Virtual Reality As A Tool In The Education

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Abstract

The usage of VR is on the rise in the classroom because it gives students greater freedom to learn by doing. In this work, we provide an educational programme for use in either face-to-face or online classes on the topic of formal languages; it allows students to virtually investigate, analyse, and learn more about a given topic. This paper introduces an educational software that uses 3D object manipulation to make learning about automata, regular expressions, and automaton minimization much simpler for students. The software has a straightforward interface and is straightforward to use. The software incorporates the programming language PHP (Hypertext Pre-Processor) for web page publication and the 3D modelling tools Blender and VRML (Virtual Reality Modelling Language) for automaton creation. The results achieved using the created software demonstrate the characteristics that make the perfect Virtual Reality for scenarios of study and learning, transferring the discipline as a point of reference from the educational setting to the computer laboratories and making the subject matter more engaging for the student and the learning process simpler.

Keywords: Virtual Reality, Educational Software, Formal Languages, 3D, Blender, VRML.
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Introduction:

As technology develops and improves, it enables the adoption of new teaching methods and materials, making the educational process more engaging for pupils. The rise of VR has been crucial to these changes. Virtual reality may mean many things to different people, but in its most basic form it is a computer-generated simulation of a real or imagined world that allows users to immerse themselves in the environment and interact with it. Virtual reality may also be defined in a more technical sense as an interface that allows the user to communicate in real time in a three-dimensional computer-generated environment by means of the user's sense

of touch and a variety of specialised hardware (Kimer, 2012). Virtual reality (VR) allows users to interact with a computer-generated environment by means of a head-mounted display (HMD), a multi-projection room (cave), or a combination of the two (Kimer, 2012).

Education may be seen of as a process of discovery, research, and observation in addition to the everlasting building of knowledge. With this, the unique qualities of virtual reality may make it a potent instrument in the service of anybody interested in advancing the state of education. Recent developments in technology have made possible many concepts that were formerly considered science fiction.

Incorporating VR into the classroom allows students to learn about and get experience with subjects and environments that would otherwise be out of reach. Virtual reality's greatest promise lies in precisely these avenues, not only via traditional classrooms or actual objects but also through the simulated manipulation of the topic to be investigated. As defined by Furtado (2012), Formal Language Theories and of the Automata is the study of mathematical models that allow language recognising (in the broad meaning of the word), including their categorizations, a) structures, priorities, properties, and inter-relationships. Language processing, pattern recognition, and modelling systems are only a few examples of the many computer-based activities b) supported by and justified by this theory (Furtado, 2012).

The goal of the suggested instructional software is to provide students and educators with a more comprehensive and engaging understanding of automata and the variations that have occurred in their reduction. The program's secondary goal is to pique students' interest in the material, which in turn facilitates their grasp of the material. Our goal is to make class time more engaging and participatory for the student. The created software may also be used to assess students' progress in a distance learning setting, saving time for the instructor by having them send their completed 3D software exercises directly to a predetermined email address.

Virtual Reality

Virtual computer interface approaches that account for three-dimensional space include virtual reality, augmented reality, and its variants. The user engages in multisensorial activity here, investigating various facets of the environment through sight, sound, and touch. Using current technology, we may also investigate other senses, like smell and taste. Tact, which is perceived by the body via the skin, encompasses sensations of cold, heat, and pressure (Kimer, 2011).

Virtual reality has been characterized by 3 basic ideas (Pinho, 2004)

The user is so immersed in the computer's simulation that actual time seems to stand still. Digital helmets and the digital cave are two devices that may provide this feeling.

Objects in virtual worlds may be interacted with in many ways. Digital gloves are a device that can provide this feeling.

c) User participation: when a user actively or passively navigates a virtual environment, he or she feels as if they have become a part of the virtual environment and may have a direct impact on the outcome of the programme.

Education Through Virtual Reality

The rise of modern information and communication technologies has made it possible to experiment with novel methods of education. Virtual reality (VR) is an example of a technology that may facilitate the development of cutting-edge educational resources by providing three-dimensional computer environments with sophisticated forms of interaction that can invigorate and enliven the educational process.

Only recently have we been able to think of small groups in big metropolitan centres and academic institutions as having the greatest potential for using virtual reality. However, the incorporation of VR-VRML has widened its accessibility, thereby increasing its potential and domains of use (Barilli et al, 2012).

a) Virtual reality (VR) may be a useful tool for teaching and learning, especially when combined with the resources of 3D

b) modelling and animation programmes like Blender 3D.

Virtual reality has been shown to have

c) additional positive effects on the classroom. Even if the cost of the simulation is high, Clark (2006) argues that it is worth it since VR may be used to make learning more engaging and enjoyable, hence increasing motivation and attention, and minimising expenses associated with utilising the target and the actual world. Exploring Mars, the human body, the depths of a cave, a molecule, a very small place, a very expensive place, or a place in the past that can't be visited in the present day are all examples of situations made possible by virtual reality that would be impossible in the real world.

Formal Languages

In 1950, the Formal Language were created so that scholars may work on ideas about natural languages. according to (Menezes, 2005) But it wasn't long before it was verified that the official languages were the best option for CS language research. The study of languages has uncovered two types of issues that need addressing: syntactic and semantic. The significance of a programme is seen through the lens of the language's syntax, which is concerned with the grammatical correctness of programmes and the language's free qualities. Three formalisms serve as the basis for the study of Regular Languages. according to (Menezes, 2012):

The recognizer formalism is based on finite automata, which are collections of states for finite systems.

Regular expression is the foundation of linguistic theory since it specifies how a language's words should be constructed.

The generator formalism for regular grammar is the same as that for the production rules.

Studies of Formal or Compiler Languages make use of finite automata, which are systems of sequential limited states representing a model of computer science. Deterministic, non-deterministic, and empty-movement Finite Automata are all possible (Menezes, 2012)..

Benefits does VR offer for education?

Virtual reality (VR) is still a relatively new technology, however its increasing availability at tourist hotspots has helped to dispel some of the mystery around it. Using virtual reality (VR) in the classroom has been shown to be both motivating and interesting for students, despite the fact that the novelty element may be decreasing as more and more students have already used VR. Virtual reality increases participants' interest and involvement with the topic, according to several research that have included measures of interest and drive (Costa &Melotti, 2012).

Many studies (Tai, Chen, & Todd, 2020; Cho; 2018; Kaplan-Rakowski & Wojdynski; 2018; Velev, 2017), for example, have shown that students' motivation increases while using VR. Students were "happier, more excited, and less bored" (p. 8) in the VR group compared to the slideshow group in a research by Parong and Mayer (2018). In their systematic review of virtual reality research from 2010-2017, Kavanagh, Luxton-Reilly (2017) note that "the increased immersion facilitated by VR was cited as a motivation factor in 46 (out of 99) of the research papers analysed (making it the most commonly mentioned factor)" (p. 96). Until virtual reality (VR) becomes commonplace, it piques students' curiosity and enthusiasm, two factors that are crucial to the learning process but often overlooked.

Inaccessible environments.

Virtual reality (VR) technology enables users to replace their everyday world with a computer-generated simulation of any location, real or fictional. Teachers may use this skill to accomplish learning goals that would otherwise be impossible given their present geographical location. Field excursions, for example, may be difficult to organise and expensive for many groups to afford.

Virtual reality (VR) projects like the one created by Blazauskas, Maskeliunas, and Kersiene (2017) demonstrate the potential of VR for education. Virtual reality (VR) is ideal for classrooms that need experiential learning opportunities but can't afford to send students on field trips, write Hu-Au & Lee (2018). Virtual reality has being used by teachers for just this reason. Nicolson (2018), principal of a virtual reality elementary school, says that his school has utilised VR to educate students about the arctic and the deep sea. According to Oak Run Middle School teacher, Mrs Hunt (2018), "We want to encourage students to look outside their hometowns and realise there's a big world out there for them to see" via their virtual field trip project. Nicole Mills of Harvard University used virtual reality to give French students a taste of Paris, and she writes that the experiences "captured a part of Parisian everyday life that often can't be described plain words (i.e., the sounds, the atmosphere, etc.)".

Using virtual reality (VR), Frazier and Roloff-Rothman (2019) gave students at a university in Japan a chance to experience refugee settlements, American political rallies, and religious pilgrimages. In contrast to two-dimensional movies, they said, "joining believers on the Hajj pilgrimage to Medina or wandering through the corridors of a Buddhist temple in a far-flung country may make

religion come alive in an approach that two-dimensional films cannot" (p. 15). Powerful experiences may be had in any imaginable setting because to the sensation of presence provided by high-quality virtual reality technology and software. It's important to remember that these opportunities also provide students with mobility restrictions a chance to participate alongside their peers in similar virtual excursions. It's worth noting, however, that it's notoriously difficult to assess the benefits of adopting VR for these kinds of experiences via empirical study and data collecting.

Expansion Through Space

Virtual reality's potential impact on schooling extends well beyond its ability to increase participation and inspiration. With an immersive approach, students are immersed in a digital environment in which they have complete freedom of movement and interaction. This enables not just movement, but also the observation of scenes and objects from various vantage points. Researchers have speculated that this might improve memory for the scene and its components (Pollard et al., 2020). In order to examine spatial learning in VR across three circumstances (low, medium, and high immersion), Pollard et al. constructed a rigorous within-subject design study.

The circumstances varied depending on the kind of content delivery system used: The medium-immersion condition had participants wear a head-mounted display that partly blocked out their surroundings, while the high-immersion condition employed a high-end virtual reality device, the Oculus Rift. High-immersion participants outperformed those in the medium- and low-immersion conditions on both the yes/no item and multiple-choice tests (p. 6). The researchers speculate that being able to see the sceneries from different perspectives may have had a role in these findings.

Training Empathy

Virtual reality (VR) not only provides access to previously inaccessible places, but also puts the user in the shoes of a different character. Developers and educators have not missed the implications of this, as seen by the proliferation of excellent VR experiences aimed at doing just that.

Anne Frank House vr, Drive While Black, Notes on Visual Impairment, and Stanford University's Becoming Homeless: The Human Experience are just a few examples of these kinds of programmes. pupils were educated by Chang et al. (2019) about sexism in mathematics classrooms by taking on the role of female pupils. 1000 Cut Journey is "an immersive augmented reality experience which enables you to walk in the shoes of Mike Sterling, a Black male, as well as encounter racism first-hand, as a young child, a teenager, and a young adult," according to its creator, Dr. Courtney Cogburn of Stanford University's Virtual Human Interaction Lab. The purpose of this research, which was part of a larger study on compassion and viewpoint taking, was to encourage students to take collective and effective social action in response to racism (Roswell et al., 2020).

Distance learning Opportunities

Virtual reality has the ability to broaden access to education beyond traditional classroom settings. The challenges of online and remote education may be ameliorated by this technology's capacity to bring individuals together over great distances and offer them with immersive settings where they may connect with others. The possible affordances offered by multiple users virtual campus where students may meet and work together are outlined by Chang, Zhang, and Jin (2017), who highlight the potential role of VR in distant education. In addition, the authors' own study (Frazier, Bonner, & Lege, 2019) describes the benefits and drawbacks of virtual reality for remote education as it is right now. With the future life of the programme depending on the widespread acceptance by a relatively limited user base (p. 4), the authors of this study emphasised the ongoing challenge posed by the fast changing software environment and the difficulties of developing material for multi-user VR software.

A number of studies cited by Kavanagh et al. (2017) in their assessment of VR literature mentioned using VR for distant education. While many of these sources discuss the potential or benefits of virtual reality for this kind of education (see Clark, 2019), only a small number of studies have evaluated its actual application in the classroom. According to Urueta and Ogi (2020), "virtual reality can provide alternate immersive learning methods featuring an elevated degree of student-teacher interaction" (p. 366), making it a promising tool for task-based language distant learning. Language learners at a distance may now engage with virtually conversational agents and immerse themselves in authentic second language settings thanks to the work of Berns et al. (2019), who developed a virtual reality (VR) environment centred around AI voice-activated 360-degree movies. The 2020 coronavirus epidemic has prompted a paradigm shift towards distant education, and the pursuit of more efficient means of online instruction. More attention will be paid to virtual reality (VR) because of its potential to ease pain points in the present.

Lack of VR Specific pedagogy

While virtual reality (VR) may be adapted to some degree into current pedagogical models, experts concur that in order to fully realise its educational potential, VR requires a new approach to teaching and learning. Based on their research, Hu-Au and Lee (2018) claim that it is not effective for teachers to attempt to recreate "face-to-face didactic experiences of learning" (p. 223). Elmqaddem (2019) says that "it will be necessary to understand how to develop and put into effect educational programmes that are well adapted to this technology" (p. 237). According to Scavarelli et al. (2020), "determining how best to utilise this technology to better enhance students' learning for a way that is not merely recreating, or substituting the physical classroom" (p. 17) is the biggest obstacle for the widespread adoption of virtual reality in education. This means that VR-specific pedagogy has to be created. Indeed, a lack of educated pedagogy underlying usage of VR is a recurrent issue in many of the current works reviewed for educational purposes.

While instructional design may help mitigate cognitive load, there are additional issues that might make virtual reality (VR) less than ideal for training and education. Factors originating from both VR gear and software interact intricately to determine how much of an immersive experience consumers get. Inadequately implemented, characteristics like visual distortions or poor-quality 3D assets might undermine the immersive benefits of virtual reality. According to a review of research on virtual reality (VR) in the classroom by Kavanagh et al. (2017), "this may detract for the educational experience" (p. 102) if the VR experience isn't realistic enough. While photorealistic graphics aren't required (many of the finest VR experiences employ a low-poly, basic colour palette art style), it is important that the experience feels consistent and that there aren't any visual aspects that detract from it. Learners will not benefit from virtual reality (VR) if they are unable to get fully immersed in the experience. The limits of the technology in sustaining immersion should be taken into account as well. Visuals on low-resolution monitors, particularly when used for widely spread VR experiences, might seem fuzzy and out of focus. When users move their heads too rapidly, the visual distortions and stuttering brought on by complex visual landscapes might make them sick. Immersion may also be broken by environmental factors like hot and humid weather, or by the pain of wearing a headset for a lengthy period of time.

Various Considerations

Even though virtual reality is becoming more mainstream, many students and educators still may not be acquainted with it. According to Southgate et al. (2018), instructors should gradually integrate virtual reality (VR) into the classroom, keeping in mind the novelty factor and the necessity to address it before diving into the actual classroom activities. As they put it, "Students needed time to play in (VR) to emerge from the novelty stage to familiarise themselves with its affordances and consider how these might be used in learning tasks" (p. 8).

Additionally, Southgate et al. (2019) highlights the need of considering gender in the secondary school classroom. Some females found wearing the HMD to be unpleasant or "embarrassing," and overall, "girls were much less likely to have previous exposure to VR with an HMD." (p. 28). The user cannot see the gaze of others or how they look to others in the classroom while in VR, therefore concerns of femininity, masculinity, and "the male gaze" must be taken into mind.

Conclusion

The programme not only facilitated the teacher's job during the assessment performance but also made the teaching/learning process more fascinating and enjoyable for the students by moving the Formal Language Subject form classrooms to computer laboratories. Virtual reality (VR) allows students to experience what it's like to learn in a realistic, although computer-generated, environment, improving their ability to picture and engage with what they're learning. Virtual reality is a great substitute for when we can't participate in real-world activities. Virtual reality (VR)

allows us to experience scenarios that would be too difficult or hazardous to access in the actual world. Additionally, VR enables teachers to show pupils otherwise difficult-to-explain material. The presented software was piloted for a year in the Official Language Subject at X University, where researchers observed enhanced concept acquisition and greater ease in the execution of activities involving automaton minimization, leading to higher grades for those students who had access to virtual reality.

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