Hands-on Article

The possibilities of virtual reality-goggles within the teaching and learning of History

Juan-Carlo Homan
Honours student in History teaching and learning
North-West University, Potchefstroom Campus
homancarlo@gmail.com

Abstract

Currently the educational system is experiencing a process in which different teaching and learning methods are being used in conjunction with several forms of technology with the aim of improving the educational process. This is only a natural aspect of the educational process when looking at it within a larger societal sphere. When placing focus on subjects - specifically History – it should be noted that History as subject requires the incorporation of more modern technology in order to move away from the traditional method of chalk and talk History instruction.

There are various teaching and learning aids like interactive whiteboards and data projectors but they are however not the latest forms of technology that can be used as a pedagogy tool that place is reserved for Virtual Reality (VR) and the goggles that accompanies it. Virtual Reality is a computer simulated environment – cyberspace/ augmented reality – with which the technology user can interact. Within this cyberspace the user focuses on virtual sights and virtual sounds in an attempt to create immersive experiences through the application of technologies like VR-Goggles which are also known as Head Mounted Displays (HMD's).

The aim of this article is to introduce Virtual Reality and the accompanying goggles to History educators and look at possibilities on how it can be utilised.

Keywords: Virtual Reality (VR); VR-Goggles; HMD's; TPACK; Technology; History teaching and learning.

Introduction

When addressing the topic of VR as a pedagogy tool it should be stated that it is not suggested that VR should replace current pedagogies tools but that it should rather be used in conjunction with other pedagogy tools and teaching and learning methods like the traditional chalk and talk method – even this method has its place within the educational system. Furthermore, it should be noted that the use of VR and VR-Goggles can only take place if the advantages and disadvantages thereof is understood especially with regards to its relationship to the learning content (Mandal, 2013). Up until now

in South Africa VR and VR-Goggles have most commonly been used as a method to improve gaming on consoles like the Playstation 4 and has been addressed in the film "Ready Player One" which is an adaptation of a novel written by Ernest Cline. This should however not become the predetermined plateau of VR especially when considering the possibilities it has for the educational environment and more specifically the History classroom. While experimentation with VR in the History classroom has taken place abroad in History classrooms from The United States and in workshops from the UK it is still needs to be thoroughly tested and implemented in South Africa.

Relationship between technology, pedagogy and content

In order to have a clear idea of the relationship between VR and VR-Goggles, how it's used and the learning content it has been found that the TPACK diagram represents this relationship the most correctly.

Diagram 1: Relationship between technology, pedagogy and content known as TPACK
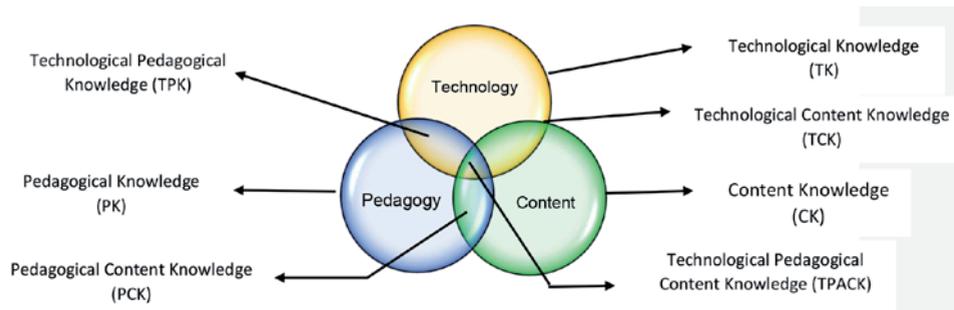
Source: Koehler; 2018.

If we look at the diagram above we find that VR forms part of the TPK, TK, TCK and then ultimately of the TPACK. VR can aid in the instruction of History through accurate content-based visual and audio stimuli that will reflect the historical environment that is being studied. It should however be mentioned that VR can't just be used for the sake of using a modern form of pedagogy tool but that it should be used with a specific purpose in mind that will enhance the teaching and learning of the prescribed content. The problem however and especially in South Africa is that VR is rather being used within gaming and films and not within the educational spheres which results in a predetermined plateau for this technology where in reality that

plateau should not exist. Well-developed VR software and hardware when used as a pedagogy tool allows for an educational process that values learning through experiences within the interactive classroom. This statement can be seen as proven true when looking at both the History classes of Mr Stahl from Franklin Regional and Mr Hanson from Hunter's Lane High School wherein they make use of VR (News Channel 5; 2017).

Five steps to incorporate VR

When looking at the prospect of incorporating VR there are five steps that can be used as a platform that directs the process of its incorporation. These steps are adapted from research done by Nies et al. (2006) regarding when to incorporate technology within to a classroom environment. These steps are as follows:

•   <u>Accepting</u> – Educators should accept that society and the educational system which is a social construct is changing and therefore History instruction should change/adapt. Due to the advances in technology History has become a multi-disciplinary process and needs to be aligned according to the TPACK.

•   <u>Recognizing</u> – Educators should recognize where, when and how technologies like VR-Goggles can be used to not only engage with subject content but to also enrich the process of transferring subject content to students.

•   <u>Exploring</u> – Educators should explore and determine which technologies can be applied to the when, where and how. For this study the focus is on VR-Goggles as pedagogy tool.

•   <u>Adapting</u> – Educators should adapt their lessons and methods of instruction to include VR-Goggles within the lesson phase identified. This however does not mean that educators should abandon their current methodologies but rather work on a way to incorporate more into their methodology.

•   <u>Advancing</u> – Within this step the educator analyses the students' understanding and interaction with VR-Goggles and determines if, when, where and how VR-Goggles should be further actively incorporated with the educational process.

Furthermore, if the above mentioned steps are to be used and VR is to be taken into consideration it should be noted that there are primarily two forms of VR that can be used within the History class. These forms of VR affords the opportunity to secondary and tertiary institutions to use technology – VR – in a way that is more modern and relevant to not only the learners at school but also in the training of the pre-service History teachers as well. According to Black (2017) these two forms are:

- <u>Simulations:</u> This computer simulated 3D environment responds to the users' movements and location in an attempt to allow interaction between the users' and the subject content.

- <u>360˚ video/image</u>**:** A 360˚ video/image is a video/photograph taken of a real-life location through one/multiple cameras. The video/image with its separate parts are then compiled together on a computer. These videos/images when compiled together are then programmed to respond to the users' head movements. This form of VR will most likely be used when a low-cost VR software and hardware is being used due to it not allowing interaction like simulations but places the user into a singular 3D environment.

While the above mentioned is the only two forms of VR there are however various forms of VR hardware that creates the above mentioned VR environments. These VR hardware systems are as follows (Black, 2017):

- <u>Head-mounted displays (HMD)</u>: A HMD is the way in which a person can experience VR. Within the HMD each eye has its own individual screen/projection. These HMD's can be applied to simulations and 360˚ videos/images and works best when it can track head or movements in real time.

- <u>Mobile VR</u>: Mobile VR works through placing a smartphone within a HMD. The sensors within the mobile system's computing system provides the ability to see in 360˚ view. This form of VR is the least expensive and most accessible due to computing power not being able to run more advanced VR software.

- <u>High-end VR</u>: High-end VR are devices made for the solitary use of VR and requires very powerful computers with highly sophisticated graphics cards. This form of VR allows for full body movement and is currently found within The Oculus Rift and gaming systems like the PS4. This aforementioned examples of high-end VR allows a person to be mostly stationary within a certain physical area except for the use of the arms while the avatar that portrays the person within the virtual environment has a full range of motion. If this VR is to be used within the educational environments each student may not have their own equipment and it is due to this that collaboration between educators within a faculty and between faculties should be promoted. The emphasis when incorporating VR into the educational process should be placed on quality over quantity while sharing resources within high quality educational programs. This form of VR hardware has the most possibilities for the educational process but until it can be mass produced it should be used in classes with a relatively low number of students.

- <u>360˚ cameras</u>**:** These cameras are able to shoot 360˚ images in high definition while some of these cameras can even record audio. If a mass distribution and

implementation of this hardware occurs the creation of VR content can more easily be developed.

Possibilities when incorporating VR into the History classroom

Immersive VR will allow History students to engage with subject content interactively and immersively instead of passively. These experiences especially in regards to History can't be obtained in any other way and affords the learner that may not have the opportunity to visit certain historical locations the possibility of an excursion to any historical site which has been recorder within a VR compatible format. Furthermore, when using VR in conjunction to other teaching and learning strategies within the interactive classroom History students with different strengths are engaged within the educational process. This means that students are all given equal opportunities to engage with the subject content according to their academic strengths. While using VR to visit any time period in History the pace of the video/ image/ simulation can cover multiple months/years during the lesson and is not fully restricted by the class schedule (Pantelidis, 2010).

VR allows the History student to experience that which has already been experienced by thousands while it allows the History educator to provide interesting and meaningful learning experiences to students.

The making of your own VR-Goggles

The main problem with the incorporation of VR is however the financial implications of this technology as a pedagogy tool within the education sector. While this can be considered as a hindrance towards the implementation of VR it should not deter the History educator from at least attempting to incorporate VR within their teaching arsenal. VR when adapted to the aforementioned classrooms can make use of HMD's to provide VR experiences to students even if the VR is low cost. While incorporating VR-Goggles there are low-cost alternative but effective ways to acquire and use this pedagogy tool like making your own VR-Goggles as will be shown in the steps below.

The following is what is needed to make low cost VR-Goggles followed by a step by step illustration of the process:

• Cardboard
• Water bottles
• Sand paper
• Glue

- Syringe
- Water

When all of the resources have been acquired there are 17 steps to follow when creating your own VR-Goggles:

Table 1: Steps to create a pair of VR-Goggles[1]

Steps	Photograph
How to make the lenses for the VR-Goggles	
Step 1 Take a water bottle and cut of the top part and use the bottle cap to draw four circles on the part of the bottle	
Step 2 Cut between the circles and then cut out the circles	

---

1   The first cm given in a sentence refers to the horizontal and the second cm in a sentence refers to the vertical unless indicated otherwise.

|	
Step 3 Glue the circles together but leave an open space at the top to inject the water – 4 circles become 2 circles. **Step 4** Use syringe to inject water into the glued together circles until full and then glue the circles/lenses shut.	
How to make the VR-Goggles after the lenses are made	
Step 5 Make 2 cardboard cut outs of 15,3 cm x 8 cm	
Step 6 Make 2 holes within the cardboard cut outs and then insert the lenses within a cut-out	
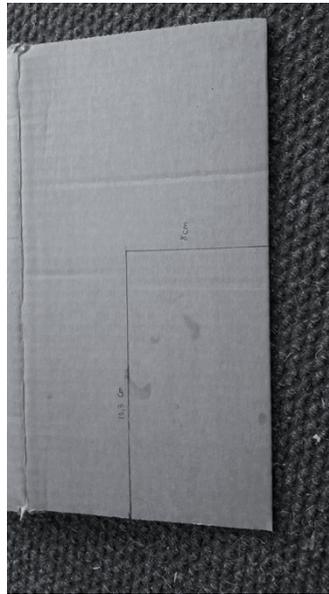
Step 7	
Make another cardboard cut-out with a half circle cut-out from it and a smaller circle cut-out of the larger half circle. This cut-out is 16 cm and 11,4 cm. At the other side of the cut-out the horizontal is 1 cm and 1 cm thus creating a half circle of 14 cm. At the centre/top of the circle a smaller circle should be cut of about 3 cm and starts at 6,4 cm and ends at 9,4	
Step 8 Make two more cardboard cut outs of 14 cm and 8 cm	
Step 9 Start assembling the cut-outs by attaching/gluing the cardboard cut-outs of step 7 & 8. These cut-outs are from the previous step is the sides of the VR-Goggles	
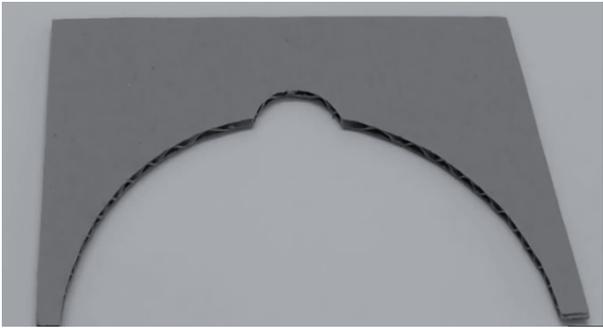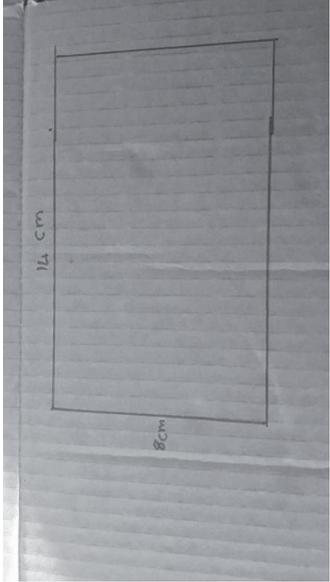
Step 10 Add the lenses cardboard cut-out to the rest of the assembled cut-outs above/ touching the small circle of step 10 within step 12	
Step 11 Make another cut-out to close the back of the goggles to hold the phone from behind	
Step 12 Make a thin cut-out to place between lenses	
Step 13 Make a cardboard cut-out to place at the top of the goggles but leave an open space of about 1 cm to fit the phone in	
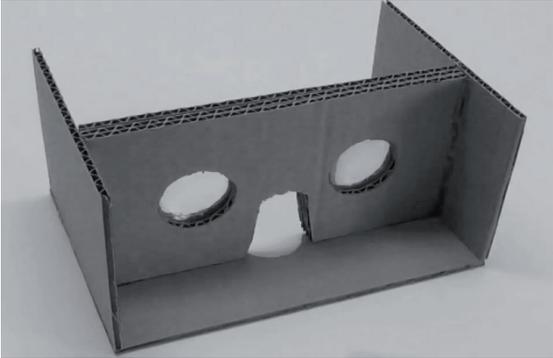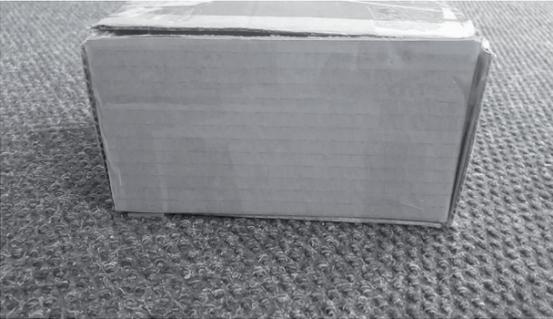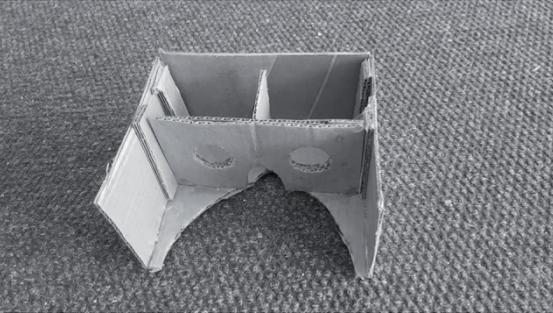
Step 14 Insert the phone and play the VR video	
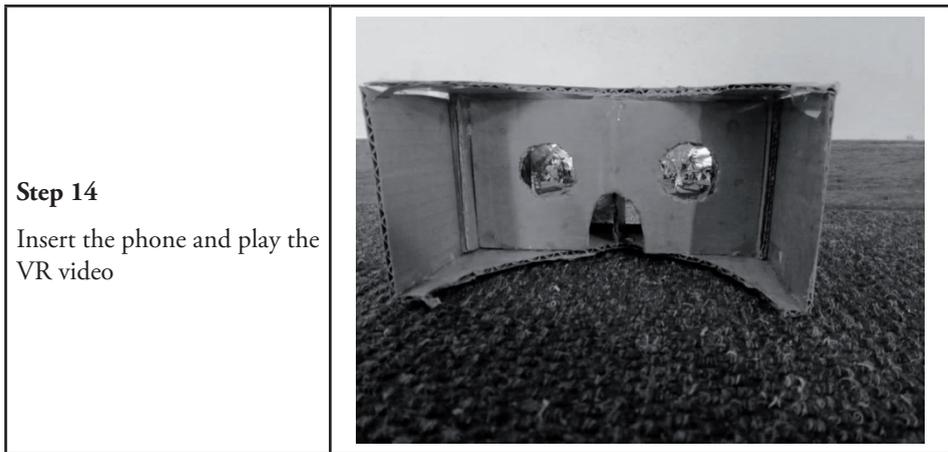
Source: The assembly of the VR-Goggles above was done by the author.

Conclusion

With VR we can take our students outside of the classroom cognitively while remaining in the classroom physically and in doing so we provide memorable teaching and learning experiences that will not only benefit them but benefit the entire History teaching and learning process. VR and VR-Goggles can provide a refreshed feeling when teaching and learning History and while it has certain disadvantages the advantages however provides us with an idea of what we can do within the History classroom. Thus, the financial implications should not deter us from attempting to use VR, a technology of tomorrow, but should rather motivate us to find alternative ways to incorporate VR as a pedagogy tool today.

References

Black, ER 2017. Learning then and there: An exploration of virtual reality in K-12 History education. Available at https://repositories.lib.utexas.edu/bitstream/handle/2152/63616/Black_Thesis_Exploration.of.VR.in.K12.education_2017.pdf?sequence=2. Accessed on 6 June 2018.

Koehler, MJ 2018. The TPACK Framework. Available at http://wwtpack.org. Accessed on 1 August 2018.

Mandal, S 2013. Brief introduction of virtual reality & its challenges. *International Journal of Scientific & Engineering Research,*4(4):304-309.

News Channel, 2017. School Patrol, Virtual Reality in the classroom. Available at https://www.youtube.com/watch?v=vY4Pg9cFjt0. Accessed on 1 July 2018.

Nies, ML 2016. *Technological pedagogical content knowledge (TPACK) framework for K-12 Teacher Preperation, Emerging Research and Oppurtunities.* Oregean: Oregon State University.

Pantelidis, VS 2010. Themes in sciences and technology education: Reasons to use Virtual Reality in education and training courses and a model to determine when to use Virtual Reality. Available at https://files.eric.ed.gov/fulltext/EJ1131313.pdf. Accessed on 18 June 2018.