

Virtual reality based solution for training medical students

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ABSTRACT: An exploratory study was conducted to examine the effects of immersive virtual reality-based training on the learning motivation of final-year medical students with video and text-based learning. Students were given different techniques of delivering a training simulation of a laparoscopic procedure, and their learning motivation was assessed using the Intrinsic Motivation Inventory. Simulation has been demonstrated to be "superior to traditional clinical education, delivering potent educational interventions that yield rapid and lasting outcomes" in a variety of disciplines. To teach complex subjects, we need a virtual reality platform that allows students to master topics on their own time. Virtual reality-based solutions for educating Ayurveda medical students about live Ayurveda surgical and para-surgical procedures are being developed. Virtual reality solutions should contain realistic demonstrations with 3D illustrations and be multilingual in nature so that students can grasp them. It should be a solution that can be scaled up. If a professor wants to update the curriculum in the future, it should be allowed."

Keywords—Virtual Reality (VR), Medical Simulations.

1. INTRODUCTION

VR is widely employed in the domains of education and training, in addition to the more obvious uses of VR technology in the entertainment industry. Because of its potential for promoting interactivity and motivation, virtual reality is often associated with high user

engagement. Furthermore, sensory inputs such as visual, auditory, and kinaesthetic provide a higher level of information absorption. When workers need to be exposed to circumstances that are difficult or dangerous to duplicate, VR is frequently employed in occupational training. VR provides a risk-free simulation in these situations, allowing users to get hands-on experience before going on to the real activity. An immersive learning environment was used to teach basic corrosion prevention and control skills to US army soldiers. Before moving on to the real world, aviation students are taught how to land an aircraft in a simulated setting. Similarly, virtual reality apps have been used to teach construction workers how to build well-balanced structures. Similarly, virtual reality (VR) may be used to effectively train young doctors by immersing them in life-like circumstances that allow them to practise and observe without risking their lives. Immersive environments hold students' attention, resulting in improved learning results.

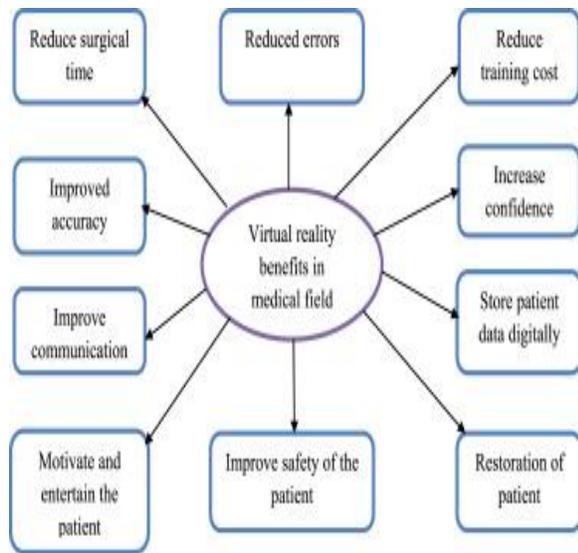


Fig. 1 Virtual reality benefits in the medical field.

Medical education frequently entails instructing students on complex procedures that must be successfully taught and communicated to them. The processes have become more difficult for students to understand as the discipline of medicine has progressed and become more sophisticated. Hands-on experience on practical exercises is required in addition to simple text-based or video-based learning. However, this is contingent on resource availability, cost, and danger. VR has a lot of potential for training pupils in a more realistic yet less dangerous approach. Students can be placed in an immersive atmosphere where they can not only see more closely, but also feel what it's like to be in the operating room. Furthermore, because there are no real-life consequences if a learner makes a mistake in a VR scenario, it can lower the setup cost and risk. Furthermore, VR enables for the reconstruction of some settings that would be impossible or difficult to duplicate in real life, which can aid in the delivery of blended curricula. Blending curriculum with technological tools like virtual reality can boost students' motivation, which can improve their academic and practical performance. This study

focuses on virtual reality and other associated technologies that have aided medical students in better learning, understanding, and increasing their learning competencies.

2. WHAT IS VIRTUAL REALITY

The words 'virtual' and 'reality' combine to form virtual reality. The word 'virtual' means close, and the word 'reality' indicates human experience. To do specific reality simulation, this indicates it's close to reality. Virtual reality (VR) uses computer technology to create a simulated environment. It allows the user to interact with a 3D virtual world via a screen, which simulates vision, hearing, and touch in an artificial 3D environment. This technology includes a head-mounted display that shows a room-sized screen. It uses software to generate an artificial world that can be accepted as real. The primary use of this technology is to create a fictitious setting for a game or interactive tale, as well as instruction in a virtual environment. This technology creates realistic pictures in a virtual environment that may be interacted with. Its applications are being used in the fields of medicine, architecture, automobiles, driving training, aviation simulation, and military training. It is utilised to gain valuable knowledge and skills without the need for an actual one. Unwanted signs such as stress injury, discomfort, and other disorders are rapidly diagnosed. It contains thorough information about the anatomy and other body parts of the patient.

3. LEARNING METHODOLOGY

During the virtual based learning approach, the author presented a briefing on VR based learning and the assignment to be completed under the supervision of the practitioner. Participants needed more explanation to comprehend the criteria because this was not a traditional manner of learning. Participants were

given Samsung Oculus Gear VR spectacles to wear on their phones at the start of the experiment. The Android version of the Medical Reality (MR) software was installed on the phone. Each participant was given an explanation of the app's navigation and categories. The content of the MR software was comparable to that of video and text-based learning, but participants in VR were able to see a 360-degree view of a laparoscopic surgical procedure.

4. PROCESS OF ADOPTION OF VR IN THE MEDICAL FIELD

The software applications Virtual reality is used to speed up the training process while removing all fear and risk. It is used to treat a variety of diseases in the medical field. This technology is helpful in improving the medical field's performance. 27,28 It is a beneficial and effective tool for increasing trainee and patient satisfaction. As demonstrated in Fig. 2, this technology provides an adequate answer in the medical field employing its technique.

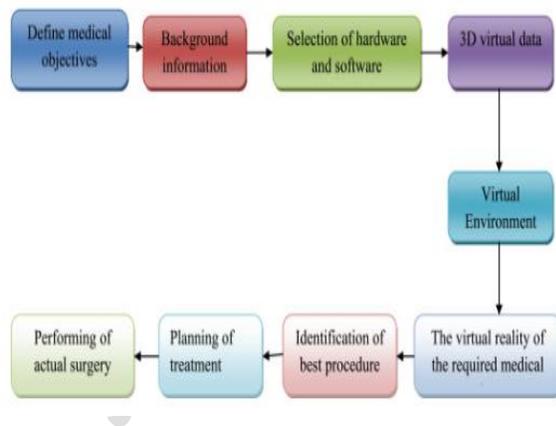


Fig. 2 Process used for VR in the medical field.

Virtual reality (VR) is an important part of the development process since it requires specialised and advanced software and hardware. We might begin by defining the particular goal of the

treatment and gathering background information. To create 3D virtual data that creates a 3D virtual world, various hardware and software are required. The essential medical data is created in virtual reality and identified using the best possible process. This approach can be used to plan a treatment and then assist with the actual surgery..

Limitations:

Limitations Due to its high cost, the fundamental limitation of this technology is its commercial deployment in the medical field. During therapy, VR takes a long time and requires a lot of software and hardware support. The expense of high-resolution patient data is higher. Virtual reality graphics necessitate a large amount of storage space to store data. This method is currently ineffective in detecting the symptoms of new diseases. It can only be used to understand specific instances and requires proper motion of the bodily part to be treated properly. It is limited in scope for the demonstration, and the VR headgear only covers a small portion of the patient's body movement. However, additional research and integration with other technologies will make this very useful to the general public.

5. VIRTUAL REALITY APPLICATIONS IN MEDICAL FIELD

This technology has implications in psychological treatment, medical rehabilitation, medical research, and teaching; as a result, students can now virtually execute safe and controlled surgery without risk. It is advantageous to master a life-saving skill in the event of an accident or an emergency. VR also teaches the patient how to live a healthy lifestyle by providing nutrition and exercise advice. Table 1 summarises the most important

applications of virtual reality in the medical profession.

Table 1 Virtual reality applications in the medical field.

S.NO	APPLICATIONS	DESCRIPTION
1	Virtual surgery	VR is used to provide virtual surgery which is helpful to reduce time and risk
2	Planning of operation	By the applications of virtual 3D models, the surgeon can successfully plan the operation to complete it successfully
3	Diagnosis	Powerful diagnosis tool for accurate diagnosis carried out by doctors and physicians
4	Physical therapy	By using this technology, there is a profound change in the way people do the exercise
5	Education and training	Helpful in medical education and training by creating the best possible learning program
6	Treatment of mental illness	This technology is used to change the way of exposure therapy which is helpful for different

		types of mental illness
7	Better treatment of limb pain	Creates a virtual limb to analyse the pain of the patient body
8	Learning of surgical technique	Interacts patient in a 3D environment to enhance knowledge and experience
9	Digital storage of patient data	Data is stored in digital format which is helpful for future treatment
10	Identification of breathing problems	It quickly identifies the breathing problem of the patient and further helpful for its treatment
11	Improve the efficiency of psychotherapy	Seems to an excellent tool for psychotherapy to improve the efficiency
12	Reduce Depression	VR changes the mind and brain of the person having depression
13	Track body movement	VR is a useful tool which is helpful to track body movement of the patient
14	Reduce trauma pain	This technology applies to reduced pain when the

		patient virtually	interact
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3D virtual reality is an important tool for practising with medical equipment. This technology is quite similar to the actual operation, and it aids in the accurate measuring of the patient's body. It provides crucial insights into behaviours such as altering vital signs, shifting symptoms, and so on. Virtual patient tissues can now be easily interacted with by medical professionals. For the best care of the patient, excellent communication is required in the medical field. By producing a cross-section in any plane, it allows for improved visibility and measurements of the patient component. The clotting of a blood artery in the brain can now be seen by doctors. Many surgeons are already adopting virtual reality to perform a dangerous surgical procedure. 80,81 It contributes to the creation of a safe, stable, and productive operating room environment, which lowers errors. This technology also aids in the cost reduction of medical student training and improves a physician's working environment.

6. DISCUSSION

Discussion Virtual reality (VR) is critical to improving the medical profession's performance. This technique is now being used to investigate the muscle, nerve, skin, bone, and blood vessel. Medical students may now quickly collect patient data and compare and contrast various medical issues. This technology appears to be a useful tool for a better experience with knee arthroscopy training. It's also utilised to evaluate and analyse a surgeon's abilities. This technology has a wide range of applications in the orthopaedic industry, including fracture repair, hip trauma, and preoperative planning. It is used to assess the motion of the bone and ensure that the implant is properly placed. VR is a practical solution to the patient's pain management. It enables medical therapy to be

designed in a virtual environment based on the symptoms of a specific patient.

VR is a new 3D computer technology that can be utilised for a variety of medical procedures and treatments. A surgeon can now see the bone, blood vessel, and other bodily parts clearly. This technology is used in difficult procedures for diagnosis planning and risk minimization. As a result, doctors can see every therapy procedure and other health conditions in great detail. VR technology can assist patients cope with their processing discomfort by providing stress alleviation. In cardiology, VR can be used to administer chemotherapy. It aids in the accurate planning of heart surgery and the understanding of patient anatomy. It creates a three-dimensional virtual environment for fruitful interaction. Virtual reality is used in medicine to alleviate discomfort during medical and surgical operations. This paper meets all of the requirements. The importance of VR in the medical area is explored, as well as its clear understanding. The steps in the medical field's implementation process are displayed and explained. Finally, it is identified and discussed in terms of its prospective applications.

7. CONCLUSION

By generating a virtual 3D world, virtual reality opens up new possibilities and helps healthcare by providing a good experience for the patient's therapy. It allows for a more accurate sense of the surroundings. This technology has potential for the treatment of stress-related diseases and has applications in neuroscience, psychology, physical and occupational therapy, and other intervention approaches. This technology breakthrough appears to be the ideal solution in the medical profession, since it allows for immersion in circumstances. It has the potential to shorten therapist consulting times. This technology can now be used to tackle distinct patient scenarios and problems. Since the last

several years, the applications of this technology have been rapidly investigated in order to obtain significant results. As a result, VR technology has been successfully utilised in the medical industry to produce effective treatment outcomes. Virtual reality appears to be an effective way to reduce the overall cost of treatment. The patient is able to focus on the real environment and is alleviated of overall tension by employing this technology. It gives the human brain experience through virtual motion and experience. This technology gives an effective and better alternative for stress management, enhancing the patient and creating a good effect to save the patient's life.

8. FUTURE SCOPE

Virtual reality applications in healthcare will become more common in the future. Any challenging procedure can be performed precisely and safely by doctors and surgeons. To arrange a successful surgery, the surgical team can see the soft and hard tissue inside the patient's body. It will develop into complex devices and a potent tool for high-quality visualisation. Knowledge, skill, habits, and other needed disciplines can all be improved by working in the medical field. This technology will be used to optimise the design of buildings, industries, and hospitals. It will become more sophisticated in the next years, allowing all medical processes to be brought into the digital realm. Virtual reality has intriguing techniques for saving and improving the patient's life. It immediately corrects any deficiencies in the surgeon's ability. This immersive technology can be used for teaching in the operating room at any time and in any location. With the use of this technology, one may quickly monitor the disease's correct and incorrect situation. It instructs doctors and nurses about the biological mechanisms of the human body. In a virtual environment, this technology provides realistic and accurate simulations.

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