

Exploring 3D painting and Joyful Learning with Virtual Reality Tilt Brush

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Abstract

Virtual Reality is a computer-generated simulation through which an individual can interact within an artificial 3D(three-dimensional) environment which gives users the ability to have a realistic experience. This study aims to understand how Google's Tilt Brush in Virtual Reality as an art tool enhances Joyful learning experience among architecture Students in a classroom setting. Interviews and questionnaires gave the study a breakthrough analysis. This paper also discusses the challenges and limitations of implementing Virtual reality in a classroom setting. Virtual reality integration encourages students to believe in the importance of technology in digital education and emphasises the idea of developing alternative creative processes and joyful learning experiences in them.

Key words: Virtual Reality, Tilt brush, 3D, Joyful learning

INTRODUCTION

Context of VR technology

Virtual reality (VR) allows a human to interact with a computer-generated three-dimensional environment. Users wear head-mounted displays and are immersed in a digital environment in which their movements are synced with their real-life movements, producing a one-of-a-kind experience. Virtual reality can benefit education by allowing students to participate in memorable and engaging experiences that they would not otherwise be able to have. Students can be engaged and inspired in a unique and powerful way through virtual experiences. Immersion, interaction, and user involvement with the environment and narrative have a lot of promise for making learning more motivating and engaging in education (Bates, 1992). Virtual reality has a wide range of application. It has been used in gaming, education, military training, and fine arts since the 1980s (Schroeder, 1993). Immersion, presence, and the capacity to move freely, interact with virtual items, and communicate with other users in the virtual environment are all elements of VR, according to Hew and Chung's study (Hew, 2010). The form of digital media art creation is more rich, creative works are more innovative, and the quality level is higher as a result of the integration and use of virtual

reality technology (Li, 2022). Art education is always incorporating new technology and broadening the toolset available to students to create with (Vossoughi, 2018).

Tilt Brush as an Expressive Art Tool

The possibilities of mixing virtual reality with digital art are astounding. Virtual Reality allows users to turn any location into a canvas, allowing them to experiment with various textures and artistic materials. Interaction resembles that of a conventional painter at work on a vast canvas. Strokes made in the virtual world can be used to create a cohesive scene. The definition of artistic medium is one of the ways a painter makes a meaningful scene through a sequence of strokes by changing the size, shape, colour, and texture of the stroke. Artists are free to create expressive brushes, then step back and examine their work from various angles, as the sketch can be shrunk, enlarged, or spun. Artists have reacted favourably to the new medium, which enables them to create advanced 3D digital drawing in VR.

The Tilt Brush app is simple enough for anyone to use to produce immersive 3D artwork, and both the artist and future viewers will be able to walk within the artistic world (Avila, 2016). Users can focus on their vision and proprioception to perceive distinctions between 2D and 3D paintings thanks to the immersive experience provided by a virtual environment by eliminating the external noises (Ho, 2019). "Not achieving an endpoint, but opening things up—giving pupils an expanded sense of what's possible in drawing and visual thinking" is the purpose of employing digital tools (Tilt brush). It's thrilling for users to be able to use Tilt Brush and virtual reality to build their own process, which has never been done before. The possibilities for digital painting odyssey are endless. (Vossoughi, 2018). The range of expression observed was found to change as a result of the immersive experience. The digital quality of the artwork, as well as the opportunity to study each brushstroke via tools like Tilt Brush, allow for a unique kind of reflection on the process (Kaimal, 2020).

Artistic potential of VR ART

Artists can use virtual reality to create fully immersive illusionary spaces. Materiality, movement, and spatiality can all be radically recreated in this new domain, which is part of what makes VR art so intriguing. It also works in a situation where physical laws like gravity don't apply. The VR works are incorporated in massive, site-specific installations in the VR art exhibition "Resonant Realities (2021)," and the artists' virtual concepts find an echo in the physical exhibition space. Lauren Moffat wins the first prize for Image Technology Echoes. The artwork aids in experiencing and immersing oneself in Moffat's characters, and leads to a reflection on the possibilities of virtual reality as a medium, as well as a meditation on human interactions and individual world perspectives. The transnational partnership association of virtual reality VR work "La Camera Inssabiata" by Taiwanese new media artist Hsin-Chien Huang and American famous artist Laurie Anderson won the VR Best Experience Award for the new virtual reality contest project at the 74th Venice Film Festival. "Through VR, this medium has given me a chance to be entirely liberated: Imagination is the only restriction," Hsin-Chien Huang said in his creative statement. Virtual reality opens up ingenious creative artistic opportunities.

As the spectator becomes the centre of an artistic experience, the medium of virtual reality brings about a paradigm shift in the creative process, its encounter with narrative frameworks, and its reception and perception. You are no longer viewing a work of art from afar; instead, you are standing right in the heart of it. The Resonant Realities (2021) explores and critically analyses the aesthetic possibilities of modern technologies, as well as their impact on individuals and society. The prize intends to assist in the structural establishment of this new visual art medium. Visual artists are frequently interested in reflecting socioeconomic or cultural situations, or they are interested in exploring the possibilities and limitations of their medium. For the first time in art history, virtual reality allows users to fully immerse themselves in an illusionary realm. However, it is still seen as only a novelty, a toy for amusement. As long as potential buyers don't comprehend why they should spend money on a gadget when it seems reasonable to buy high-end smartphones it is hard to perpetuate.

We developed a course for architecture students to learn about and create art in an artificial virtual environment (Artificial virtual environment is a term coined by Zimmerman in his study on virtual reality technologies as a medium for artistic expression (Zimmerman, 2001), as well as to give students hands-on experience working with virtual reality environments. In the following parts, we'll go over the course's overall structure, the student perspectives, our assessment of the course, and the problems that students experience in a virtual reality classroom.

Research Gap

From the existing studies the researcher has found there is a requirement to study digital drawing skills in virtual reality and how it is creating a joyful learning experience in students in a classroom environment. Many studies have been done on virtual reality, but works on tilt brush is going unexplored. Despite the fact that much work has been done on a worldwide basis, research has demonstrated that there is a need to investigate virtual reality on a domestic level. The scarcity of virtual reality resources and research in India, Bangalore necessitates the audience learning and utilising the numerous benefits of virtual reality.

Aims and Objectives

This study aims to understand how Google's Tilt Brush in Virtual Reality as an art tool enhances Joyful learning experience among architecture Students in a digital classroom. This paper also discusses the challenges of implementing Virtual reality in a classroom setting.

THEORETICAL FRAMEWORK

The scientific revolution that led to the constructivism paradigm deeply influenced the concept of education and new technologies, starting with a new model of reality, knowledge, and pedagogical practices mechanisms. A view of this relationship provides a broad and coherent conceptual framework for the educational value of even modern virtual reality systems, beginning with the importance placed on the subject's activity in building knowledge, which is inseparable from contextual elements because it is necessarily

"situated". The phenomenon of knowledge, according to the epistemological perspective, is mainly driven by a construction phase and exegesis that is based on personal experiences, psychic structures, and experiential mechanisms that are strongly embedded in the individuals corporeity and in real and/or simulated settings.

As a result of the use of technology based on constructivist approaches and centred on the improvement of action, practise, and context (Jonassen, 1991), teaching practises gain their own value. As a result of these principles, virtual reality becomes a test of cognitive structures as well as experience, facilitating knowledge transfer. The constructivist paradigm also offers up completely new teaching potential through the use of virtual reality tools, attributable to the complexity of isolating learning processes from their context, in which crucial cognitive exchanges are achieved through action.

Virtual Environments for Experiential Learning

Kolb proposes a four-stage learning process in motor sense model (1975) that follows a cyclic structure:

- In skills based on real experience, where learning is primarily produced through perceptions and reactions to experiences, feelings, complexity, and an intuitive approach are highlighted.
- Reflective observation approaches, where learning is primarily focused on listening and observing, and where emphasis placed on comprehension, in-depth analysis, and correctness, along with reflection.
- Detailed analysis and abstract conceptualization abilities are achieved primarily through imagination, theory processing, and a scientific approach.
- Active experimentation abilities can be demonstrated by engaging in action or involvement, experiencing, analysing results, emphasising practicality, focusing on what is practically doable (rather than what is accurate), and doing (Aiello, 2012).

The use of systems that construct virtual worlds occurs in workshop activities that encourage learning that employs experimental methods in which the abilities of perception and the action of the body interact in favour of cognitive processes is obvious in this view of learning.

METHOD

Because action research is both a design and a strategy for change, it was used in the research design. Action research is an iterative process in which academics and practitioners collaborate on a set of tasks, such as problem identification, action intervention, and reflective learning (Avison, 1999). Action research is a transformation tactic as well as a design. This project was started with the goal of developing and implementing a change as well as drawing conclusions. The study is a quasi experimental pre test post test design because it involves the manipulation of an independent variable without random assignment of participants to conditions or orders of conditions and allows for the uncomplicated evaluation of an intervention applied to a group of study participants.

Data collection and analysis

The data is gathered using a mixed method approach since the data cannot be quantified or qualified just to get an accurate conclusion because both comprehensive, contextualised insights from qualitative data and generalizable, externally valid insights from quantitative data are required. Questionnaires were used to collect data, and at the end of the process, Interviews were conducted to analyse the findings in relation to the Virtual Reality Tilt Brush application.

Scale Development

Demographics of the participants

The fundamental demographics of the participants were acquired in the pre-questionnaire. Participants were also polled on their experiences with virtual reality. This section's questions covered previous participation in VR research, age and average hours of playing each week.

Table1. Demographics of the participants Frequency

No of Participants(n)	20
Male/Female (n)	6/20
Age	
Minimum – Maximum	22 - 24
Mean	23
Prior VR experience	
Yes	16
No	4
Avg usage per week (Hrs)	
>1	17
<1	3

Results of analysis of scale items

Content and Scale Validity

A comprehensive literature review and conceptualised item formulation were used to create the questionnaire. Axis of the Extraction Method The scale was validated using factoring and the Oblimins rotation method. The scale validity was determined using Factor Analysis. The scale's items were created with the help of experts as well as input from the target demographic. The data is gathered using a five-point Likert scale.

CVI scores of at least 0.80 with two expert ratings are considered acceptable (Davis, 1992). Expert 1 has a proportion relevance score of 0.96, whereas Expert 2 has a score of .84. Based on the Content Validity Index average and the Item Content Validity Index (I-CVI) and Scale level Content Validity Index (S-CVI) Universal Agreement (UA) average, the scale attained a sufficient degree of content validity (>0.80).

Table 2. Computation of an S-CVI for a Scale With Two Expert Raters*

Proportion Relevance

Expert 1* =.96

Expert 2* = .84

SCVI = .9

UA = .84

The following is a list of the resources that were used during the qualitative data collection process: All participants were asked "Can you share your experience of VR classroom" and "According to you, what are the challenges you faced in VR classroom" as part of the discussion establishing students' expectations of implementation of VR into a classroom setting. If necessary, appropriate follow-up questions along the lines of "Can you tell me more about it" were asked. With the help of a smartphone, all of the discussions were audio recorded. The tapes were transcribed by a transcriptionist. In the method indicated by, the transcripts were analysed and important themes and frequency of replies were found (Pope et al, 2000). Any discrepancies were rectified by reanalysing the transcripts together after independent examination.

Participants and recruitment

This study was carried out with fourth-year architectural students. The experiment involved a total of twenty students, fourteen of whom were females and six of whom were males. The instructor taught the students Design Principles through narratives and illustrations. Despite the fact that the students had experienced Virtual Reality but had never used Tilt Brush, they expressed an interest in learning on new digital media. The information was acquired through observing the participants. Because Joyful Learning is a good intellectual and emotional state of learners obtained when an individual or a group derives pleasure and a sense of satisfaction from the process of learning and to understand, observations were chosen as the primary technique of data collecting (Widyawulandari , 2019). Each observation was recorded using field notes, and we interacted with the students while they were using virtual reality, asking clarifying questions about the functions done by the students in order to better understand how they understood their work. The observations' field notes were analysed (using previously generated codes) and also used in the item generation phase of scale construction.

Procedure

Participants were placed into four groups, each with two students (Groups 1, 2, and 3 had two students, while Group 4 had three), and they all went through the identical procedure. The lesson always began with a warm-up that included the virtual reality game Beat Saber. Gamification is the best training approach for warming up the participant before going into Tilt Brush Tool since it increases the interest of learning processes, originality, fun, productivity, and the capacity to retain knowledge and develop new abilities (Dale, 2014).

They eased into the sketching by learning the steps of the process and practising with the VR Tilt Brush tool. Participants were first educated about design aspects and principles before being shown how to utilise the Tilt Brush Tool. They then put on the Oculus Quest 2 HMD and held controllers as we explained what each button did. To avoid simulator sickness, the participants were only given 30 minutes to utilise the apparatus. During an even semester, the course was offered. The classes were three hours long and held on Thursdays. By the end of the semester, students had a final project submission and viva for performance evaluation, which were required for holistic educational course completion. The students took a pre-test and a post-test before and after the intervention in the study. The participants' knowledge levels were assessed during the pre-test to determine if they were eligible to participate in the post-intervention test. From the beginning to the finish of the course, each participant's experience was unique.

Pre test Questionnaire

Along with the demographics of the participants, a qualifying exam was also administered following the theoretical sessions. The goal is to ascertain the students' level of knowledge. The questions for the test were derived from Design Principles theories. The course content was separated into three portions (eg. Introduction to Virtual Reality, Elements of Design and Principles of Design). Depending on the topic, the test consisted of a number of multiple choice conceptual questions. Angelo and Cross (1993) suggest that the assessments include only a few questions that most students should be able to answer properly and that technical Jargons be avoided. The tests were graded on a twenty-point scale. While the pre-test result was not utilised to determine the students' course marks, it was recorded. The students were given class time to work on the pre-test questions.

Course Objectives

The primary goals of the course were to:

- To use Tilt Brush knowledge in the creation of art work
- To use drawing and design skills to graphically communicate abstract notions with Tilt Brush
- To observe data and convert it into graphical drawings

The Instructor

The course instructor has taught Design classes at both the graduate and undergraduate levels, as well as a wide range of other courses across the curriculum on a regular basis. Since 2010, he has been fascinated by art and technology.

Classroom Time

Traditional lectures, group topic presentations, demonstrations, and group-lab time were all employed throughout class time. In the beginning, a small fraction of the entire course was used to teach how VR works. Design principles, health and safety warnings, and a discussion of various creative themes relating to virtual environments were among the topics covered. The completion of the course required attendance at all sessions.

Course Assignments and evaluation

Throughout the semester, students were required to make a variety of art works of increasing complexity. Because the syllabus was broken into many divisions, the students developed art works for each course. These tests aid in a thorough investigation of the subject. However, in the end, they each created a single composite artwork that combined all of the units covered.

For the first projects, each student took theory lessons that covered the fundamentals of design principles as well as well-known art movements and styles. The goal was to familiarise the participants with virtual reality digital drawing skills. We made certain that everyone had an equal opportunity to participate in the course.

Because this course was introduced as part of their academic programme, CIA (Continuous Internal Assessment) and viva voice were required at the course's final phase. Each assignment and viva voice was scored using a holistic rubric technique and descriptive scoring schemes, which are made up of three parts: evaluation criteria, quality definitions, and scoring strategy.

Hygiene

The gadgets were distributed among the group's members. Because the HMD requires intimate contact with the face, proper hygiene precautions were taken. Because the device was passed around the group, the students used disposable stretchy circular caps. Given the COVID'19 pandemic condition, hand sanitizers were regularly used.

Virtual Reality Tilt Brush

Tilt brush is a Google-available 3D application created by Skillman and Hackett (2016). With virtual reality, you can paint, draw, and build in 3D space in 360 degrees. It offers audio reactive features, as well as multiple brush materials and shaders, and allows you to save sketches into the Unity editor. The dynamic brushes in the palette may be used to produce everything from ink to smoke and fire. To use Tilt Brush, the user will require a headset or VR glasses (Oculus, Quest, or Rift), two controllers, and a computer. The files we worked on with the virtual reality tilt brush can be saved in the Oculus quest 2, but you'll need a computer to transfer them to a system. The application consumes 589.6 MB of memory.

Tilt brush files in 3D

Previously, the tilt brush models were exported to Google Poly, Google's 3D content engine. Google Poly was unfortunately shut down on June 30, 2021. There are, however, various options for exporting the model. The most popular technique is to upload directly to Sketchfab (an online platform for 3D model display). To publish, the user must first establish an account and log into Sketchfab. Furthermore, the model can be downloaded directly from Sketchfab. Manually exporting a 3d model from tilt brush creates a .glb file that can be used in a variety of modelling products (Blender), game engines (Unity utilising the tilt brush sdk toolkit), and visualisation platforms (styly studio).



Figure 1.

Another popular format for manual export is .fbx, which is compatible with most modelling and animation tools. The tool also allows you to import a 3D model to enhance/optimize it. The 3D model must be dragged and dropped into the tilt brush local folder by the user.

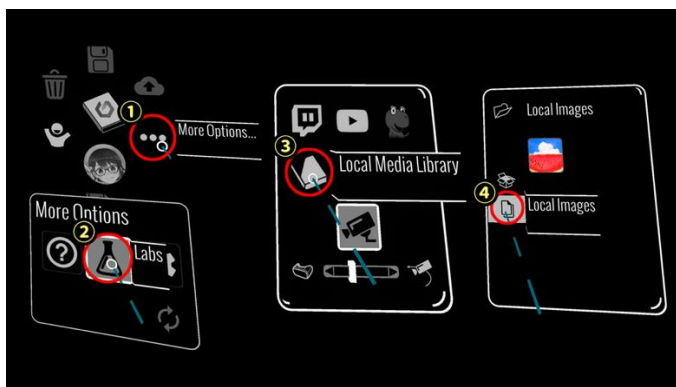


Figure 2.

Fig 1 and 2. Tilt Brush Tool Palette UI

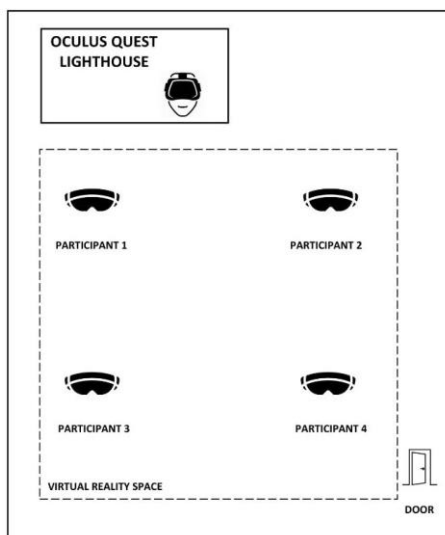
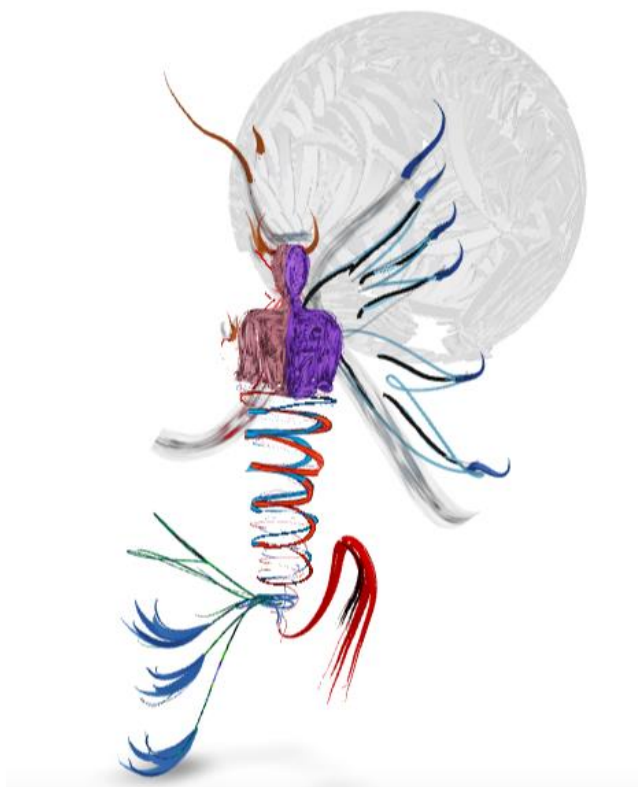


Figure 3. Diagram of the virtual reality experiment environment



Figure 4. Students in their VR space



(a) Perspectives



(b) The protector

Figure 5.(a) (b) Results of students

Data Analysis and Presentation

Students were invited to complete the 'Virtual Reality and Joyful Learning' Questionnaire, which was based on a Likert scale, after completing the assignment. The findings, which include a summary of the virtual reality classroom's experiences as well as discussions with the participants, are presented to demonstrate the outcome of usage of tilt brush in the classroom.

Findings

Knowledge level assessment

Table 3. Pre – Test Scores

Results of the Pre- test		
Topic	Mean	N
Introduction to Virtual Reality	6.9	20
Elements & Principles of Design	6.5	20

Because all of the students scored more than 50% on the pre-test, they were all eligible for the intervention. There were no absences or withdrawals throughout the test, therefore the number of participants remained constant.

Tilt Brush and Joyful learning experience

Participants were asked how Joyful they could be in virtual reality classroom. The participants were questioned about a number of assertions relating to virtual reality and enjoyment among participants, on a 5 point scale(1='strongly disagree' to 5= 'strongly agree'). The participants gave the highest score to enjoy working in virtual reality class; 'I enjoy working with VR tilt Brush in VR class: 0.84 range 2-5). Subsequently, participants gave a score to ' Virtual Reality helped me to be innovative in the classroom 0.88 range 2-5). The statement 'I feel engaged while participating in activities in the VR class scored 0.73 (range2-5). I did not notice time passing while using VR tilt Brush had a score of 0.69 (range3-5). The final statement 'VR classroom stimulates me to explore more' had a score of 0.70 (range 2-5).

Table 4. Tilt Brush and Joyful learning experience

Results of the Post- test		
	SD	Range
I enjoy working with VR tilt Brush in VR class	0.84	2-5
Virtual Reality helped me to be innovative in the classroom	0.88	2-5
I feel engaged while participating in activities in the VR class	0.73	2-5

I did not notice time passing while using VR tilt Brush	0.69	3-5
VR classroom stimulates me to explore more	0.70	2-5

Challenges of using VR in a classroom setting

The second question, 'What are the concerns and challenges of employing virtual reality in the classroom?' was answered through an analysis of the discussions with the participants. Themes emerged from the thematic analysis are affordability, health concerns, exhaustion, and change.

Health issues had been mentioned by several participants as an issue while using VR in the classroom.

“Last few days I felt dizzy and had some problems using virtual reality.”
[Passang, 24 years]

“I have a condition wherein my eyelids start swelling and this made it difficult for me to use VR headset during that session.” [Chirag, 22 years]

“The VR experience after the session takes a toll on your mind. You feel tired. Your head hurts and the dissociation from the Virtual Reality to the physical world can sometimes be disappointing if you seek consolation within or use it as an escape from the real world.”
[Nidhi, 23 years]

“I had severe toothache, due to my tooth extraction I faced difficulty in using the VR headset.” [Chaithanya, 22 years]

“In most cases after using it for more than 20 minutes I get tired with my eyes. And need a break for 15 minutes before continuing to the next turn to use. So that’s one of the drawbacks I found and also the color, tilt brush has good colors but some of the colors suddenly are getting into eyes like neon and all when I explored that was disturbing.” [Renin, 24 years]

The participants also mentioned that Adapting to VR was challenging.

“Initially I was a bit scared to use VR” [Spurthi, 23 years]

“The initial stages had faced some difficulties in terms of wearing it with spectacles and adjustments . During playing games sometimes there was a clash with controllers where we move our hands in opposite directions. The most challenging parts of this entire program was getting in the hang of VR oculus for the first time and exploring the tools.” [Sai Madhuri, 22years]

“...in the initial stage I could not do it completely as I have claustrophobia into space but eventually I got along with it”. [Shani, 22 years]

“...A bit difficult as I am wearing glasses.” [Alfiya, 22 Years]

Participants had mentioned that the device is too delicate which affects daily use.

“Initially I was a bit scared because the device should not fall down and something should happen but then I got used to wearing it...” [Shilpa, 22 years]

“Have to be more careful as it is made of glass” [Subiksha, 22 Years]

Change was another factor that affects the use of VR in a classroom.

“The most challenging part for me was that when I started with an art I forgot that I can literally go 3d, as in paper we do 3d but that is brought out through perspective, shading, texture etc but here we have to create volume to make it look like an object. I started with my first assignment which was a dot, so it was a flat figure.... I could have made a 3d out of it.”
[Abin, 23 years]

A participant also informed that affordability was an issue in using VR in a classroom

“For me this was a new experience, even though I was aware of the technology but never thought that I could use it” [Veronica, 22 years]

Exhaustion caused an issue in successfully implementing VR in a classroom.

“...initially I felt a little tired after 15-20min but I have got used to it now... [Sarah, 22 years]
The VR experience after the session takes a toll on your mind. You feel tired. [Fathima, 23 years]

Challenging part of the VR was we get tired after 20min of use, Though it is exciting we are tired.” [Catherine, 22 years]

Rigorous action also resulted in causing sweat which was difficult to wipe with a VR headset

“...Then during the working with VR after 15-20 minutes had mostly started getting sweaty around the headset zone which is a little bit uncomfortable.” [Sakshi, 23 years]

Participants found that many apps and the device itself was still developing and needed lot of improvements before being using in classroom

“I think VR was kind of a fun class but if we look from the side of architecture, it is not there yet I think. We were not able to explore that side of it. I don't think it can be used on a big scale yet. Maybe it is not, it will take a bit more time to develop so it comes to the level

where it can be used as part of architecture. But there may be chances to be in the market in some years.” [Claudio, 22 years]

“In Terms of tilt brush I feel they have to develop more because it is complex because when we draw certain lines are going in 3D plane and not straight and every time you have to check if it is proper or not so it makes artwork in 3D a little bit complex.”
[Yogeshwar, 23 years]

Attitude of the participants was another factor which affected usage of VR in classroom

“We should be open minded about the prospects of this program and use it in a positive and effective way.” [Chirag, 22 years]

“I am not sure if I am considering this for the future even though I enjoy it. I want to learn and explore now to see if I have any scope in me to pursue it further. So far I am enjoying it and learning new things and techniques from it” [Nidhi, 23 years]

A participant also identified that VR Tilt Brush disrupts work efficiency as taking numerous breaks in between is impossible as it affects the flow of the task in a professional setting.

“But when we come to the drawing part, when it is in architecture level, we have to design a building with landscape, so we need to work more. We cannot take risk.so in so we cannot take a break for 30 minutes and then work for some time.” [Passang, 24 years]

“While saving the project I was getting notifications saying it cannot be saved and I was disappointed. It affected the workflow.” [Sai Madhuri, 23 years]

Challenges of using VR in the classroom

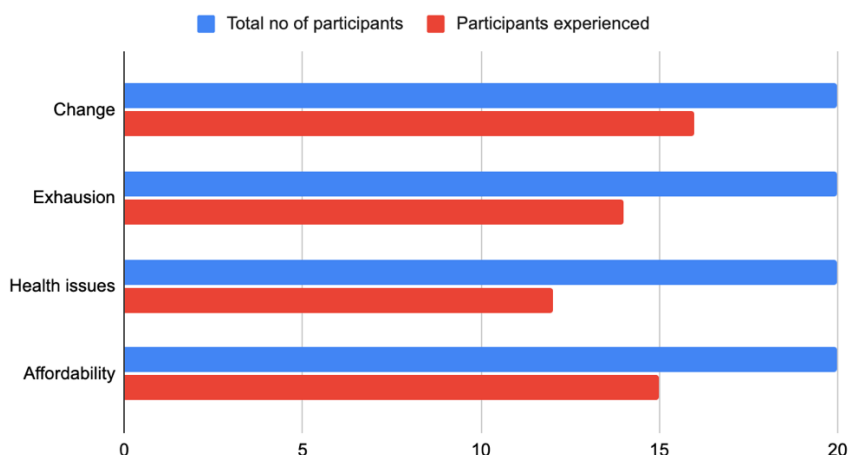


Figure 6. Challenges of VR classroom

Seventy five of the participants identified affordability as the principal cause of using VR in a classroom setting. Eighty percent volunteered change as being a contributing factor. Common determinants included exhaustion (14/20) and health issues was another facet that was identified as a cause (12/20). Conclusion: Participants attributed various issues to be the cause of VR encountering challenges in being successfully implemented in a classroom. Various participants identified affordability as the major challenge of having a VR setup in a classroom. Other participants also raised health issues, exhaustion, and adaptation issues as the next major reason for VR facing issues in a classroom. There are various other factors like the headset being fragile, not having the right attitude and efficiency being disrupted that were identified as an obstruction in setting up VR. VR and its applications are still new and have a scope of developing further. Participants shared that for now it is still nascent and will encounter various issues while being implemented in a classroom setup.

Conclusion

The purpose of this project is to present the results of a Virtual Reality experiment with students that used Digital Drawing skills with a Virtual Reality Tool (Tilt Brush). This is an exploratory study aimed at determining the participants' perspectives on the programme and determining whether this type of programme could benefit their joyful learning experience. Several conclusions drawn from the findings warrant greater attention. The first pertains to the notion that incorporating virtual reality into a classroom setting was not difficult. The second pertains to the program's contributions to the participants' joyful learning experience.

The exploratory character of this work entails a number of constraints, as well as the need to pursue specific areas of research in the future. The sample size and composition were among the limitations, as they prevented a more extensive study of the data as a function of parameters. Among the lines of research we consider appropriate to extend the need of study to understand how students from different disciplines make a change in the findings.

We discovered that Virtual Reality can provide participants with creative options that are not available in physical work, as the experience of immersion can modify the range of expression that serves as inspiration for art creation. High immersion experiences added to the enjoyment of the training. Add-ons such as music and workout engagement have been shown to increase the likelihood of happiness. It also aids in the perception of oneself as inventive, as the immersive atmosphere may aid in the evocation of specific thoughts and possibilities not available through other guided imagery approaches. The tool may also be beneficial for introverts who want to explore spaces and settings in a digital world because it is a platform that provides a higher level of immersion than a typical screen-based interaction, as introverted participants tended to experience increased confidence and reduced self-consciousness during the experience, and it is speculated that this is because VR does not appear as real as a face-to-face meeting, but the entire point of the tool is to allow people to explore spaces and settings in a digital world.

Tilt Brush works best with the wireless Quest configuration since you may freely rotate while considering your 360-degree canvas without getting tangled in cables. Tilt Brush continues to

be one of the easiest and most comprehensive apps for creating art in virtual reality when compared to other VR programmes available on the market. Since each brushstroke has its own depth of focus, you can see your artwork from any perspective. Before advancing to the more sophisticated features, those who are doubtful of their artistic talent can use the Beginner mode to learn the fundamentals.

Limitations and Future Research

Unfortunately, the Quest port does have some limitations compared to the PCVR edition. The limitation of the study is that the technology used is Oculus Quest 2 and the limited memory puts a constraint on how detailed your creations can be, you must sideload reference images before you can access them in-app, and a few new features like camera paths aren't supported yet. Still, the vast majority of tools work seamlessly. Unable to paint details on existing shapes is another limitation of the app. As VR equipment is expensive, giving the students one-on-one training was out of the question as we had to divide the students into groups and assign the equipment's. Future studies can employ other artistic VR Apps that are available on Oculus Quest for the study.

We're also conducting research to determine whether using virtual reality in the classroom may foster creativity in students from different academic fields. Extending this concept to students from other academic fields would be intriguing to observe how adaptable they are and to give them the chance to experiment with a new form of artistic expression.

The fact that the course was provided during a regular semester added to the quality of our research design. This gave students more time to process class material, as well as more time to coordinate and work successfully in groups on the assignment. The focus group discussions were also conducted by an instructor with prior teaching and curriculum design experience. The researcher was able to connect with the participants and comprehend their experiences in the classroom as a result of the event. The main limitation of this study is that it was conducted during the pandemic COVID'19 and is an exploratory study, despite the fact that it cannot be generalised due to the small sample size. To get more accurate results, this study might be extended and undertaken among a larger population.

ABBREVIATIONS

2D - 2 Dimensional

3D - 3 Dimensional

AR - Augmented Reality

AVE – Artificial Virtual Environment

CAVE - Cave Automatic Virtual Environment

HEI - Higher Education Institutions

HMD - Head Mounted Display

STEM - Science, Technology Engineering, and Mathematics

VR - Virtual Reality

VW - Virtual World
XR - Mixed Reality

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