



## **Virtual Reality and Augmented Reality potential in education and trainings**

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### **ABSTRACT**

*In this article, we tried to show how Virtual Reality(VR) and Augmented Reality(AR), that have found their places in game and entertainment industries, can be used in some more useful and instructive fields like education and trainings, with all aspects and problems that might happen during using these technologies. Moreover, we tried to predict their future potential for schools, colleges, universities.*

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## Introduction

We live in a great time, a time where technologies are closely linked to everyday routine, where games are no longer just games but an artwork, where technologies like Virtual Reality(VR) and Augmented Reality(AR) are not just simple words but a reality. All these new machines and devices, that were designed for the last couple of years, give us not just an opportunity to cross the Galaxy while we are playing video games, but also a chance to make educational process more curious, entertaining and far effective. But how can we widely use VR and AR technologies nowadays? The answer is very simple: we have to connect these technologies with a device that almost all people have – mobile phone. Why mobile phone? The mobile phone is an ideal platform for Augmented Reality. The current generation of phones have full-color displays, integrated cameras, fast processors and even dedicated 3D graphics chips. Henrysson [1] with his *'Virtual Object Manipulation using a Mobile Phone'* and Moehring [2] with *'Video SeeThrough AR on Consumer Cell Phones'* have shown how mobile phones can be used for simple single user AR applications. In their work, they create custom computer vision libraries that allow developers to build video see-through AR applications that run on a mobile phone. Additionally, only by the year of 2015, the population of the Earth was 7,324,782,00 and more 7,000,000,000 mobile phones by the same year [3]. That, in its turn, means that by 2017 we have in average more than 1 phone per person, so right now a smartphone is one of main information processing devices for users. Using it, a user not only receives and makes calls but also performs information tasks. However, a mobile device is still resource constrained, and some applications, especially work related ones, usually demand more resources than a mobile device can afford.

## The history of VR and AR

To understand how new technologies can be used in educational process nowadays, first, we have to look at one of the first real applications - Rekimoto's [4] Transvision interface, where two users sit across the table and see shared AR content shown on handheld LCDs panels. They can select

objects by ray casting and once selected objects are fixed related to the LCD and can be moved. The ARPAD interface is similar, but it adds a handheld controller to the LCD panel. Selection is performed by positioning virtual crosshairs over the object and hitting a controller button. Once selected the object is fixed in space relative to the LCD panel and so can be moved by moving the panel. The object can also be rotated using a trackball input device, thus ARPAD decouples translation and rotation. More recently the Invisible train uses a PDA to view AR content and users can select virtual models directly by clicking on the model with a stylus. Similar stylus based selection has been implemented in AR interfaces that run on tablet PCs. Although the application was very simple and basic, it showed the future potential of the technology.

Right now we are moving away from simply learning to feel the content. That is the truth. With every new day the list of apps being generated is dramatically growing, and with every new piece of software, another avenue for learners opens up. The reason for this incredible progress is very simple - sometimes it is much easier to see and hear something, than have it explained; to be taken out of a classroom environment and be dropped into the amazing world of cognition. It is a well-known fact that AR and VR technologies very soon will become an inherent part of our life. Madis Vasser, the founder of Computer Graphics lab at Tartu University, says that these technologies have a huge potential to turn into something greater than just an entertainment [5]. Unfortunately, nowadays virtual reality is more concentrated on games rather than education. There are several reasons for that: the first one is because people are players who have a desire and possibility to afford all these modern devices. Another important reason is those game companies have a nice experience in the virtual world creating and in how people will react to it. Statistically, virtual reality is used in different fields but more than ¼ used by game industry. It is slightly difficult to imagine a field where VR cannot be used: medicine, military, space, education, architecture - this technology covers almost everything. Currently, VR technology used for treatment different phobias. For instance, during arachnophobia treatment picture of a spider shown to a patient and after that a real spider. It is real uncomfortable because at least

you have to have a spider. This process is far simpler with the new technologies when a non-detailed 3D picture of a spider shown first and it becomes more detailed with time. In that way, virtual reality can be used to treat different fears and post-traumatic stresses. Another nice example of using VR is war modeling. There are a lot of applications to prepare soldiers for unpredictable situations during a war.

## Destroy the barriers | The usage of VR in education

In The UK in Sevenoaks School, the government has decided to use Virtual Reality to prepare the pupils for a future dominated by technology. It is a really nice example of how the old, standard way of education in one of the ancient British schools, where traditions play a very important role, was changed to the modern one. It illustrates that people understand how far technologies can go and that no one can stop the progress, so rather avoiding it is better to adapt and to grow a population that would be into technologies [6].

Nevertheless, after the innovation the two main and very significant problems, that hamper the progress and slow down implementation of the new technologies, defined. The first one is a financial problem. The price for a single device like VR helmet is still pretty high. Cheaper model costs around 70 €. Ideally, a class needs more than 1 device to have an effective lesson. Additionally, it soon loses its novelty when all the class monitors a progress of a single student, so soon the lesson becomes boring. It is also not enough just to buy a helmet. The cheaper models require powerful mobile phones to make them work, so governments that are interested in implementing high-tech at schools are at crossroads: to make students pay for the devices or to oblige schools to buy a set. The second problem is an equipment problem. Right now all the devices are very limited, so there is not a gadget out there which does not have a significant constraint attached for school acquisition and inclusion in the curriculum. "There is an abundance of 360-degree videos and thousands of apps, but in my opinion, all these devices have a little way to go before they are genuinely useful in the classroom" - says Graeme Lawrie, the director of

Innovation and Outreach at Sevenoaks School. Therefore, governments usually come to the conclusion that the technology now is too expensive, fastidious and developing too quickly. Moreover, probably, there is no reason for schools to buy expensive equipment which in two years should be thrown out.

## Noteworthy AR & VR applications

Layar [7] was founded in 2009 as a project to break the wall between real and virtual worlds. The applications significantly expand the boundaries about everything that we knew before. It allows us to scan special posts or articles and to see the additional information about the product that we were reading about. In future people would be able to scan literally everything and receive all the addition facts or statistic. This app could radically change media as we know it today.

Anatomy 4D [8] is an application that was designed to represent anatomy aspects of human body to the students of anatomy class. It has very flexible options where the users can choose how many layers of skin should be shown.

EyeSim [9] is a Virtual Reality ophthalmic training simulator application designed for educators to use in the classroom for learners to achieve mastery learning through deliberate practice. Currently available modules include ocular anatomy, pupil simulator, ocular motility simulator, and a visual pathway simulator.

EON Reality created an Augmented Reality application called LKDF [10] Interact for Volvo's Selam Vocational Training Centre. This application teaches the basics of diesel engine maintenance through a gamified AR experience. By letting the learner experience the subject matter, Augmented Reality learning transcends literacy and language barriers by showing as opposed to telling. This application was introduced as part of the students training program.

Marine and Offshore Technology [11] - is a nice VR simulation that was designed to fuel minds and excite learners at ITE. The authentic game-like

interactive VR environment significantly increases the engagement of today's digital learners.

## What's next for VR & AR in education?

The Google company, interested in VR technology, has created a terrific solution for schools called Google Expedition which allow teachers and students to take virtual journeys, such as exploring interesting places like coral reefs or surface of Mars. Additionally, Google is going to provide different trainings for teachers to show how both Virtual Reality and Augmented Reality can be used in a variety of ways to enhance literacy, what, in its turn, is a very good solution.

What is more impressive is that on the 7th of March, 2017 Mozilla presented their revolution technology called WebAssembly [12], where content (like games) are no longer on users' computer but moved into a cloud; it gives a wonderful opportunity to play any game with high requirements on a not very powerful computer, what is great. Just imagine that this technology can be used with VR & AR, when we would be able to run whatever we want with no afraid that our device can be not suitable because of some characteristics. Certainly, these technologies will bring a lot of new to the educational process so implementing them is essential therefore schools should definitely pay attention to the evolution of VR and AR and plan effectively for incorporation them in the curriculum

## Conclusion

Right now, more and more companies are interested in Virtual Reality and Augmented Reality, for instance, Mozilla presented their WebAssembly, Google tries to come with its own solutions and viewpoints, The Facebook is trying to add new AR features on their website and mobile applications to bring the communication to the next level.

As was mention before, companies are not interested in anything that does not bring money, that is why people should express their interest in applications not only for entertainments but also for those programs that can help with gaining new and improving current skills.

Developers should keep their eye on these technologies because soon they can change everything, from games to the educational process and they should be ready to develop the application that users might be interested in.

## References

- 1 Henrysson A., Billinghurst M. and M. Ollila. Virtual Object Manipulation using a Mobile Phone. [https://ir.canterbury.ac.nz/bitstream/handle/1009/2/2325/12602110\\_2005-ICAT-VirtualObjectManipulationMobile.pdf%3Bsessionid%3D634676B10CDE709CA02F56026D4A72E3?sequence%3D1%20](https://ir.canterbury.ac.nz/bitstream/handle/1009/2/2325/12602110_2005-ICAT-VirtualObjectManipulationMobile.pdf%3Bsessionid%3D634676B10CDE709CA02F56026D4A72E3?sequence%3D1%20).
- 2 Moehring, M., Lessig, C. and Bimber, O. Video SeeThrough AR on Consumer Cell Phones, 2004, <https://pdfs.semanticscholar.org/8ad2/12ed792352a57a589b5f23ae26d1570ae724.pdf>
- 3 List of countries by number of mobile phones in use, [website], [https://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_number\\_of\\_mobile\\_phones\\_in\\_use](https://en.wikipedia.org/wiki/List_of_countries_by_number_of_mobile_phones_in_use)
- 4 Rekimoto, J.: Transvision: a hand-held augmented reality system for collaborative design (1996), [https://www.researchgate.net/profile/Jun\\_Rekimoto/publication/228929153\\_Transvision\\_A\\_hand-held\\_augmented\\_reality\\_system\\_for\\_collaborative\\_design/links/0fcfd50fde14404200000000.pdf](https://www.researchgate.net/profile/Jun_Rekimoto/publication/228929153_Transvision_A_hand-held_augmented_reality_system_for_collaborative_design/links/0fcfd50fde14404200000000.pdf)
- 5 Säde M., 'Virtuaalreaalsus sööstab varsti igasse eluvaldkonda', *Tartu ülikooli ajakiri*, erinumber 2016.
- 6 Lawrie G., 'How our school is using Virtual reality to prepare pupils for a future dominated by technology', *The Telegraph*, 29 January, 2017, <http://www.telegraph.co.uk/education/2017/01/23/school-using-virtual-reality-prepare-pupils-future-dominated/>.
- 7 Layar, [website], 2009, <https://www.layar.com/>
- 8 Anatomy4D, [website] <http://anatomy4d.dagri.com/>
- 9 EyeSim, A Virtual Reality Ophthalmic Simulator For Medical Educators and Students, [website], 2015, <https://www.eonreality.com/press-releases/eyesim-a-virtual-reality-ophthalmic-simulator-for-medical-educators-and-students-to-launch-on-january-28-at-aupo-meeting-in-tucson/>

- 10 LKDF Interact – Diesel Engine Operation, [website],  
<https://www.eonreality.com/portfolio-items/augmented-reality-diesel-engine-training/>
- 11 Marine and Offshore Technology, [website],  
<https://www.chevron.com/projects/jack-stmalo/virtual-offshore-experience>
- 12 Bryant D., ‘*Why WebAssembly is a game changer for the web – and a source of pride for Mozilla and Firefox*’, 7 March, 2017,  
<https://medium.com/mozilla-tech/why-webassembly-is-a-game-changer-for-the-web-and-a-source-of-pride-for-mozilla-and-firefox-dda80e4c43cb#qmn9av8ap>.
- 13 Brunch A., ‘*The top 10 companies working on education in Virtual Reality and Augmented Reality*’, 2 June, 2016, <https://touchstoneresearch.com/the-top-10-companies-working-on-education-in-virtual-reality-and-augmented-reality/>.