

# Hybrid Reality-Based Education Expansion System for Non-Traditional Learning

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## ABSTRACT

Many educators utilize conventional coaching methods to coach and study behaviors in a classroom with face-to-face, verbal contact. But, the coaching with learning atmosphere has developed further than the classroom. The incorporation of technology at the coaching with learning procedure is the novel tendency at teaching, by a favorable result. Technologies present surroundings for learning behaviors to happen anytime also everywhere to advantages instructors with students universal. One of the skills to have been demonstrating feasibilities of the appliance at learning surroundings is Hybrid Reality (HR), which includes together Virtual Reality (VR) with Augmented Reality (AR). This work attempts to construct ahead the recent condition of hybrid reality also its appliance at learning. The initial section depicts the fundamental formation of hybrid reality also its various divisions. The subsequent sections provide the superior construction of a few innovative appliances that are implemented for the hybrid reality. Lastly, the paper shows the benefits of those applications over the traditional teaching methods and the essential user reactions. The outcomes have highly in assistance of taking mobile applications based on Hybrid Reality into a contemporary teaching scheme.

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## 1. INTRODUCTION

In this century, educators and learners are perceived to be technological savvy. Technologies influence an alteration of coaching with learning technique between instructors with students. In the meantime, technology further reduces obstacles or restrictions at teaching also promotes independence at coaching education procedure. A technology discussed underneath and are: Virtual, Augmented, and Hybrid Reality (see Fig. 1).

Virtual reality (VR) utilizes a computer graphics system at mixture by a different display with interface tools to give the consequence of fascination at the interactive 3D computer-created surroundings [1, 2]. We term such surroundings a virtual environment (VE) [3]. Research and development (R&D) into VE and VR appliances could be discovered in numerous places worldwide. The VE is generated for teaching, for example, the virtual learning environment (VLE) and virtual classroom [4]. The utilization of VLE at teaching is creating its mark since the VLE raises contact chances among learners and instructors [5]. A VLE allows instructors to perform coaching with learning processes virtually also perform education behaviors that are challenging to implement in the classroom [6]. The VLE further encourages collaborative education; also, a critical aspect of cooperation is social communication. The learners could cooperate with their peers in a virtual world also participate virtually in group behaviors. Furthermore, the VE further encourages modern education plans appropriate for all individuals [7, 8]. Therefore, learners are comfortable with this education model since they could manage their education procedure using their speed.



Fig. 1. Virtual, Augmented, and Hybrid reality.

Augmented reality (AR) was established in the 1950s by Morton Heilig, a cinematographer, who generated a VR scheme with appropriate aspects, for example, a surrounding, however, with no communication. In 1968, Ivan Sutherland implemented the primary AR scheme by utilizing visual transparent head-mounted displays (HMDs) to view the computer-generated objects multicolored by the real-life physical object. AR has used in numerous areas, for example, healthcare, teaching, gaming, entertainment, aircraft imitations, machine fix, manufacturing, and robotics. AR links the computer world to the human world. Additionally, AR is further explained as a technology that permits consumers to observe the actual world through computer-generated objects. At first, the AR was utilized for military purposes to implement a superior aircraft simulator through the US Air Forces Armstrong Medical Research Laboratories in 1982. Currently, AR is further executed in the teaching environment. Numerous researches demonstrate that AR can improve coaching with education skills. Incorporated AR into the teaching environment connects the student to discover the real world by utilizing multimedia aspects, for example, pictures, videos, and texts like additional aspects to perform inquiries of the environment [9]. AR can further increase the incorporation of the actual world by digital education assets at a three-dimension (3D) structure [10]. For instance, AR allows the student to study the complex technical phenomenon in Chemistry, for example, Chemical bonding. Chemistry needs abstract conceptions for comprehensive comprehension. Thus, AR decreases the difficulty of understanding abstract concepts through visualizing the fundamental sources of the covalent bond at the subject of Chemical Bonding [11]. One more instance where the AR assists students is in understanding the solar system.

Hybrid Reality (HR), which comprises AR and VR, is a rising technology also being ambitious and incorporated into new learning. The most notable reason behind the appliances is that persons identified HR acts as an essential also basic fraction at building the knowledge of every object virtually. In any case, the HR gadget was costly as of not long ago; the HR apparatus is adequately inexpensive suitable these days to be linked entirely the more broadly. HR is the consequence of a combination of the physical world. HR is the subsequent development at human-computer interaction (HCI) also unlocks feasibilities with progressions at mobile technologies. Because then, the appliance of HR exceeds display and contains ecological input, spatial noise, with the position. At real-time devices, consumers focus in together actual also virtual circumstances. Compared to the previous techniques, VR is compelled at the virtual surroundings. These communications imitate our usual communication activities; for example, an object receiving more significance like a person gets nearer, also a perspective changes like that person shift approximately an entity.

The remainder of this paper prepared as follows: Section 2 explains the associated work. Section 3 describes a Hybrid reality-based education expansion system for intelligent learning in detail. Next, section 4 gives the experimental validation. Lastly, the end of the paper is provided in section 5.

## 2. RELATED WORK

Dinis et al. [12] proposed VR appliances implemented with the first-year student through an introductory class of an incorporated Masters at Civil Engineering explained. In addition, two tests regarding AR and VR applications to Civil Engineering held in the local high school are further described. After the trials, learners were reviewed. Also, information was gathered.

Nanthanasit et al. [13] presented a technique to combine an AR scheme with real-time depiction to improve art teaching, which creates a novel education skill also superior excellence of coaching. Along with the topic concerning shade with light, which every art learner should understand. Through learning how light functions over a first quantity of the shape, for example, the cube, cylinder, sphere, also the learner would be capable to sensibly shadow also deliver necessary forms be organized to sketch very multifaceted subjects. But, the coaching procedure is challenging for a learner who did not have skills at Shade and Light to know the technique clearly through illustrated books. Augmented reality technology can support an efficient method to explain how shade and light task demonstrates the form at 3D by shade and light. The light source could shift approximately to cast the various forms of shadow and light from the real-time rendering technique. It is easy to use and know for students.

Education to act as an apparatus is difficult for together adults with children. Totalling to this, music teaching at K-12 frequently is topic to financial plan cut. Serafin et al. [14] suggest that VR might present kids with an option technique to attaining musical abilities. Firstly, they offered a summary of the modern software with a skill for virtual [15]. The AR at music also summarizes the sequence of deliberations on how VR and AR could assist music learning.

Ying et al. [16] provided a modern education technique VREX (Virtual Reality-based Education eXpansion), by a mixture of offline also online, enhancing the prospectus also constructing education practice. VREX uses Virtual Reality (VR), and the authors consider VR could transform the education system. With a few trials, the authors found VR could encourage curriculum competence in the immersive surroundings; thus, those learners could have the intuitive intelligence to know little abstract data, which is forever complicated for instructors to explain. The authors attempted to transmit slide to VR prospects for learners to study ability at the somewhat actual however entirely virtual world. Significant assistance was prepared: (1) VREX construct a free also fascination virtual O2O classroom by VR devices with the internet; thus, those real classrooms may utilize various methods at the upcoming. (2) VREX presents a disseminated manner for learners to familiarity a communicative education procedure anywhere, anytime, also on any occurrence. (3) VREX could utilize to sustain learning at various regulations, from K-12 to university. The authors presented a few realistic cases, similar to 'Marine Life', to demonstrate individuals at the marine, who offers an immersive knowledge to constructs learner, feels they were present. Lastly, a possibility also benefits of VREX verified through actual statistical records at the 3<sup>rd</sup> period of 2017.

Weiner et al. [17] had past victorious manufacturing efforts at using Second Life to execute a virtual reality world into both nursing education and practice. Their current efforts center on a virtual reality application that presents learners with the opportunity to master competencies in using ultrasound technology, which has surfaced numerous nurse practitioner certifications like an essential ability. Using the authoring tool of CenarioVR™, also capture video footage of a nurse practitioner utilizing the ultrasound tools, students could don a VR headset for immersive knowledge. These ultrasound tools are costly, and letting learners study abilities in a virtual environment proposes fewer risks to both the tools and the patients.

The augmented reality (AR) system has achieved a particular stage of maturity in educational systems, and its efficiency has been broadly verified. Numerous related studies have decided a trend, affordance, and rising knowledge at learning surroundings. But, this learning is doing not suggest a realistic resolution that intends to resolve the challenge with problems discovered at AR schemes. There are still few issues that require being addressed to get the most excellent of this technology also guarantee the most suitable combination of AR into education. There are still unexpanded areas of the appliance in that AR schemes could assist in developing the potential and enhance learning procedure. Garzón et al. [18] suggested five guidelines for upcoming study approximately feasible resolutions for a few of the vital challenges of AR appliances for learning. These suggestions are using the related work of 50 learnings issued from 2011 to 2017 in a scientific journal. Accordingly, the authors provide a principle for practitioners and developers to maintain to enlarge the precise combination of AR schemes into the educational environment.

New VR equipment for learning often appears on the market. However, it uncommonly has open attributes. Johnston et al. [19] discovered and classified principles and practices of prominent pedagogy, however not uttered at chosen VR appliances for learning. A study of public substance for VR appliances demonstrated most were empirical though others classified like situated cognition, constructivism, discovery learning, unclassified techniques, or direct teaching. VR designers and educators can use a transparent

teaching framework to sustain faculty development, stimulate feedback, develop insights, and create a comprehensive and consistent curriculum selection that ensures innovative and evaluative results.

### 3. HYBRID REALITY-BASED EDUCATION

The hybrid reality, when combined with AR and VR, creates a magical experience for the students because they can communicate with their concepts in virtual objects form as if they survived in front of them. The hybrid reality, if utilized in its best possible way, can help education to reach the next level and revolutionize the student's experience. HR is a consequence of combining a physical world. HR is subsequent developments at HCI also, therefore, unlock potential through progression at mobile technology also novel HR devices.

About VR, there has progressed from devices that merely permitted the transmission of data at single intelligence, expressly, those that simply provided for observation. At present, the technology is by now at an exceptionally superior version. There has been a vital task at raising a communication of the consumer by surroundings. It offers an added value over critical because it allows a human being to experience similar to the actor at circumstances, exceeding being the meager viewer. Visualization forms the packages constructed for the utilization of skill. Two kinds of visualization apparatus could set up. Those offered wholly to this ending, between which a leading exponent is a brand HTC Vive and Oculus Rift. These are apparatus that considerably go beyond \$600 also need a computer by massive processing facility, that takes an entire collection of device essential to enjoy a skill by VR to surpass \$3,500. It cannot forget which apparatus provided through Sony for elite utilize over its PlayStation platform sell out at a 2016 Christmas campaign for fewer than \$400 per apparatus.

Conversely, there are inexpensive devices that have utilized the processing ability of smartphones. These are simple housing with various aspects, relying on their frequently moved cost underneath \$100 per device. They present headphones with glasses in many cases. Several producers, similar to Samsung, have added the tiny trackpad, which permits improved communication of a consumer by surroundings. Others have included a headset with enhanced sound excellence. These manufacturers did not offer additional devices, which would increase communication like a dedicated device. However, further, through the increase in smartphones' dispensation ability, other devices would be obtainable. Followed by the many well-liked assemblies is totaled up of aspects provided through the same producer, in addition, lacking compatibility by further dealers. Over a year before, fewer important companies begin initiation tangential presenting compatibility by various packages advertised through significant trademarks.

Furthermore, it enlarges potentials for a developer with low costs by enlarged opposition. It provides consumers enhanced choices; in addition, the capabilities have been implemented. A clear case of this kind of constituent is haptic gloves formed through establishing in 2015. One more necessary element of the immersive experience through VR is the physical mobility of an actor. Until extremely recently, the display with the sound device was required to join to the processor through cable. It restricted communication by deducting comfort from the knowledge. Presently, the producer has previously openly presented the main prototype, free of this cabling, constructing wireless links. The consumer advantages at mobility also with it, at comfort, can interrelate by a programmed surrounding. Regarding AR, two obvious conditions of technology could explain. At first, the primary appliances which arranged utilization of this technology concentrated their value involvement on an understanding of symbols or codes, also a replacement at a scheme of visualization through previously programmed features.

The precise instance of this is an appliance that permits a consumer to place over on furniture spaces of the catalog to near how they will robust if they buy also install. One more example that has supposed a massive quantity of profits for a corporation which set it on the marketplace is a game utilizing Pokémon animation. Using a camera which an enormous more significant part of smartphones has, it places over animated characters over the near reality. The effect on the marketplace has exceeded some confident anticipation on the fraction of its manufacturers. They are thus obtainable appliances which superimpose digitally produced images on images taken from the actual surroundings by together images viewing on a tablet, mobile screen, or any connected device.

Another line of energy is AR glasses. Though offers are increasing each year, the Microsoft HoloLens device has unquestionably opened up the market, constructing solid appliances, and up to now has only been cinematic fiction. This gadget maps the virtual environment approximately. It magnifies its viewer information, gets the person's eye to realize the new images, and is digitally integrated into the same reality. A few of the notable events demonstrated in the ad are redesigning, and interiors designing also calls among persons, adding both partners into the same room. The result is that each speaker has a digital image with length also movement that is fully synced by the one more ending of the communication, simulating the other person's hologram.

Like the SCIEN-hosted workshop at Stanford, the HR demos displayed on a large screen in front of the conference participants' room are attractive. For instance, the Mars experience for HoloLens looks similar to what you are nearly in Star Trek HoloTech. Likewise, it is compelled to see Meta CEO Maron Griffets blowing windows with his hands, similar to the performer of a symphony orchestra.

### **3.1 Learning-by-doing: HR makes it easy to teach any subject**

There are two methods to use HR in the classroom. The primary is very conventional; this includes the desktop where students discover the VE utilizing a PC, mouse, keyboard, or any other input device, for instance, a wireless controller: It is well defined like VR.

Next, we use nowadays to discover real HR: This is the full in-depth experience of wearing HMD and motion controller to communicate by the surroundings created by the combination of real and virtual worlds where digital and physical objects are combined.

Thanks to this HR, students could manipulate and touch objects that create more comprehension, which does not stop. Students could communicate by dataset, complicated formulas, and concepts of an abstract that are hard for teachers to realize by verbal instruction. For numerous learners, truly, it is simpler to learn by doing than by listening.

This second type of HR offers a very charming, amusement and efficient education experience than the first experience. It goes in the absence of that entire other conventional education techniques. Also, this is right for any subject:

#### **Hard Science**

Astronomy, geography, anatomy, and Biology - conventionally regarded as the most complex - offer novel education chances for interacting by dimensional shapes, animals, the human body, and the surroundings.

#### **Social Studies**

More classes worldwide have previously tested HR to plan architectural methods, reconstruct natural or historic sites, discover abroad also interact with a novel, various cultures. Topics associated with literature eventually became "actual" also "initiative" due to the immediate sense of time and place presented through HR devices.

#### **Art and Creativity**

HR promotes cooperation between learners, faculty, and outside tutors, providing the opportunity to task together remotely. Let's imagine an artist will call a class to an exclusive workshop at his studio, the curator leading thousands of kids on every side of a museum or an actor guiding an actual-time master class with learners from worldwide, collaborating on them in a general theatre piece.

### **3.2 How students can bring HR experiences to education:**

The major two devices are Immersive Devices and Holographic Devices, are needed for HR experience to education.

#### **Immersive devices**

Immersive devices provide non-translucent displays which block the real world completely. These devices use cameras for tracking. For example, Acer and HP [20] provide Windows mixed reality headsets.

#### **Holographic Devices**

The translucent glasses take place in holographic headsets, which permit the user to see and feels the surroundings. Hologram creates virtual experiences. For example, Microsoft launched Microsoft HoloLens in 2016. HoloLens head-mounted see-through display device can carry out a spatial mapping and display 3D holograms precisely in specific environments [21].

To provide a superior plan of how MR is altering the learning scenery, below are the top 5 HR apps presently obtainable for utilizing at the market.

#### **HoloStudy**

HoloStudy is an HR learning tool implemented for Microsoft HoloLens 2 that could be utilized everywhere, everyone, to attain a superior appreciation of human beings [22]. It makes simpler complex subjects similar to medicine, geology, chemistry, biology, and physics. The entire while it is engaging learners at an innovative method.

### HoloTour

HoloTour is one more inventive app implemented for the Microsoft HoloLens 2, which harnesses HR to transfer consumers to various periods and places [23], [24]. Through entering these HRs, learners could experience the happiness of immersive education also advantage from informative area tours to the various country significant instants at person record, the entire with no still have to leave their classrooms.

### HoloHuman

HoloHuman provides learners with the possibility to increase a deep sympathetic of person anatomy through discovering comprehensive, under-the-skin holographic demonstrations of the human body [25], [26], [27]. This completely immersive experience permits the learner to discover a life-size body also understands how they perform at a novel also thrilling method.

### Lifelique HoloLens

Lilique combined with Microsoft HoloLens to implement this distinctive app that gets an interactive 3D method to instructors, learners, and schools [28], [29]. Through combining HR methods also lesson strategies into each day's classroom experience, Lilique could assist get teaching to life also employ learners at a technique that was once considered unfeasible [30].

## 4. EXPERIMENTAL VALIDATION

A collective of 103 evaluations of the 35 visualizations attained. For this evaluation, we acquire the information presented through a national university of Columbia that used the arrangement with four dimensions content, functional, aesthetic, and educational. Table 1 shows viewpoints to assess at every size, a level for an evaluation was from 1 to 5, being 5 "clearly agree" also 1 "strongly opposes this scheme." A methodology of an experiment incorporated the moment where the learners did their communication by a Visual demonstration of items through utilizing mobile devices and markers. Next, the learners assessed every visual object using the survey—the information, when computed, presents the subsequent consequences in terms of average with standard deviation. In addition, Fig. 2 demonstrates the graph for the total lower values.

From Fig. 2, you could realize that all the dimensions are higher than the average 4.1. The best qualifying dimension is education worth 4.43, and the lowest qualifying dimension is 4.12 worth of content. These results could conclude that the visualization of items at AR prepared that they have done the enjoyable attention to the target populace.

### Advantages of HR in the classroom:

HR provides expert teachers novel, inventive feasibilities to discover by student's gratitude to its aspects:

- **Universal:** HR in school promotes people-to-people interactions, regardless of community, economic or geographical inequalities.
- **Involvement:** Direct experience creates a great method to impress struggling learners or present one more chance to increase participation during school lessons.
- **All-Purpose:** As stated before, HR could be utilized to coach all topics since it is simpler to view and hear than to explain something, with abstract ideas above all else.
- **Distant worlds:** Utilizing HR, learners and tutors could go back in time also interact with humans, animals, and objects that no longer exist: Dinosaurs and superhuman get a new, very realistic image in the minds of students.

**Table 1.** Various dimensions Deviations

Dimension	Average	Standard Deviation
Content	4.12	0.61
Functional	4.25	0.52
Aesthetic	4.39	0.59
Educational	4.43	0.47

## 5. CONCLUSION

This paper discussed the tendency of technologies utilized in the education domain. This work also addressed a part of the excellences of each novelty to be used as a fraction of the teaching and learning procedure, learning flexible state learning at the training area. Besides, we further attained the information

presented through the National University of Columbia also provided a few comprehensive imminent on the communication among the HR mobile appliance utilized through the learners. The consequences have been tremendously in favor of getting the HR-based portable devices into the contemporary learning scheme.

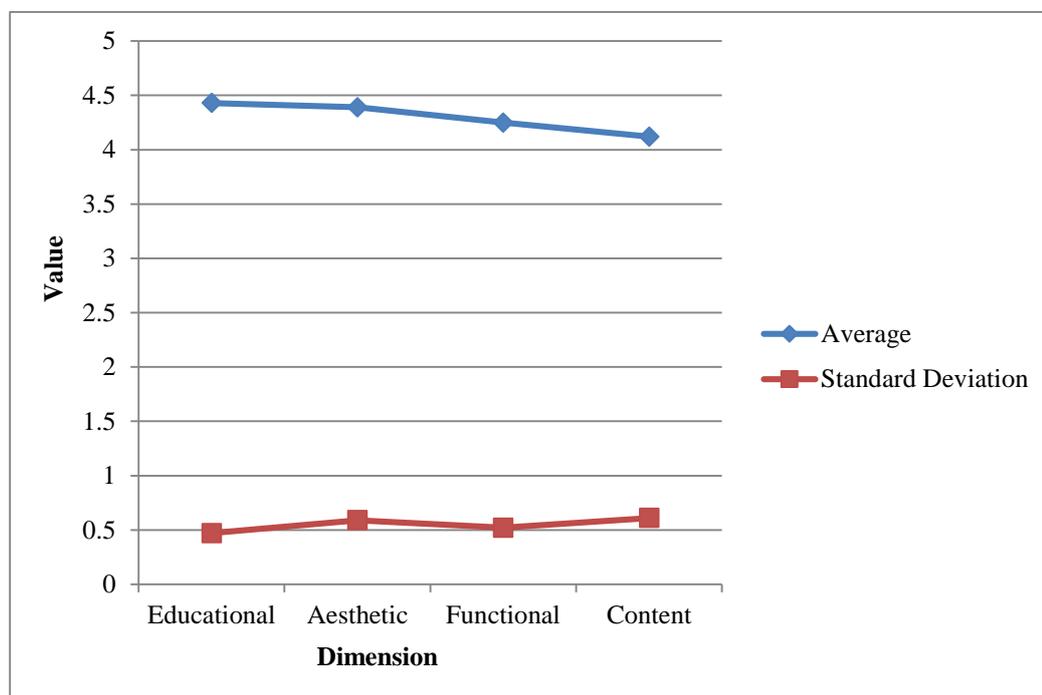


Fig. 2. Deviations in Different Dimensions

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