies (2011) integrating the visual, audience and kinetic senses lead to a better learning process. The same conclusion drew M. Tadayon and R. Afhami from their research on doodling[9] (2016). Blending more senses brings positive effects due to activation of both brain hemispheres. In *Brain-Based Teaching: Does It Really Work?* (2012) C.F. Calhoun provides a detailed description of a method called *whole brain teaching* and mentions a lot of researches conducted on the subject but the overall conclusion is very simple: the more parts of the brain are active, the more efficient the learning process becomes.

Another asset of applying VR as an educational aid is a matter of the necessary storing space. It is most safe to keep the headsets in their original boxes whose dimensions, for Quest 2, equal to 43×20×13 cm. What it means in practice is that to store 25 VRs, a space of less than 0,3 m^3 is needed so basically, one cupboard can contain a set of comprehensive, modern tools for the whole class.

VR drawbacks

Despite all the advantages discussed in the previous paragraphs, certain VR limitations have to be mentioned, especially when considering elementary education. Though it might seem like the first counter-argument for the presented learning method should be the headset price, those became fairly affordable recently: at the time of writing this article, the standalone Oculus Quest 2 can be bought for 330€. Even when the Quest's price is multiplied by the average number of students per class (roughly 25), the costs of providing a school with headsets is approximately half the budget needed to build and furnish a basal technical workshop, and almost three times lower when considering adding the modern equipment[10] (i.e., 3D printers) (Papież, 2020).

Considerable space is required for the play itself. However, an area spacious enough to provide comfortable conditions for the whole class to use VR already exists at schools and is called a gymnasium. Since Oculus Quest 2 is a standalone headset, gyms can be very easily adapted for its usage. On the other hand, carrying out such adaptation before each class may be too time-consuming so school authorities should consider assigning a specific person responsible for it. A timing issue is not only setting up the headset but also the children's pace of putting it on (especially during the first usage). Most probably, half of the initial VR lesson

9 Unconscious drawing of patterns and shapes.

10 According to B. Papież's engineering thesis Modern school technical lab (2020), the cost of workshop equipment with sartorial and heavy treatment tools amounts to a bit more than 16 000€. As an additional aids Papież lists a 3D printer, a milling plotter, six Arduinos, six sets of LEGO MINDSTORMS EV3, and a specialistic software that raise the price to over 22 000€.

should be a free-play, dedicated to letting the students familiarize themselves with the equipment, to speed up the process during following classes. Likewise, time to save the progress and take the set off at the end of each lesson should be calculated in the teacher's plan.

Another issue is the headsets' weight – those might be too heavy for the youngest or smallest kids to use. It might come as an obstacle because Polish students start technology classes at the age of 9–10.[11] Some students may need to buy a special silicone face cover (what is recommended for all pupils due to hygienic matters) that brings the additional cost of 13–20€.

One of the undeniable biggest issues with implementing modern methods in schools is providing proper training for all teachers. Not everyone is familiar (or eager to familiarize themself) with the newest technology, and so the process will surely take time. During my pedagogical internship, I faced many teachers' opinions stating that the longer break from technology kids have, the better for them. One of the educators even elaborated on the prohibition of bringing phones to school as the best idea the authorities could think of. Showing such teachers that today's students live in a different world, will definitely be the greatest challenge of bringing VRs to schools.

Besides all mentioned problems, there are undoubtedly many which I cannot foresee right now. That is why I decided to test my game's prototype on a small group of students, and discuss the situation from their and their teacher's perspective. All drawn conclusions are described at the end of the next article's section.

Project description

The game was developed by two AGH[12] students: Alex Świątkowski, article's author and game designer, and Kamil Szczerbik – Unity and C# developer. The whole project originated with assist of EduVRlab.[13]

Considering the potential and possibilities of virtual technology in the realm of education, we dedicated ourselves to creating a video game which would substitute for traditional technical labs. We initially went through a selection of a proper game genre[14] and, ultimately, have chosen so-called *wilderness survival*, whose core gameplay chiefly consisted of crafting utility items. We aimed to inspire a feeling of 'consciousness' and technological culture in today's children with said culture referring to awareness of how the most basic of tools are built and the way they work.

11 In compliance to the curriculum from the year 2020.

12 AGH Univeristy of Science and Technology in Cracow

13 An interdepartmental research unit working on the AGH's Faculty of Humanities http://eduvrlab.agh.edu.pl/

14 The analysis consisted of testing 5 popular survival video games in the realm of implemented mechanics (especially their educational potential) and the range of passed knowledge.

Research Methods

The objectives of the research varied according to the specific stage within the game development. One of the first and most significant goals was to gather information and observations from the user group in regards to their needs and expectations of their currently ongoing technology classes. Acquired information contributed to the creation of the design of *user experience*[15] which met expectations of teachers and students.

Major role was played by three types of research described in detail in following chapters:

- In-depth interviews
- Task-based usability tests
- Focus group interview

In-depth interviews

In the selection of this method, we intended to obtain a meticulous analysis of every subject that arose during the research, and so we settled for a method that enabled our respondents to answer freely within their sphere of knowledge. Research in a form of a discourse facilitated modification and allowed us to adjust questions to every respondent. We also had chances to deepen the conversation, which in turn was pivotal in the completion and expansion of the already obtained information as well as in ascertaining that everybody understood the discussed issue.

Sample group

We applied *nonprobability sampling* to our research and by determining adequate criteria we divided the sample group into three subgroups:

1. Children attending primary school, grades 4–6, who make up the target audience of the application. We conducted 6 interviews with them;
2. Technology teachers, who have been teaching students for at least 5 years. The prototype is designed to help them with the realization of the school curriculum. We conducted 5 interviews with this group.
3. Participants of survival camps, who have the elementary knowledge of survival and possible means of obtaining such knowledge. We conducted interviews with 3 such people.

We arranged a set of 10 questions for each group with the aforementioned objectives in mind and results of our analysis of survival games. The analysis of the data acquired from the interviews served as the basis of answering the question "will the game be an useful educational aid?" Additionally, we acquired information

15 "The person's receipt and reactions which are a result of using, or predicted using, of a product, service, or system." (Mościchowska and Rogoś-Turek, 2015) – author's own translation.

on key needs and expectations of both students and teachers in the realm of the technology lessons. Moreover, we identified the students' preferences in regards to video games. The following chapter contains the results and interpretation of the data gathered during the interviews.

Description of the research and result analysis

The interviews were conducted by Alex Świątkowski and Kamil Szczerbik. Due to the form of the research being qualitative, during the analysis of the given answers we mostly focused on emotions (both teachers' and students') related to the currently held technology lessons, brought up subjects, and their usefulness in everyday life. We also mentioned the topic of the conditions prevalent in schools and the effectiveness of applied teaching methods.

To conclude the respondents' answers, we formulated conclusions after conducting every individual interview then we have extracted regularly occurring patterns.

Respondents' Answers

Students

The majority of the children paid attention to the unsatisfactory level of the lessons and the low quantity of useful topics as well as practical projects, what proves the necessity of introducing the new didactic solutions in contemporary schools.

The part of the discussion concerning video games revealed that the students' preferences are equally divided in terms of both single/multiplayer gameplay and the difficulty level: some children prefer challenges while others feel discouraged by them. Everyone proclaimed indifference or outright negativity towards the complex narration. Half of the children noticed unfair randomness of algorithms or events. While listing features of their favorite games the students frequently mentioned the freedom of building and crafting.

Teachers

According to the teachers, most of the students do not exhibit any interest in technology classes, unless when it comes to obtaining the bicycle card.[16] All the interlocutors emphasized the lack of proper conditions to conduct technology lessons, which often take place in the computer room. Because of that (safety reasons), the students do not use such basic tools as power drill, soldering iron, etc. There is also a lack of didactic resources and materials necessary for projects – a situation in which a student or a teacher has to fund the materials occurs on a daily basis. Each and every respondent was aware that the main interests of their student concern

16 Montessori school being the exception, as their primary purpose is to spark interest in the realm of the subject at hand.

new technologies, yet modern didactic resources such as interactive whiteboards or smartphone applications are used very sporadically throughout the lessons.

Interviews Conclusions

In accordance to the previous chapters, hands-on activities could return to schools thanks to the introduction of the game as a new educational aid. Application of modern technologies would evoke motivation and interest in the subject of the lesson. Additionally, underlining their usefulness in the extracurricular, after school life.

The project

The design of the application was based on the idea of user-centered design – "Consider the user on every step during the creation of your product." (Garrett, 2010)

On the first stage of the game-design process, I came up with a scenario for a technology lesson during which the pupils got acquainted with the methodology of constructing a wooden log house. While composing the scenario, I purposefully have chosen a topic impossible to carry out in schools, yet still present in the curriculum. The definitive selection of content enabled us to compose a GDD (*Game Design Document*), which is a document incorporating all, design decisions of the project regarding game mechanics, aesthetics, and relevant features. We referenced the document during each following step of building the game, starting from establishing the three, core mechanics: *crafting*, wood cutting, and building.

Tool *crafting* is predominantly inspired by the mechanics used in *The Forest*. It consists in filing in a semi-transparent model with adequate materials.

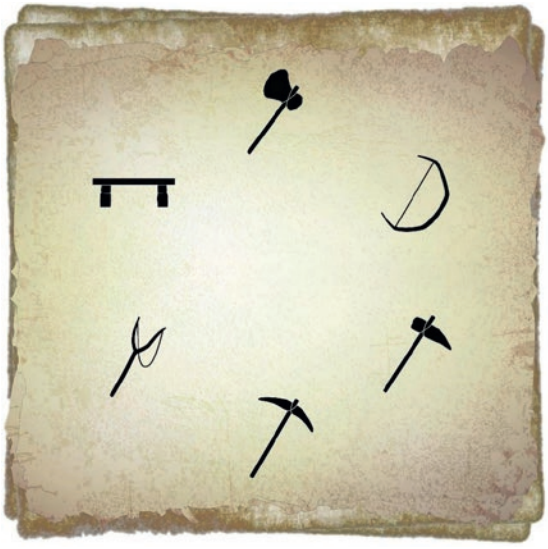

Figure 1. Item-select menu.

Figure 2. Bow – 3D model

Such a choice allows to maintain the game's dynamics whilst familiarizing the player with the elements and materials constituting the necessary tool.

Wood-cutting mechanic was designed from scratch with our focus set on maintaining realism. To imitate the strength needed to ram an axe into a tree, we used previously measured speed at which the tools 'sinks into' the tree model and we assigned an appropriate amount of 'health points' to it, so that a player has to hit the tree a number of times. Thanks to that, the effort put into the action of cutting wood gave extra realism to the whole process, which is very satisfactory within itself.

The implementation of a buildable shelter in the prototype of the game is very linear. Due to time constraints, only one shelter type is available, creation of which starts with assembling of the wall made out of logs and pegs. The construction, then, automatically erects itself on a previously designated location and subsequent walls attach themselves to it immediately after formation. The entire process rendered time-consuming and, as such, not really engaging. Due to that, a new building mechanic shall be one of the first adjustments to the next versions of the game.

When all functionalities had been ready, we added boards with instructions informing players about tools they should use to acquire relevant materials. Apart from the obvious practicality, a tutorial in this form corresponds with teaching methods stating that a student should be able to freely access the theoretical knowledge throughout the whole execution of a given task.

Figure 3. Shelter – 3D model

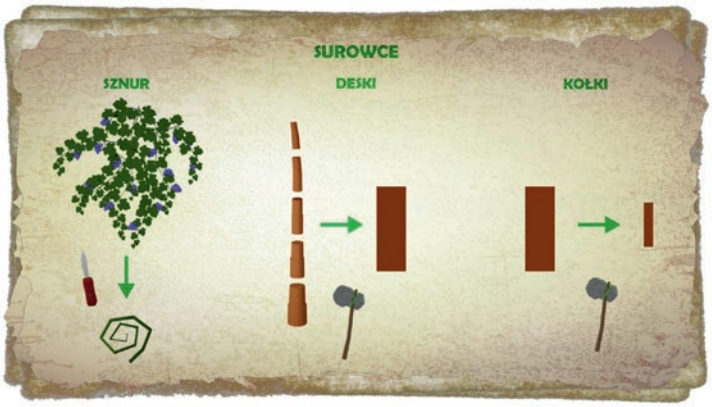

Figure 4. One of the four instruction boards.

Testing the game

Figure 5. A screenprint portraying a scene used in the testing of the prototype.

When the prototype was ready, we checked its educational capabilities by conducting short usability tests with a group of 9 students and their teacher.

> Usability tests method revolves around user-based interface testing in accordance with a previously prepared task scenario. A respondent executes a given task while simultaneously sharing their observations with a moderator, who supervises the whole meeting. The sessions are usually recorded but they may also be observed by a different researcher or even a client located in a separate room. [...] Utility tests constitute a perfect manner of comprehension of the way users perceive and use the system. These tests are a source of considerable knowledge related to an interactive product, so necessary in the verification and improvement of possible solutions.[17] (Mościchowska and Rogoś-Turek, 2015)

Such tests are used in checking e.g.: whether or not navigating the interface is troublesome for the users, if the activity of the system (e.g.: loading time) does not disturb the natural flow of interactions, or even whether or not the user is aware what the product is used for and what actions can be taken while using it.

Testing procedures

In order to conduct the testing, we invited the students to the lab. Tester's main objective was to acquire the knowledge of the methodology of constructing a log house. Testing itself was carried out in accordance to the scenario presented below:

1. Introduction of the theory
   The introduction consisted of an explanation of the house-building process, review of the use of the VR headset and individual tasks to be performed by students.

17 Author's own translation.

2. Game tests
   a) The game was tested simultaneously by two people at the same time;
   b) The students started the game with one tool only – a pocket knife;
   c) Each participant had 30 minutes to:
      i) Prepare a tool using the basic *crafting* mechanic (an axe and a hammer);
      ii) Get familiarized with the shelter-building mechanics and create as much of the construction as possible.

3. Mockup
   To examine the effectiveness of the application in the didactic spectrum, we decided to prepare a task evaluating students' comprehension of the subject. Their job was to construct a 1:10 mockup of a house presented in the game. The students were handed in a set of wooden rolls and pegs as well as necessary tools (handsaws, hammers). They had 2,5 h to finish the task.

4. Focus group
   After the testing was done, we took 30 minutes to perform a focus group interview with all of the students and their teacher. Such method usually takes up to two hours, however I decided to cut the time due to the students' age. I have chosen this specific method because, as opposed to individual interviews, FGI is characterized by a group discourse which supports the creative output of the respondents. As such we have obtained what was not only an honest opinion of the students, but also a plethora of ideas concerning the future development of the game. It allowed us to confront the design decisions taken after the interviews and apply necessary adjustments to the prototype.

   > Focus Groups are described chiefly by their group manner of discussions. Several people participate in the interview instead of a one, as opposed to in-depth interviews. Group dynamics are present, which greatly influences the results in a negative and positive way. Focus Groups are perfect for talking with groups of respondents, e.g.: with students from the same class or employees working during the same shift, especially when familiarizing yourself with such groups is crucial. Focuses are great in fields which encourage discussion, like education, for example.[18] (Mościchowska and Rogoś-Turek, 2015)

   Focus Group Interview required writing a separate scenario defining the framework of the discussion with the participants. Initially, we checked the students' comprehension level of the material and asked them about their general feelings and opinions concerning the VR headset. We discussed several aspects of the game, including but not limited to controls and planned functionalities of the game. The last part of the discussion dealt with the participants' ideas for the future application of the VR technologies in schools and the difficulties such technologies could bring or eliminate.

18 Author's own translation.

Test Conclusions

The students have perfectly mastered the prepared material concerning the methodology of building log houses, despite the fact that they have not perceived the game as 'educational'. The objective and certain tasks that they had to perform were clear to them on every step throughout the meeting. The students found the tasks simple but extremely time-consuming.

When it comes to the technical aspect of the application, it was received very positively. Thanks to implementating teleportation instead of smooth movement, we eliminated the discomfort caused by the simulation sickness. Interface was deemed very clear and intuitive. Basing the mechanics on already known, popular productions allowed to minimize the time necessary for familiarizing oneself with the application in favor of time dedicated to learning.

The technical aspect of the utilized hardware posed a slight problem. The students often stood backwards the motion detectors which caused breaks in sensing the location of the controllers. The cable connecting the goggles to the computer proved to be the biggest impediment, although this can be eliminated by using a standalone headset. Ensuring the proper functioning of the set called for conducting an individual calibration for each participant. Measuring the position of the floor was the main problem, due to which some of the pupils had difficulties with picking up the items from a ground level.

During the focus group interview, the participants gave many ideas for conducting topics with the help of VR technology, i.a. during subjects like physics, chemistry, geography, music, and especially PE. Both the conception of teaching technology with this method and the proposition to introduce a multiplayer mode were met with great enthusiasm. The participants listed examples of didactic functions e.g., the option to make notes during the game. The teacher who participated in the tests noted, aside from the aforementioned advantages, several potential issues regarding the introduction of VR to school like storing and amount of necessary hardware, the purchase of appropriate computers, and time necessary for putting on goggles before class. As can be seen, some of the potential issues were foreseen correctly, and for almost all of them a corresponding solution was already provided in a first article section. Moreover, hearing about those obstacles, students proposed to use VR during the extracurricular classes, which are significantly longer and have a smaller attendance in comparison to the regular lessons. A valuable teacher's remark stated that if the hardware were to be supplied to the students by the school, it would lower the feeling of exclusion in the less well-off children.

The participants shared loads of suggestions concerning the future development of the game, not only submitting propositions of new assets, but also gameplay improvement. They listed ideas for new interactions with objects already existing within the game. An interesting conception was adding roleplay elements and minigames. The students enthusiastically approached the subject of implementation of

a map and an assets creation kit. The teacher emphasized the didactic role of such solutions e.g., during teaching Blender in eighth grade. The participants suggested introducing various gameplay modes as well (they mostly referenced those known from Minecraft). All students unanimously agreed that it is necessary to port the game to PC or mobile because they 'don't have VR set but would like to play the game at home'.

Conclusions

We managed to design and implement a survival video game prototype which, to a great extent, may contribute to improving the quality of teaching methods used in schools. The application was met with positive feedback both from the students and their teacher. Moreover, it caught the children's interest thanks to the applied technological solutions.

The conclusions stemming from the analysis of the currently popular games of the genre allowed us to effectively use the medium's potential in the realm of practical skills additionally boosted with the use of VR technologies. We based some implemented functionalities on known solutions thanks to which the testers could fully focus on mastering the prepared material, without wasting time on mastering the game.

The conducted research showed that there is a huge need for implementation of new teaching methods in schools (not only when it comes to technical subjects). The interviewees underlined the huge issue of lack of resources and financial means necessary to conduct lessons in a proper manner. The application tests showed that these shortages may be at least partially covered thanks to the introduction of our game to schools. The participants mentioned the immense potential of the VR technology and described the directions the prototype might take to develop, as well as necessary adjustments close to their needs. One of the most important observations was the lack of accessibility.[19] It is one of the issues that we will take care of first and foremost, with an emphasis on enabling players to map the buttons on their controllers on their own, and softening the assets' colors. A further necessary modification will be the implementation of a multiplayer mode, which will enable students to work in groups and porting the game to PC, thanks to which every student will be able to play the game at home. The last modification to be implemented in the near future will be an achievement system, which will serve as a motivation for further education through playing.

Sudents' reaction to the prototype proved just how creative the youth can be upon experiencing new technologies. During 30-minute tests, the children not only managed to complete assigned tasks but also learned how to use implemented

19 The colours used in the game were so garish for a suffering-from-daltonism student that they caused an eye strain.

functions to create their own minigames. It is exactly the engagement in learning process that is currently lacking at schools. Moreover, as mentioned in the frist section: an interesting lesson is an efficient lesson. While playing with VR, all senses (excluding olfaction) are active. It is physically demanding, dynamic, and carries a huge load of didactic capability. During the FGI, the proposal of developing a kit for creating self-made content sparked a lot of enthusiasm. Such a program would allow the application to be used interdisciplinarily and not only by the technology teachers. Considering the extremely positive reception of the prototype, it is the objective we desire to pursue in the near future.

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Can VR replace an axe and a hammer? Research of a new methodology of conducting hands-on activities

Abstract

The purpose of the below article is to show the potential of new technologies applied as educational aids, emphasizing VR technology. The text is an elaboration on differences between traditional and modern learning methods, as well as expected drawbacks and advantages of implementing VR as teaching resource in Polish elementary schools.

The article's second section presents the development of an educational game prototype, designed to compromise the overall lack of technical resources and a proper workshop. It describes the most important research preceding implementation (in-depth interviews), design brief phrased based on the interviews, mechanics from the prototype, and task-based usability tests organized once it was completed. The testing session is summarized by a focus group interview with students who tested the game and their technology teacher. This project not only draws out the urgent need of revamping the current teaching methods, but above all provides an easy and relatively cheap way of achieving it.

Key words: VR, education, games, technology, survival, Unity

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