**Introduction and summary of constraints**

Virtual Reality (VR) is a computer technology that creates a simulated environment. It generates an artificial computer-generated world and users can experience and interact with that environment. VR is not like traditional user interfaces but VR places the user inside an experience. Users are not just viewing a screen in front of them but users are immersed and able to interact with that exciting 3D world. By simulating as many senses as possible, such as vision, hearing, touch, even smell, the computer is transformed into a gatekeeper to this artificial world.

Virtual reality has long held promise as a tool to enhance education with immersive and interactive experiences in disciplines ranging from science and engineering to foreign languages and social sciences. Now that virtual reality devices are more affordable and widely available, the challenge has become finding ways to employ this technology effectively.

Augmented Reality (AR) in education features aspects that enhance learning of abilities like problem-solving, collaboration, and creation to better prepare students for the future. It is also good for traditional pedagogy focused on technical knowledge and proficiencies.

While AR is still somewhat in its infancy, especially in comparison to virtual reality (VR), it does offer more cost-friendly options to school districts with tighter budgets – while still providing many of the same features and benefits. Augmented Reality (AR) Training adds interactive, digital elements to a live, real-world environment through a tablet, phone, or headset. AR can be used in corporate training in the following areas: Technical Skills. Multi-Step Tasks, Onboarding.

**Risks and uncertainties of the project**

Pros

* Can be administered in large numbers and is cost-effective.
* It can be used to compare and contrast previous research to measure change.
* Easy to visualize and analyze.
* Questionnaires offer actionable data.
* Respondent identity is protected.
* Questionnaires can cover all areas of a topic.
* Relatively inexpensive.

Cons

* Answers may be dishonest or the respondents lose interest midway.
* Questionnaires can't produce qualitative data.
* Questions might be left unanswered.
* Respondents may have a hidden agenda.
* Not all questions can be analyzed easily.

User requirements concerning implementation.

First, you will be using a VR headset or a VR projection system, or both? Second, you’ll need a rendering computer with ample graphics capabilities, and possible wide-area motion tracking and other sensor systems such as eye tracking or biofeedback. Third, you’ll need VR software for creating and rendering your applications. Last but not least, you’ll want to think about your facilities, personnel, installation, training and support. Here is an overview of each component to give you an idea of what you may want to spend.

**Recommended approach**

**Methodology**

Research design

Augmented reality superimposes sounds, videos, and graphics onto an existing environment. It uses four main components to superimpose images on current environments: cameras and sensors, processing, projection, and reflection.

Each of these components provides an individual function. For example, cameras and sensors can detect an image’s depth or calculate the distance between two objects before superimposing digital content atop the user’s view. Projection and reflection add virtual information over what a user sees; for example, a method known as projection mapping enables AR apps to digitally overlay video onto any physical surface.

As for processing and transmitting data, limited bandwidth and latency of wireless networks have typically posed challenges to wide-ranging adoption of AR. But thanks to faster wireless connectivity through 5G cellular networks and next generation devices’ improved processing power, opportunities to explore AR’s full potential are expanding.

With these core AR components, educational institutions can incorporate interactive classrooms into their curricula. Why use augmented reality in education? Using AR in the classroom can improve learning by helping educators create interactive classrooms that increase student engagement.

When it comes to implementing augmented reality technology into the classroom, there are a few design principles that instructors should keep in mind. As discussed by researchers Robert Miller and Tonia Dousay, the first duty of a teacher is to ask why. Why are they implementing the technology and how do they intend to use it to support learning goals? Haphazardly introducing a technology just for the sake of using it won’t lead to improved outcomes.

The best role for augmented reality is as a supplementary tool, rather than as a primary method of delivering content. So, while teachers can use it to bring lessons to life, they also need to maintain a focus on more traditional ways of delivering content. Augmented reality is best suited to enhancing those traditional lessons rather than acting as stand-alone methods of instruction.

It’s also important for teachers to know their classrooms. If their students don’t possess a certain level of technological knowhow, they won’t be able to work with augmented reality effectively. If teachers are hoping to use such technology, they should probably gauge their classroom at the start of the year first. This is important because Miller and Dousay suggested that trying to use this technology among students who didn’t have a certain level of technological competence would only detract from meeting learning goals.

**Methods**

It is classified as a qualitative research, descriptive in nature, as it is not limited to data collection, but also refers to and analyzes the interaction of the consultants achieved in the discussion forums and portfolio activities through the collaborative work of the course "Virtual Learning Environments" developed in a virtual learning environment. To express Danhke, (1989) quoted in Hernández, Fernández and Baptista, (2006, p. 102) "These studies measure concepts, collect information, data (variables), dimensions, components of the phenomenon to investigate." From the analysis of the consultants participating in the workshop course, an instrument was designed under the format "Checklist to evaluate Virtual Learning Environments", using as indicators the spaces from the perspective of communicative processes, referred to by Chan (2004), that is to say: informative, interactive, production and exhibition. With some adaptations to the same taking into account the agreements of the advisers.;

**Requirements for AR in the Classroom**

* A minimal AR setup for almost any class may include:
* an Internet connection
* Mobile devices (i.e. smartphones or tablets)
* AR apps (especially one tailored for education)

“Triggers” or “Markers” (i.e. images, objects, locations and/or actions that trigger an action on the device screen via the AR app)

Implementation

**Target hardware/software environment.**

VR Headsets

Schools need a way to view and interact with VR content, meaning they need to invest in virtual reality headsets. Don't worry if you don't have the funds to buy VR headsets for each student; the great thing about VR headsets is they can be easily sanitized and shared. They are portable so schools can use them for multiple VR-based learning programs. Here are some popular VR headsets available in the market: Oculus Rift S, HTC VIVE Pro, HTC VIVE Pro 2, Oculus Quest, Microsoft HoloLens, Samsung Gear, etc.

Worried you cannot afford these headsets? Cardboard headsets are emerging as a scalable, inexpensive alternative.

Training

Typical systems come with a minimum of ½ day training. For a group of new users, we recommend 1 ~ 4 days of on-site or remote training depending on system complexity and goals. Cost for training depends on length and location of the training and required level of training (entry or advanced).

Implications

**Project products and activities- these will have an effect on the schedule duration and overall project effort**

Content Production

Unlike traditional mobile or web applications, a virtual reality experience relies on available visual content. VR learning programs are based on engaging video and 3D visuals that will immerse the user. As a budget-friendly option, you can utilize the free Android and iOS applications to create very basic 360° videos and images. However, if you want to create a more immersive experience through high-definition graphics, you need a 360° camera and computer hardware to edit the VR content.

Facilities

Depending on research or presentation goals, your existing facilities might need to be modified somewhat to fit a VR lab or a demo room. Facilities cost can be as low as zero if a fitting room is already available. If re-modeling is needed, it can be a substantial budget.

For corner projection systems: A flat uniform walls with white matt paint in a room with ideally high ceilings

Software Development

Creating a basic smartphone application for low-end VR experiences is a low-cost option. However, if you want to go beyond images and videos, you need to build applications using Unity, which requires more skill. Further, the development costs go up significantly for building applications for Oculus, HoloLens, VIVE, etc.

Software development and content creation make up most of the cost involved in incorporating virtual reality in classrooms. However, today, there are tools available on the market that allow you to cost-effectively create and distribute engaging XR content with no coding experience required.

Installation

A small ready-to-use system does not require installation. It’s portable and made to work “out of the box”. Large systems like projection setups require substantial work. Installation cost also depends on location for travel cost and time.

Cost for installation: Typical cost for a one-person installation (if required) varies from depending on location, install duration and requirements for the system scope.

VR and AR development and programming could take 5 to 6 months or more depending on size of the virtual environment, number of digital assets, and the number of interactions.