



‘Is There a Role for Virtual Reality (VR) and Augmented Reality (AR) to Inspire Children to Pursue a Career Within Pharmacy?’

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Full Paper

Abstract

Welsh Government and the Royal Pharmaceutical Society are explicit in their ask for the profession to transform pharmaceutical care across Wales. With Health Boards in Wales seeing an average vacancy rate of 20% across the pharmacy workforce, this ask is more challenging than ever.

Virtual-reality (VR) and augmented-reality (AR) has embedded itself throughout industries worldwide, providing a variety of valuable ‘hands-on’ experiences without users having to be present in the environment. Throughout generations, children have been expected to be physically present in the workplace to gain experience, but advances in technology allow this to be more accessible than ever before.

This review aims to bridge the knowledge gap regarding the adoption of virtual reality (VR) and augmented reality (AR) in relation to pharmacy careers. Healthcare leaders should support and assist in the creation of engaging and contemporary resources to introduce younger generations to the roles available within the pharmacy profession.

Keywords: *Pharmacy, careers, STEM, virtual-reality, augmented-reality, pharmacy education.*

Introduction

Pharmacy is the third largest healthcare profession in the U.K., comprising of many different roles within communities, hospitals, research, academia and the military. ‘Pharmacy’ is often spoken as an all-inclusive term, encompassing all roles and often causes confusion, leading to misunderstanding and under-appreciation of the specific roles of all those working within the profession. With increased demand for pharmacy services and non-clinical roles for pharmacy professionals, the U.K. is beginning to notice vacancies within the system, with Pharmacists and Pharmacy Technicians both being listed on the UK Government's skilled worker shortage list (U.K. Government, 2024). In 2024, the U.K. Government pledged £645 million towards the expansion, in support of community pharmacy services (NHS England, 2024), in hope to relive pressure on primary and secondary care.

From 2026, all students who successfully undertake the Master of Pharmacy (MPharm) qualification within the U.K. will become independent prescribers (IPs) at registration. This transformational shift will allow Pharmacists to fulfil an increasing clinical leadership role, highlighting the important role that Pharmacists have within the health and social care sector and within the multi-disciplinary team, reducing the pressure on the wider workforce.

To ensure that health and social care services are sustainable for future generations, schools and employers must find innovative ways of encouraging and inspiring children to work within health professions. The implementation of digital technology within academia and for training purposes in other roles is becoming commonplace, and it is likely that it will become further standardised as digital technology continues to evolve. It is vital that employers within health and social care begin to develop engaging, contemporary resources to inspire the younger, ‘tech-savvy’ generation to work within an increasingly modern and digitalised healthcare sector.

Background

The workforce within the National Health Service (NHS) comprises of over 300 different careers, employing around 1.98 million employees as of the third quarter of 2023 (Statista, 2023). The NHS is currently the biggest employer within the United Kingdom, indicating how important the NHS is to citizens of the U.K. and the U.K. economy. Since 2020, the NHS has faced a number of significant challenges; the COVID-19 pandemic, insufficient funding, staff shortages, industrial action supported by Trade Unions, and increasing NHS waiting lists across specialities. It is no surprise that staff feel under-appreciated and are re-considering their career options. In September 2023, there was an estimated number of 6,075 full-time equivalent (FTE) vacancies across NHS Wales, equating to a vacancy

rate of 6.2% (Welsh Government, 2024). Given the various pressures facing the NHS, it is imperative to not only fill these vacancies but also to seek novel ways to expand the workforce.

Modernisation and digitalisation of healthcare has resulted in an expansion of the traditional scope of practice of pharmacists and pharmacy technicians (Royal Pharmaceutical Society, 2022). Pharmacy professionals are considered to bring a different skillset, complimentary to doctors, nurses and allied health professionals, and the optimisation of pharmacy roles has the potential to enhance other professional roles within clinical teams (Boughen et. Al, 2017). The crucial roles played by supporting staff, such as pharmacy technicians and assistants are often overlooked, presenting an opportunity to provide education on the various roles available within the profession. The enhanced and advanced clinical roles within the profession could now be seen as a more attractive career prospect and one that students may not have considered. This also affords an opportunity to display how each have an essential role to play in patient-centred care, contributing and assisting in sustaining the pharmacy workforce across all sectors.

There has been an abundance of research suggesting that exposing students to science, technology, engineering and mathematics (STEM) will increase the likelihood of them pursuing a career involving STEM (Dabney et al., 2012; Maltese & Tai, 2010; Sadler et al., 2012). The Universities and Colleges Admissions Service (UCAS) report a continued demand for STEM courses since 2023; engineering and technology courses growing by 10%, and mathematics and computing have seen an increase of 7% (UCAS, 2024). University application figures suggest that there are thousands of children who aspire to enter the healthcare workforce and are awarded places at universities throughout the U.K. (UCAS, 2024), yet there is still a significant workforce shortage within the sector. Despite the challenges and current denunciation that the NHS receives, 73% of young people aged between 16 and 26 are considering, or have considered a career in healthcare (Censuswide, 2023), exhibiting the potential of the younger generation.

Children's motivation to pursue a career in healthcare will be hugely dependent on their enthusiasm, academic potential, personal interest and engagement in careers relating to STEM. Motivation to pursue such careers will also be dependent on parental and familial guidance, and support offered by secondary schools and colleges. Without appropriate role models or those with enough knowledge relating to the professions within academia, children may feel discouraged to actively seek opportunities and thus considering a career in healthcare. Engaging, immersive experiences could significantly impact the academic and career decisions made by students and it is integral that all involved in educating the younger generation consider the creation and application of such experiences.

To achieve a sustainable workforce in times of a growing and ageing population, attention must be paid, and resources steered towards an increased engagement and awareness of healthcare careers. This will help strengthen existing relations with past, and current students, secondary schools and careers advisors. This will also forge new relationships, creating a new understanding between the education and healthcare sector, dispelling perceptions of traditional roles due to advances within the profession.

Background

Generation Z & VR

Generational typology has been widely described and recognised that the current workforce comprises of five distinctly different groups; triads, boomers, Generation-X, Generation-Y and Generation Z (Consultancy.uk, 2015). Despite earlier generations living and ageing with technology, Generation Z (Gen Z), are the first to be born into a connected and digitalised world (Cilliers, 2017). In today's era, children are accustomed to instant gratification, where waiting is no longer the norm, and accessibility to material goods or other resources is expected within a few hours. Due to this, Gen Z are often believed to have a shorter attention span than other generations. However, research suggests that they are more selective on how they spend their time and what captures their attention (Mckinsey, 2022). Meeting the educational needs of diverse learners while considering their individual interests, hobbies, and the challenges of digital poverty and social deprivation poses a significant challenge for academia. It requires providing inclusive, appropriate, and accessible educational material that not only piques learners' interests but also capitalizes on them, all while being mindful of the digital and social disparities that may exist.

Rothman (2016) described how 'brains of Generation Z have become wired to sophisticated, complex visual imagery, and as a result, the part of the brain responsible for visual ability is far more developed, making visual forms of learning more effective' and how modern learning styles are different to those of earlier

generations (American Nurse Journal, 2021). Children are becoming increasingly auto-didactic due to their proficiency in the use of technology, alongside the increase in online tutorials, virtual learning environments and eLearning; some of which was accelerated by the COVID-19 pandemic. These findings demonstrate the importance of adapting existing educational resources to ensure they are suitable for educating and inspiring the younger, highly-connected generation. This is particularly crucial given the widespread acceptance within society, as well as the ongoing evolution and adaptation of the human brain.

Markus & Nurius (1986) detailed the notion of possible selves, described as ‘representations of the self in the future’ - potential versions of an individual that represent values, expectations, hopes, goals, and fears, which can also be used as a source of motivation. Due to the emergence of immersive technology and media, individuals can now ‘transcend the bounds of their immediate environment’ (Bandura, 2021), allowing individuals to become ‘someone else’ or access experiences and settings that would not have been possible. Kabil & Shepard (2003) discovered how children that grew up in certain settings had a reduced understanding of occupations outside of their immediate environment, affecting their beliefs on possible selves and limiting their intrinsic motivation and potential. Children can loosely describe roles and their associated tasks having seen media representations (Stinke et al., 2009), demonstrating the impact of accessible media in learning and teaching pathways.

Shin (2017) describes how virtual reality (VR) enables users to immerse themselves in realistic, interactive settings, facilitating experiential learning through active participation, often referred to as ‘learning-by-doing’ (Figure 1). This learning approach encourages users to engage actively and is typically task-based, further enhancing user involvement (Bruce & Bloch, 2012). It has been recognised that VR simulation is an incredibly useful learning tool where tasks are ‘expensive, risky, or dangerous to undertake in the real world’ (Dalgorno & Lee, 2010), such as the military (Linde & Kunkler, 2016), electrical systems (Cardoso et al., 2016) and orthopaedic surgery (Aim et al., 2016). However, these are not without their disadvantages with Sharples et al (2008) terming them ‘virtual reality induced symptoms and effects (VRISE)’. Similar benefits have been noted when VR is used to improve mental health (Seabrook et al., 2020) and in minor procedures to avoid the use of anaesthesia (Salimi-Jazi et al., 2024).

Experiences in VR are not always educational and have been assessed as being more enjoyable due to the user being fully immersed and absorbed by the task (termed ‘*ludic immersion*’ by Reuda et al. (2018)). Evidence indicates that when students learn and study in realistic environments (like those experienced in VR), they are more likely to recall what was taught and effectively apply it in practical situations (Chittaro & Buttussi, 2015). These tasks then translate into further learning benefits, boosting the users confidence having become accustomed to undertaking specific tasks that are consistent with real-life (Jiang et al., 2021), becoming confident in their ability to transfer and apply this knowledge outside of the virtual reality space (Dalgorno & Lee, 2010).

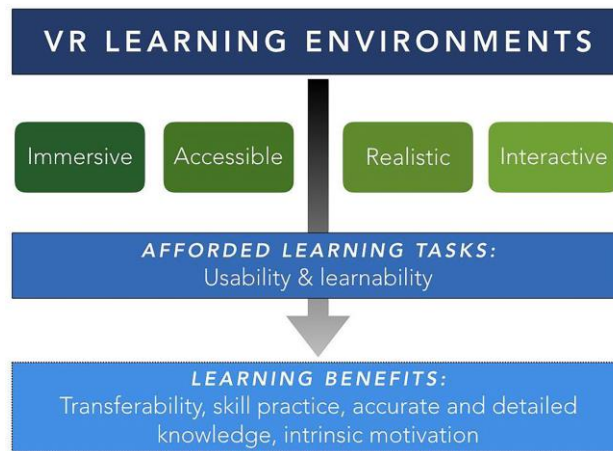


Figure 1: An affordance model of VR learning environments adapted from Shin (2017).

Healthcare has been slower to adopt virtual reality (VR) technology in educational platforms compared to industries like education, commerce, industry, and entertainment, which have been utilizing it since the 1990s (Dalgorno & Lee, 2010). Given the barriers facing children in accessing healthcare settings (NHS Employers, 2024), VR environments are a potential avenue for exploration, being appealing and appropriate for Gen Z learners. To ensure inclusivity and accessibility, resources should be available across multiple platforms, including smartphones, tablets, desktops, and VR headsets, accommodating diverse user needs and technological preferences.

Jiang et al. (2021) provided 20 children an opportunity to experience six 360-videos relating to STEM careers on either an iPad or a wearable Google Cardboard headset with an attached iPhone. Between them, children detailed how the immersive nature of the Google Cardboard allowed for a *'full body experience'* and that the headset blocked off the surrounding environment (Figure 2). In comparison to the iPad alone, students preferred the Google Cardboard as there was no screen-glare. One child stated: *'you feel like it's real'*, and another saying *'I can imagine myself in there because I can see what they do'*, demonstrating the impact of using VR for educational purposes and the feeling of actually *'being there'* (Dalgorno & Lee, 2010).



Figure 2: Participants using Google Cardboard headsets during the VR experiences (Jiang et al., 2021).

Some NHS organizations have introduced virtual reality (VR) technology, primarily in academic institutions for undergraduate programs related to medicine, with positive feedback being reported.

- The *'Wales Virtual Hospital'* provides a tour of health and education organisations within NHS Wales (Cardiff University, 2021). This resource is also used within multiple years of the Cardiff School of Medicine programme and has helped prepare students for examinations and clinical practice. Its application outside of medicine remains unexplored.
- Great Western Hospitals NHS Foundation Trust partnered with Goggleminds and The UK Sepsis Trust to provide education to hospital staff and students on how to spot symptoms of sepsis; a condition which kills over 48,000 individuals per year in the U.K. (Figure 3) (BBC, 2024).
- The University Hospital Leicester NHS Trust created a 360-video interactive film, *'Stroke VR'* (2022). In collaboration with their Stroke Team, they demonstrate the protocols and treatment for stroke patients arriving via Accident & Emergency, going through the same protocols as they would in a real-life admission. *'Stroke VR'* was compared to a face-to-face manikin simulation, didactic lecturing and e-learning.
 - 64% of participants expressed a preference for receiving stroke training through virtual reality (VR) in the future, while 36% favoured 'traditional' simulation training. Notably, no participants selected workshops or eLearning as their preferred method.
 - 72% of the group rated the VR station as the same or better than the traditional simulation station.
- *'Pharmacy - A Day in the Life'* (NHS England Technology Enhanced Learning Team, 2023) involves a mixture of 360-video and still images, and is the first interactive and immersive series of pharmacy career videos for 14-to-18-year-old learners. This resource contains three separate environments; Community Pharmacy, Hospital Pharmacy and Primary Care.
 - Students commented that they enjoyed how the immersive video enabled them to interact with patients and gave them a different insight into what the role involved.
 - They felt that the VR experience helped them to take in information *'with no distractions'*;
 - *'I thought they just sat in the back and did the medications, but they actually have a one-on-one with patients.'*

Current healthcare policy

Eluned Morgan (Minister for Health and Social Services in Wales) described how digital, innovation and technology must underpin the delivery of optimum care and services for patients and the workforce (Welsh Government, 2023). A priority is to improve access to general practice, dentistry, optometry, and pharmacy, and VR resources could certainly assist in providing education to a wider-audience to help support the delivery and meet this priority. VR resources can provide a ‘real-life’ feel to what you can expect to see and hear in these settings, with gamification to further facilitate interaction. Audio enhancements can be incorporated to guide and enhance the learning experience, while ‘checkpoints’ can serve as markers to shift focus and create a more holistic experience, rather than solely focusing on specific tasks. This offers all children the chance to engage in a novel, enjoyable learning experience, showcasing the diverse roles within the pharmacy team and the sectors they could potentially join. Currently there is no pharmacy-specific resource in existence that incorporates 360-video, still images and VR elements, leaving a gap in Pharmacy-related education for the younger generation.

The increased awareness and STEM engagement will also be of benefit to local communities, secondary schools, careers advisors, careers groups and STEM organisations throughout the U.K. A pharmacy-specific resource would undoubtedly benefit organizations like the RPS and the Association of Pharmacy Technicians UK (APTUK), as it would raise awareness and challenge current perceptions of pharmacy. However, its potential impact extends beyond these groups, potentially benefiting professionals across the health and social care sector.

Due to the advances in healthcare and progression of therapeutic treatment options, those living in the U.K. are now expected to live longer than ever before. The average age for those born between 2020 and 2022 is calculated to be 78.6 years for males and 82.6 years for females (Office for National Statistics, 2024). ‘*Prescribing Progress: Transforming Clinical Hospital Pharmacy in Wales for Enhanced Patient Care*’ (RPS, 2023) was commissioned by the Welsh Government. The RPS were commissioned to undertake an independent review of the provision of clinical pharmacy services provided in NHS hospitals across Wales, making further recommendations on how services should develop to meet the changing needs of citizens within Wales and the NHS.

‘*A Healthier Wales: Our Plan for Health and Social Care*’ (Welsh Government, 2018) details how there is a need for citizens to age and live well; preventing illness, and supporting them to manage their own health and wellbeing to prevent avoidable long-term illness. Whilst ageing and living well allows citizens to live longer and happier lives, an ageing population will lead to increased costs due to likely healthcare-related intervention placing heightened demand on the NHS in the coming decades. It is vital that there is enough staff educated and trained to provide continuity of care, and sustainability of services.

Since the COVID-19 pandemic, workforce issues have worsened throughout the United Kingdom and the shortage of pharmacists has resulted in incidents of pharmacy services being reduced in both Primary and Secondary Care. NHS England’s ‘*Community Pharmacy Workforce Survey*’ (2022) found that the number of full-time equivalent (FTE) community pharmacists had decreased by 13% compared to 2021, with FTE foundation pharmacist numbers decreasing from 1,573 in 2021 to 1,419 in 2022 (The Pharmaceutical Journal, 2023). The shortage has not only affected the roles of a pharmacist, with NHS England noticing a significant reduction in the number of FTE pharmacy technicians; 1,320 less than in 2017 (The Pharmaceutical Journal, 2023). NHS England are aware and recognise the impact and the shortage of pharmacists, detailing this in their ‘*NHS Long Term Workforce Plan*’ (2023). Keen to address the ongoing shortage, they pledged to increase the number of pharmacy training places by nearly 50% by 2032 ‘to meet the demand for pharmacy services’ (The Pharmaceutical Journal, 2023).

Education is a key theme throughout ‘*A Healthier Wales: Our Plan for Health and Social Care*’ (Welsh Government, 2018), recognising the need to collaborate and work with stakeholders to develop strategic education and training resources to create ‘*exciting career opportunities*’. Children and schools should feel confident that there is an exciting career pathway awaiting them - working alongside other talented Welsh students in diverse, exemplar workplaces with an overarching commitment by the Welsh Government: to improve health and social care services for future generations to maximise the benefits for our communities. The ‘*HEIW Strategic Pharmacy Workforce Plan*’ (HEIW, 2023) specifically states how HEIW ‘will ensure that the next generation of pharmacy teams are highly digitally capable’, identifying the potential capabilities of the future workforce in relation to digitalisation.

The need to develop the workforce is also listed within ‘*Pharmacy: Delivering a Healthier Wales*’ (PDaHW) (RPS, 2019), focussing much wider than the role of a Pharmacist. PDaHW describes how placements expose undergraduate students to ‘real life learning opportunities’ and can be useful in complementing their training – more valuable than ever in the changing landscape of the profession. Recognition of other professional groups, such as

social care, and how Pharmacy Technicians can immerse themselves into multi-sector roles, improving the quality of care that is given to patients. Harnessing and embracing the unique skill set of Pharmacy Technicians will be invaluable in embedding the principles of medicines management throughout health and social care. This will release capacity within the workforce to allow Pharmacists to focus and deliver enhanced clinical care and services, thereby reducing pressures elsewhere within the system.

Being well-established in cities, towns and villages, community pharmacies often consist of individuals who live within the locality; ideal for those who are unable to travel considerable distances or where public transport is an issue. Community pharmacies have an established training pathway with potential for school leavers to gain experience and qualifications through external accredited providers, enabling students to support the health and social care sector directly from school. This is often seen as an attractive offer and is a suitable and viable option for those who do not want to progress onto university studies, or for those who are keen to pursue alternative post-16 education. With support from employers and professional bodies, individuals can progress into a registrant role as a Pharmacy Technician; essentially a 'gateway' to enable access to further roles within the health and social care system.

Understanding, visualising and participating in roles of those within the health and social care sector from a young age would help to support their realisation of 'possible selves', gaining a valuable insight into the career options available. This develops an early understanding of the responsibility and accountability which runs parallel with becoming a registrant, allowing mature behaviours to be learnt and refined prior to entering the setting, or enrolment onto an academic programme. This will also assist the development of their emotional intelligence and empathic skills, which will aid their personal and professional development regardless of career path.

This review highlights the importance of training and education, as well as the need to offer virtual environments to increase accessibility and capacity to those individuals who cannot access face-to-face opportunities (Figure 3). It allows individuals to access these resources in their own time, and therefore the resource is not restricted to those who can only attend during traditional working hours. VR resources also remove the need for healthcare professionals to 'host' students within a healthcare setting, something which is critical and potentially unrealistic given the lack of staffing in such areas. There is also an opportunity for this to be accessed publicly, and no requirement for registration to a specific workplace-learning platform, which encourages accessibility.

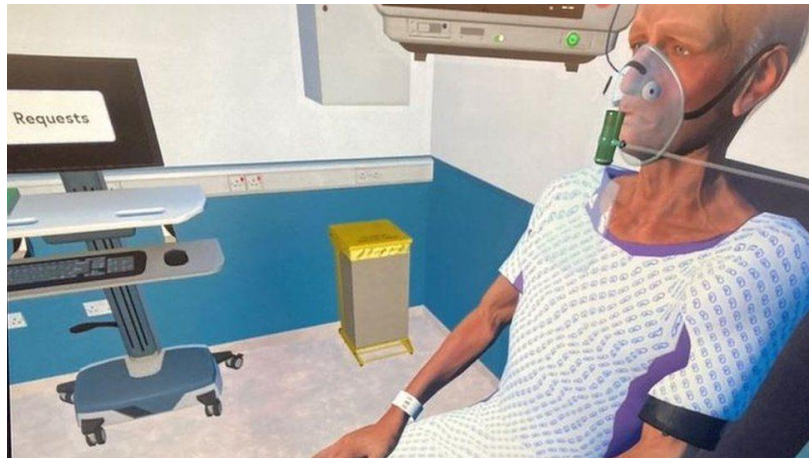


Figure 3: Software created by Goggleminds for Great Western Hospitals NHS Foundation Trust in partnership with The UK Sepsis Trust (BBC, 2024).

Combining innovative approaches and working with stakeholders, there is a real opportunity to address some of the other themes and potential deliverables in the aforementioned strategy documents. With the theme of education and learning being prominent throughout all strategic documents, it highlights the importance of education and how collaborators must be supportive of such work. Employers should also be as committed to lifelong learning, being mindful of innovative approaches to learning and advancing knowledge of the expanding roles within the workforce and how each are recognised as an invaluable member of the multiprofessional team.

Conclusion

When discussing healthcare, children often think of doctors and nurses, and usually within a hospital-setting. The healthcare workforce comprises of many more healthcare professionals, each with additional and supplementary skill sets to support safe, effective, and modernised care. Engaging students early can really help to increase the number of individuals who would consider a career in healthcare, reducing the impact and addressing the issue of a healthcare workforce shortage. Increasing knowledge and awareness within the education sector may help to influence children to consider working within pharmacy, as they may understandably wish to explore different workplaces and experience throughout their youth.

The creation and implementation of digital technology for educational purposes is becoming commonplace within other industries and there is a risk that healthcare could fall further behind. It is crucial for those overseeing healthcare workforce education to start creating compelling, modern resources to motivate a younger generation to pursue careers within the sector. VR has been demonstrated to be effective in other teaching pathways, and has significant potential to allow students to visualise, learn and understand how vital the pharmacy profession is to the MDT. Resources can also showcase the advances of the profession and how these coincide with current healthcare strategies.

Whilst the target audience and scope of this piece relates mainly to children, the sphere of influence could go far beyond the classroom, hence why sharing via an easily accessible medium is critical to their success. Novel and engaging resources would also create awareness of the advancing roles of healthcare professionals, supporting the vision detailed in 'A Healthier Wales: Our Workforce Strategy for Health and Social Care'. Wider-distribution and accessibility of resources allow an opportunity to educate the public on the transformation and accessibility of Pharmacy services. This creates a shared understanding and respect of the expansion of roles within the profession, reducing pressure on other healthcare services and complimenting the methodologies and importance of self-care.

Interactive learning opportunities build upon the initiatives of strategic and academic bodies across the U.K., serving as a valuable complement to existing work within the pharmacy education portfolio. Effective collaboration with interested parties will not only strengthen links with internal departments but also foster connections with external stakeholders, ensuring the longevity and effectiveness of existing resources. Effective and impactful education via VR has already been demonstrated in many settings, including healthcare. Despite its cost and challenges, it should be supported and embraced by academia, and professional and strategic workforce body responsible for health education and improvement.

'And you'd be surprised how many of them don't require a degree, aren't directly patient-facing, or aren't clinical or hands on. Although everything that everyone does is for patients, their families, carers and the public, we can all contribute in different ways.' - NHS Careers (2020)

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