



## Smartphone Based Virtual Reality (VR): an Immersive Simulation Tool

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### What is Smartphone Based Virtual Reality?

Smartphone Based Virtual Reality (VR) enables an immersive simulation activity that would use both: (1) free VR apps downloaded on a smartphone from Google Play App store and other apps store, and (2) a VR Headset (e.g. Google Cardboard), to simulate an environment and teach students a set of concepts that otherwise would be difficult to experience and illustrate in a classroom (i.e. space and time restriction) or inaccessible location (i.e. hazardous space).

VR was initially used in video gaming and entertainment until recent research has shown its great potential for educational purposes. In spite of that, VR was held back due to its complex setup and high cost, which has limited its use in educational and learning activities. However, with the advent of VR apps downloadable on smartphones and the new head-mounted displays, the current system enables portable and simple VR setup, designed to be cost-effective and easy to operate at the same time.

### Introduction

The VR simulation is designed to enable students learning key concepts discussed in the class, where students would explore, describe, identify and categorize elements of the environment, operationalize and experience some concepts learned in class. The VR simulation activity is designed to support the following learning objectives: (1) increasing students' awareness about the capabilities of the VR emerging technology, (2) enhancing students' experiential learning and (3) providing students with hands-on experience in using VR for applications.

The use of VR in education could be considered as one of the natural evolutions of computer assisted instruction or computer based training (Pantelidis, 2010). The VR simulation affords the levels of cognitive, affective and psychomotor learnings. For instance, the use of VR to simulate a shopping environment (e.g. store, mall, etc.) would enable students to recognize and categorize elements and attributes into dimensions of the simulated environment (i.e. Bloom's taxonomy of cognitive learning). Furthermore, when tasked to explore the VR environment, students would operate in a simulated space and could perform sequential steps of a decision making process (Harrow's taxonomy of psychomotor learning), besides experiencing a set of related concepts (Krathwohl's taxonomy of affective learning).





## Implementation

### Before Class

1. Instructor determines what learning objectives may be best support by experiencing the Smartphone-based virtual reality experience
2. Instructor searches for an app to use & explores the app prior to class to ensure they understand what the possibilities are within the app and some challenges that may arise when students use the app
  - a. Ensure the classroom space works with the app (i.e. if students physically have to move around, be sure there are open spaces to do so in the classroom)
3. Instructor develops a mechanism for feedback from students; this would be an assessment of what they learned, a reflection on their experience using the app and its relationship to learning objectives or something else
4. Students receive a booklet of instructions (see Table 1 in Resources section for an example specific to a shopping experience) and some material to read before coming to class

### During Class

1. Start class by reviewing concepts discussed in the previous lecture or an assessment related to the pre-class reading
2. Instructor describes the purpose of the activity & expectations for the students
  - a. Introduce students to how to navigate in a VR Space
  - b. Do a practice run with the students – include how to start the VR experience and have a student come up and model safe use of the headset, movements (if necessary), and the roles student will play
3. Students are paired up, download the app and run the VR simulation – be sure to give students timelines for using the VR set (how long the simulation will last)
4. Debrief with students regarding their experience

## Frequently Asked Questions

- a. *Does VR work for all students?* The use of VR simulation may not appeal to all students. For instance, students who have prior knowledge and interest in VR as applied to video games and entertainment, would take more advantage of VR simulations as compared to those who are not familiar with the VR applications.
- b. *Are there any challenges that come with the implementation of the VR simulation?* Setting up the VR simulation could face some challenges. For instance, the existing free apps (available on Google Play, App store, etc.) could have a very poor resolution, making it difficult to simulate a highly immersive environment and therefore would significantly limit possibilities of instructing students to perform tasks in the VR environment. Furthermore, these apps may not be compatible with all types of smartphones (i.e. some of the apps works only on iPhone, or on a smartphone with screens up to 6 inches, etc.). Moreover, the use of VR in classrooms (a limited space) would require VR Headsets with a remote control to allow physical movements when navigating in the virtual environment and avoid in-class traffic. However, these are usually more expensive than the conventional VR Headsets



- c. *How to incorporate a VR simulation into the curriculum?* Virtual reality cannot take the place of lectures, textbooks, or laboratories. The best use of VR is to supplement traditional educational methods. VR could be offered as an available resource for those students who did not fully grasp the material in class or from the text. VR could be used as the basis for an analysis of the simulated environment, in order to reach the higher levels of Bloom's taxonomy (levels 4 to 6).
- d. *Which VR app should I use for the simulation?* The instructors should consider carefully the trade-offs of simulation realism versus performance, and plan out the simulation carefully and aligning it to the learning objectives and expected outcomes.
- e. *Are there any side effects with the use of VR?* Using VR for an extended period of time could result in some negative effects such as eye soreness, loss of spatial awareness and vertigo. The makers of the most popular VR headsets, the Oculus Rift and HTC Vive, recommend taking at least a 10 to 15 minute break every 30 minutes, even if you don't think you need it.

## References

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## Other Resources

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Jensen, L., & Konradson, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies, 23*(4), 1515-1529.

**Table 1:** Example Lesson Plan for VR Simulation

<u>Time</u>	<u>Round</u>	<u>Role/material</u>	<u>Instructions</u>
Up to 10 min	Step #1 Briefing	Professor <ul style="list-style-type: none"> <li>• Instructions booklet and PowerPoints</li> <li>• Selected chapters from <i>Human Walking in Virtual Environments, Perception, Technology, and Applications</i>, by Steinicke et al., (2013).</li> </ul>	<ol style="list-style-type: none"> <li><u>Brief review of the concepts</u> selected to be taught through the VR simulation and the <u>course objectives</u></li> <li><u>Overview of types of walk in a VR space:</u> <ul style="list-style-type: none"> <li>○ Look movement (i.e. gazing)</li> <li>○ Physical movement (i.e. body movement)</li> <li>○ Space movement (i.e. the use of controller)</li> </ul> </li> </ol>
Up to 10 min	Step #2	Professor/students <ul style="list-style-type: none"> <li>• Smartphone/pair of students</li> </ul>	<ol style="list-style-type: none"> <li><u>Initiation to VR simulations:</u> <ul style="list-style-type: none"> <li>○ Students <u>choose</u> a partner to work in pairs</li> <li>○ <u>Go to <a href="#">Google Play</a></u></li> <li>○ <u>Search, download free</u> VR apps on your smartphone. A sample of these include (but not limited to):               <ul style="list-style-type: none"> <li>- <u><a href="#">Supermarket VR Cardboard</a></u> </li> <li>- <u><a href="#">Supermarket VR Cardboard</a></u> </li> </ul> </li> <li>○ <u>Select</u> one app of your choice.</li> </ul> </li> </ol>
Up to 20 min	Step #3	Students <ul style="list-style-type: none"> <li>• Smartphone (+) VR Headset /pair of students</li> </ul>	<ol style="list-style-type: none"> <li><u>Partner#1</u> <ul style="list-style-type: none"> <li>○ <u>Open</u> the selected VR app</li> <li>○ <u>Insert</u> your smartphone into the Headset</li> <li>○ <u>Hold</u> the headset up to your eyes</li> <li>○ <u>Walk</u> and <u>explore</u> the environment</li> <li>○ <u>Describe</u> and <u>categorize</u> the peripheral elements of the environment.</li> <li>○ <u>Perform</u> a task (e.g. walking, browsing, gazing, etc.)</li> <li>○ <u>Reflect</u> on your VR experience (sequential steps of decision making process).</li> </ul> </li> <li><u>Partner #2</u> <ul style="list-style-type: none"> <li>○ <u>Document</u> partner#1 experience: record, take pictures and take notes, and use a checklist of the activities mentioned above.</li> </ul> </li> </ol>
Up to 20 min	Step #4	Students	<ol style="list-style-type: none"> <li><u>Rotate</u> roles (partners#1 and 2) and <u>Redo</u></li> </ol>
Up to 15 min	Step #5 Debrief	<u>Professor/ PowerPoints</u>	<ol style="list-style-type: none"> <li><u>Debrief:</u> <ul style="list-style-type: none"> <li>○ <u>Link</u> the VR simulation to the course objectives &amp; learning outcomes.</li> <li>○ <u>Ask</u> students to reflect on their VR experience</li> </ul> </li> </ol>