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Virtual Reality As An Effective Means Of Career Development

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Jason Nguyen

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Advisors

Gerard Fitzgerald, Department of Engineering and Society

Rosanne Vrugtman, Department of Computer Science

Introduction

In the contemporary job market, a significant number of professions require a combination of relevant skills, education, and/or experiences in order for success. Individuals who invest time and effort in improving their qualifications tend to perform better in interviews and have a greater chance of obtaining the job (Cuddy, Wilmuth, Yap, & Carney, 2015). Skills training is also significant for current employees. According to a study by the World Economic Forum, 54% of employees will need reskilling and upskilling in 2022 to remain relevant in their roles (McSilver, 2023). Unfortunately, acquiring these skills and qualifications comes at a substantial financial cost.

Higher education alone costs over $100,000 (Hanson, 2023), and this amount does not cover expenses related to postgraduate studies or living costs. Even for occupations where degrees are optional, the substantial financial outlay persists for materials, certifications, and instruction. Various online platforms have played a pivotal role in attempting to decrease this financial outlay. For example, LeetCode caters specifically to software engineers, offering coding challenges and interview preparation materials (LeetCode, 2023). However, the majority of these online platforms focus only on technical skills. Access to free resources for soft career skills development is still limited, despite its crucial role in professional success. Soft skills such as creativity, emotional intelligence, and analytical thinking make up, on average, 9.1% of core skills reported by companies in 2023 (Masterson, 2023). The biggest issue with online platforms teaching soft skills is that they are unable to mimic real life environments.

Given the limitations of these platforms replicating real-life environments, a possible solution is Virtual Reality (VR), a simulated three dimensional environment that enables users to explore and interact with a virtual surrounding that mimics reality (Sheldon). VR is already revolutionizing society, such as being used for exposure therapy, by providing patients with immersive experiences to help treat conditions such as anxiety disorders and posttraumatic stress disorder (Kothgassner, 2019). This research seeks to determine whether VR is suitable to be used for frequent and long term training development, based on feedback from participants, and ultimately prove that Virtual Reality can be safely and effectively used for long term training.

Case Context - Virtual Reality

Virtual Reality is the use of computer modeling and simulation that enables a person to interact with artificial three-dimensional visuals or other sensory environments (Lowood, 2024). Initially, VR was simply seen as the “next social and communications platform” (Meta, 2014). However, it has found its way beyond social and communication realms, finding numerous applications in diverse fields. VR already offers immersive entertainment experiences such as virtual music festivals and immersive gaming, allowing users to engage with the content in ways traditional media can’t replicate. Various defense industries, including the military and airforce, are already using VR simulations for training purposes. Pilots can practice flight maneuvers while soldiers undergo combat simulations in safe virtual environments (Lasserre, 2022). All these are activities achievable in real life but were made safer and/or unique through VR.

Existing applications of VR argue in favor of using this technology for career development but there is not enough evidence to show that it is actively being used by different fields. The lack of standardized development and content tools has slowed innovation and limited the availability of compelling VR experiences, which may explain why different fields are reluctant to use its applications (LinkedIn, 2023). Without proper accessibility in VR, cost also remains significant for many individuals. Additionally, limitations such as motion sickness and visual discomfort have impeded overall user acceptance (McGill, 2019). While fixing these issues may require time and resources, it will ultimately lead to a more efficient and impactful utilization of VR technology. By investing in its development, improving accessibility, and mitigating user discomfort, various stakeholders will be more willing to back the use of VR in their respective fields.

Ideally, virtual reality would serve as a powerful tool for career development, offering immersive and interactive experiences tailored to individual learning and professional growth needs. Simulations could provide aspiring professionals with realistic scenarios and hands-on training opportunities, allowing one to hone their skills in a safe and controlled environment. For instance, a meta-analysis found that VR surgical simulations led to improvements in surgical skills and reduced errors among medical trainees (Sommer, et al. 2017). That being said, by leveraging advancements in VR simulations, individuals can acquire and improve skills in various career paths with no major consequences. Many different careers can benefit from an official incorporation of VR into professional development. Industries like architecture and construction can use the technology's virtual environment for design processes, allowing for immersive visualization of projects. Software engineering fields can practice in virtual coding environments and laboratories, allowing for practitioners to improve programming skills, explore algorithms, and prototype software in a simulated setting. However, this expansion of VR used for career development across different industries can not occur unless relevant stakeholders can see its benefit and are willing to invest in the technology.

Social Construction of Technology

Virtual Reality as a method in career development will be dependent on and create many complex interactions between the human, social, and technical elements. These interactions can be viewed through the framework of the Social Construction of Technology (SCOT) described in

Trevor Pinch and Wiebe Bijker's article, *The Social Construction of Facts and Artifacts*. The SCOT framework is an approach used to understand how technological artifacts are created, shaped, and interpreted within society. It can be broken down into two stages, interpretive flexibility and closure (Pinch & Bijker, 2008).

Interpretative flexibility is the concept that different stakeholders or social groups have various interpretations to a technology, which can influence its development, adoption, and impact (Pinch & Bijker, 2008). This can be seen by the development of the bicycle, as many saw it as a mode of transportation common to all while others saw it as a recreational device for the wealthy (Pinch & Bijker, 2008). Closure and stabilization is the process in which various interpretations of a technology become relatively stabilized within specific social groups over time (Pinch & Bijker, 2008). Again, using the development of the bicycle, it can be seen that after the period of debate on bicycle designs, a dominant design became widely accepted and stabilized within society, due to various factors, including technological advancements, market demand, user norms, and cultural norms (Pinch & Bijker, 2008). This framework is important to understand as it provides insights on how technologies are not just developed in isolation by engineers, they are shaped by social forces and their inherent meanings are constructed through human interactions and interpretations.

With the idea from SCOT that the meaning of a technology is shaped by human interpretations, it can be concluded that Virtual Reality as a method in career development is possible if relevant stakeholders can see and accept its potential applications. VR as a technology has already seen various interpretations, including career development. One of VR's first interpretations was for it to be used as a flight simulator to provide realistic training experiences for pilots (Virtual Reality Society, 2024). As time went on, VR found more applications in entertainment, gaming, and art. But certain stakeholders also saw VR as a way of training for many mainstream jobs besides the military. One such example is using the headset to create an interview simulator app, named VRJob, for software engineers (Stanica, 2018). The app allows users to practice their interview by answering hard and soft skills questions, all while being virtually present in an interview room.

But while there are numerous positive interpretations of the technology, VR has also been the subject of controversy and debate. There have been many reports that prolonged use of VR can cause motion sickness, eye strain, and headaches, commonly referred to as "cybersickness' (Interaction Design Foundation, 2024). These stakeholders also worry about the lack of data on long-term effects of VR on visual development and physical well-being, especially among adolescents whose sensory systems are still developing. There are also concerns about VR experiences raising ethical dilemmas related to behavior, identity, and social norms. Many social groups saw virtual environments as a way to promote escapism, a need of wanting to 'leave' the real world, cognitively and emotionally (Han et al., 2022). With the implementation of VR in career development, which incentivises users in reality by improving real world skills, these social groups believe that people with issues of escapism will not leave the VR, leading to potential psychological issues, including a detachment from reality, escalation of addiction, and loss of motivation (Afolabi, 2023).

In order for VR to be effectively integrated into career development, the amount of interpretations must be stabilized so closure can be achieved. This means that major stakeholders, including educators and employers, must believe that VR can be a viable method. This also means that stakeholders concerned about health must be shown that VR can be effectively used safely. Highlighting potential benefits of VR in enhancing career development, coupled with robust safety measures and guidelines, can effectively persuade stakeholders to establish common norms and practices, facilitating effective integration of VR technologies into professional settings.

Research Question and Methods

Given the interdependence between VR development in career industries and stakeholder interactions, it is crucial to demonstrate the effectiveness and safety of VR as a long-term method for skills advancement to start large-scale change. Therefore, my research will revolve around the question: Can Virtual Reality be used for frequent and long term periods of learning? Specific inquiries include the duration individuals can comfortably stay in VR, their ability to learn and retain knowledge inside the environment, and their overall perception of VR as a viable training method for professionals.

To address these questions, two experiments were conducted over a span of two weekends involving a diverse group of five participants, including current employees and university students (Table 1). The first experiment sheds light on the feasibility of utilizing VR for extended periods of time. By simulating realistic conditions, tolerance levels and comfort thresholds can be better understood, which is crucial for several reasons. One, it helps determine whether the duration of time individuals spend in VR, within established safety parameters, is reasonable for professional training purposes. Two, it provides insight into usability and user experience as well as pinpoints areas for improvement in VR systems. The second experiment delves into the viability of learning within a virtual environment, which is crucial for validating the effectiveness of VR training. By assigning tasks, a participant's ability to engage with educational content while immersed in the VR can be studied. With realistic break schedules and note-taking abilities facilitated through the VR controller, mimicking realistic work environments, it provides insights into the potential of VR for educational purposes and underscores its capacity to simulate real-world scenarios.

Participants	**Occupation**	**Age**
1	Accountant	54
2	University Student	19
3	Nail Technician	50
4	Software Engineer	25
5	University Student	21

Table 1. Occupation and ages of participants used for the experiments.

For the first experiment, titled “Duration and Comfort Experiment”, participants entered the virtual environment and remained until they felt uncomfortable or strained, with a maximum limit of four hours for safety. Short breaks (five minutes) were scheduled every 30 minutes, with a twenty-minute break after two hours for restroom usage, hydration, and food. Virtual games and web browsers were available to maintain user interest. After exiting VR, participants provided feedback on their experience and factors influencing their decision to remove the headset. Example questions participants would be asked is as follows:

1. What was your main reason for exiting the device? Did you leave due to boredom, discomfort, or other factors?
2. As you stayed in the virtual environment, did you feel any mental or physical discomfort?

For the second experiment, titled “Learning Viability Experiment”, participants were tasked with two specific assignments: first, to conduct a 250 word analysis on the first Netflix episode of “Avatar: The Last Airbender”, and second, to provide a succinct summary (250 words) of "A Supposedly *Fun Thing I’ll Never Do Again"* (David Wallace). For both tasks, participants were required to engage with the content within the virtual environment. For the video analysis, participants were told to watch the entire video, with one five-minute break halfway, during which they were encouraged to pause and take notes using the headset's tools. Similarly, for the article summary, participants read through the entire document, with identical break intervals but were free to note-take anytime during the reading. Following the completion of these tasks, participants were asked about their overall experience and opinions towards engaging in these educational activities within the virtual environment. Although the time completed and summaries themselves were not subject to analysis, participant responses to their experience were analyzed to draw conclusions regarding the efficacy of learning in a virtual setting. Example questions participants would be asked is as follows:

1. How did you find the experience of engaging in educational tasks within the virtual environment compared to traditional methods?
2. Do you believe that VR has the potential to be a viable method for career development in today's industries? Why or why not?

Results and Analysis

The results of the experiments provided insight on the suitability of VR for frequent and long-term training development. The first experiment concluded that participants could comfortably spend a reasonable time within the virtual environment, long enough to engage in activities such as skills training. The second experiment concluded that the efficacy of learning in a virtual environment was present and that participants saw VR as a good tool to use for career development.

The "Duration and Comfort Experiment" resulted in an average of 1.57 hours spent in the virtual environment, with a minimum of one hour and a maximum of two hours (Table 2). Although there is no set duration someone should spend practicing, studies show that most adults practice a skill for 45-60 minutes a session (Kageyama, 2009), which falls under the average time found in this experiment. From the feedback participants answered post experiment, almost every individual said that their main reason for exiting the environment was from a lack of enthusiasm after breaks. This apathetic behavior is seen in the duration data, as four out of five participants stopped during a break period. This is reasonable, as there were no tasks for participants, and although there was streaming entertainment and video games to maintain interest, it may not have appealed to everyone. Additionally, only one participant reported leaving the virtual environment due to physical strain, as seen by the only duration that wasn't within a break period. However, the symptoms that were reported, such as eye strain and headaches, are identical to symptoms of extended screen time (Kaspersky), and the participant still remained comfortably in the VR for over an hour. This demonstrates that VR is capable of being used safely for extended periods of time, provided that users adhere to outlined safety protocols.

Participant #	**Time Spent in Virtual Environment (hours)**
1	1.35
2	2
3	1
4	2
5	1.5

Table 2. Time participants spent in the virtual environment in hours.

The "Learning Viability Experiment" showed that participants generally found the experience of engaging in educational tasks within the virtual environment enjoyable and recognized its potential benefits in industry development. When asked about how they felt interacting in the VR with each task, every participant said that the immersive nature of the virtual environment enabled them to more effectively engage with the content. This feedback was anticipated, as once immersed in the VR, participants were able to tune out outside distractions, focusing solely on the material and notes at hand. It is noteworthy that all participants demonstrated a general understanding of both the video and the article, as evidenced by their summaries, showing an effective engagement with the content. Every participant also expressed appreciation for the convenience of having their notes readily accessible beside the content, regardless of their physical orientation. Two participants noted their comfort in being able to sit or lay down while completing these tasks because of the headset being attached to participants. In traditional note-taking scenarios, users often have to constantly shift their focus between their written or typed notes and the content they are studying, which can disrupt concentration and flow of learning (Naven, 2020). However, in the virtual environment, this did not occur due to the fact that notes were always present on the screen along with the material at hand.

Despite this, when asked about their opinion on VR being a viable method for career development, every participant expressed optimism but were hesitant to fully embrace it over current traditional methods. Most participants commented on the technology's immersive capabilities and ability to generate unique environments, noting that its features fostered a deeper sense of engagement and allowed for more interactive learning experiences. But as the technology currently stands, participants expressed skepticism about its applicability in other fields, noting limitations and practical challenges during their experience. One of the common limitations was the note taking tool. Despite it being so accessible, the headset used had no easy writing utensil, such as a keyboard or electronic pen, making note taking much more long and difficult. Another common complaint was the quality of the environment, noting that the material present was blurry and the surrounding environment looked almost "blocklike". These results demonstrate that despite the technology's limitations, learning is still fairly effective. Instead, one of the biggest reasons VR hasn't seen widespread adoption in industries is attributed to its underdeveloped state.

Discussion

Tying the results back to the social construction of technology, participants' positive experiences and recognition of VR's benefits for industry development reflect a social construct of VR as a viable tool for career development. SCOT emphasizes that the perceptions and interpretations of stakeholders influence the development of technology (Pinch & Bijker, 2008). Their feedback on its immersive nature and effectiveness in facilitating engagement with content further highlights how users' interactions shape its perceived value in utility. Additionally, participants' optimism yet skepticism regarding VR's use in other fields underscores SCOT's idea that different stakeholders can have various interpretations of the same technology. Overall, these results underscore the importance of considering social factors and stakeholder opinions in shaping the trajectory of VR technology and its integration in career development.

One of the biggest limitations to this research was the technology present at hand. Despite having a fairly up to date model of a VR headset, the software had no free educational or learning apps for participants. Therefore, the content of the second experiment had to be adjusted and external materials were imported into the virtual environment to simulate learning scenarios. Although the second experiment did simulate a learning environment, it was not unique to a virtual environment as the tasks presented could have easily been done outside of the environment. Therefore, it would be unjust to claim that VR is an effective learning tool from this experiment. In a more ideal research it would have been better to purchase one of the technology's educational applications and use that to simulate a learning environment for participants in order to better judge the effectiveness of VR for skills training.

If I were to perform this experiment again or continue this research, I would want to increase the sample size of participants. Five participants is nowhere near enough of a sample size to draw definite conclusions about the validity of VR in career development. Next time, I would plan to obtain more virtual reality headsets and conduct these experiments on multiple participants at once, in order to generate a greater sample size.

Regarding my engineering practice, I will use the information I learned about VR in my future work. I believe that there are many opportunities where VR can be used in engineering projects, training programs, and/or research endeavors, even more so than traditional methods. The research done to understand VR's potential sheds light on the fact that many technologies go unnoticed. With this in mind, I will remain vigilant for emerging innovations that can revolutionize my fields.

Conclusions

The current landscape of VR implementation in industries has both promise and challenges. While there is compelling evidence of VR's efficacy across various industries, the absence of standardized development practices, innovation, and safety protocols has impeded its widespread adoption. According to SCOT, central to overcoming these challenges is the imperative task of convincing major stakeholders of VR's viability and safety as a method in facilitating career development pathways.

My research highlights the aspects of VR's safety. While it is true that VR can be utilized safely with appropriate guidelines and rest periods, the need for hardware improvement can not be overstated. Enhancements in VR would not only enhance user experience but also mitigate existing limitations, improving stakeholder confidence and paving the way for mainstream usage in industries. VR's current ability to create distinct training environments is a significant change in how people can learn skills and gain practical experience. By putting users in simulated scenarios with minimal associated risks, VR transcends traditional training methodologies, offering immersive learning experiences for skill development. This means that the imperative lies in developers' concerted efforts to prioritize resolving current technological challenges. By addressing these obstacles, stakeholders can be emboldened to invest in VR, propelling the technology towards broader adoption in industry usage.

Despite the limitations of my research, it provides a foundation for future exploration and development of VR applications in career development. As technology continues to evolve, it will offer more innovative solutions to traditional challenges. If VR's development is invested, current engineering projects, training programs, and research endeavors will see a new technology play a pivotal role in industry.

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