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Facilitating The Successful Communication and Knowledge Acquisition of Students with Unique Needs in Virtual Environments. Formal Education Entails Gaining Information and Competence Via Classroom Study

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Abstract

Virtual reality (VR) encompasses a range of technology advancements that allow people to actively participate and interact with computer-generated three-dimensional "worlds" or "environments." These virtual settings have significant promise for including digital replicas of urban landscapes, architectural structures, scenic routes, and molecular structure models. Debates arose in the early 1990s over the possible integration of virtual reality (VR) in educational environments. Bricken (1991) asserts that throughout that period, there was a prevailing conviction in the development of unique and influential learning settings that surpassed all other surroundings. Following that, a growing group of scholars specialising in virtual reality (VR) has sought to investigate the possible advantages of this technology in various educational settings, spanning from basic to advanced training. This article briefly discusses the potential benefits of integrating virtual reality (VR) technology into educational settings. Through the utilisation of virtual reality (VR), individuals have the opportunity to participate in highly authentic simulated scenarios, allowing them to enhance and perfect their interpersonal communication skills in controlled and supervised environments. This article provides an account of four studies undertaken by the Virtual Reality Applications Research Team and their collaborators in the subject of special needs education, starting in 1991. The focus of these studies was primarily on the application of virtual reality in this sector. The field of inquiry focuses on the creation and evaluation of applications specifically built for virtual environments. The main objective is to improve the daily independence of individuals with learning and communication difficulties.

Introduction

There exist several distinguishing characteristics between virtual environments (VEs) and conventional computer programs. One notable distinction is the ability for users to navigate within the VE without constraints imposed by a predetermined path. Additionally, VEs offer specialized displays that facilitate an immersive experience, enabling users to perceive themselves as being physically present within the VE. Furthermore, it is important to note that the virtual world is characterized by three dimensions rather than two. According to Cobb, Neale, Crosier, and Wilson (2002), some aspects of virtual environments (VEs) have been identified as beneficial in educational settings. The topic of discussion pertains to the depiction of the environment and objects within a certain context. These renderings have the potential to represent tangible phenomena, such as actual items, as well as intangible entities, such as hypothetical or imperceptible entities like molecules or particles. Individuals have the ability to assume different postures, enabling them to engage with the virtual environment (VE) through various means. For example, a user who utilizes a wheelchair would have their eye level adjusted to a seated position, and their range of movement would be primarily restricted to linear movements with minimal rotational capabilities. The perspective can navigate the virtual environment akin to a helicopter pilot, owing to its ability to move in six degrees of freedom. The distinction between reality and super-reality: Through the utilization of a Virtual Environment (VE), individuals are able to engage in activities that are unattainable within the confines of the physical realm. For instance, one might simulate the act of "flying" within a virtual apparatus in order to get insights into its internal mechanisms and operations. Virtual environments (VEs) can be observed through many mediums such as a projected screen, a desktop computer, or a headset. Individuals utilizing the aforementioned kind of technology are restricted to observing the virtual environment solely through a head-mounted display. The erratic movement of their heads implies that they are visually exploring the virtual environment. Within Single-User Virtual Environments (SVEs), the task of directing movement and engaging with the many elements present in the environment is assigned to a sole user. When many individuals engage with a shared virtual environment, they typically manifest their presence through the appearance of personalized digital representations, commonly referred to as avatars, which are displayed on the screen. By utilizing headphones that are equipped with microphones, individuals have the ability to engage with virtual objects and engage in communication with one another.

Internet-based learning systems refer to educational platforms that utilize the internet as a medium for delivering educational content and facilitating learning activities. These systems leverage the capabilities of the internet to provide. During the early 1990s, there emerged a discourse surrounding the prospective utilization of virtual reality (VR) as a platform for traditional educational purposes. The provision of learning opportunities that are not feasible through traditional media has been the subject of discussion in relation to virtual reality (VR) learning settings. This is attributed to the unique attributes of VR, including the capacity to navigate a virtual environment and intuitively explore conceptual knowledge (Bricken, 1991). Numerous research conducted during the 1990s examined the possible applications of virtual reality (VR) in educational settings, specifically focusing on children with and without exceptionalities. Numerous publications on this subject were found in academic forums focused on the domain of education, including Virtual Reality in the Schools (Auld & Pantelidis, 1995), the Virtual Reality in Education and Training conference (VRET, 1997), a special issue of Presence: Teleoperators and Virtual Environments (1999), and various scholarly journals. Several publications, including Bricken and Winn (1992), Byrne and Furness (1994), Dede, Salzman, and Bowen Loftin (1996, 1999), and Salzman, Dede, Bowen Loftin, and Chen (1999), have examined the possible instructional uses of virtual reality (VR) in the fields of science, technology, engineering, and mathematics (STEM).

The publication of a comprehensive analysis on the possibilities of virtual reality in educational settings occurred in 1998. Based on an extensive analysis of over fifty scholarly works, Youngblut (1998) ascertained that the use of virtual reality (VR) has the potential to enhance students' learning outcomes in a more efficient manner.

Science Space has developed various virtual environments (VEs) with themes centered around chemistry, electricity, and physics. These VEs include Pauling World, Maxwell World, and Newton World, which correspond to these respective scientific disciplines. A total of eighteen students enrolled in a high school physics course were assessed on their comprehension of the subject matter subsequent to engaging with the Maxwell World simulation as a means of studying the material.

The facilitation of interactive role-play in simulated environments, such as the ExploreNet 2D collaborative improvisational drama simulation (Moshell & Hughes, 1996), can serve as a means to assist situated learning. The facilitation of constructionist learning can be enhanced by the implementation of collaborative activities wherein students collectively engage in the creation of virtual models. An illustrative example is the construction of a solar system model, which can effectively demonstrate the occurrence of eclipses (Barab et al., 2000). The evaluation of the shielding capabilities of different materials against various radioactive sources can be conducted using the methodology outlined by Crosier, Cobb, and Wilson (2000). The inaugural symposium on virtual reality and disability (Murphy, 1993) involved a comprehensive discussion on the potential applications of this technology. These applications encompassed several domains such as mobility improvement, accessibility enhancement, educational facilitation, rehabilitation support, and evaluation capabilities. A number of these findings were showcased during the 1996 iteration of the European Conference on Disability, Virtual Reality, and Associated Technologies (ECDVRAT), a highly esteemed platform for scholarly discourse on these subject matters. There is an increasing body of evidence indicating that virtual environments (VEs) and virtual reality (VR) technologies are being employed in many contexts, as outlined by Cobb and Sharpey (2007). The proliferation of assistive devices and display systems has been driven by the increasing availability of multimodal digital media for a variety of reasons, including assessment and rehabilitation, behavior therapy and phobia treatment, training and teaching, among others. The review conducted by Standen and Brown (2005) emphasizes the significant benefits associated with the utilization of virtual environments (VEs) in the training and education of individuals with intellectual disabilities. An illustration of an activity that can be simulated in a virtual environment (VE) prior to its practical application in the physical world is the preparation for a court appearance. Previous studies have demonstrated the efficacy of utilizing virtual environments (VEs) to provide training opportunities for students with intellectual impairments. For instance, Rose, Brooks, and Attree (2000) found that VEs were effective in facilitating kitchen training for this population.

Similarly, Mendozzi et al. (2000) reported successful outcomes in utilizing VEs for training individuals with intellectual disabilities in protected industries.

The concept of virtually realized artwork refers to the creation of artistic pieces that are produced and experienced in a virtual environment. The establishment of the Virtual Reality Applications Research Team (VIRART) at the University of Nottingham in the United Kingdom took place in 1991, with the primary objective of exploring and developing novel applications for virtual reality (VR) technology. The potential of virtual reality (VR) for implementation in educational environments has aptivated the interest of researchers. According to VIRART (2007), demonstration projects encompass a range of educational initiatives, including industrial training, rehabilitation, general education, and education tailored to the needs of children with special requirements. This article examines four distinct programs designed to enhance the learning and communication skills of individuals with special educational needs (SEN).One of the challenges encountered in the development of virtual environments (VEs) for individuals with special educational needs (SEN) was the absence of comprehensive design rules for content and interfaces. Additionally, there was a limited understanding of the cognitive and emotional processes involved in perceiving and interacting with VEs among this population. The implementation and refinement of user-centered design methodologies were undertaken to ensure that the resulting virtual environments adequately addressed the requirements of both educators and learners. During this phase of application development and research, our team has concentrated on a variety of study objectives, which encompass the subsequent:

The process of constructing and customizing virtual environments (VEs) to meet the individual needs and preferences of distinct user groups. The level of user familiarity with the technology and the virtual environment's depiction; The extent of user involvement with the virtual environment; Evidence of learning outcomes or other advantageous outcomes; and The process of transforming individual and collective knowledge into different forms to enhance organizational learning and innovation is referred to as knowledge conversion.Table 1 provides a summary of the chosen projects, highlighting their primary areas of research, key findings, and the virtual environments (VEs) that were developed as a result. Individuals with a desire to acquire further knowledge regarding these undertakings are advised to delve into the previously released materials cited in Table 1. The Shepherd School, located in the United Kingdom, is an educational institution that caters specifically to children who experience severe and profound learning challenges. This institution played a pivotal role in the initiation and execution of the initial three programs.The utilization of immersive virtual environments (VEs) has made it feasible to incorporate real-world experiences into the educational setting, thereby enabling the integration of the outside world into the classroom. Educators perceived this discovery as potentially valuable for pedagogical and scholarly purposes in the domain of Makaton, a comprehensive system of gestures and visual representations employed for facilitating communication throughout an entire educational institution. According to Grove and Walker (1990), the Makaton library consists of approximately 350 visual symbols. The instructional technique employed to teach Makaton, referred to as the "association" approach, involves sequentially presenting an object, verbally identifying it, visually displaying the corresponding Makaton symbol, and afterwards demonstrating the corresponding sign. The issue of incorporating associations with objects such as vehicles and buildings, which are prohibited within the educational setting, was brought to attention. Educators employed visual aids or replicas resembling authentic things as a means of compensation, although had concerns regarding the limited potential for pupils to acquire comprehensive knowledge about the intended functions of those objects in the absence of hands-on examination and interaction. In order to attain this objective, it seemed logical to use virtual reality (VR) technology, enabling students to engage with a virtual environment (VE) and acquire knowledge about the functionality of objects through interactive experiences with virtual goods.

The Makaton project utilized a user interface design known as the "split screen," which consisted of two main components. On the left side of the screen, there was an interactive virtual signer, accompanied by a constant display of the Makaton symbol representing the item of focus. On the right side, a virtual environment (VE) was presented, containing a diverse range of virtual objects. As depicted in Figure 4, the "boat warehouse" constitutes one of the four components comprising the transport vehicle. The learner is afforded the opportunity to engage in independent exploration of the virtual environment (VE), wherein they may analyze the three-dimensional objects from various perspectives and activate interactive elements, such as the boat that traverses the VE. When the cursor was placed inside the box, an audio file was played, which corresponded to the Makaton sign displayed on the box. In this particular instance, the word "boat" was rendered. In Figure 4, the shown scenario showcases a virtual environment wherein a Makaton symbol is being expressed by a signer. Specifically, if the cursor were to be positioned within the box that contains the manikin, the sign for "boat" would be demonstrated. In the event that the learner requires auditory repetition, they can simply engage the signer for further articulation. Multiple indicators were employed to evaluate the efficacy of the Makaton program. According to Neale et al.'s (1999) multiple activity analysis, it was observed that there was no obligation for teachers to foster student-teacher interactions. While a small proportion of students encountered difficulties in manipulating the mouse, the vast majority demonstrated proficiency.

Additionally, there were indications of impromptu peer tutoring.

From an observational standpoint inside the educational setting, the instructor observes that a student of lesser age and ability was receiving guidance from a more senior student within a Makaton context. This assistance involved instructing the younger student on the proper execution of hand gestures and verbalizing the corresponding word linked to each symbol. Both alternatives offer substantial advantages. It was hypothesized that students will derive advantages from the element of "practice makes perfect" inherent in virtual world engagement and inquiry. Based on the findings of Brown et al. (1999), the Life Skills Education project was an endeavor in community-based research that sought to deliver education and training in essential life skills to students diagnosed with specific learning disabilities (SLD) who were aged 16 or above. The primary objective of this initiative was to equip these students with the necessary knowledge and practical experience required for self-sufficient living. A virtual city was constructed by utilizing a virtual dwelling, grocery shop, and cafe as foundational components, alongside a virtual transportation network.

The participants were provided with a simulated work environment were they were assigned the responsibility of decision-making and task execution. This involved scenarios such as organizing a bus trip to a grocery store and creating a comprehensive shopping list. In order to ensure the correct allocation of passengers to their respective buses, it was necessary to verify the name exhibited on the front of the bus with the corresponding information presented in the lower section of the screen (see Figure 5). The students had the capability to manipulate the shopping cart in their vicinity while navigating around the virtual supermarket due to the stationary perspective, as depicted in Figure 6. The split-screen design allows customers to conveniently access their shopping lists in full screen mode, facilitating the identification of specific items (see Figure 7). The diagram presented in Figure 5 illustrates the spatial arrangement of a bus station.

Diagram 6 illustrates the layout of a supermarket.

Meakin et al. (1998) argue that the use of a user-centered design approach facilitates active involvement of users in decision-making processes related to virtual environments (VEs), including the selection of learning scenarios and the evaluation of VE interfaces. The organization and design of the learning scenarios were shaped by the input and expertise of educators and training specialists. A comparative analysis was conducted between empirical investigations on the efficacy of a certain entity and studies examining the subjective enjoyment derived from its usage. The assessment of utility and contentment was conducted through the utilization of observational analysis, questionnaires, and interviews.

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